

DESIGN OF ASSISTIVE VIDEO FOR HEARING-IMPAIRED (AV4HI) BASED ON VISUAL PERCEPTION THEORY

Ariffin Abdul Mutalib, Syarifah Nadia Syed Yahaya, Sobihatun Nur Ab Salam, Mazida Ahmad, Massudi Mahmuddin

Universiti Utara Malaysia, Malaysia, am.ariffin@uum.edu.my

ABSTRACT. This paper reports on an initiative that assists hearing-impaired students and their teachers in the teaching and learning activities. Through a preliminary study, it was found that both hearing-impaired students and their teachers face many problems with the existing approach, including difficulties in acquire contents, high tendency of getting stressed, and high potential to miss the syllabus. Based on the identified problem, this study initiates an alternative approach, by introducing a type of specially-designed learning material for the hearing-impaired called Assistive Video for Hearing-impaired (AV4HI). User-centered Design (UCD) approach has been utilized in carrying out the study, in which both hearing-impaired and their teachers were involved in the process of coming out with the design. Eventually, it was found that the hearing-impaired students enjoy the prototype very much, and expect to have the AV4HI in their teaching and learning activities.

Keywords: assistive, video learning, visual learning, hearing-impaired, visual perception theory

INTRODUCTION

The design and development of the video has an important role in determining the level of success of a learning process. However, there is limited research on designing video lectures, such as the presence of humans in the video and navigation support through video (Chorianopoulos & Giannakos, 2013). According to Kushalnagar, Lasecki, and Bigham (2013), many variables affect the ability of the user to read and follow the captions or transcripts, including the complexity of the visual flow and content simultaneously. According Chorianopoulos and Giannakos (2013), video format is the most popular lecture material. It could assist hearing-impaired students to get access to the contents. According to the definition of Oyer et al. (1994), the degree of hearing loss depends on the extent of damage, classified as listed in Table 1.

Table 1. Level of Hearing Loss

TYPE OF FAILURE	RATE (dBHL)	IMPACT
PROFOUND	91 above	Hearing loss as a whole. There can be helped with hearing aids.
SEVERE	(80–90)	Significant hearing loss, hearing aids are a must
MODERATE	(45–79)	Troubled to hear loud sounds
MILD	(30–44)	Troubled to hear normal speech
SLIGHT	(15–29)	Difficulty hears whispers and conversation light.

With reference to Table 1, this study focusses only on students with severe hearing impairment (80-90 dBHL). The learning material contains contents on recipes namely *Video Masakan Timur*.

The findings from previous studies found a correlation between learning style and teaching strategies in the classroom. As an example, Hayes and Allinson (1996) found that teaching strategies affects the performance of students who have a particular type of learning style preferences. Also, Wiley (1990), found that visual perception determines the ability of a student to understand the overall picture in mind. It consists of three levels and each level has certain stages that must be taken by an individual before it reaches the level of visual maturity. In terms of that, this study only studies the first stage of learning hierarchy. According to Saud and Lee (2007), the first stage of the hierarchy of visual learning is 'Visual Cognition'. Visual cognition is a process for understanding, remembering, creating, and editing visual information mentally. Similarly, Rhonda (2003) found a big difference between conventional teaching methods and methods that take into account of the wider learning styles with emphasis on various elements showed significant differences in performance.

While Mayer (2001) suggests that the use of various media elements can trigger the verbal and visual channels in the memory that is most effective for capturing, storing and recalling information in the learning process, this study adheres to the suggestion. Additionally, this study also applies the theory of visual perception, after considering the advantages of visual as an agent to transmit information, and helps facilitating identification in the context of a comprehensive explanation of concepts, ideas, and processes (Spence, 2000). Additionally, Saud and Lee (2007) recommend incorporating Visual Learning Hierarchy, which is supported by Wiley (1990). The first stage of the hierarchy of visual learning is known as 'Visual Cognitive'. Further, there are three levels in this first stage, which are visual perception, visual memory, and visualization.

Among all that, this study only focuses on the cognitive theory of visual angle for visual perception in developing the *Video Masakan Timur*. Students with hearing impairment problem at Polytechnic Tuanku Syed Sirajuddin (PTSS) are the subjects involved in this study as the testbed.

The Problem

Findings through observation, interviews, and rough opinions through a survey reveal that hearing-impaired students do not have the same level of understanding like typical students. Obviously, they receive and process learning input at a slower rate than the typical student. In addition, the processed information does not remain long in their memory. Besides, they also have trouble to fully focus in classroom. In common situations, they quickly get bored. This problem is obviously seen in practical sessions like during cooking.

In the meantime, lecturers have difficulties to show all steps in cooking. According Jamaludin and Siti Nurulwahida (2010) and Shahrudin and Ahmad Khairi (2011), the use of multimedia elements and visual learning can make weak students interested, enthusiastic, and strive to learn by exploring and pursuing. This means that the combination of text, graphics, animations and others is able to affect the hearing-impaired students' motivation to process information and bring the actual realistic elements to the user and influence their feelings and emotions (Jamalludin & Zaidatun, 2003).

In addition, always the hearing-impaired students require reliance on the services of an interpreter to follow the teaching and learning lessons by the lecturer. When asked to the lecturers, among the responses include "...it is a problem because language teachers in polytechnic are limited. If interpreters are not able to attend any lecture, the class has to be cancelled and this makes the lecturers and students stressed. As a result, the syllabus are not possible to

finish ... "(R1). Also, the hearing-impaired student said, "...not all lecturers who teach us are good at sign language. It is difficult for us to ask a question that we do not understand if the language interpreter is not available ... "(R2). In that scenario, both lecturers and students prefer to have a learning material that enables them to ensure learning takes place at any time when necessary. Therefore, this study proposes a concept that addresses the needs of the hearing-impaired community in the interaction. It is applied when preparing the Video Masakan Timur. With that, the Video Masakan Timur is referred to as Assistive Video for Hearing-impaired (AV4HI). With that, this paper aims at elaborating the concept of a learning material specifically designed for hearing-impaired students

THE DESIGNING PROCESS

This section explains the steps this study has gone through in ensuring the objectives are achieved. First, the needs of the hearing-impaired students were determined. It was accomplished through a series of interviews and observations involving the hearing-impaired students and their lecturers. The findings of that formulate the understandings on the problem being in place in their current teaching and learning activities.

Based on that, the AV4HI was designed. It involved the same persons in a series of meeting. This technique is referred to as User-centered Design (UCD) approach. During the design stage, design artefacts were decided upon, based on feedbacks by the users. In fact, users also participated in drafting their preferred interface and interaction styles. After four cycles of designing, the most preferred design has been obtained.

Then, based on the findings in the design stage, the desired design has been transformed into a working prototype. It incorporates various media elements as suggested by the theories and preferred by the users. Further, the AV4HI is elaborated in the following sections.

THE AV4HI

When designing the AV4HI, color plays the most important role to support users' needs. During the requirement gathering session, it was found that plain color especially green is the most preferred one, else blue. It really meets the Itten Theory, a theory that has been developed based on the classification of video that makes use of color. This theory has a hue of 12 in the five floors of the 180 kinds of colors. According to Itten (1961), green is a harmony color and it is a composition of vivid colors. Thus the selection of green background as in Figure 1 was decided, in order to create a medium that is alive and looks easy by the hearing-impaired students. The white color is selected for the font foreground, to increase hearing-impaired students' memory retention. Regarding this, a respondent said ... "I love the background color because it does not interfere my learning sessions ..." (R1). Further, Figure 2 shows the difference in the thickness of the color, to distinguish more clearly between the main chapters and their subject matter.

Images

Images are arranged in the form of order shown in Figure 3. This can enhance the understanding and knowledge of students about the cooking procedure after watching the AV4HI. A respondent said ... "After seeing the time sequence of dry and wet spices, it becomes clearer to me and it is easier to understand because they are equipped with the sign language shown beside it that runs simultaneously..." (R2). Image is also a very effective source of information for all kinds of messages received by the hearing-impaired students through their eyes. They can be accepted directly in more detail, and it has its own durability and high memory. In fact, the use of visual to explain concepts that cannot be explained by the text and the student is able to describe objects regularly (Makeup & Zaman, 2013), which is highly meaningful.

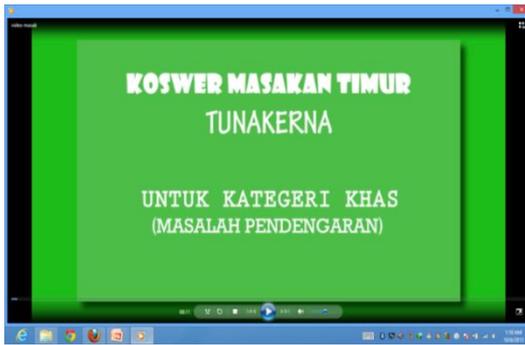


Figure 1. Main montage



Figure 2. Foreground and Background



Figure 3. Layout for images



Figure 4. Text and Video Pattern



Figure 5. Video Synchronized with Sign Language

Pattern

Style compilation in AV4HI is very important. In this study, the pattern is visualized in Figure 4. It is seen that the text and the video are placed side by side. This is to increase the focus on the main subject that the lecturer wishes to highlight. The approach of using a modern communications technology pattern to implement a system that analyzes the environment

and signals events to consumers is highly relevant. Hence, this study adopts such recommendations in addressing learning contents to hearing-impaired students.

In Figure 5, it is seen that the contents are placed at the middle of the screen. It is very significant to attract the attention of hearing-impaired students. The sign language video is arranged neatly on the right side to facilitate the students to see. The title is placed over the top of the subject to avoid confusion. According to the third respondent, "...the ingredients are clearly displayed, and it is easy to play or pause the video at any place that is difficult to remember, I feel so free ..." (R3).

Motion

To create a module that emphasizes the theory of visual perception, motion is one of the important features. According Elhadj, Zemirli, and Al-vaginal (2012), motion is really necessary to attract attention. Hence, in this study, motions especially sign language is used to assist the hearing-impaired students. With these signs, the hearing-impaired students are able to understand the contents.

Eventually, the contents in the AV4HI are presented in both video and sign language as exhibited in Figure 5 and Figure 6. This approach helps hearing-impaired students to understand the step-by-step process of preparing the recipes. With this, long text explaining the contents are avoided.



Figure 6. Video Showing Steps in Cooking

Referring to that approach, respondent five commented ... "...the combination of video and sign language is very interesting, easy to remember, and even easier to understand. Other learning materials only provide video without sign language..."(R5). Another commented "...although the video and sign language are located side by side, it does not distract my vision. In fact, it accelerates my information acquisition..."

The effectiveness of teaching and learning process is highly dependent on the methods and strategies of teaching and learning material. While that argument has been the basis of this study, the AV4HI is designed, specifically to adhere to the needs of the hearing-impaired students, who rely very much on hand gestures, finger spelling, and body movement (Harper & Huenerfauth, 2013).

DISCUSSION

This study believes that if the hearing-impaired students are tackled through ways they prefer to work with, their limitations in the teaching and learning context could be handled nicely. One of the initiatives carried out in this study is the design of appropriate learning material for them. While the market has provided massive learning materials for students, it is hardly found one that supports the needs of the hearing-impaired students. Hence, this study sees it from a different perspective, that the hearing-impaired students should be approached differently. Based on visual theories, the AV4HI has been designed. Eventually, it is proven

through a field study that the hearing-impaired students are happy in their learning activities with the AV4HI.

While the prototype has been tested with the market, that has received highly positive remarks from the hearing-impaired, the concept is simple. This enables the teachers who teach the hearing-impaired students to design and developed their own AV4HI in support of their teaching approach.

CONCLUSION

This study initiates a project that assists hearing-impaired community in their learning and teaching activities. While they are slow through the conventional method, an alternative should be provided for them. Accordingly, this study ventures into the landscape, by introducing a concept of learning material that is specifically designed for them. In ensuring that the design meets the needs of the hearing-impaired learners, theory of visual perception is incorporated. Eventually, through users' feedback during field testing, the hearing-impaired students were found happy with the concept, which is referred to as AV4HI. While this paper reports on the concept of the AV4HI, other aspects are discussed in other avenues.

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