

Assistive Courseware for Hearing Impaired Learners in Malaysia based on Theory of Multiple Intelligences (MI)

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Abstract—This paper reports a research on Hearing Impaired (HI) learners in Malaysia which focuses on beginner level. This research has been carried out with the intention to solve problem faced by parents of HI children in teaching their children to know the six (6) basic sounds which is known as Ling-6 Sound. The HI learners were assisted by specially-developed electronic-learning application or known as Assistive Courseware (AC) in their teaching and learning process. The AC utilizes the mother tongue language. The objectives of the study include 1) To identify the characteristic of AC for HI learners, 2) To design the storyboard of AC for HI learners, and 3) To design the interface of AC for HI learners based on MI theory. This study adapts the Iterative Triangulation Methodology, and it is integrated with the IntView Methodology. The storyboard of the prototype is outlined next. The findings of this paper highlight the prototype of the AC labelled with certain characteristics representing MI theory which is suitable for HI learners and the result is based on interview with parents. The final part concludes this paper.

Keywords—learning, e-Learning, Assistive Courseware (AC), Hearing Impaired (HI), Multiple Intelligences (MI) Theory

1. Introduction

The increasing number of people with disabilities in

Malaysia attracts the concern of researchers to produce various technologies, hoping that these technologies can assist the population in carrying out their tasks in everyday life parallel to normal people [3]. The increasing trend of people with disabilities has been reported by Country Report Malaysia, the 7th ASEAN and Japan High Level Officials Meeting on Caring Societies in 2009. As stated in the report, in 2008, there were only 30,522 children with disabilities detected. The amount increased to 13.7% in 2009 where 35,368 people with disabilities were registered with the Department of Social Welfare [12]. Therefore, technologies are considered the best solution to assist this community to learn as normal as other people do. According to [1], technology can help to lower many of barriers that people with disabilities faces to accessing information services.

Parents highly expect their HI children to be independently in performing daily activities. With help of computing technology and particularly the voice processing technology tasks such as reading and writing documents, communicating with others and searching information on the internet, people with disabilities will be capable to perform independently. In addition, as stated by [11], the evolution and development in IT promises every individual to information accessibility, better and more facilities for those in the education sector and also other fields. This development and progress also provides better opportunity for the disabled. In

education sector, there is no such thing as discrimination. Everyone is treated and given equal opportunities in obtaining education, regardless of social class, ethnic groups, background or whether one is normal or disabled. Thus, all people in the society have equal rights to be educated. In this context, the deaf also have rights to use educational peripherals or tools including ICT or computer based tools [11, 7].

The most familiar technology used for hearing disabilities is AT [2, 3, 4, 5]. Unluckily, most of the ATs available in the market are very expensive, whereby disabled people and also parents of disabled children cannot afford to buy [1]. It is also observable that the availability of ATs for HI people in Malaysia is still lacking especially ATs in Malay language [2, 3, 4, 5]. ATs can be designed in terms of hardware and software (courseware) [2, 3, 4, 5]. This paper discusses on designing software based AT, particularly on the design of the interface for Assistive Courseware (AC) for education which is scope to beginner users. The AC is also included with MI theory.

According to the Malaysian Social Welfare Department, there are more than 30, 000 deaf people who are officially registered, out of the country's population of approximately 24 million in Malaysia. The main problem of the deaf is communicating with other people. Malaysian Sign Language is widely considered as the language of the deaf as well as a medium to communicate with normal people. The deaf community is very much dependent on interpreters to help them bridge the communication and information gap [11, 13]. However, not all deaf people (especially children) know how to use sign language. This is because there is no standard version for sign language, besides limitation in movements making it difficult to represent special terms for example scientific terms [11, 14]. This situation creates difficulties for them especially when the children want to communicate with their parents and peers.

Therefore, the researchers come out with this AC. The AC in this study is specifically designed for parents to teach or guide their HI children in learning six (6) basic sounds also known as Ling-6 Sound. Scope for this paper is for beginner who learns on animation, graphic, video, audio and text. Interview with parents found that currently there is no courseware available for HI children in Malay language [6]. This limitation makes the parents feel hard to train their HI children as Malay language is

the native language to communicate at home in Malaysia. Therefore, three (3) objectives have been carried out in this paper to overcome the problem. The objectives are:

1. To identify the characteristic of AC for HI learners.
2. To design the storyboard of AC for HI learners.
3. To design the interface of AC for HI learners based on MI theory.

In addition, there is an interesting issue to ponder that is the attitudes of the learners in accepting the courseware as their method of learning. [15][16] have discussed that individual differences play an important role in learning. Individual differs in traits such as skills, aptitudes, and preferences for processing information and applying in real world situations. In order to attract the learner's behaviour, there is a need to study the design of courseware whether it meets the requirements of MI theory. As stated by [16], MI is one of the prominent theories regarding individual differences. The theory serves as one of the most effective curricular and instructional frameworks for classroom teachers to use in designing their lesson plan. In the same time, it can also be a good assistance for parents in teaching their HI children to really understand and apply the content of AC in their daily life.

The MI theory was proposed by [17]. He viewed "intelligence" as the capacity to solve problems or to fashion products that are valued in one or more cultural setting. [17] and [18] also discussed that the most important contribution of the MI theory to education is that it allows the educators to expand their repertoire of methods, tools and strategies beyond those that are frequently used in the classrooms.

In relation with that, the AC needs to be tested to the learners based on the eight (8) types of intelligences as follow:

- i. **Verbal-Linguistic:** The ability to understand and use language, both written and spoken; sensitivity to the meaning of words and the different functions of language.
- ii. **Logical/Mathematical:** The ability to use inductive and deductive thinking, numbers and abstract patterns. It often referred to as scientific thinking – comparing, contrasting, and synthesizing information.

iii. **Musical-Rhythmic:** The ability to discern meaning in or to communicate with tonal patterns, sounds, rhythms and beats.

iv. **Bodily/Kinaesthetic:** The ability to use and understand physical movement; a mastery over body movement or the ability to manipulate objects with finesse.

v. **Visual/Spatial:** The ability to perceive and recreate the visual world accurately, to visualize in one’s head, and to give some kind of order and meaning to objects in space.

vi. **Interpersonal:** The ability to make distinctions among other individuals in regard to their moods, motivations and temperaments, and to communicate with others.

vii. **Intrapersonal:** The ability to self-reflect and have an awareness of one’s own internal state of being. Ability to define one’s own feelings as a mean of understanding and guiding one’s behaviour.

viii. **Naturalistic:** The ability to recognize patterns in nature and to classify according to minute detail.

According to informal interview that had been done with parents of HI learners, only four (4) types of intelligences can be applied in the courseware. The four types are Naturalistic, Visual or Spatial, Musical-Rhythmic and Bodily or Kinaesthetic. All the four types of MI have been chosen to be included in the AC for the first version (beginner level). Another four types will be included in the second version of AC after the learners achieve certain level (intermediate level) and they are ready to learn new things.

2. Methodology

The research works are based on the Iterative Triangulation Methodology adapted from [9]; integrated with the IntView Methodology [8] which is specific for prototype development. The general methodology is outlined in Figure 1. In Iterative Triangulation, it is suggested to have a number of approaches in every task. This paper focuses on theoretical aspect and prototype development. For the theoretical aspect it is suggested that data sources, methods, theoretical, and data analysis are composed in different ways. Therefore, in this paper, data regarding theoretical has been obtained from document review, interviews with parents, and experience with HI learners. Further, the activities of

the research are outlined in Figure 2. This paper focuses on the works in phase 2, in which the storyboards of the prototype were designed. Whereby, Figure 3 illustrates the steps in IntView adapted in this study. [8] proposed the IntView methodology for developing a small scaled courseware. There are two major phases in IntView v1, which separate the tasks into pre-development phase and development phase. Pre-development phase has been highlighted in this study. In step 10, the storyboard of the prototype has been sketched.

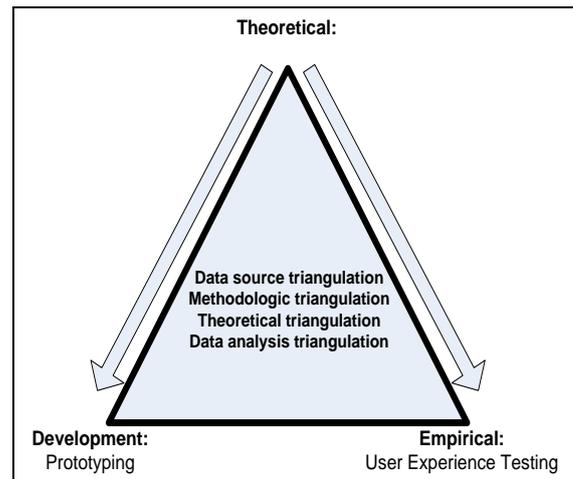


Figure 1 - Basis of Methodology

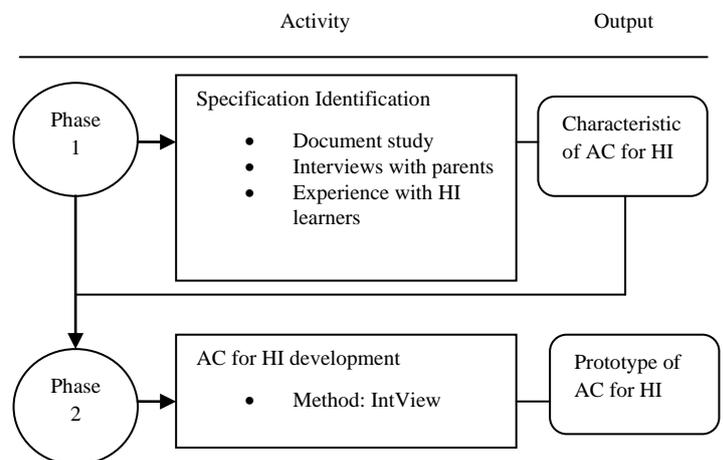


Figure 2 - Summary of activities

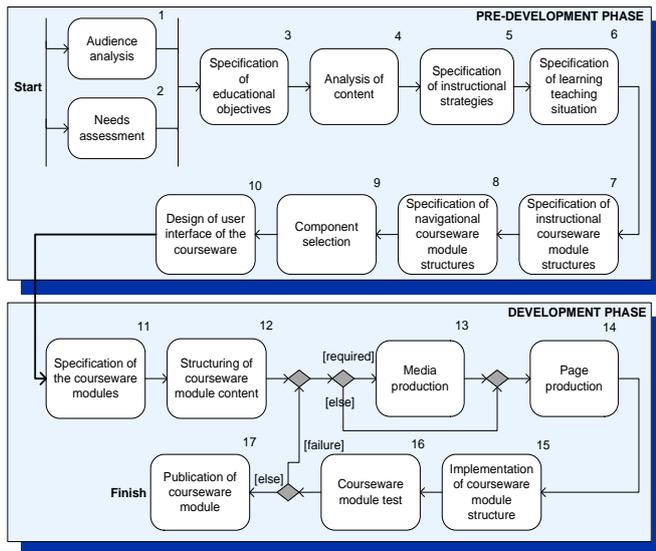


Figure 3 - IntView courseware development methodology

3. Storyboard

The storyboard has been illustrated and shown in Figure 4 which is based on document review, interviews with parents, and experience with HI learners. The prototype consists of two main modules. Fig. 4(a) illustrates the storyboard for Module 1. Fig. 4(b) illustrates the storyboard for Module 2. The content of the AC focuses on Ling-6 Sounds [10]. The Ling-6 Sound represents various different speech sounds from low to high pitch (frequency) [10]. It helps to test the children’s hearing level and check whether they have accessed to the full range of speech sounds necessary for learning language. In Module 1 the HI learners learn the subject through audio, graphics, and video and in Module 2, simple exercises are provided in order to test the HI learners’ capabilities. Each page is also provided with a clickable button link to the next and previous page which can assist the learners to navigate the AC easily. Audio are in .mp3 format, all of the graphics are in .gif format and video are in .mpeg format. There are seven (7) buttons that have been designed in the storyboard for Module 1 where six of the buttons placed on the left side and one of the buttons placed on the right side of the interface. Button 1 until 6 have been designed to enable the HI learners to navigate the main content of AC. Button 7 has been designed for HI learners to navigate the next module which is Module 2. Primary and secondary colors have been utilized for all buttons and also for animation text. Beside the six buttons, there are animation graphics which is designed horizontally to have a better preview in order to attract the HI

learners. Video will be inserted beside the animation graphic to avoid the HI learners to feel bored during the learning process. *Comic san* has been chosen as the best font types for animation text. The font size for animation text is between 18-20 points.

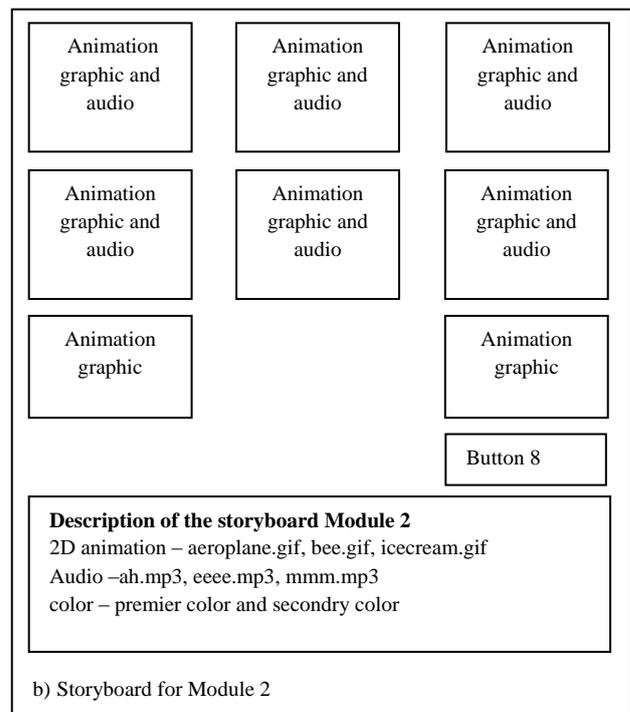
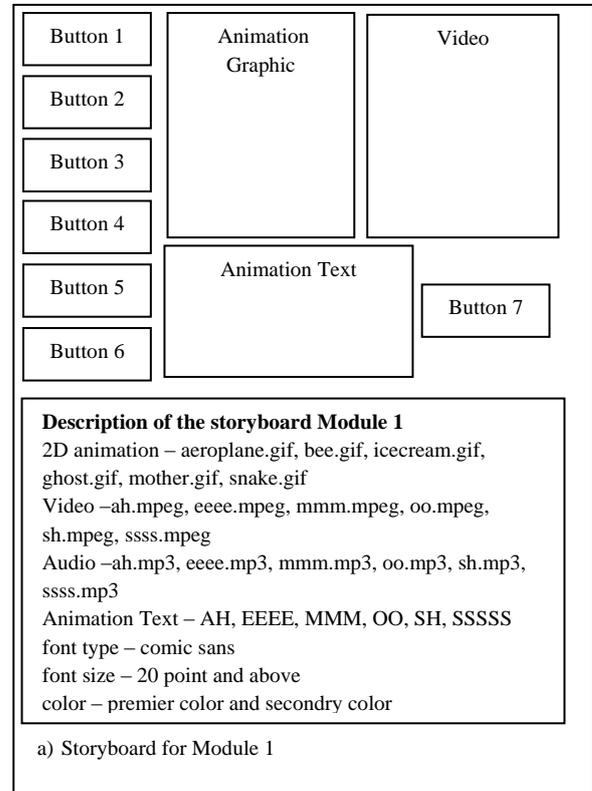


Figure 4 - Storyboard

3.2 Implementation Issues

This section discusses the implementation issues into two parts; modules and features; which are discussed separately.

3.2.2 Modules

It was found that HI learners were facing difficulties in understanding English [2] [6]. Interview with parents, stated that as a Malaysian people, the HI learners faced with difficulties and confused between the learning processes with their daily routine [6]. The HI learners could not adapt the subject that they learnt through the available courseware with their daily routine especially for the beginner. For that reason, mother tongue language has been decided as the most appropriate language for beginner HI learners and the Ling-6 Sound has been chosen as the main content of this AC. Two modules were designed to include appropriate multimedia elements. Description for each module is provided below:

1. Module 1

Figure 5 shows the snapshot of Module 1. Module 1 enables the HI learners to learn six basic sounds (ah, eeee, mmm, oo, sh, ssss) together with animation graphics, videos, and animation texts. Six buttons were designed linking to the main content of AC. Two dimensions animations, videos, and animation text appears simultaneously when the user click on one of the six buttons. Video were provided to show the real situations for that sound. Combination of these multimedia elements could reduce their confusion and at the same time could enhance their level of knowledge [2] [6].

2. Module 2

Fig.6 shows the snapshot of Module 2. The purpose of this module is to test the learners' knowledge level after learning with the AC. The exercise part provides animation graphics and audio. For this prototype, the exercise tests on the differences between the three types of Ling-6 Sound. By using pointing devices for example optical mouse, the user must point and click to the first box in the first row. The box provides one of the Ling-6 Sound. After 10 second the picture appears in the box. Within 10 second the user should guess the type of sound. After that, by using the rollover mouse the

user must point to any of the box in the second row to match with the sound and picture that appears in the first row. If the user point to the correct answer, the score of the exercise will appear in the same screen. The animation character was designed to show the expressions and emotions for the correct and wrong answer. These elements could enhance the enjoyment of learning process for HI learners in beginner level [2] [6].

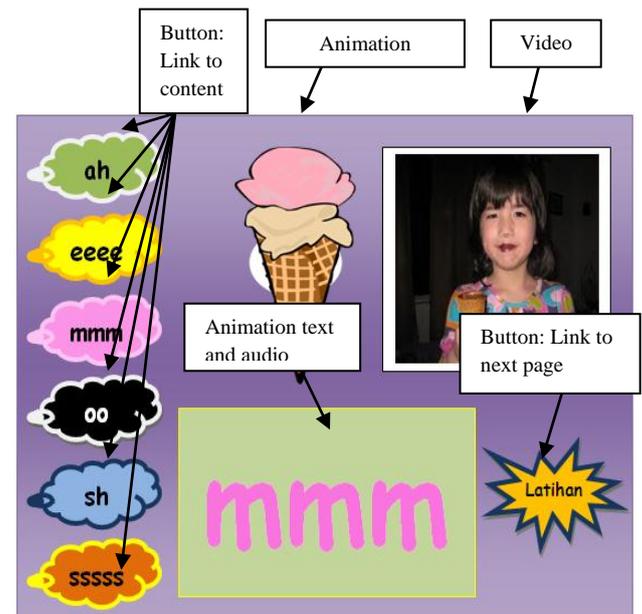


Figure 5 - Snapshot of Module 1

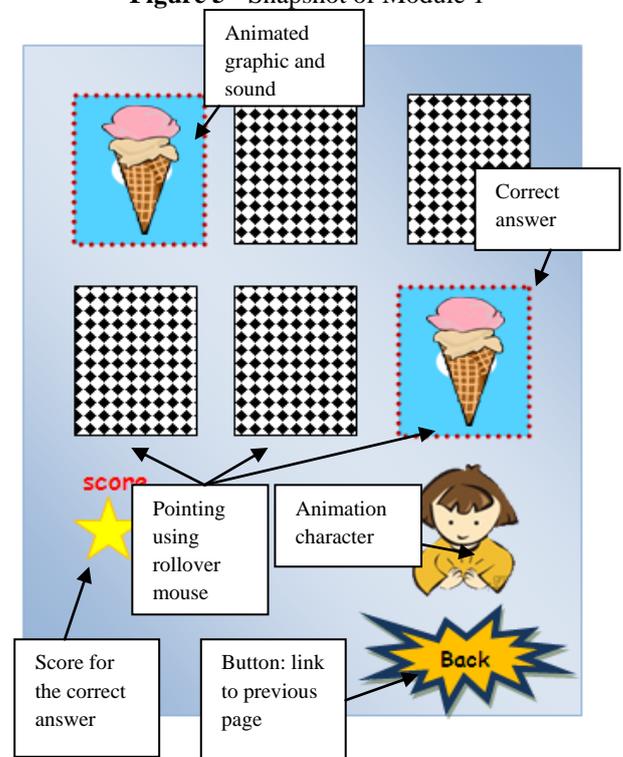


Figure 6 - Snapshot of Module 2

3.2.3 Features

The features added in the AC were discussed as follow:

1. Audio

It was found that audio is one of the important elements in AC for HI learners. In this study audio should be clear and concise in order to make sure that the HI learners have accessed to the full range of speech sounds through this AC. At the beginner level, the Ling-6 sound is very important for them as the basic sound before they can proceed to another sound which is at intermediate level. Background music was found confusion [6]. Hence, in this study the background music was omitted.

2. Video

Visual cue is the most important element in developing the AC for HI learners [2]. Therefore, video were utilized for each type of Ling-6 Sound. The video shows the real situation related to the sound. The expressions and the emotions shows in the video combined with the audio could demonstrate the full knowledge for HI learners to understand the main subject.

3. Animation

Two dimensions animations were utilized in the prototype for each type of Ling-6 Sound. It is important for HI learners to build up their mind to relate the sound with the graphic. At the beginner level, animated graphics was found interesting for them and at the same time could develop their curiosity.

4. Text

Animated texts were utilized for each type of Ling-6 Sound. It is important for HI learner especially for beginner user to create the relationship of sound between the animation and video.

5. Relation with MI theory

Feature 1 and 2 (audio and video) cover the **Musical-Rhythmic theory**. This AC is provided with sound starts from the first until the last modules. The parents of HI learners can choose either to play or mute the sound during teaching and learning process. In order to make the learning process more enjoyable, the learners have been tested with simple exercise which is equipped with sound effect. For the exercise,

the learner needs to enter the correct answer. Different sound effects have been used to differentiate between correct and incorrect answers. To make learning livelier, narrations are supplied to the exercises given in the modules.

At the same time, Feature 1 and 2 also cover **Bodily/Kinaesthetic theory** where the learners can use the pointing device to move the pointer to the picture and then they can hear the sound from the animated pictures and also from the video.

In addition, Feature 2 and 3 (video and animation) have applied the real situation where it shows the real children saying the text. In the AC, there are numerous of natural elements are also being used such as animal, flora, and fauna in order to attract the students' attention. All the elements are presented in interesting images and some of the images are presented in animated version. This kind of approach can help the students to adapt the learning process with the real world environment. The usage of real situation covers **Naturalistic theory**.

In **Visual/Spatial theory**, the AC covers Feature 3 and 4 (animation and text). For these features, the courseware has been provided to attract the learners' attention during learning process. Each module contains a large-scale pictures and simple animated elements. In addition, the best font size, font colour, and background colour have been considered to ensure the learners can read, understand, and apply the knowledge smoothly.

4. Result and Discussion

This section highlights the results and discussions based on the interview that has been done to evaluate the storyboard and interface which is designed for the prototype of AC. The discussion is focused on the multimedia features and elements designed in the storyboard and interface. The result from the interview has been discussed as follow:

4.2 Button

Based on the interview that has been done with parents of HI learners, they indicated that the six buttons that have been designed in storyboard for Module 1 looks crowded. HI learners will be confused when there are too many buttons in one scene [6]. The interviewee suggested that there must be only one button in one scene. In addition, they were satisfied with the colour and size of the buttons which are suitable for HI learners [6]. Other than that, the HI learner's parents also mentioned that the

shapes of the buttons are not suitable for the HI learners because they faced with difficulties to differentiate whether it is graphics or buttons.

4.3 Animation Graphic

Animation here means two dimension (2D) animations. According to [6] HI learners can only recognize certain animation and graphic that has been standardized by expert. For that reason, suitable animations have been identified in storyboard. For example ice cream in a cone is the suitable animation for the sound 'mmm'. According to interview, the interviewee stated that for the sound 'mmm' it cannot be related to other graphic such as ice cream in a cup.

4.4 Video

Based on the interview, video is the most suitable element for HI learners to enhance their understanding process. Video that relates with animation graphics and texts can attract the HI learners to explore the whole content of AC [6].

4.5 Text

As per discussed in the previous section, animation text has been designed in Module 1. The result from interview stated that animation text is suitable for HI learners. The colour and size of text also can give meaningful lesson to HI learners [6].

4.6 Layout of interface

The parents also indicated that there is certain part in the interface layout for Module 1 that are not suitable for HI learners where HI learners faced difficulties with the arrangement of buttons. For the interface layout of Module 2, the interviewee stated that multimedia element is completely enough for them as a parent to guide their HI children to do the exercise in Module 2 [6].

5. Conclusion

As for conclusion, AC is designed to help the users in teaching and learning process. Different kinds of users have different needs for the content of courseware. For HI learners, aspect of graphics, videos, audios, texts, and animations need to be stressed on therefore they can enjoy the learning process and at the same time can attract their focus towards the content inside the courseware. The main discussion of this paper is on designing the storyboard and interface of AC for HI learners at beginner level that covers a part of MI theory. Mother tongue language has been decided as the medium of

transferring knowledge. Next step of the study is not only to report on the findings of the observation, the AC will be also included another four types of MI theories which is not covered in the first version. At the same time, the researchers also plan to experiment the prototype with HI learners in terms of cognitive implications using empirical data.

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