Usage Concepts of Augmented Reality Technology in Islamic Study

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Abstract

The augmented reality (AR) has been identified to be suitable for use in education. However, studies that particularly identify this concept are still rare. Therefore, this qualitative study was conducted with objectives to determine the perception of teacher educators from the Islamic Study Department, Teacher Training Institute in Central Zone of Malaysia towards AR, and to develop a usage concept that can be implemented when teaching and learning Islamic Study. Explorative case study method involving three teacher educators was used. They were interviewed by using an in-depth semi-structured interview schedule. From the interview, all responses provided by the informants are very positive and admitted that AR technology is suitable to be used in the Islamic Study. The usage concepts discussed in this paper can be used as guidelines to those who are interested in developing or using the AR application based on Islamic Study topics.

Keywords: Augmented reality; Visual informatics; Islamic study; Instructional technology; Usage concept

Introduction

Augmented reality (AR) is a variation of the virtual reality. It enables users to synthesise an object from the virtual world to the real world (Azuma, 1997; Bimber & Raskar, 2005). AR also enables one to interact between these two worlds in real time. Therefore, due to these capabilities, AR has been recommended to be applied in the education field by many researchers (Billinghurst, 2002; Educause Learning Initiative, 2010). AR has also been applied in several topics such as science (Norziha et al., 2009), astronomy (Soga et al., 2008), mathematics (Elango & Halimah, 2009), and language (Roslinda & Halimah, 2009) as teaching and learning aid. However, the application in teaching and learning for Islamic Study is still rare (Mubarikah, 2009).

The application of AR in the education field is encouraged due to its various advantages. Among the advantages include its ability to help students' cognitive process especially in the visual spatial process (Khalil et al., 2005; Scheiter et al., 2009), its ability to raise students' motivation level, its positive impacts in learning experience especially for weak students (Freitas & Campos, 2008), its

ability to help creative thinking development and to enhance comprehension, its ability to change the paradigm in students' learning curve in learning any subject (Huda Wahida et al, 2010), its ability to give a new and fun learning experience (Juan et al., 2008), and its ability to encourage students to explore the learning topic on their own (Kaufmann, 2006). These advantages will help students to reduce their total time needed to learn. This AR technology could be an alternative instructional media for the teachers as well, especially those who are teaching Islamic Study (Huda Wahida et al., 2010).

These advantages can be easily gained because the AR technology has certain characteristics that enable users to move or manipulate virtual objects and view them in several perspectives (Billinghurst, 2002). Moreover, AR technology supports the seamless interaction between the virtual and real environments as it is capable to do smooth transition between both environments. Figure 1 shows an example of the AR application with the Kaabah as the virtual object in real world.
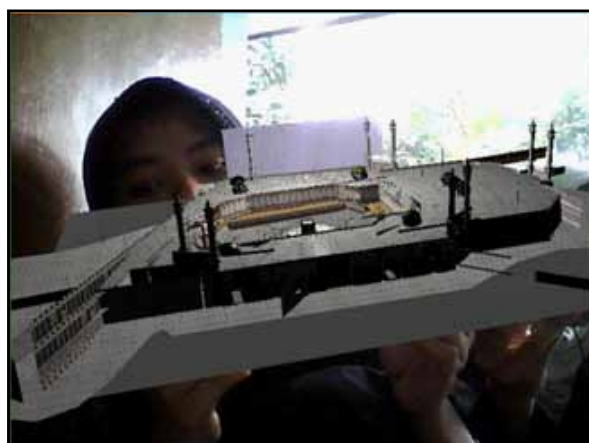

Figure 1: Example of AR application. Source: Mubarikah (2009)

Furthermore, AR technology uses real world metaphor to do the manipulation by replacing input devices such as mouse and keyboard to the marker (Figure 2).

Figure 2: An example of a marker. Source: Mubarikah (2009)

Most of the previous researches focused on the application of AR technology in certain topics of school syllabus involving acceptance of the technology as an alternative instructional media (Norziha et al., 2010), assessment of the use of the technology (Vilkoniene, 2009), evaluation of the AR application (Rasimah et al., 2011) and exposure of this technology to the world of education (Shelton, 2003) and school environment (The European Commission, 2006). However, based on the researcher's knowledge, there is no research that particularly studies on how this technology can be used in the teaching and learning of Islamic Study. Therefore, a research was conducted with objectives to determine the perception of teacher educators from the Islamic Study Department, Teacher Training Institute towards the AR, and to develop a usage concept that can be implemented in the teaching and learning of Islamic Study. This will help in guiding the user or developer of AR application in Islamic Study, in order to optimize AR as the instructional media in appropriate and suitable usage context.

Methodology

This qualitative study involved three teacher educators (known as informants from now) from the Islamic Study Department of Teacher Training Institute (TTI) in Central Zone in Malaysia. The purposeful sampling was used based on the informants' experience of teaching in school and teaching the teachers as they were teacher educators of in-service and pre-service

teacher in Islamic Study option. According to Wiersma and Jurs (2005) "those selected are believed to be information-rich cases" and the sample size is based on Merriam (2009), where she had suggested that "the sampling is terminated when no new information is forthcoming from new sampled units". A face-to-face interview using an in-depth semi-structured interview schedule was held in August 2011. An AR technology using AR application, developed by the researcher was demonstrated to the informants. Then, a video related to the application of AR in education that was prepared by the other researchers, was also shown to them.

Results and Discussion

Demographic Distribution

Table 1 tabulates the demographic distribution of the informants who were involved in this study. Two of them were female and one was male. All three of them have more than 18 years of teaching experience in Islamic Study and with at least three years of teaching experiences as teacher educator for pre-service and in-service teacher in the Teacher Training Institute.

Table 1: Informants' Demographic Distribution

Teacher Educator (TE)	Gender	Teacher Experience (General)	Teaching Experiences in TTI
TE 1	F	23	6
TE 2	F	18	3
TE 3	M	18	7

Informants' Perception towards AR

From the interview, all the informants have claimed that they have never seen or have any knowledge about this technology. But, despite their lack of knowledge and exposure on AR technology, they gave very positive responses and admitted that this technology is suitable to be used in the education field in general and in Islamic Study in particular. They also agreed that AR technology has the potential to enhance the effectiveness of teaching and learning as it is able to easily attract the students' attention. Furthermore, it is able to increase the understanding on certain abstract concepts that the teachers may want to explain. The followings are some of the responses given:

"So amazing! (laugh), it helps teachers and students to gain knowledge. They can also go in-depth. If it is a book, only flat surface but with this, it's emerge. It's able to attract attention and obtain a deep understanding of something that is not able to be seen and that is hidden" (TE1)

"Awesome! It really can help student in comprehension. Interesting, more amazing than video. If video, it's already recorded but this (AR), student must like this. They able to hold the virtual object. It is able to attract attention. Interactive." (TE2)

"Uhh! Remarkable. So teaching and learning will be more interesting and effective. The most important, it can attract students' interest in learning… Very good. It is suitable for teaching and learning... " (TE3)

Usage Concept of AR Application in T&L of Islamic Study

All of the informants have suggested that the AR technology is suitable to be applied in some topics such as those related to ibadah (religious duties in Arabic term), sirah (history in Arabic term), and aqidah (creed in Arabic term). The application is believed to be able to assist the teachers in explaining the topics and thus enhancing the students' comprehension on the topics. Below are the usage concepts that are suitable to be used in teaching and learning of Islamic Study based on the results from the interview.

AR acts as an aid to substitute the real object.

One of the characteristics of AR is the ability of the virtual 3D objects to "act" just like the real objects. Users are able to hold and move the

objects using their hands as if the objects are real. This characteristic makes it possible for teachers to "bring" various sizes of objects in virtual form to class. The followings are some of the statements made by the informants about this usage concept.

"...about universe... how info from universe help in determining time to pray... new moon of Ramadan... it's different from video as we are able to see at different angles, for example Kaaba, where Abraham Tomb is, where to start. It's like they (students) are already there. No more abstract visualisation. ...for sirah, such as war, strategy in Badar and Khandaq, it can show how or where the drain is ..."" (TE2)

"...show the place of throwing stones at the pillar" (TE1)

AR helps in explanation of processes

AR is able to show 3D objects with or without animation, which could help teachers to explain certain processes. When viewing the animation of processes students are able to see and learn all the processes in several perspectives or views. The following is a statement made by one of the informants about this usage concept.

"...human creation, from early process to baby... unlike video, this technology allows students to hold and move the object as they want. This is fun for students." (TE2)

AR acts as simulation tool

According to TE3, by applying this usage concept, the AR technology is more suitable for teaching topics related to ibadah. Usually, the teachers use demonstration or simulation to teach students with topics related to ibadah. Sometimes, they also show videos or posters. But with this alternative teaching method, it allows the teachers to teach more effectively and efficiently as it enables students to view the 3D simulation on several perspectives in real time. The followings are some of the statements made

by the informants about this usage concept.
"...slaughter...which vein should be cut.... how to throw stones at the pillar (while performing haji)" (TE1)

"...for example in the topic of ibadah ... performing wudu' (a cleaning ceremony before prayer using clean water)... prayer for sick people, if MS PowerPoint is used, it's commonly using picture only but with this 3D, more meaningful... tayammum (a cleaning ceremony before prayer without using water in the absence of it), how we move our hand, show the face... students are able to see the simulation many times.... other example, tawaf (one of the ritual activities while performing hajj)...slaughter....ihram (ritual cloth while performing hajj), how to wear seamless cloth worn by pilgrims. We able to move the human model..." (TE3)

AR is able to attract attention

Previous usage concepts will indirectly have this forth usage concept. Furthermore, with the uniqueness of AR and the new experience that students will encounter, this will attract the students' attention and engagement with the teaching and learning process. The technology already had this usage concept even if the developer of AR application does not intend to use any of the previous usage concepts. This argument is supported by previous researches (Huda Wahida et al., 2010; Juan et al., 2008; Sumadio & Rambli, 2010). The followings are some of the statements made by the informants about this usage concept

"...it's new... students are able to see in different angles, can hold and move the object... it's fun for students. Not only them, we also have fun (laugh)" (TE2)

"In Arabic language, to introduce or to teach its letters, shape, pronunciation... the letters and objects can be moved in real time." (TE3)

Although the three informants did not know

about the existence of AR, they still gave positive responses on using AR in the teaching and learning (T&L) of Islamic Study. They agreed that, with the characteristics possessed by the technology, it is able to give positive impacts towards the students' learning process. They also agreed with the previous researches that this technology is suitable in education (Billinghurst, 2002; Educause Learning Initiative, 2010) especially in Islamic Study as the technology could help teachers to explain many topics especially those involving abstract objects or visualisation. The informants acknowledged that AR allows students to interact with the virtual objects in real time, thus helps to increase the students' attention and focus in learning the topics (Billinghurst, 2002; Billinghurst et al., 2008; Zagoranski & Divjak, 2003). Furthermore, the informants also acknowledged that the technology helps to improve the students' cognitive process of visualisation as they are able to observe the objects in several perspectives.

As an individual media, AR has some characteristics that determine its capability to handle specific instructional strategies. Gagne et al. (2005) stated that certain media are better than others in representing objects, facts, ideas, process, modelling behaviour or human activities, and in showing spatial relationships or developing motor skills. Furthermore, Gagne et al. (2005) also concluded that there is no medium which is universally superior to all other media for all types of desired outcomes and for all learners. In most situations, several strategies and methods can be combined to achieve an effective learning process. From the interview, it can be outlined that in order to optimally use the AR as an instructional media, there are four usage concepts that can be used when one decides to use or develop the AR application in teaching and learning of Islamic Study. They are (1) AR acts as an aid to substitute the real object, (2) AR helps in explanation of processes, (3) AR acts as simulation tool, and (4) AR is able to attract attention. Basically, these four usage concepts

are also suitable to be used when teaching any subtopics, as a topic is a combination of a few subtopics. Table 2 shows the previous studies on topics and subtopics in several domains in the education field.

Table 2: Previous studies with usage concept used

Topic/Subtopic	Usage Concept			
	1	2	3	4
Astronomy - universe (see Aw & Halimah, 2010)	✓			✓
Chemistry - molecule (see Chen, 2006)	✓			
Interior human body (see Juan, et al., 2008)	✓			
Geometry (see Kaufmann & Meyer, 2008)	✓		✓	
Reading (see Hafiza & Halimah, 2010)	✓			✓
Colours (see Ucelli et al., 2005)				✓
Mathematics - negative numbers (see Elango & Halimah, 2011)		✓		
Haji (see Mubarikah, 2009)	✓	✓	✓	✓

Based on Table 2, it can be seen that most of the topics/subtopics used the first and forth usage concepts. This explains the characteristics of AR, in which its ability is to help students to visualise real objects that are difficult or impossible to be brought over to class as they are either as big as the planet, Earth, or as small as molecules. Previously, the teachers used models, videos or pictures to help with students' cognitive process of visualisation. Although there is no substitute for the real thing while learning some topics (Smaldino et al., 2005), AR could be an alternative for teachers to assist them in teaching their students. In some situations, storage may be a problem to keep the instructional media such as models for future use. Therefore, the AR is an alternative for the solution.

This study discovers that the third usage concept is the most suitable usage concept for simulating some activities on certain topics in Islamic Study (TE3), where the AR enables one to see, interact and move the simulation in the

form of a 3D model in real time as if it is a real object. Moreover, most of the methods used in teaching and learning of Islamic Study, for instance in *ibadah* topic, will need the teachers to do demonstration or show-how to the students (TE3). The AR enables students to view the demonstration repeatedly and in different perspectives as they wish. On the other hand, the fourth usage concept is also known as the unique characteristic of AR as it is capable to attract students' attention due to its ability of the technology as used in certain topics/subtopics in the education field as shown in Table 2. Although this study only listed four usage concepts, there could be other usage concepts that are suitable for other domains, but not for Islamic Study. The usage concepts for AR application in Islamic Study may be useful as guidelines for those who are interested to use or develop an AR application or courseware. As a reminder by Gagne et al.(2005), he stressed that in most cases, new technology is used to reinforce the conventional approaches to learning. Thus, AR has this ability to complement other instructional media and also to fill the gap left by other instructional media (Norabeerah et al., 2011).

Conclusion

Although AR has been discovered since the last 40 years, it is still new to the field of education especially in Malaysia. Many studies have found out that it is suitable to be used in the education field. AR has already been implemented in several subjects. But, it is still new for Islamic Study. From the interview conducted in this study, all informants gave very positive responses and have admitted that this technology is suitable to be used in the education field in general and in Islamic Study in particular. From the analysis of the interview, four usage concepts in using AR application in Islamic Study have been identified: (1) AR acts as an aid to substitute the real object, (2) AR helps in explanation of processes, (3) AR acts as simulation tool, and (4) AR is able to attract attention. These four usage concepts may serve

as guidelines for those who are interested to use or develop the AR application in teaching and learning of Islamic Study.

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