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THE MODEL OF PERSUASIVE HAJJ LEARNING ENVIRONMENT

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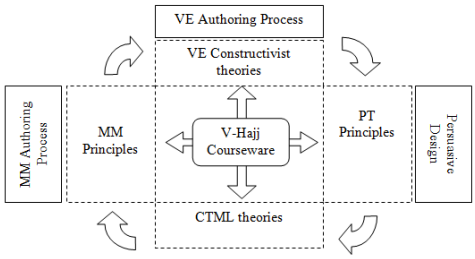
Graphical abstract



Abstract

Hajj is one of five pillars of Islam. Every capable and able-bodied Muslim is obliged to make the pilgrimage to Mecca at least once in their lifetime. Even though comprehensive courses were provided before the pilgrimage particularly in Malaysia, additional learning material is still needed. This is due to the complexity of Hajj procedures comprehension including the practical parts. Multimedia (MM) and virtual environment (VE) technology adaptation seems appropriate to be used for Hajj learning. Nevertheless, to design and develop a Hajj learning procedure application needs thorough preparation to achieve the objectives of use, particularly when it deals with elderly peoples who are not really interested in the technological approach learning. Thus, this paper proposed a model of persuasive Hajj learning environment and the theories usage; covering constructivist, MM principles, persuasive design principle and CTML use. This prototype was developed based on the model, and a heuristic evaluation also has been discussed in the end of topic. The methodology used in this study is an adaptation of the research design used by Vaishnavi and Kuechler in 2008. This paper is hoped to bring ideas and help designers and developers in the future.

Keywords: Multimedia; virtual environment; persuasive design; Hajj procedures

1.0 INTRODUCTION

According to [1], many pilgrims face many difficulties and problems to perform the Hajj as a result of lack of knowledge and weaknesses towards the practical steps of Hajj. This view is also supported by [2] based on their own experience, when they were bewildered by the amount of information, rules, tasks, practical steps and the Al-Quran verses that must be understood and memorized after the Hajj courses. Author [2] concluded that supplementary materials are the alternative solution to increase their retention and understanding towards the learning. However, according to [3], the existing supplementary learning materials for Hajj are lacking in terms of constructing learners' own experience. Practical steps in Hajj require pilgrims to involve actively in performing the steps for Tawaf, Sa'ie and throwing of the Jamarat. A survey was conducted as part of the preliminary study involving 60 respondents. A convenient sampling technique was applied and the age of the selected respondents was 19 years old and above. 22 respondents above the age of 40 were grouped as elder while 38 respondents between the age of 19 and 39 were grouped as youngster. Since there are various types of Hajj supplementary learning materials which include book, magazine, VCD/DVD, online, radio, talk, seminar, television program and computer application available in the market, the respondents were asked to select their preferences. The results of the preliminary study revealed that even though computer applications have been

widely used nowadays, the elder were not likely to use it as one of their preferred supplementary Hajj learning approach [4][5][6]. Whereas for the youngster, even though the computer application was not their first choice, they still considered it as one of their preferred supplementary Hajj learning approach.

2.0 PERSUASIVE HAJJ LEARNING MODEL

Figure 1 depicts the model of persuasive Hajj learning environment for this study. Seven important guidelines and elements have been identified as important for the V-Hajj study, based on the literatures and previous studies. They are related to; VE constructivist theories, PT principles, CTML theories, MM principles and persuasive design. Further details on how the model guidelines were used in the V-Hajj prototype are elaborated in the following sections.

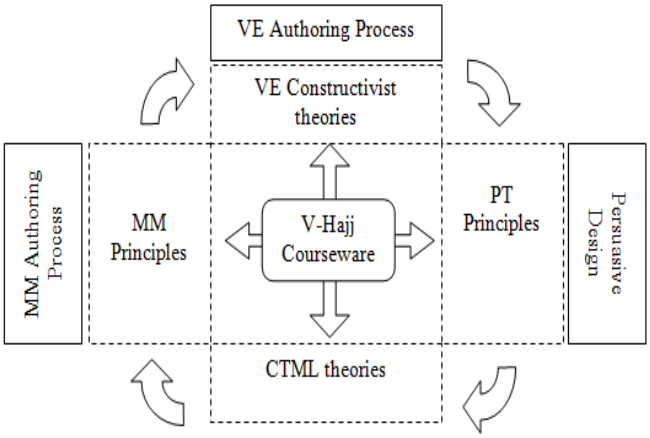


Figure 1 The model of persuasive hajj learning environment

2.1 VE Constructive Theories

Constructivist is important to shape learner's understanding towards a learning process which can be derived from active experience in the process [7]. According to constructivist theory, learning is not only a one-direction process, however it requires learner's active role to construct knowledge. On that matter, this study utilized VE technology in promoting active learning to the learners. Figure 2 depicts the VE part in the V-Hajj prototype. The VE parts enable learners to self-manoeuvre in the environment. In this study, three parts were involved in VE which include; Tawaf, Sa'ie and Throwing of the Jamarat. The VE simulates the real world of Hajj so that the users may understand and apply what they have learnt in the real context. Thus, VE has the capabilities in supporting the constructivist learning.

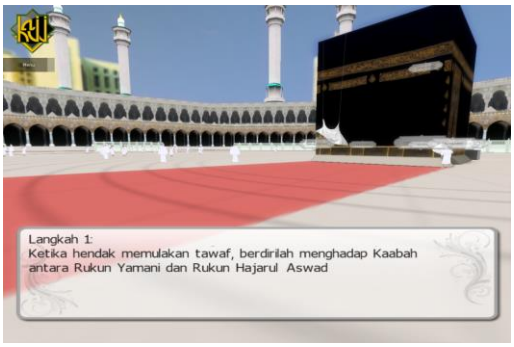


Figure 2 Self-Maneuver in VE supports constructivist theory

2.2 Persuasive Design Principles

Five persuasive design principles were used in this study as follows. The selections of these principles are based on the appropriateness of the principles in supporting this study. Figure 3 depicts the design use in the prototype.

Principle of Cause and Effect. VE can persuade people to change their attitudes or behaviors by enabling them to observe immediately the link between cause and effects [8][9][10]. In order to apply this principle, V-Hajj provides immediate response whenever users wrongly move in the practical steps such as the throwing of the Jamarat. A tool-tip sign will appear to warn the users, and then suggest the right area and steps to continue their throwing of the Jamarat. It was purposely done to change the behavior, so that the users will remember the actual procedures, whenever they are in the real situation.

Principles of Virtual Rehearsal. The principle of virtual rehearsal stresses that by providing motivating simulated environments, such as in *Tawaf* (in which to rehearse behavior) enables users to change their attitudes or behavior in the real world. V-Hajj provides learning by experience which can increase users' awareness towards the procedures. The experiences help the users prior to performing the real Hajj procedures. A learner can experience performing the Tawaf and reciting the related Doa step by step as presented by the V-Hajj prototype.

Principle of Simulations in Real-World Contexts. The principle of simulations in real-world context stresses that VE simulation that developed for use during every day routines can highlight the impact of certain behavior and motivate behavior or attitude change. Therefore, in this study the V-Hajj was based on the actual situation that will be faced by the users while performing the Hajj procedures. Regular maneuver of the VE for the Sa'ie procedure can enhance learners understanding on the procedures.

Principle of Conditioning. This principle emphasizes that the computing technology can be used for positive reinforcement in shaping complex behavior or transform existing behaviors to habits. In V-Hajj prototype, users will utilize, learn or practice for example the throwing of the Jamarat in a real time

situation whereby they can experience the process themselves and this will make them feel comfortable and confident with the procedure in the actual situation later. The practical experiences in V-Hajj make the users to be familiar with the Hajj practical procedures involving the Tawaf, Sa'ie and throwing of the Jamarat.

Principle of Similarity. This principle stated that the computer application or product that was built within some similarities with the target users can increase the persuasive impact. Thus, in this study, the simulations of VE emphasize the use of environments and characters that highly similar with the target users. The environment is similar to the real situation that the users will be in, and the characters were male and female pilgrims who are performing the procedures by wearing the *ihram* clothes. The similarities that have been created were attempts to persuade the users to use V-Hajj as their Hajj learning supplement as well as to provide real experiences to them.

2.3 Cognitive Theory of Multimedia Learning (CTML)

This study is an attempt to convey an effective learning environment for users to understand the Hajj procedures. CTML describes how cognitive science can guide us to create more effective computer-based training and MM instruction, which [11] simply defines as the presentation of material using words and pictures. CTML states that MM narration and graphical images produce verbal and visual mental representations, which integrate with prior knowledge to construct new knowledge. In fact, from the first phase, graphics (still or moving), animations and texts related to Hajj were organized in two; visual and verbal. For example, Figure 4 shows CTML and the Talbiah part for Hajj procedures. Besides the texts, the audio has also been embedded together to simplify the learner's understanding on how the doa is read. The multimedia elements were integrated in order for the information to be kept in the users' long-term memory. At the end of the process, it was hoped that V-Hajj can increase users' understanding and retain the memory on the Hajj procedures.

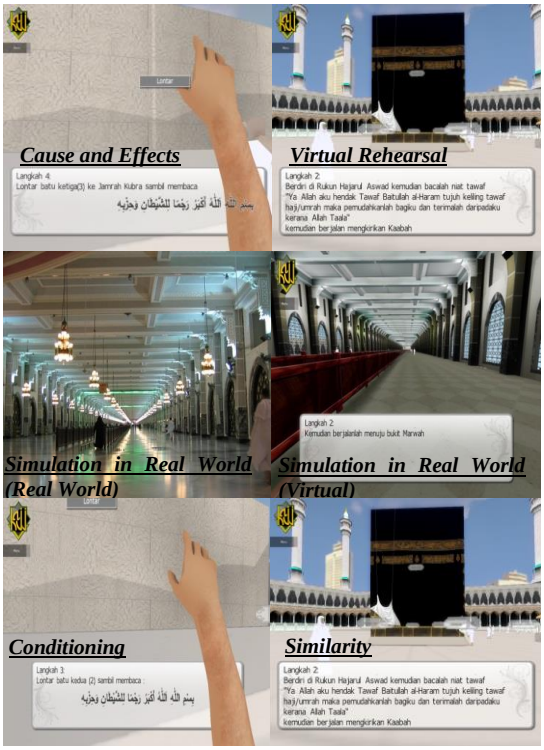


Figure 3 The example of persuasive design principles use

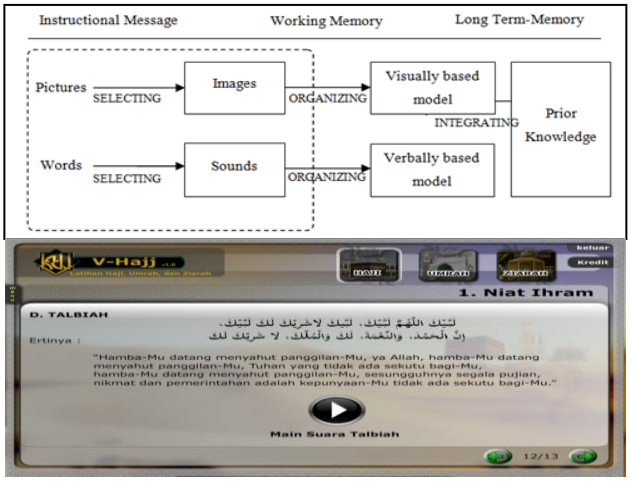


Figure 4 CTML and the theory use in prototype

2.4 Multimedia Principles

The collaboration among MM elements in a learning process might improve the learners' long-term memory in storing information and knowledge. Thus, [11] has summarized seven principles of nature and effect of MM presentation design to the learners. These Multumedia principles are derived from the light of CTML. Five principles were applied for the V-Hajj prototype as proposed by the persuasive Hajj model.

Multimedia Principle. This principle considers explanation in words and pictures is better than in words solely. For V-Hajj, every parts of the Hajj procedures was presented in the form of words and

pictures to facilitate explanations. The words can be either texts or narrations. For example, the figure depicts the instruction of the Tawaf procedures. The picture was used to simplify the learner's understanding on how the Tawaf should be.

Spatial Contiguity Principle. Spatial contiguity principle explains that when giving a MM explanation, words and pictures should be presented contiguously rather than separately. Thus, in V-Hajj, explanations and pictures were attached with contiguous texts or graphics. The figure shows the 'Clothing' part for men. Beside the texts in explaining the clothing rules, a picture is also embedded together to simplify the learner's comprehension.

Temporal Contiguity Principle. Temporal contiguity principle emphasizes that simultaneously presented corresponding words and pictures are better learned rather than successively presentation. Hence in V-Hajj, the pictures were presented simultaneously with the text explanation. The utilization of this principle facilitates the learners to understand the explanation together with the displayed pictures, rather to move next page to view the correlated picture. This principle can be viewed in the same figure of the spatial contiguity principle. The picture is presented simultaneously rather than successively in order to facilitate understanding among learners.

Coherence Principle. Coherence principle stresses that when giving a MM explanation; use only few rather than many extraneous words and pictures. In this study, by using the principle to facilitate users, the explanations in V-Hajj were brief and easy to understand. The explanations in the form of pictorial, videos and VE strengthen the information delivery to learners. As depicts in figure, the extraneous texts were avoided. Hence, simple figure is displayed to present the information to the learners.

Individual Differences Principle. This principle is related to the type of learners whereby the design effects are more important for low knowledge than high-knowledge learners, and for high-spatial rather than low-spatial learners. Considering this principle, V-Hajj attempted to maximize the use of graphics and animations to facilitate any level of users. The figure depicts a video of how wearing an ihram. Instead of many texts, V-Hajj presented a video together with texts in brief to ensure any level of low knowledge or high-knowledge learners and for high-spatial or low-spatial learners can understand the step easily.

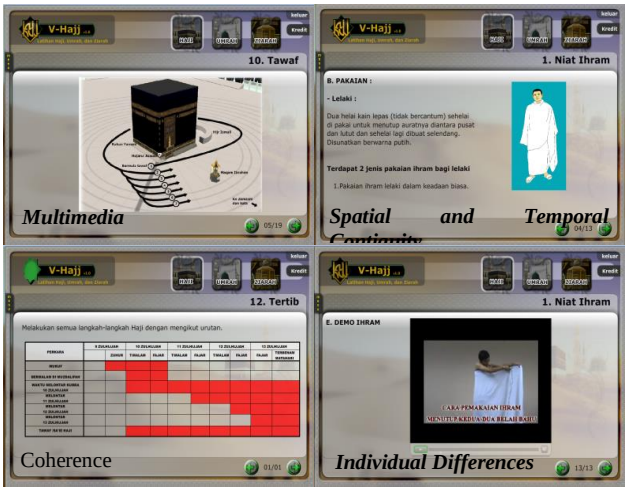


Figure 5 The example of multimedia principles use

3.0 HEURISTIC EVALUATION

Heuristic evaluations have been conducted by presenting the V-Hajj prototype to three experts of Hajj content, MM and VE interfaces. Nielsen's Heuristic guidelines [12] were used for the evaluation of the MM component of V-Hajj while VE Heuristic guidelines [13] were referred to for the VE component of V-Hajj. The expert for the Hajj content was a qualified Lembaga Tabung Haji Hajj instructor who has been conducting Hajj training for more than five years. While the experts for the MM and VE interfaces were lecturers who have been teaching in these areas for more than five years. The experts were responsible to check on the content and also the design and functionality of the V-Hajj prototype interfaces.

3.1 Multimedia Heuristic Evaluation

Table 1 presents the identified usability problems and suggestions provided by the experts based on the heuristic guidelines proposed by [12]. In this guideline, ten heuristics were adapted.

Table 1 MM Problems and Suggestions by Experts

Heuristic	Problem	Solution
Visibility of system status: the system informs and give feedback what's going on within a reasonable time	Feedback are slow, some of the menu not functioning well	Recheck the functions of each menu and repair
Match between system and the real world: the system speak users' language, follow the real world conventions, information appear naturally	**Suggestions:** Good presentation format but could be improved. No problem. The system is good enough for motivating the learners to study and make use of the system for the preparation to Hajj.	-
User control and freedom: provides the emergency exit for mistakes by users	-	-
Consistency and standards: the contents (texts, images, situations etc) do not confuse the users and the system should follow platform conventions	Some images are blur which can confuse the users what the pictures are **Suggestion:** The idea of presentations is good. Appropriate level of detail is good and just need additional contents	Try to find the good image with good resolution at least 300dpi
Error prevention: options are provided to avoid errors from the users	-	-
Recognition rather than recall: minimizes users memory load in remembering information	-	-
Flexibility and efficiency of use: provide accelerators to speed up interaction that can be applied by both inexperienced and experienced users, allow users to tailor frequent actions	Some of the interaction unattractive and hard to be controlled (the pages are long and must be scrolled down)	Change the scrolling pages with the back and previous button, only a page appear at one time
Aesthetic and minimalist design: Avoid extra information that is irrelevant or rarely needed	-	-
Recognize, diagnose, and recover from errors: error messages in a simple language and suggests solutions	-	-
Help and documentation: provide helps to the users	-	-

3.1.1 Solutions for Multimedia Heuristic Evaluation

(a) Visibility of system status:

This part stresses that the system should always keep users informed about what is going on, gives feedback within a reasonable time.

Problem:

- Feedback is slow because some of the menus are not functioning well.

Solution:

- Rechecking and debugging the non-functional menus.

Explanation for the problem:
The problems derived from the Flash Actionscript, because the scripting in Flash is very case-sensitive. All the non-functional navigation has been corrected and repaired.

(b) Consistency and standards:

This part is related to whether the users will confuse about the contents such as words, situations, images, actions or others.

Problem:

- Some images or pictures are blur.

Solution:

- Try to find the good image with good resolution at least 300dpi.

Explanation for the problem:
There are limitations in getting the raw materials in this case good quality photos. Some of the materials were obtained from the internet, books and photos.

(c) Flexibility and efficiency of use:

This part is related to the ability of presenting the contents or information in a facilitating way. It benefits both experience and inexperienced users.

Problem:

- Some of the interactions are hard to be controlled such the long scrolling pages.

Solution:

- The scroll bar approach in accessing the page was changed to slide presentation approach where only a single page will appear at one time and the pages can be viewed using the forward and backward buttons.

Explanation for the problem:
It was not actually a major problem if the user is familiar with the use of scroll bar approach, however, the slide presentation approach was used to make it easier for users to access the pages.

3.2 VE Heuristic Evaluation

Table 2 presents the identified usability problems and suggestions provided by experts based on the heuristic guidelines proposed by [12] and extended by VE principles from [13]. In these guidelines, twelve heuristics were evaluated. Table 3 describes the guidelines.

Natural engagement relates to interaction should approach the user's expectation of interaction in the real world as far as possible. **Compatibility with the user's task and domain** describes that the VE and behavior of objects should correspond as closely as possible to the user's expectation of real world objects; their behavior; and affordances for task action. **Natural expression of action** explains that **t**he representation of the self/presence in the VE should allow the user to act and explore in a natural manner and not restrict normal physical actions. **Close coordination of action and representation** describes **t**he representation of the self/presence and behavior manifest in the VE should be faithful to the user's actions. **Realistic feedback** is **t**he effect of the user's actions on virtual world objects should be immediately visible and conform to the laws of physics and the user's perceptual expectations. **Faithful viewpoints** explain the visual representation of the virtual world should map to the user's normal perception, and the viewpoint change by head movement should be rendered without delay.

Navigation and orientation support relates on how the users should always be able to find where they are in the VE and return to known, preset positions. **Clear entry and exit points** means of entering and exiting from a virtual world should be clearly communicated. **Consistent departures** emphasize the design compromises are used they should be consistent and clearly marked. **Support for learning** describes that active objects should be cued and if necessary explain them to promote learning of VEs. **Clear turn-taking** is where system initiative is used it should be clearly signaled and conventions established for turn-taking. Lastly, **Sense of presence** relates to the user's perception of engagement and being in a 'real' world should be as natural as possible.

Table 2 VE Problems and Suggestions by Experts

VE HEURISTIC EVALUATION
Natural Engagement
Problem: Major problem is some graphic rendering delays, interfered with the user's engagement during navigation. No collision detection was set up in the environment. *Suggestion:* Should no double-faces in the graphics environments. The collision detection should be added to increase users' senses in "Tawaf", "Sa'ie" and "Jamarat".
Compatibility With The User's Task And Domain – No problems
Natural Expression Of Action
Problem: Not really natural expression of action but in can be improved. *Suggestion:* For example, during Sa'ie, between the green light should show that the person is running slowly.
Close Coordination Of Action And Representation – No problems
Realistic Feedback – No problems
Faithful Viewpoints
Problem: The setting viewpoint is good but sometime its make faithful during the action in virtual reality where it's very fast and difficult to control. *Suggestion:* Try to control the viewpoints to be more flexible where maybe it can detect the speed of the computer and setting the viewpoints appropriately.
Navigation And Orientation Support
Problem: Good navigation and orientation support but can be improved. *Suggestion:* For example, measure the real distance between each "Rukun" in Kaabah and measure the normal steps of the people and make the system follow exactly the number steps needed to walk between each Rukun. It will make the user know how long it will take to perform the real "tawaf" (do not care about the crowd)
Clear Entry And Exit Points
Problem: For Sa'ie, the person did not know where they should start because the instructions are not completed. *Suggestion:* Adding the complete instructions for "Sa'ie" including the audio instructions.
Consistent Departures
Problem: Some of the places did not have consistent departures. *Suggestion:* For example, during "Sa'ie" for the second round is not consistent where the instruction is different than the person's moves. Checks back all the steps and instruction in all situations Tawaf, Sa'ie and "Melontar".
Support For Learning
Problem: The system supports learning in Hajj practical as the preliminary study before the users perform the real Hajj. The users can run the system many times at anyplace to make more understanding of the Hajj practical. *No Suggestions*
Clear Turn-Taking
Problem: Some position is not clear turn taking. *Suggestion:* For example, the viewpoint for "Sa'ie" should show the Start or 'sign in' first to do it.
Sense Of Presence
Problem: It should have collision detection for the users during the "Tawaf" to increase the sense of presence, which is, in reality, the people collide with each other during the "Tawaf". *Suggestion:* It must add more people and more crowds during the "Tawaf" and add collision detection.

4.0 DISCUSSION AND CONCLUSION

From the literature reviews, several prominent elements have been discovered in proposing an effective V-Hajj prototype for learning the Hajj procedures. The elements act as guidelines in developing the prototype and have been abstractly portrayed in the persuasive Hajj learning model. Basically, the model suggested two main technologies to be incorporated into the V-Hajj prototype. However, since this study also attempts to change the elders' perception towards a computerized learning material, persuasive design has also been incorporated. By applying the theory, the prototype was developed by referring to the actual environments and procedures of performing Hajj in Mecca. The learners can also experience maneuvering the environment on their own. However, future works are needed to make the Hajj more interactive and attractive besides can increase learners' comprehension. The application can be developed in fully immersive VE system by using CAVE to immerse the learners to the maximum level

in the VE while performing the learning process. On the other hand, the Hajj learning also can be upgraded to be in augmented reality environment as the augmented reality also has its own strength for engaging learning process. Augmented reality enables real and virtual information to be combined in a platform. It is hoped that these future recommendations can be implemented in some days.

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