Abstract: -The primary focus of this paper is to investigate the effect of including multimodal metaphors on the usability of e-learning interfaces. This investigation involved two different interface platforms performed by forty users. The first interface platform (textual interface) based on three input modalities, namely, text, graphic, and image was used to deliver information about note-taking. The second platform interface (multimodal interface) was based on three input modalities as well, including; speech, video, and avatar to deliver the same information. The aim of the study was to measure and compare the level of usability of textual and multimodal interfaces. The usability parameters, which are efficiency, effectiveness, and users’ satisfaction, were considered in the study. The scope of this paper is to discuss the results that related to efficiency only in terms of the time spent by users to complete the required tasks. The results obtained from this investigation have shown that the multimodal e-learning interface increased the level of usability as users took significantly less time to complete the tasks, performed successfully in a higher number of tasks.

Key-Words: - E-learning, Usability, User interface, Multimodal Interaction.

1 INTRODUCTION
There has been a marked increase in the number of e-learning websites in the recent years [1, 2]. However, some of these websites are consistent with Human Computer Interaction guidelines, in term of multimedia such as speech, avatar, and video [3, 4]. E-learning is one of the main facilities available to students in order to help them with their study [5, 6]. As more and more institutions are relying on presenting their material online, the need to present this material in a more efficient way has also increased [7, 8].

2 E-LEARNING
E-learning could be defined as the process of delivering, supporting and administering of the learning opportunity using electronic means. E-learning has become a popular method of teaching within academic institutions and organizations [9, 10]. Rosen berg (2001) argues that “e-learning refers to the use of the internet technologies to deliver a broad array of solutions that enhance knowledge and performance” [11]. Also there are some advantages of e-learning such as the students can plan the learning program according to their strengths and weakness [12]. Students are able to access the online learning 24 hours per day[13].

3 MULTIMEDIA METAPHORS
Recent studies undertaken in human-computer interaction on the use of multimodality have shown that use of multi-modal metaphors have positive effects on the usability of interactive computer systems [14, 15]. Other studies performed in this area have concluded that multimodality applications can be used to assist users for improving learnability [16, 17]. Focus on the visual channel of user to communicate information in its interface. In software applications, speech and sounds, after visual output, are the most common methods for communicating a response to the user[18,19].

4.1 EXPERIMENT
Two different interface of the experimental e-learning tool were designed to be used in this study. The first interface platform (textual interface) based on three input modalities, namely, text, graphic, and image was used to deliver information about note-taking. The second platform interface (multimodal interface) was based on three input modalities as well, including; speech, video, and avatar to deliver the same information. In each interface participants were required to make notes about specific words by selecting a word and then right clicking the mouse to display a menu of
options (add speech, add video, add avatar in multimodal interface and add text, add graphic, add image in textual interface). For example, in the multimodal interface the participant was required to read and select a word from a passage of text and then make some notes relating to the selected word by speech. The same task was then replaced with a recorded video for adding notes. In the last task, a human-like avatar was included in the multimodal interface to represent the recorded speech.

4.1 PROGRAM LANGUAGE

The experimental platform was developed using the visual basic programming language from Microsoft Visual Basic 6.0 because it was recommended to be useful software. This work was supported by the fifth Frameworks Programme. First frame box was the main interface which presented the output of textual interface text, graphic, and image; the others frames used as input of text, graphic and image. In the multimodal interface it was four frameworks programme. The first frame was the main interface that presented the output speech, video, and avatar.
4.2 PARTICIPANTS
Forty participants, consisting of under-graduates and post-graduates were selected to investigate the effect of including multimodal metaphors usability of e-learning interfaces. A post-experimental questionnaire at the end of the experiment was answered by all participants. Participants were 15% of them had a bachelor’s degree, about 30% had doctor’s degree and the remaining percentage had master degree 55%.
The participants have been grouped into three categories on the basis of age. The result shows that the majority are aged between 25 and 34 years old (43%) followed by those between 35 and 44 (38%) and the remaining percentage was over 35 years old.
The average genders of participants were 78% male and only 23% were females. The reason for a low number of female participants was due to scarcity of females meeting the criteria of English as a second language and some basic computer competency. The participants also had a scientific background and they were using the experimental platform for the first time.

4.3 TASKS
The participant was asked to go through four tasks in each interface. The tasks were designed with the objective of testing all the three different modalities listed above for the multimodal interface. For the textual interface the steps were exactly the same for each task. They were given a set of pre-selected words and some notes to add as comments for them. These tasks were gradually increasing in terms of complexity; thus, were equally divided into easy, moderate, and difficult. Each task comprised a set of requirements which asked the user to place the mouse cursor over a selected word.

In the first platform interface (textual interface) the user was required to make notes about a specific word by text, graphic, and image. In the second platform interface (multimodal interface) required to make notes by speech, video, and avatar. Each user had to do these steps for 3 words in each interface. The number of requirements in each task was proportional with the level of task complexity. After completion of the requirements, the time taken to perform the tasks and errors while performing tasks was recorded.

4.4 PROCEDURE
The participants were briefed on the procedure and then given approximately ten minutes to read and understand the text that they were expected to use in the experiment. Further, a quick demonstration of the procedure was given to ensure all participants fully understood what was required from them. This time spent was not included in the timings for the actual experiment. Each of the users had to individually accomplish each of the specified tasks. The experiment time was recorded for each individual task and also for the overall experiment.

5. RESULTS AND DISCUSSION
Task Completion Time
The results of the experiment show the mean completion time for all tasks in the multimodal interface was lower than textual interface. Figure 3 shows the mean values of task completion time. It can be seen that the time needed to perform the tasks in the multimodal interface was lower in all tasks.
The t values obtained by a series of t-test calculation showed a statistical significant difference between the two interfaces in relation to the time users spent in performing each of tasks. The difference was found to be significant ($t = 2.92$, $cv = 1.68$, $p<0.05$). The reason behind this result is attributed to the inclusion of speech, video, and avatar in the multimodal interface. These results explain the effect of speech, video, and avatar in the achievement of users in the multimodal interface and how these metaphors contributed to help them to complete the required tasks in required time.

Successful Completion of tasks

The users in multimodal interface managed to complete tasks successfully (approximately 95% or 152 out of 160 tasks) more than textual interface as they appeared in figure 4. The overall mean completion time for all tasks was significantly lower in the multimodal interface in comparison with the textual interface ($t = 2.72$, $cv = 1.68$, $p<0.05$). However, there were 76% and 24% of the users in the multimodal interface preferred to use the application based on video and avatar and the application based on recorded speech. On the other hand, there were approximately 78% of participants who participated in the experiment and described the multimodal interface as very good. Only a small percentage expressed negative view of such use. The experimental interface with multimodal was chosen and ranked positively almost by every user.

6. CONCLUSION

An empirical study involved two different interface platforms performed by forty users. The first interface platform (textual interface) based on three input modalities, namely, text, graphic, and image was used to deliver information about note-taking. The second platform interface (multimodal interface) was based on three input modalities as well, including; speech, video, and avatar to deliver the same information. The results in this paper have shown that incorporating speech, video, and avatar can improve the efficiency of e-learning applications. The overall time taken to complete the required tasks was significantly less when these multimodal interaction metaphors were utilised to communicate information about electronic notes.

References:


