Comparisons of Game-Based and Traditional Mobile Navigation Systems

Gwo-Haur Hwang[a*], Chien-Wen Jerry Chen[b] & Yu-Ting Huang[c]
[a]*Department of Information Networking and System Administration, Ling Tung University, Taiwan*
[b]*Department of Visual Communication Design, Ling Tung University, Taiwan*
[c]*Department of Information Technology, Ling Tung University, Taiwan*
*ghhwang@mail.ltu.edu.tw

Abstract: With the rapid development of science and technology, mobile navigation has become very popular. How to improve the learners' interest and motivation is very important. A lot of scholars have proposed game-based learning that can enhance learners' interest and motivation. In this study, we have developed two mobile navigation systems which include game-based as well as traditional ones. Thereafter, we try to explore how to improve the learners' interest and motivation. The experimental results show that, with 108 subjects divided into experimental group and control group, experimental group can really help the users' learner attitudes and behavioral intentions.

Keyword: Mobile navigation, game-based learning, learners' motivation, QR Code

Preface

In recent years, arts and humanities have been increasing emphasis. Most of people like to make the outdoor leisure or learning activities to be the depth of travel, such as museums, art galleries and marine biology museum. In these locations, mobile navigation is indispensable. Good mobile navigation can provide information, guide, and education. Visiting the exhibits in the process builds bridge between people and systems. Mobile navigation provides services for people to use to explain the media, to get good information and experience to the people (Kuo, Wang, & Liu, 2007) [8].

During of mobile devices and wireless networks, mobile device-assisted learning and teaching strategies to the wireless network for teaching and learning environment, are not less to diversified teaching. Game-Based learning is gradually importance attached by the information education, and many scholars believe that the game is the leisure activities followed rules of the game, but the nature of the game with goals, constraints, competition, rewards, results to attract people's spend the time to practice and competition (Dempsey, Lucassen, Haynes, & Casey, 1996) [3]. Game-based learning is considered to be a way of learning can enhance learners' learning interest and motivation. This study, with game integration into the exhibits, explores the game-based and traditional learners in the navigation systems. The study adopts a questionnaire to analyze the use of satisfaction and cognitive load, also collects written experience to understand the process and condition of learners.

1. Review

1.1 Mobile navigation

Arts and humanities is very important, but a lot of learners are lack of art knowledge, thus spent a long time during the navigation, and unable to understand the contents of the exhibits. In the navigation, it's more attractive for learners to operate and interact than just visualize. Yang (2006) referred to navigation-assisted can learn at any time and any place, the content must be shown the learning materials and wireless communication between teachers and students [11]. Hwang, Chen, Lai and Lin (2009) used RFID to design a set of adaptive navigation system. Learners achieved in the right place to meet the learners' level and the exhibition time of learning content which improved navigation effectiveness [4]. Chen, Jhanh, Yang, Wu and Huan (2010) used RFID with mobile devices combined with the concept of game to learn, that made learners get the information of the navigation quickly [5]. Tian and Lu (2009) used QR Code to link art and learning platforms with in the school, learners could explore and use mobile devices to interact with the learning, teaching and learning activities at any time and place [9]. Therefore, this study will also use the QR Code to link to the school Art Center, and combine the game-based learning to design navigation system.

1.2 Game-based learning

Game-based learning can help learners to practice repeatedly, contribute to memory and willingness to learn (Brophy & Good 1986) [1]. Prensky (2001) also emphasized that game-based learning should include features with fun, play, rules, goals, interactive, outcomes and feedback, adaptive, win states, competition and challenge, problem solving, representation and story [7]. Yu, Hsiao, Hung and Tsai (2004) showed that game-based learning can improve learners' motivation and active participation in learning, and sustained the attention of the learners in the learning process [6]. Hsu, Liu and Wang (2011) used learning websites in the museum for learners, applying game strategies to enhance the learning satisfaction, and attracted children immersed in the exploration and learning. This is a key factor in the continuing use of this system [10]. Accordingly, in this study, the navigation system will be integrated into the game-based learning; learners in the process of navigation can retrieve the learners' curiosity and attention to enhance learning motivation.

2. Introduction System

2.1 Game-based navigation system: Experimental group

The learners can use the smartphone to photograph the QR Code of exhibits and then get into the game-based navigation system. First, learners can choose a helper right after login ID and password (Figure 1). The helper will lead the learners to the introduction of the exhibit content and narration during the navigation (Figure 2). And then, get into the navigation product questions and answers (Q & A). The Q & A content is the subject of the exhibits (Figure 3). While getting the correct answers, there are two food bags provided for learners, whereas wrong answer will be deducted a food bag and won't be given the answer (Figure 4). By the way, the answer in the subject will not happen again until the exhibits Q & A are completed. When subject answers are all finished from the questions, learners will go back to home of helper (Figure 5). The helper's home shows the amount of food bags on the top list. The helper will eat a food bag each minute until

consumption to nothing at all. If the food bag is not consumed in the Q & A phase, learners will be lead to the angel list (Figure 6).

Figure 1 Choose a helper

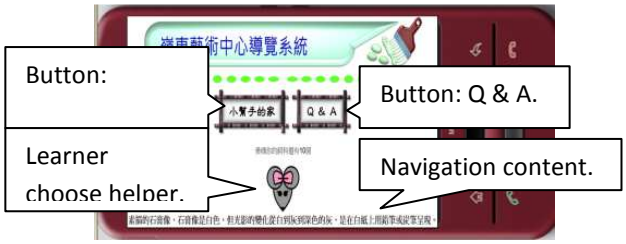

Figure 2 Navigation

Figure 3 Q & A

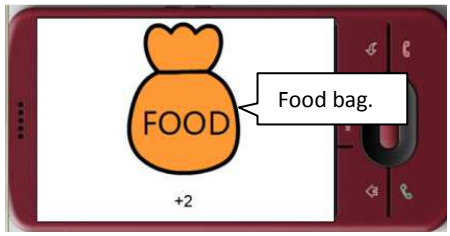

Figure 4 Learners get two food bags while answer correctly each time

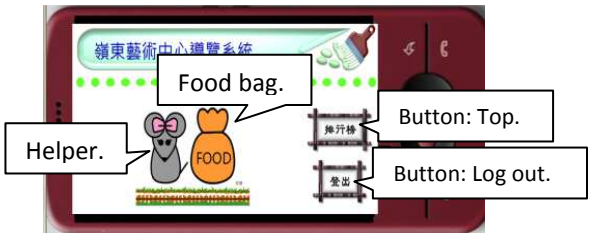

Figure 5 The helper home

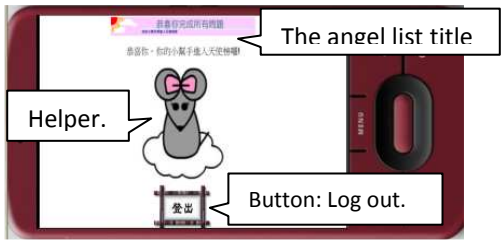

Figure 6 The angel list

2.2 Traditional navigation system: Control group

The learners can use the smartphone to photograph the QR Code of exhibits and then get into the traditional navigation system (Figure 7). The system will guide the learners to the introduction of the exhibit content and narration in the navigation. The system can provide the learning information during the process. When navigation ends, learners can photograph the other exhibits' QR Code until the navigation reaching the end.

Figure 7 Traditional navigation

2.3 Art Center

This study used the exhibits of the art center at one university of science and technology in Taiwan. The art center provides school exhibited arts and design achievements that brings art to the teachers and students and people of neighborhood. Thus, teachers and students may get closer to the art and culture (Figure 8).

Figure 8 Art Center

3. Planning and analysis of experiment

3.1 Experimental framework

In the end of the experiment, written questionnaires were required for the learners which will be used to explore the learner motivation, technology acceptance model (Davis, 1898) [2] and learners' cognitive load. The questionnaire is analyzed with SPSS to explore whether the use of diverse navigation systems make different. The experimental structure is revised and updated by the study that was drawn by dimensions (Figure 9).

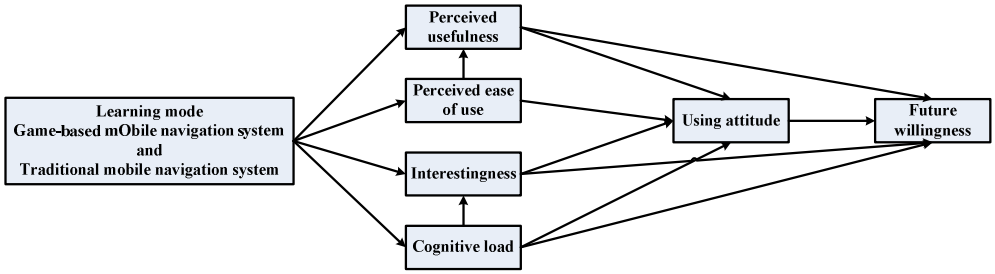

Figure 9 Experimental framework

3.2 Subjects

In this study, the experiment was conducted on June 8, 2012 at one university of science and technology in Taiwan. The students of school of design were the experimental subjects. The subjects were divided into game-based navigation system group known as the experimental group (Figure10) and traditional navigation system group known as the control group (Figure11). There were 54 learners in each group to participate the experiment.

Figure10 Game-based navigation system

Figure11 Traditional navigation system

3.3 Experimental process

The experimental procedure took two classes, total of 110 minutes, including 10 minutes break (Figure12). First, the experimental activities were carried out in 50 minutes; the system uses the description and the smartphone for the experimental subjects. After 10 minutes break, the experimental subjects were lead to art center. In order to avoid missing the learning objectives, the control group was given a study list. It took 50 minutes for each group to write the questionnaire and the experiment experience.

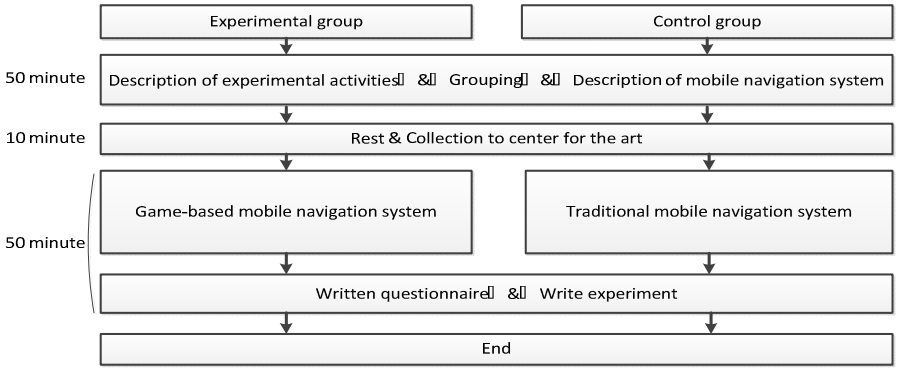

Figure 12 Experimental process

3.4 The experimental results

In this study, 108 questionnaires were distributed and 107 were retrieved, 99% recovery rate. There were 54 subjects both in the experimental group and control group. The missing or invalid questionnaire was not adopted, thus the valid questionnaires were 79. In experimental group, the overall reliability of Cronbach's Alpha value is .881 and the overall reliability of Cronbach's Alpha value is .863 in control group. Overall, this questionnaire is credible (Table 1).

Table 1 Number of participants

	Experimental group	Control group
Number of participants	54	54
Valid questionnaires	37	42
Cronbach's Alpha	.881	.863

3.5 Questionnaire analysis

The questionnaire used Likert 5-point (5 stands for very satisfied, 1 stands for very dissatisfied). Questionnaires were analyzed using independent sample t-test which investigated whether the different mode of learning impact on aspects. Perceived ease of use in the questionnaire analysis (Table 2) showed that the control group system is easier to operate than experimental group system, but less significant differences. Perceived usefulness of the questionnaire analysis (Table 3) showed that the experimental group system is better than the control group system. Concerning the experience in the experimental group within the system, Q & A provided may deepen learners' impression and increase the sense of accomplishment, but less significant differences. Cognitive load of the questionnaire analysis (Table 4) found that two groups are not confronting with the problem of cognitive load.

Table 2 Perceived ease of use

		N	Mean	SD	t
Perceived ease of use	experimental group	37	3.76	.51	-.735
	control group	42	3.87	.75	

Table 3 Perceived usefulness

		N	Mean	SD	t
Perceived usefulness	experimental group	37	3.81	.65	1.717
	control group	42	3.54	.69	

Table 4 Cognitive load

		N	Mean	SD	t
Cognitive load	experimental group	37	3.31	.88	1.383
	control group	42	3.05	.72	

In the questionnaire analysis (Table 5) discovered more interestingness in the game-based learning system than in the experimental group system, with 3 stars significant. While testing the indirect effects of attitude (Table 6), the questionnaire analysis showed that attitude in the experimental group was more significant than the control group with 1 star. It also directly affects the future willingness (Table 7), the questionnaire analysis showed that the experimental group was more willing to use the system than the control group in the future with 1 star significant. In accordance with Davis (1986) Technology Acceptance Model, use of attitude will directly affect the future wishes, and so implementing the game-based learning in the mobile navigation system, can increase learners' motivation.

Table 5 Interestingness

		N	Mean	SD	t
Interestingness	experimental group	37	3.66	.64	4.462***
	control group	42	3.02	.61	

*p<.05. ** p<.01. ***p<.001.

Table 6 Using attitude

		N	Mean	SD	t
Using attitude	experimental group	37	3.56	.63	2.498*
	control group	42	3.17	.74	

*p<.05.

Table 7 Future willingness

		N	Mean	SD	t
Future willingness	experimental group	37	3.50	.86	2.294*
	control group	42	3.08	.74	

*p<.05.

Conclusions and future work

In this study, two mobile navigation systems were developed: one is game-based and the other is traditional. The systems were used on the exhibits of the art center at one university of science and technology in Taiwan, to explore the use of system satisfaction, interesting of learning process and differences in cognitive load. Researchers found that the experimental group system providing real-time narration in the game navigation helped learners better understanding the exhibits, also enhanced learner motivation and wanted to use the same way to continue their studies. The control group with traditional navigation system aroused immediate doubt of explanation. The control group queried this way was unnecessary and why not just post the description next to the exhibit. This study did not explore the learners' learning outcomes, only exploring which group of learners increasing motivation, without exploring which group achieved better learning results. The future work for learners in the learning process, learning outcomes to differences in game-based navigation system and traditional navigation system are suggested.

Acknowledgements

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