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Study of Game-based Learning upon Flow Experience: An Example of Mobile App System for Visit Historical Monuments

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Abstract: This study aims to develop a smartphone application system that helps users search for historical monuments. Users can discover the history and historical attractions of Yilan City, Taiwan through the system; moreover, they can use the navigation function to locate the attractions conveniently and quickly. In addition, the system has a built-in evaluation and feedback function that allows users to understand their learning effectiveness. This study collected data via a quasi-experimental method from 55 undergraduates enrolled in courses related to the study of historical monuments. Flow questionnaires were distributed after the participants had used the system. Statistical findings indicated that presenting courses related to historical monuments in the form of stories and games is more effective in evoking the interest of learners.

Keywords: Game-based learning, Flow experience, learning effectiveness

1. Introduction

Due to the rapid changes in computer technology, the development of both hardware and software equipment have undergone rapid progress. The impact of computers is observed in not only companies, homes, schools, and design but also socialization and the field of education. In recent years, game-based learning has made considerable contributions to strengthening learning experiences (Connolly, Stansfield, & Hainey, 2011). Computer-assisted learning is also becoming more common, as it improves users' willingness to learn and learning effectiveness (Admiraal, Huizenga, Akkerman, & Dam, 2011; Peter, James, Chen, & Kulik, 1982). Computer games have already become a teaching method that can achieve satisfying learning outcomes, and the use of play in teaching is one of the most effective ways of motivating users to learn. Playing games is a positive activity in itself. If the learning process is made as interesting as a game, it would be an ideal learning method. Using computer games is a promising approach in game-oriented teaching. An interesting teaching environment can easily be developed by combining a game-based story with computer multimedia sound and light effects (Liao, 2001). Game-based learning is the combination of learning and play. However, it comprises certain rules, and users can only complete the levels through repeated practice and operations (Frost, Wortham, & Reifel, 2001). Since it can increase the fun in learning and combines teaching with entertainment, game-based learning is an effective learning method (Ang & Radha, 2003). Digital game-based learning is a close combination of digital learning and computer games; it uses computers as a tool to conduct game-based learning (Prensky, 2001). In recent years, digital technology and learning have garnered the interest of the education sector. In an era where smartphones and tablet computers are commonplace, teaching and teaching aids are no longer limited to traditional blackboard writing and paper textbooks; rather, by connecting to the Internet, which offers unlimited information transfer, users can utilize and learn through digital technology products, such as desktop computers, smartphones, tablet computers, or portable devices, to improve learning effectiveness and make learning more interesting. Thus, technology devices have gradually become an important tool in facilitating teaching. This study aims to understand the historical and cultural monuments of Yilan City in Yilan County, Taiwan. Thirteen architectural monuments, including the Zhongshan Park, were selected, and a story- and game-based learning application system for

smartphones or tablet computers was designed. The historical stories in the system were written based on information that was retrieved from historical references and relevant to the attraction. The stories featured dialogues about the history of the attraction and narratives on the development of events. Before and after an event, the system would automatically generate a question for the user to answer. Thus, in addition to advancing in the game, users could gauge their own level of awareness. The study objectives were three-fold: 1. To understand the level of user acceptance for the system. 2. To understand the level of user engagement while using the system. 3. To understand the level of difficulty for a user while using the system.

2. Literature Review

With the development of computers and networks, computer games have gradually played a leading role in the related media product chains. As the number of computer and mobile phone users increases, the proportion of people using such devices for gameplay is also rising (Wang & Chen, 2010; Papastergiou, 2009). Malone and Lepper (1987) highlighted that computer games incorporate factors such as imagination, challenge, curiosity, and control that can attract the attention of children. Computer games, with their sound and light and special effects, provide instant rewards and satisfaction to the players (Dickey, 2011; Ebner & Holzinger, 2007). Computer games are interesting because real-life games are relatively boring. Thus, computer games are more capable of captivating the interest of users (Miller, Chang, Wang, Beier, & Klisch, 2011). Computer games have received many positive evaluations in research about their use in learning; for example, repetitive game processes can enhance learning outcomes (Ebner & Holzinger, 2007), provide learners a sense of dominance and accomplishment (Selnow & Reynolds, 1984), promote active participation and strengthen competitive learning, thereby enhancing learning outcomes (Alessi & Trollip, 1985), and allow learners to find more interesting learning methods beyond traditional textbooks (Embi & Hussain, 2005; McLaren, Adams, Mayer, & Forlizzi, 2017). In addition, the results of the survey by Selnow and Reynolds (1984) revealed that the process of computer games allows players to gain a sense of dominance and accomplishment that is unattainable in real life. Malouf's (1988) study allowed users to learn using computer game-based and non-computer game-based teaching. The results revealed that the learning motivation was higher among users who experienced computer game-based teaching. Digital game-based learning is the new trend of the twenty-first century; learners particularly favor game-based teaching (Huizenga, Admiraal, Akkerman, & Dam, 2009). Prensky (2001) asserted that digital game-based learning is a close combination of any educational content with computer games; it can be defined as any educational game on a personal device or online. The American scholar of game-based education, Gee, published an academic paper that greatly influenced digital game-based learning (Gee, 2003). According to the paper, a game design must include three important elements: storyline, core mechanism, and interactivity (Ding, Guan, & Yu, 2017; Rollings & Adams, 2002). The storyline is a crucial element for attracting learners, the core mechanism is the knowledge to be learned, and the interactivity influences the length of time that learners spend being immersed in the game. Ketelhut and Schifter (2011) argued that a game-based learning environment can stimulate students to reflect on the knowledge they learn in a game, allowing students to acquire knowledge through games, and experience learning in a relaxed way. Many studies have shown that appropriately integrating learning content into a game-based environment can improve students' learning performance, maintain a happy mood among students, and enhance their learning interest and motivation (Burguillo, 2010; Dickey, 2007; Gros, 2007; Harris and Reid 2005; Kumar, 2000; Malone, 1980).

3. Research Method

3.1. Participants

The study participants were 55 students (49 males, 6 females) enrolled in a general education course at a university; among them, 33 were freshmen, 14 were sophomores, 6 were juniors, and 2 were seniors. The participants used our system during class to search for designated historical attractions and applied the related system functions. Under the leadership of the lecturer and guidance of the researchers, the participants spent two hours a week for three weeks to complete two visits to historical sites in Yilan. They also read and evaluated a chapter extracted from the historical stories, and finally completed questionnaires built into the system.

3.2. System design and development

This system is a smartphone application that integrates stories and game-based learning with the aim of allowing users to search for and discover historical monuments in Yilan. The system was developed using the development platform of Android Studio; Java was used as the programming language. The system framework includes five major components: historical stories, introductions of attractions, quick navigation, evaluation feedback, and questionnaire survey. The details are outlined as follows:
(1) Historical stories: The history of Yilan was used as the background; the development stories of Yang Tingli (eighteenth century official) and other historical figures were also included. The objective is to allow users to learn about the history of Yilan by reading stories.

(2) Introductions to attractions: It offers users a choice of historical attractions to visit; the information is presented using images and text. The aim is to enable users to learn about the historical origins of the monuments.

(3) Quick navigation: The system uses the Google Maps application interface to provide route suggestions to travel from their current location to the historical attractions.

(4) Evaluation and feedback: To enable users to know whether they are absorbing and understanding the history in the process of reading the historical stories, when a user completes a certain section or paragraph, the system displays a question window related to the story content for the users to answer. This helps users continue with the story smoothly. In addition, after users complete the test, the system automatically checks the answers and calculates and displays the score, providing users with immediate feedback.

(5) Questionnaire survey: To understand the levels of user acceptance, engagement, and difficulty, a Likert five-point scale was set up in the system using Google Forms. The Cronbach α coefficient was .851, indicating that the consistency criterion was fulfilled. The Cronbach α coefficient for each dimension also fulfilled the criterion (>0.7) and passed the reliability test.

This study developed a smartphone application that can help users discover the historical monuments of Yilan. Through the stories and game-based learning in the system, users can learn about the history of Yilan and read the introductions of various historical attractions. They can also locate the attractions quickly and conveniently by using the navigation function. In addition, the system also has a built-in evaluation and feedback function to help users understand their learning effectiveness.

4. Results and Discussion

In summary, the study objectives were three-fold: 1. To understand the level of user acceptance for the system. 2. To understand the level of user engagement while using the system. 3. To understand the level of difficulty for a user when using the system. According to the data collected in the study, 79% of the participants had a level of acceptance of "Acceptable" or better, whereas only 7% of users expressed dislike, as shown in Figure 1. This indicates that the system is relatively favorable. In terms of level of interest, 80% of the users chose "Acceptable" or better, whereas only 6% of the users found it uninteresting, as shown in Figure 2. This indicates that users generally find it interesting to learn about historical monuments using smartphones. Regarding the level of difficulty, 80% of the users believed it was acceptable, simple or very simple, whereas only 5% believed it was very difficult, as shown in Figure 3. This indicates that the design of the system's user interface is simple; in other words, it was easy for users to begin and operate.

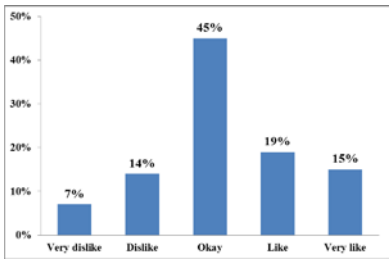

Figure 1. Level of acceptance

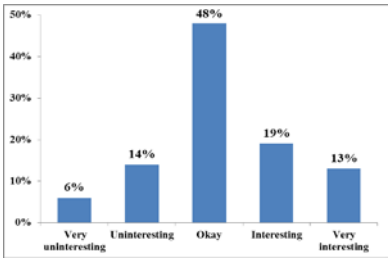

Figure 2. Level of interest

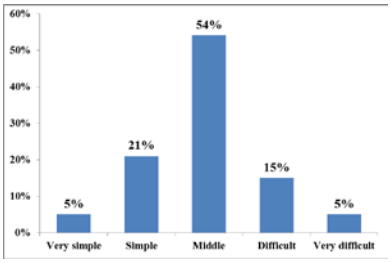

Figure 3. Level of simple

5. Conclusions and Suggestions

The system was self-developed, including the story scripts, program design, artwork, music, and sound effects. Although the system still has considerable scope for improvement, it has not been an easy process to achieve the current functions. According to the results of this study, presenting a course related to historical monuments in the form of stories and games can stimulate interest in learners. This study presents four suggestions for reference in future research: 1. Improve the design of the user interface, for example, page transitions, animation effects on the login page, effects during page switching, and appropriate special effects; 2. consider allowing users from a wider age range to use the system, making improvements such as enlarging the font size of the text, reducing the difficulty level of assessment questions, and improving the clarity of questions to make them easier to understand; 3. instead of retaining the current single endings of the historical stories, consider including plots related to the places or people involved, to enhance the interest of users; 4. develop an iOS mobile version to expand the user population.

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