



# The Effect of Gender on Motivation and Student Achievement in Digital Game-based Learning: A Case Study of a Contented-Based Classroom

Liang-Yi Chung

Chihlee University of Technology, TAIWAN

Rong-Chi Chang

Taiwan Police College, TAIWAN

Received 31 May 2016 • Revised 22 October 2016 • Accepted 31 October 2016

## ABSTRACT

This study attempts to probe into the impact of learners' gender on learning outcomes and motivation. A digital game focusing on the topic of emergency first aid is designed for the purpose of this present study, according to the curriculum objectives for a content-based instruction (CBI) course as part of the experiment. In the process of playing the game, learners are able to acquire both first aid knowledge and language skills at the same time. Results show that gender has no significant effect on the learning achievement, but causes significant differences in learning motivation. Learners of different genders are found to have better learning achievement through digital game-based learning. In a moderate genre digital game, female learners' motivation is significantly higher than that of male learners. The usability of the digital game in this study receives positive response from learners regardless of gender. This evaluation on usability is correlated with the findings of this study. Our analysis also demonstrates that game contents in the moderate genre reduce the effect of gender on learning achievement and motivation. Based on the above findings, this study suggests a relationship between gender and digital game-based learning and proposes avenues for further research.

**Keywords:** digital game-based learning, gender, motivation, achievement

## INTRODUCTION

Learning in the digital age capitalizes on the use of new technologies to attract students to gain new knowledge and achieve better learning outcomes. Among these technologies, digital games act as a medium that offers entertainment, and have been widely used in recent years in complementing learning in the classroom. For the digital native generation, the incorporation of digital games in the learning content facilitates the utilization of knowledge intended to be learned and more in-depth understanding of the contents. The impact of game-based learning lies in triggering their intrinsic motivation and interaction (Farber, 2015; Hogle, 1996). As an extension of the concept of game-based learning, digital game-based learning furthers the engagement and interaction through the use of computers and online media.

© **Authors.** Terms and conditions of Creative Commons Attribution 4.0 International (CC BY 4.0) apply.

**Correspondence:** Rong-Chi Chang, *Taiwan Police College, Taiwan.*

✉ [rongchi@gmail.com](mailto:rongchi@gmail.com)

### **State of the literature**

- Adaptive digital game learning mode encourages active learning and enhances learning motivation.
- Digital games combined with educational contents can improve learners' thinking and reasoning skills and allow them to have fun in the process.
- The differences of how learners of different genders receive and process information affect their learning outcomes in a digital learning environment.

### **Contribution of this paper to the literature**

- Digital games integrated with subject knowledge have a positive impact on learning motivation.
- Digital games of a moderate genre benefits learners by helping them enhance their cognitive, affective and skills development, regardless of gender.
- There are no significant differences in the attitude towards digital game-based learning between genders.
- Regardless of gender, learners display high levels of participation and interaction through the digital game-based learning process.

Interactive and fun learning activities developed through digital games not only enhance the immersive engagement of learners but also help achieve the goals of sustained learning (Prensky, 2001). Better learning outcomes can be achieved through the experience gained during the process and the interactive feedback from their peers.

The rapid advances and ubiquity of mobile technology have driven the development of digital games, in turn making digital game-based learning an emerging educational approach and strategy. This rise has led to the research of digital game-based learning in diverse contexts. Gender is one of the factors studied for its influence on learning differences and outcomes. Studies have shown that different genders prefer different game achievement goals which affect learning outcomes (Kapp, 2012; Kinzie & Joseph, 2008; Jakobasson, 2011). Men are focused on attaining achievements in games, thus they prefer the goals of "performance" challenges. Women, in contrast, like the learning relationship with peers in games, preferring the goals of self-pursuit. Yee (2006) maintained that the motivation from games is related to behaviors, and achievement is one of the critical elements in game motivation. The achievement goals in games trigger men's motivation to learn, thus making them to exhibit a more active performance than women. However, Begy & Consalvo (2011) proposed a different view, where they pointed out that effective instruction design using digital games can also inspire learning motivation and performance in women. Hsu (2013) further confirmed that with appropriate instructional guidance, digital games have a positive impact on female learners to effectively enhance their learning performance. It can be concluded that the learning performance and motivation from digital game-based learning vary by gender, but adaptive instruction can provide positive guidance.

Digital game-based learning focuses on learning and engagement, which affects the motivation and learning achievements of learners. Prensky (2007) pointed out that the ideal digital game-based learning involves high intensity and high engagement activities. Gender difference is further accentuated in these types of learning situations. Current studies on gender differences in digital game-based learning are primarily focused on the preferences of game types and comparison of learning methods; few studies have analyzed the motivation and learning achievements in relation to learning and engagement. Therefore, this study aims to delve into the impact of gender on motivation and learning achievements by looking at the relationship between engagement in digital games and learning. Studies on the integration of digital games in subject learning have shown that this approach is particularly suitable for uninspiring difficult subjects, because students generally lack the needed learning motivation for these subjects. A content-based instruction (CBI) class, which combines language and subject learning, is chosen as the focus of this study. CBI is characterized by interdisciplinary learning, where learners have higher learning goals, including the acquisition of language skills and subject knowledge. A digital game is designed to assist learning in a CBI classroom for the purpose of the study. The impact of gender on learning motivation and performance is investigated by probing into learners' engagement and learning in the process of using this digital game.

## LITERATURE REVIEW

By applying the concept of digital game-based learning, this study examines the impact of gender on motivation and learning achievements through a CBI course. Literature review is divided into three parts, including digital game-based learning theory, gender differences in digital game-based learning, and the content and structure of CBI.

### **Digital Game-based Learning**

Studies have shown that digital game-based learning provides an atmosphere and opportunities for learners to be actively engaged in learning (Garris, Ahlers & Driskell, 2002). By participating in the games, interactive learning is achieved through the cooperation or competition among learners. Digital game-based learning can also promote high-level thinking (Dondlinger, 2007). From the cognitive development point of view, Piaget (1929) noted that the construction of knowledge is the result of the interaction between an individual and their environment. Participants in digital games are also experiencers who are essentially consolidating what they have learned to solve problems or make a decision in a game. Such interaction design is in line with human cognitive architecture, where learners have the opportunity to immerse themselves in the learning situation. Compared to conventional instructional media and tools, digital games are able to promote learners' thinking capacity and enhance their interests in learning. Prensky (2007) suggested that digital games are characterized by several elements, including entertainment, gameplay, rules, objectives, human-machine interaction, outcomes and feedback, adaptability, sense of triumph, conflict

competitiveness and challenges, problem solving, social interaction, images and narratives; the impact of these factors has been validated in various studies.

In the application of digital game-based learning in language instruction, Lee et al. (2008) found that the entertainment factor in digital games reduces the anxiety of second language acquisition. Adaptive digital game-based contents can help learners learn more effectively and raise their motivation. Cornillie, Clarebout, & Desmet (2012) indicated that second language learners are more engaged in games through role-playing, which effectively enhances the learners' intrinsic motivation and learning outcomes. Furthermore, digital game-based learning is even more effective when the virtual contents overlap with professional knowledge in the real world. Virvou, Katsionis, & Manos (2005) integrated virtual reality in digital learning games, and found significant enhancement and improvement in students' learning motivation and learning outcomes. Delwiche (2006) used Massively Multiplayer Online Games (MMOGs) to teach students about research methods, game design and cyber culture, and learners displayed positive and motivated response towards the educational approach using MMOGs. According to Delwiche (2006), the virtual interactions in digital games make learning more dynamic. Findings from Chuang & Chen (2009) also demonstrated that virtual reality in digital games can help improve learners' ability in fact differentiation and recall processes, and enhance their cognitive thinking and problem-solving abilities. In short, digital games serve as an effective medium for learning.

### **Gender and Digital Game-based Learning**

According to Riding and Grimley (1999), the performance of digital learning is differed by gender. One key reason lies in the different approaches adopted by men and women in receiving and process information. Riding and Grimley (1999) suggested that women tend to have a more complete understanding of information than men, since women are willing to spend a longer period of time to process new information and associate the newly received information to existing knowledge. On the other hand, men have a more shallow understanding of new information, but are able process more information than women. This gender difference in information processing is also reflected in the different attitudes towards digital game-based learning. As opposed to women who prefer exploratory games, men prefer gameplay that involves strategy and direct instructions given by the system. In addition, women's tend to adopt autonomous learning, while men see digital games as a medium for socializing and skills development. This explains why men are more engaged in digital game-based learning with higher sense of participation and motivation.

There are significant cognitive learning differences between genders. Women tend to have a clearer understanding of the game content and objectives in the digital game-based learning process. Female learners perform better when they need to apply the knowledge learned during the process to complete puzzles and quests. Meanwhile, digital games featuring a story line and role-playing offer a guidepost for learning; male learners perform better in these types of games than their female counterparts. Wang and Wang (2008) found

that male learners experience higher pleasure and satisfaction when playing Massively Multiplayer Online Role-Playing Games (MMORPGs) which highlight cooperative learning. This positive affectivity allows men to reach higher learning achievements from playing MMORPGs. Lowrie and Jorgensen (2011) showed that the level of cognitive perception differed by genders plays a role in the attitude towards digital game-based learning, and learning attitude is correlated to learning achievements.

### **Content-Based Instruction**

Content-based instruction (CBI) is an approach in language education based on subject-matter contents. Unlike common language education approaches centered on imparting language skills, CBI is conducted through synchronous learning of a language through "subject contents", since every course has its particular subject-matter contents. Many second language or foreign language instruction methods first set forth the language skills to be learned before looking into suitable subject contents to match the learning (Richards & Roders, 2001). In contrast, the CBI approach first decides on the "subject matter", then chooses the applicable language skills intended to be learned to design the curriculum (Brinton et al., 1989). This instruction model uses professional contents as the language learning input, where learners progressively acquire the language skills through learning professional knowledge in the target language (O'Malley & Chamot, 1990). Larsen-Freeman (2000) elaborated a more sophisticated notion that CBI imparts knowledge through communications, and not teaching how to communicate. Aside from acquiring the target language, learners must also obtain new knowledge in the target language. In a word, the concept of CBI links language acquisition with various subject matters to achieve multi-aspect learning.

In a CBI classroom, learners are given a chance for dual learning, because the language learning objective is closely connected to the contents. The CBI approach maintains that when learning is meaningful, meets the needs of learners and helps learners develop more language skills, learning will be more successful (Grabe & Stoller ,1997). Such view echoes the theory of second language instruction: when the learning of a target language is meaningful, it will inspire motivation and result in higher learning achievement (Krashen, 1985). The core of CBI is first deciding on the "contents" through understanding the purpose of language learning, followed by the learning of the "contents" in relation to the role of language (Grabe & Stoller, 1997). This process allows CBI to attain the dual training effect of learning subject knowledge and language communication skills (Haley & Austin, 2004) . In addition, CBI learning activities are learner-centered. Three common models of CBI—theme-based, sheltered and adjunct model—have been developed to allow learners to be more engaged in the learning activities. The application of teaching models is based primarily on the learners' learning objectives. This present study adopts the adjunct model, which focuses on a shared emphasis on language and professional contents, so that learners can simultaneously acquire subject knowledge and be exposed to comprehensible language input.

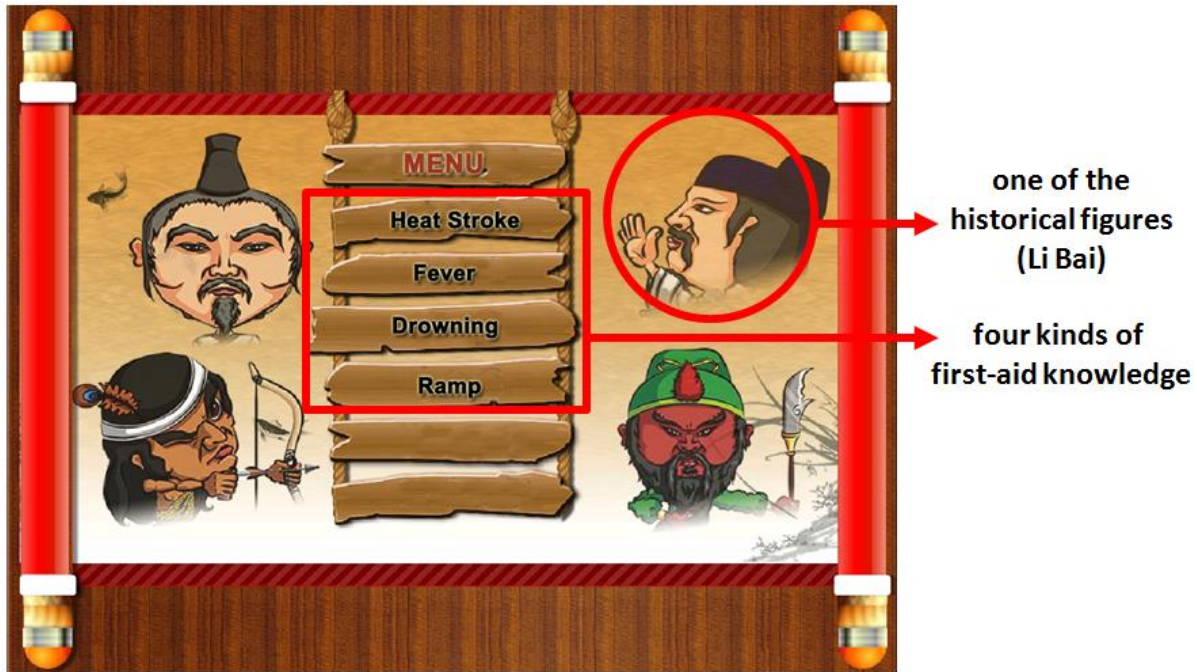


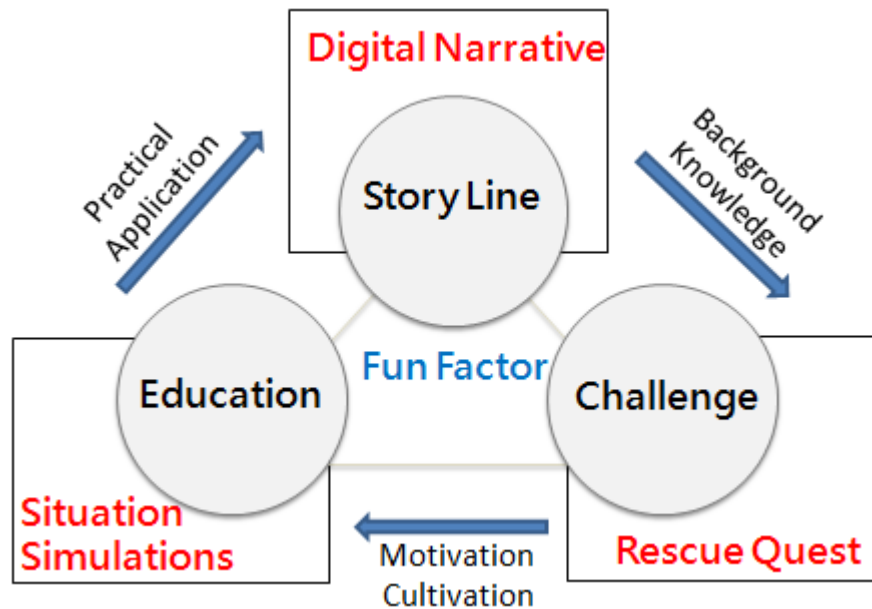
Figure 1. Main menu of EFA digital game learning activities

## METHODS

In this study, the teaching subject chosen for the CBI course was part of the health education curriculum, with "first aid" as the learning content. Research subjects consisted of elementary school students who are non-native English speakers. This CBI course incorporated language learning into the context of topic knowledge for learners to acquire both language and subject knowledge at the same time. In this study, English was chosen as the language input and first aid contents as the subject knowledge to be acquired. A digital game on the topic of first aid was designed for the purpose of this present study. The game contents, research subjects, evaluation methods and research procedures are described as follows.

### Design of the digital game

An English digital game—Emergency First Aid (EFA)—was designed to combine English acquisition as the language input and first aid as the subject knowledge for digital game-based learning. The impact of gender on learning motivation and achievements was explored by looking into learners' experience in playing the EFA digital game. A class of Chinese non-native English-speaking students were the research subjects. The EFA digital game was designed to comprise two learning objectives: first aid knowledge acquisition and application of the target language. Selected from a wide range of first aid situations, this study focused on the knowledge of common incidents, such as heat stroke, drowning, fever and cramps, in the development of the digital game-based learning materials. The EFA game was



**Figure 2.** Design architecture of EFA digital learning game

developed from a scenario-based interactive learning approach and designed through story scripts and interactive animations. Each unit was given a story based on an incident in need of first aid, complete with interactive contents on the symptoms and the provision of first aid measures, as shown in [Figure 1](#). In a bid to enhance non-native English learners' memorability and amusement, well-known history stories were incorporated into the EFA game, where incidents and their corresponding symptoms are told through characters in a story. For instance, Houyi, a mythological Chinese archer who shot down suns from the sky, was chosen as the victim of a heat stroke; while Qu Yuan, a patriot in the Era of Warring States known for wading into a river holding a rock, was the victim of drowning. Learners are guided through the situations in each unit, where they come to understand the cause of the incidents and how to respond through interactive dialogues; they then use the tools or methods provided to them in the game to learn about the correct procedures and acquire first aid knowledge. Students learn about first aid knowledge and related English vocabulary in the process of playing the game.

Each unit in the EFA digital game consists of three learning activities: digital story, rescue quest and situation simulation. As presented in [Figure 2](#), the critical elements of digital games, such as story lines, challenges, educational values and fun factors, are designed into the learning activities. First, digital story offers a visualized learning environment that guides learners to ease into the lesson. The rescue quests are developed from the stories in the digital game. Learners are required to apply their first aid knowledge and use the target language to complete the quests, the purpose of which is to inspire learning motivation through the competitive interactions in the game. After completing the game tasks, learners can begin the activity of emergency first aid rescue. Clearing checkpoints in an online simulation of first aid



**Figure 3.** EFA digital game: scenes from the digital narrative

rescue allows learners to learn the proper, correct response measures. Situation simulation grants learners clearer understanding of the symptoms and emergency response. These three learning activities are designed to let learners learn in the context of the game, where the interactive competition promotes learning motivation and enhances learning outcomes.

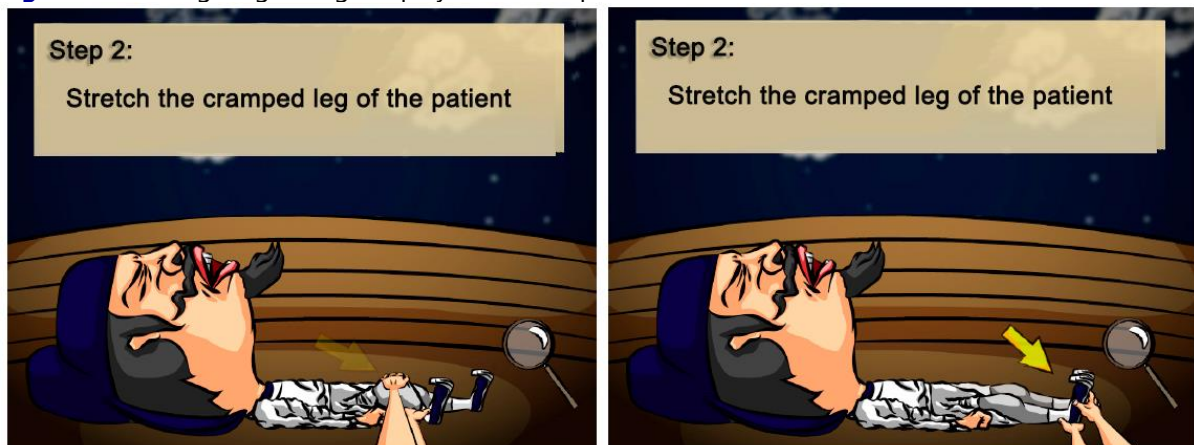
At the start of the EFA digital game, learners need to select an emergency first aid topic. After the topic is confirmed, the system will display relevant first aid knowledge, symptom descriptions and English vocabulary words. This topic warm-up provides learners with the basic background knowledge and language input. After completing the learning warm-up exercise, learners can select the digital narrative activity to begin the game learning mode. The digital narratives are scripts designed corresponding to well-known historic characters against their historic backdrop. For instance, the unit on cramps, as shown in **Figure 3**, features the famous poet Li Bai, who, according to legend, died from drowning when trying to catch the moon reflection in the water. The story begins with Li Bai enjoying a full moon on a boat, then he accidentally falls into the river. He suffers from severe leg cramps after being rescued. At this time, a number of first aid options are displayed, entering the second phase of the game, where learners begin the rescue as guided by the situational digital story.

The rescue game inspires imagination and curiosity, and offers challenges. In the unit on cramps, the rescue game is similar to a fish catching game, as illustrated in **Figure 4**. Learners play the role of a fisherman in rescuing Li Bai from the water. The fisherman has a limited time to save Li Bai from drowning. Many questions presented in English and traps would appear during the gameplay as obstacles in the rescue process, necessitating the full attention of learners in order to successfully complete the task. In addition, the rescue game is played as an online competition game, in which learners are given a chance for cooperative learning and, at the same time, confronted with the pressure of competition. The challenging rescue game enlivens the learning experience in the classroom, and motivates the acquisition of first aid knowledge and target language.





**Figure 4.** EFA digital game: gameplay of rescue quest



**Figure 5.** EFA digital game: situational simulation of emergency first aid procedure

As a continuation of the rescue game, learners then enter the situation simulation part of the game, where the mode is set to first aid training. Learners are asked to perform the correct emergency first aid procedures as guided by the system. Next, learners practice the emergency response measure for different symptoms through the digital simulation game. For example, in the unit of cramps, the rescue of Li Bai continues, as the situational simulation for first aid picks up from Li Bai being saved from drowning by the fisherman. Learners once again play the role of a fisherman to alleviate Li Bai's cramps. Through the system prompts, learners are taught how to correctly perform first aid procedures. After learning the steps, learners can play the online simulation game, as shown in **Figure 5**. If learners select the wrong step during the game, the system would display the mistake and offer recommendations for a better option. The integration of first aid training simulation game allows learners to gain a clearer picture of the first aid process, thus reinforcing memorability.

**Table 1.** The two groups of participants

	Experimental group	Control group	Total
Males	25	25	50
Females	25	25	50
Total	50	50	100

**Table 2.** The system usability scale

Item 1. I think that I would like to use the game frequently.
Item 2. I found the game unnecessarily complex.
Item 3. I found the game easy to use.
Item 4. I would need technical support to be able to use the game.
Item 5. I found the categorized result in the game well sensible.
Item 6. I thought that there was too much inconsistency in the game.
Item 7. I would imagine that most people would learn to use the game very quickly.
Item 8. I found the game very cumbersome to use.
Item 9. I felt very confident in using the game.
Item 10. I would need to learn a lot of things before I could get going with the game.

## Participants

This study adopted a quasi-experimental design to explore the effects of the EFA digital game. The participants in this experiment consisted of 100 fourth-grade students, who are non-native English speakers, from several classes in an elementary school in Taiwan. They were randomly divided into an experimental group and a control group that respectively consisted of 50 students. **Table 1** shows the distribution of the participating students by gender. Each group consisted of 25 male students and 25 female students.

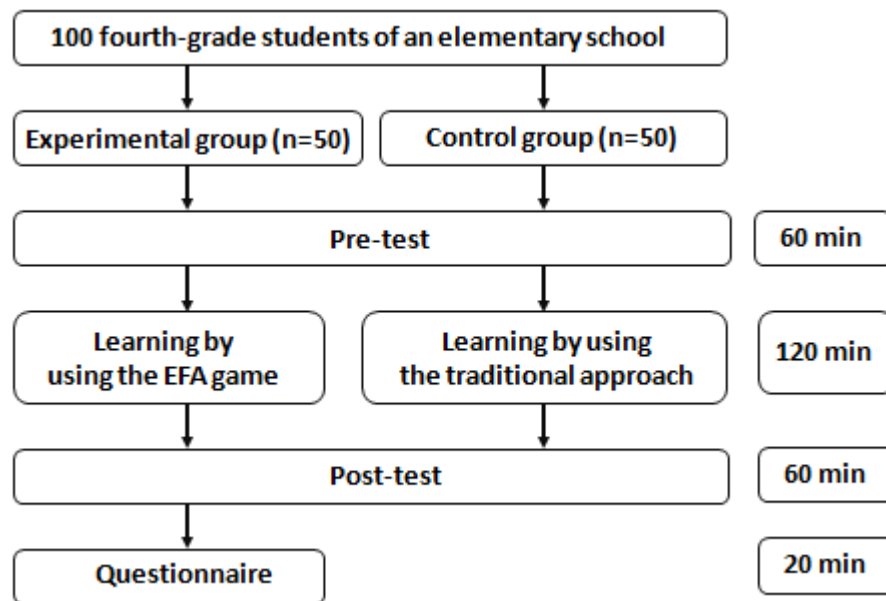
## Measurement tools

The measurement tools for this experiment included a pre-test, a post-test, a system usability scale, and a questionnaire on learning motivation. The pre-test contained forty true/false questions. It was designed to measure the understanding of first-aid knowledge and language skills that the two groups of students possessed before they engaged in the learning activities. The result of the pre-test informed us of whether the two groups of students possessed similar level of first-aid knowledge and language skills. In the pre-test, the students were asked to answer questions according to the correctness of the statements. They would be awarded 2.5 points for each correct answer, with the full score at 100 points. The post-test was designed in a similar way to the pre-test.

Brooke (1996) developed the system usability scale (SUS) which can be applied to providing an overview on subjective assessments of system usability. The SUS consists of ten items combined with a Five-point Likert scale ranging from “Strongly Disagree” to “Strongly Agree.” In this scale, five items were positively worded, and the other five negatively worded (shown in **Table 2**). This study employed a technique for integrating the ratings into an overall score (on a scale from 0 to 100). To calculate the SUS score, this technique began with summing

**Table 3.** The questionnaire on learning motivation

Item 1. I want to learn first-aid knowledge because of the game.
Item 2. The game is enjoyable and interesting.
Item 3. The game makes learning first-aid knowledge easy.
Item 4. I like using the game to learn.
Item 5. I want to continuously use the game to learn first-aid knowledge.

**Figure 6.** The experimental design

the score contributions from each item. The score contribution of each item ranged from 0 to 4. The respective score contributions of items 1, 3, 5, 7, and 9 were counted by the scale position minus 1, while those of items 2, 4, 6, 8 and 10 were counted by 5 minus the scale position. The overall value of system usability was therefore derived from multiplying the sum of the scores by 2.5. A score over 80 implies the best system, 70-80 can be regarded as excellent, 65-70 as good, 60-65 as average, 55-60 as poor, 45-55 as awful, and below 45 as the worst (Tassabehji & Kamala, 2012).

The questionnaire on learning motivation was designed by modifying the measure developed by Zaharias (2009). The questionnaire contained five items evaluated on a five-point rating scheme (shown in [Table 3](#)). The Cronbach's alpha value of this questionnaire was measured at 0.72, demonstrating high and consistent internal reliability.

### Procedure

[Figure 6](#) illustrates the experimental design of this study. The students were asked to take a pre-test before learning first-aid knowledge and language skills. After taking the pre-test, the two groups of students engaged in their respective learning activities that lasted for 120 minutes, during which they learned the basics of first-aid in English as a part of their health

**Table 4.** The Mann-Whitney U test results of the pre-test

	<b>N</b>	<b>Mean</b>	<b>S.D.</b>	<b>p</b>
Experimental group	50	78.80	11.71	.16
Control group	50	82.20	12.82	

**Table 5.** The Mann-Whitney U test results of the post-test

	<b>N</b>	<b>Mean</b>	<b>S.D.</b>	<b>p</b>
Experimental group	50	88.80	12.06	.00
Control group	50	82.20	10.55	

education curriculum. The courses were conducted in English. The students in the experimental group were provided with the EFA digital game in the classroom to promote their level of first-aid knowledge and language skills, while those in the control group learned the same knowledge from the traditional approach, i.e. instruction using paper-based materials. After the learning activities came to an end, the students were required to take a post-test for the purpose of assessing their learning achievements and level of motivation; they were also asked to fill out a questionnaire on their assessment of the game.

## RESULTS

This study employed the Mann-Whitney *U* test to analyze the data, given the relatively small sample size and non-normal distribution.

### Analysis of learning achievements

**Table 4** shows the Mann-Whitney *U* test results of the pre-test. The mean of the pre-test scores achieved by the students in the experimental group was 78.80 (SD=11.71), and that in the control group was 82.20 (SD=12.82). There was no significant difference between the pre-test results achieved by the two groups of students ( $p = .16 > .05$ ). It was therefore assumed the two groups of students possessed similar level of first-aid knowledge and language skills before engaging in the learning activities.

**Table 5** shows the Mann-Whitney *U* test results of the post-test. The mean of the post-test scores achieved by the students in the experimental group was 88.80 (SD=12.06), and that in the control group was 82.20 (SD=10.55). The results showed that the learning achievements of the students in the experimental group was significantly higher than those of the students in the control group ( $p = .00 < .05$ ). This finding suggests digital game-based learning to be more effective than the traditional approach in helping students improve their learning achievement.

**Table 6.** The Mann-Whitney U test results of the pre-test by gender

	<b>N</b>	<b>Mean</b>	<b>S.D.</b>	<b>P</b>
Male (Experimental group)	25	79.60	13.06	.75
Female (Experimental group)	25	78.00	10.40	

**Table 7.** The Mann-Whitney U test results of the post-test by gender

	<b>N</b>	<b>Mean</b>	<b>S.D.</b>	<b>P</b>
Male (Experimental group)	25	88.40	12.13	.53
Female (Experimental group)	25	89.20	12.22	

**Table 8.** Learning motivation of the students in the experimental group by percentage

<b>Items</b>	<b>Strongly agree</b>	<b>Agree</b>	<b>Undecided</b>	<b>Disagree</b>	<b>Strongly disagree</b>
Item 1	58%	24%	18%	0%	0%
Item 2	68%	30%	2%	0%	0%
Item 3	64%	32%	2%	0%	2%
Item 4	72%	24%	2%	0%	0%
Item 5	66%	24%	10%	0%	0%

This study further analyzed the difference in the level of first-aid knowledge and language skills between the male and female students in the experimental group before they engaged in the learning activities. **Table 6** shows the Mann-Whitney *U* test results. The mean of the pre-test scores achieved by the male students was 79.60 (SD=13.06), and that by the female students was 78.00 (SD=10.40). There was no significant difference in the pre-test results between different genders ( $p = .75 > .05$ ). In other words, the male and female students had similar level of first-aid knowledge and language skills before they engaged in the learning activities.

This study then performed the Mann-Whitney *U* test on the post-test scores achieved by the male and female students in the experimental group after they gained first-aid knowledge through the EFA game (shown in **Table 7**). The mean of the post-test scores achieved by the male students was 88.40 (SD=12.13), and that by the female students was 89.20 (SD=12.22). The results demonstrate that gender is not a relevant factor in influencing students' learning achievements ( $p = .53 > .05$ ). It can be concluded the digital game-based learning developed by this study is effective in improving student's first-aid knowledge and language skills regardless of gender difference.

### Analysis of learning motivation

**Table 8** demonstrates the students' learning motivation by percentage, indicating the level of acceptance of the digital game from the students. 58% of the students expressed that they really wanted to learn more first-aid knowledge and language skills because of the game. 68% of the students agreed that the game was enjoyable and interesting. 64% of the students strongly agreed that the game made learning first-aid skills and language easier. 72% of the students liked playing the game to learn. And 66% of the students would like to continuously use the game to gain first-aid knowledge. These results indicate that the EFA digital game

**Table 9.** The Mann-Whitney U test results of the learning motivation by gender

	<b>N</b>	<b>Mean</b>	<b>S.D.</b>	<b>p</b>
Male (Experimental group)	25	4.44	.45	.03
Female (Experimental group)	25	4.69	.42	

**Table 10.** The Mann-Whitney U test results of the SUS scores by gender

	<b>N</b>	<b>Mean</b>	<b>S.D.</b>	<b>p</b>
Male (Experimental group)	25	73.80	9.87	.15
Female (Experimental group)	25	78.40	15.79	

enjoys a high level of acceptance among the students, thereby successfully encouraging their motivation for gaining first-aid knowledge and language skills.

This study further analyzed the learning motivation between the male and female students in the experimental group. **Table 9** shows the Mann-Whitney *U* test results of the assessed learning motivation of the male and female students. The mean of the learning motivation of the male students was 4.44 (SD=.45), and that of the female students was 4.69 (SD=.42). The results demonstrate a significant difference in the learning motivation between students of different genders ( $p = .03 < .05$ ). The findings suggest a difference in motivation for digital game-based learning between male and female students.

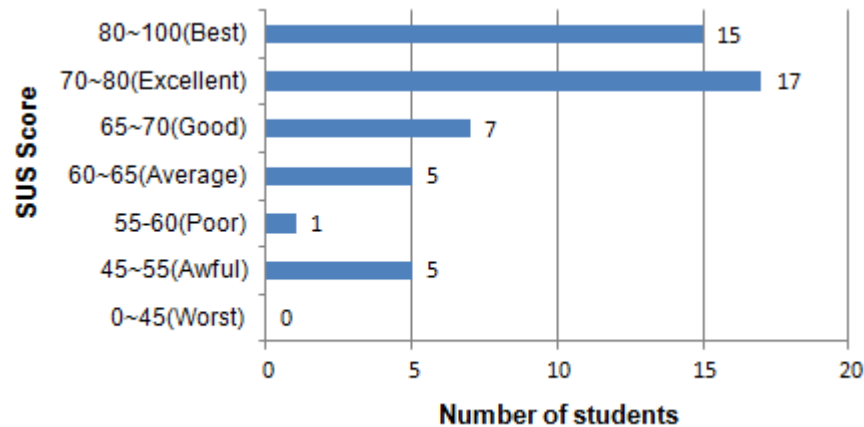
### Analysis of game usability

**Figure 7** demonstrates the system usability scale (SUS) result obtained from the questionnaires filled by the fifty students in the experimental group. The results indicated that 78% of the students gave the game higher than “good” in usability, including 30% “best” and 34% “excellent.” However, 10% of the students regarded the game as “awful,” implying the game necessitates further improvement, whether in terms of game design, content, or interface.

This study subsequently analyzed the perceptions of the male and female students in the experimental group on the usability of the EFA game. **Table 10** shows the Mann-Whitney *U* test results of the SUS scores given by the male and female students, respectively. The mean of the SUS scores given by the male students was 73.80 (SD=9.87), and that given by the female students was 78.40 (SD=15.79). The results demonstrate no significant difference in the SUS scores given by the students of different genders ( $p = .15 > .05$ ). The results suggest male and female students have similar perspectives on the usability of the EFA game.

## DISCUSSION

From the findings, it can be observed that digital game-based learning produces better learning outcomes regardless of learners' gender. Similar to the findings in previous studies, learners in the digital game-based course were found to perform significantly better in the post-test than their counterparts in the traditional lecture-based course (Chuang & Chen, 2009; Robertson & Howells, 2008). The application of knowledge learned during the gameplay



**Figure 7.** The SUS result

process not only enhances the understanding of the contents, but also helps learners achieve better learning outcomes. The integration of digital games with educational content makes knowledge and learning fun, challenging, yet achievable (Prensky, 2001). The multimedia environment created by digital games also provides diverse learning resources, which enrich the learning contents and raise learning effectiveness. The EFA digital game specially designed for this study, for example, engages students in strengthening their first aid knowledge and application of the target language through a series of digital game contents.

The attitude towards digital game-based learning was found to be positive, regardless of gender; there was no significant difference in learning achievements between genders. This finding resonates with the research results of Papastergiou (2009), where male learners were found to exhibit a higher preference and motivation for digital game-based learning and have better engagement and learning performance compared to female learners; however, female learners seemed to display higher cognitive abilities in the game content and learning objectives. Gender differences in learning cognitive ability reduce the impact of gender on learning achievement. Furthermore, previous studies have shown the setting of achievement goals affects the performance of learners of different genders, in which setting higher achievement goals produces better learning performance. Male learners tend to set a higher achievement goal in game-based learning than females, hence they tend to have a better learning achievement. Hwang et al. (2013) incorporated massively multiplayer online role-playing games (MMORPGs) into learning, and found that male learners' achievement goal setting allows them to have a higher learning achievement than female learners in a competitive or collaborative learning environment. In contrast, female learners display learning anxiety in a competitive game and cannot find pleasure in the process; such negative affectivity affects their learning performance. Lowrie and Jorgensen (2011) also found that women tend to have a lower learning achievement than men in digital games of a competitive nature. This study showed that there was no significant difference in the correlation in the achievement goals between genders, representing a different result from the aforementioned

two studies. The main reason could be attributed to the digital game used in this study belongs to a moderate genre, which benefits learners by helping them enhance their cognitive, affective and skills development, regardless of gender.

The motivation for digital game-based learning differs by gender. According to our analysis, learners of different genders exhibited significant differences in their motivation towards the EFA digital game. This finding echoes that of Joiner et al. (2011), whose results illustrated that the preference for the type of digital games between genders affects their level of motivation. Previous studies show that male learners prefer digital games involving competition and collaboration, whereas female learners prefer games involving exploration and themed tasks. The three learning activities in the EFA game are designed with the elements of story lines, challenges, educational values, fun factor, and interactivity, making the EFA game trending towards the moderate genre without containing extreme contents. The rescue game designed in our EFA game offers challenges but does not emphasize competition, thus motivating the engagement of female learners. At the same time, the situation simulation part of the game offers exploration opportunities, contributing to a higher motivation in female learners. Belonging in the moderate genre, the EFA digital game makes the learning motivation of female learners higher than male learners.

All in all, both male and female learners thought the story scenarios and interactive design of the EFA digital game effectively enhanced their motivation in learning about first aid knowledge. This supports the claim regarding digital game-based learning helping to enhance learning motivation. (Burguillo, 2010; Dickey, 2011; Ebner & Holzinger, 2007; Fengfeng, 2008; Quinn, 2005). The SUS analysis revealed that learners responded positively towards the usability, satisfaction and willingness for continued use of the EFA digital game; meanwhile, there was no significant differences in the views on usability between genders. Learners of different genders gave positive responses to the operability and smoothness of the EFA game. The ease of use of the digital game, closely tied to learning motivation, is also a factor affecting the learning outcomes.

## CONCLUSION

This study examines the impact of gender on digital game-based learning from the relationship of learning and engagement. The results show that there is no significant differences in the learning achievement in digital game-based learning between genders. The EFA game delivers high engagement and interactivity for both male and female learners. This high learning engagement leads to higher learning performance, as evidenced in the significant improvement in the learning achievement in first aid knowledge and language skills from learners of different genders. According to Prensky (2007), the ideal digital game-based learning involves high intensity and high engagement activities. The learning mode of our EFA digital game is consistent with the concept put forward by Prensky. This study suggests that the ideal digital game-based learning approach can reduce the impact of gender differences on learning achievement.



Digital game-based learning is a dynamic learning process, during which the learner's motivation and game contents are interconnected. Female learners display higher learning motivation than male learners in this study, with the main reason attributed to the EFA digital game belonging to a moderate genre. Female learners' motivation is raised when no overly intense or competitive game contents are present. Moreover, from the motivation analysis, learners are found to express high interests in the digital narrative and simulation interactions in the EFA game, regardless of gender. Krapp (2001) believe that when learners are interested in a particular topic, they will naturally be motivated to learn more about it. The EFA digital game in this study give learners the autonomy to apply the learned knowledge in the gameplay, exerting a positive impact on motivation.

Taken together, this study offers a number of suggestions as a frame of reference for further research. First, the SUS survey results show that the vast majority of learners are satisfied with the usability of the EFA digital game, but there are still a small number of learners who express dissatisfaction. This implies the digital game content and interface still warrant fine-tuning. We suggest future researchers take into consideration adaptive learning to improve the system. Meanwhile, there is no significant differences in usability of the EFA digital game between genders, indicating male and female learners have similar perspective on the usability of the game. We suggest future studies to include an open-ended questionnaire as a complement to the in-depth exploration on the factor of gender. Lastly, the research subjects in this study only consist of students in a CBI course, thus the results are somewhat limited and cannot be applied to other subject areas. Therefore, we suggest a larger sample size in the future to explore the impact of gender on digital game-based learning.

#### ACKNOWLEDGEMENTS

The authors would like to thank the Ministry of Science and Technology of the Republic of China for financially supporting this research under Contract No. 102-2511-S-468 -005 -MY2.

#### REFERENCES

- Begy, J. & Consalvo, M. (2011). Achievements, Motivations and Rewards in Faunasphere. *Game Studies*, 11(1).
- Brooke, J. (1996). SUS: a "quick and dirty" usability scale. In P. W. Jordan, B. Thomas, B. A. Weerdmeester, & A. L. McClelland. *Usability Evaluation in Industry*. London: Taylor and Francis, UK.
- Brinton, D., Snow, M. A., & Wesche, M. B. (1989). *Content-based second language instruction*. Boston: Heinle & Heinle Publishers.
- Burguillo, J. C. (2010). Using game theory and competition-based learning to stimulate student motivation and performance. *Computers & Education*, 55(2), 566-575.
- Cornillie, F., Clarebout, G., & Desmet, P. (2012). Between learning and playing? Exploring learners' perceptions of corrective feedback in an immersive game for English pragmatics. *ReCALL: Journal of Eurocall*, 24(3), 257-278.
- Chuang, T. Y., & Chen, W. F. (2009). Effect of computer-based video games on children: an experimental study. *Educational Technology & Society*, 12(2), 1-10.

- Cornillie, F., Thorne, S., & Desmet, P. (2012). Digital games for language learning: from hype to insight? *ReCALL: Journal of Eurocall*, 24(3), 243-256.
- Dondlinger, M. J. (2007). Educational Video Game Design: A Review of the Literature. *Journal of Applied Educational Technology*, 4(1), 21-31.
- Delwiche, A. (2006). Massively multiplayer online games (MMOs) in the new media classroom. *Educational Technology & Society*, 9(3), 160-172.
- Diane Larsen-Freeman, (2000). *Techniques and Principles in Language Teaching*, Oxford University Press.
- Dickey, M. D. (2011). Murder on Grimm Isle: the impact of game narrative design in an educational game-based learning environment. *British Journal of Educational Technology*, 42(3), 456-469.
- Ebner, M., & Holzinger, A. (2007). Successful implementation of user-centered game based learning in higher education: an example from civil engineering. *Computers & Education*, 49(3), 873-890.
- Farber, M. (2015). *Gamify your classroom: A field guide to game-based learning*. New York: Peter Lang Publishing, Inc.
- Fengfeng, K. (2008). Alternative goal structures for computer game-based learning. *International Journal of Computer-Supported Collaborative Learning*, 3, 429-445.
- Garris, R., Ahlers, R., & Driskell, J. E. (2002). Games, motivation, and learning: A research and practice model. *Simulation & Gaming*, 33(4), 441-467.
- Grabe, W., & Stoller, F. L. (1997). Content-based instruction: Research foundations. In M. A. Snow, & D. M. Brinton (Eds.). *The content-based classroom: Perspectives on integrating language and content* (pp. 5-21). NY: Longman.
- Haley, M. H. & Austin, T. Y. (2004). *Content-based second language teaching and learning*. USA: Pearson education.
- Hwang, M. Y., Hong, J. C., Cheng, H. Y., Peng, Y. C., & Wu, N. C. (2013). Gender differences in cognitive load and competition anxiety affect 6th grade students' attitude toward playing and intention to play at a sequential or synchronous game. *Computers & Education*, 60(1), 254-263.
- Hsu, H. (2013). Gender differences in elementary school students' game design preferences. *Information and Education Technology*, 3(2), 5.
- Hogle, J. G. (1996). *Considering Games as Cognitive Tools: In Search of Effective Edutainment*, in University of Georgia Department of Instructional Technology.
- Joiner, R., Iacovides, J., Owen, M., Gavin, C., Clibbery, S., Darling, J., & Drew, B. (2011). Digital games, gender and learning in engineering: do females benefit as much as males? *Journal of Science Education and Technology*, 20(2), 178-185.
- Krapp, A. (2005). Basic needs and the development of interest and intrinsic motivational orientations. *Learning and Instruction*, 12, 383-409.
- Krashen, S. (1985). *The input hypothesis: issues and implications*. NY: Longman.
- Larsen-Freeman, D. (2000). *Techniques and principles in language teaching*. Oxford: Oxford Press.
- Krahnke, K. (1987). *Approaches to syllabus design for foreign language teaching*. Washington, DC: Center for Applied Linguistics.
- Larsen-Freeman, D. (2000). *Techniques and principles in language teaching*. Oxford: Oxford Press.
- Lee, Y. L. (2008). A Maths Game Model for Learning Fractions. *The International Journal of Learning*, 14, 225-235.
- Lowrie, T., & Jorgensen, R. (2011). Gender differences in students' mathematics game playing. *Computers & Education*, 57(4), 2244-2248.

- O'Malley, J. M., & Chamot, A. U. (1990). *Learning strategies in second language acquisition*. NY: Cambridge University Press.
- Papastergiou, M. (2009). Digital game-based learning in high school computer science education: Impact on educational effectiveness and student motivation. *Computers and Education*, 52(1), 1-12.
- Prensky, M. (2001). *Digital game-based learning*. New York: McGraw-Hill.
- Prensky, M. (2007). *Digital game-based learning*. St. Paul, MN: Paragon House
- Piaget, J. (1929). *The Child Conception of the World*, New York: Harcourt, Brace, 1929; London: Routledge & Kegan Paul, 1929. (Originally published, 1926).
- Riding, R., & Grimley, M. (1999). Cognitive style and learning from multimedia materials in 11-year children. *British Journal of Educational Technology*, 30(1), 43- 59.
- Quinn, C.N. (2005). *Engaging Learning: Designing e-Learning Simulation Games*. San Francisco, CA: Pfeiffer.
- Richards, J. C., & Rodgers, T. S. (2001). *Approaches and methods in language teaching: A description and analysis* (2nd ed.) New York, NY: Cambridge University Press.
- Robertson, J., & Howells, C. (2008). Computer game design: Opportunities for successful learning. *Computers & Education*, 50(2), 559-578.
- Tassabehji, R., & Kamala, M. A. (2012). Evaluating biometrics for online banking: The case for usability. *International Journal of Information Management*, 32(5), 489-494.
- Virvou, M., Katsionis, G., & Manos, K. (2005). Combining software games with education: evaluation of its educational effectiveness. *Educational Technology & Society*, 8(2), 54-65.
- Wang, H. Y., & Wang, Y. S. (2008). Gender differences in the perception and acceptance of online games. *British Journal of Educational Technology*, 39(5), 787-806.
- Yee, N. (2006). Motivations for play in online games. *Cyber-Psychology Behavior*, 9, 772-775.
- Zaharias, P. (2009). Usability in the context of e-learning: a framework augmenting 'traditional' usability constructs with instructional design and motivation to learn. *International Journal of Technology and Human Interaction*, 5(4), 38-61.

**<http://iserjournals.com/journals/eurasia>**