Effect of Gender Difference on Students' Perceptions toward Instruction Technology in Problem-Based Gamming Environment

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Abstract: Educational game combines gameplay characteristics with learning content, not just for fun. It can be used to support learning that refers to the use of digital technology to promote learning performance and experience through game-based activity. Currently, several researchers mentioned that digital game-based learning could promote students' interest and enhance students' motivations and learning outcomes by appropriately visualizing abstract ideas. This study aims to investigate the correlation between gender difference and student's perception toward instruction technology in problem-based gamming. The participants in this study involved with the tenth-grade students totally 106 students. The results showed that males and females had the same perceived ease of use, perceived enjoyment, and perceived satisfaction toward instruction technology in problem-based gamming. In contrast, males and females had difference among perceived learning, perceived flow, and perceived playfulness toward instruction technology in problem-based gamming. Overall, the results revealed that females had better perceptions toward instruction technology in problem-based gamming than males had.

Keywords: Perceptions, Educational digital game, Gender, individual difference

1. Introduction

Currently, science and technology has been continued development and that has a role and influence daily life. Technology has been used widely in learning environment, especially in science education (Nieto and Carbonell, 2012). Technology can also enable new ways of education to deliver knowledge directly from teachers to students and the learning can take place anywhere and anytime. Recently, there are many technologies to supported inquiry-based science learning environments such as WISE, Co-Lab, Island and Inquiry (Sun et al., 2013). The instructions that teachers implement have been changed by conducting the new learning paradigm and innovative educational tools.

In a present, technologies have been used to support learning science. With the benefit of computers and technology in science education community, the contemporary technology-based approach has been used to enhance students' conceptual understanding (Srisawasdi and Kroothkeaw, 2014). Rieber (1996) describes video games-as-microworlds having intrinsically motivating features to offer high potential for learners to engage and persist in the embodied learning activities. Video games are encouraging students to act as self-regulated learners participating in a learning activity and they are thereby better able to monitor and evaluate their own learning. This is in contrast to other types of e-learning, such as web-based instructions or simulations, which offer a direct link to the subject matter or content and therefore encounter the challenge of engaging unmotivated students (Cheng et al., 2014)

Digital games or computer games are programs or software that was created for entertainment purpose (Rollings and Adams, 2003). Recently, digital games have been becoming popular and integral part of our society, especially children or younger generation who like to play game as a favorite

activity. To apply the game to educational system, teachers and educators have attempted to find the new ways of teaching by adding educational purpose into the games which is called educational games or serious games, this approach namely game-based learning (Tang, Hanneghan and Rhalibi, 2009). Educational games combine gameplay characteristics with learning content is not just for fun, it can be used to support learning by appropriately visualizing abstract ideas and key principles of given topics in game environment to support active and authentic learning, and provide concrete and direct experience to evoke students' motivations and facilitate their understanding (Cheng et al., 2014). In addition, educational games have a positive impact on learning outcomes (Echeverría et al., 2011; Giannakos, 2013). Learning by using the educational digital game-based learning, learners can learn lessons of subject matter by playing the game, might learn higher level thinking skills and improve their problem-solving ability by immersing themselves in the games. With educational games, students' experience in the embedded learning activities is a series of problem-solving processes. Students constantly have to use newly acquired knowledge and skills to overcome subsequent challenges. Several researchers revealed that it might be much easier for students to apply knowledge gained from the games to solve real-life problems (Cheng et al., 2014). Huang (2012) indicated that learners have more confident in learning after playing with educational game. In an addition, using game in education increased students' perceived learning, enjoyment and flow of learning experience (Barzilai and Blau, 2014). Similary, Cheng et al. (2014) indicated that students who learned through playing educational game generally had a positive learning experience and increased their perceived useful, easy, appealing, playful, and satisfying.

Human immunology, which is one topic in biology course, is difficult to learning due to its complexity and much information. The immune system is crucial to living organisms, yet it is inherently complicated and extremely difficult to understand, as immune processes involve cellular and molecular interactions among a variety of cell types and antigens (Kelly et al, 2007). The regulation of human immunological defense is a physiological process that intertwines both humoral and cellular interactions among a variety of cell types and antigens. The students often feel confused and have difficulties in learning this subject (Kelly et al., 2007). Moreover, the processes, microscopic and connections among different lines of human immunological defense are much more abstract than any of the other biology topics, and students usually do not have sufficient prior knowledge when they first encounter the topic (Cheng and Chen, 2009). However, in biology class, there is few studies investigated influence of educational game on students' perceptions.

Consequently, the researchers created an educational problem-based gamming on biology concept of human immunology and this pilot study was to investigate correlation between gender differences and students' perceptions toward instruction technology in problem-based gamming.

2. Literature Review

2.1 Educational Digital Game

The new media and digital technology industries and digital gaming immerse several environments. Digital game include of dazzling and sophisticated image and sound, be parallel textual communication. Player get engagement which is both pleasurable and challenging. The educational digital game keep players immersed in digital worlds, knowledge and information become increasingly accessible outside confines of formal education (Castell, Jenson and Taylor, 2007). Moreover, in the educational games, students' experience embedded learning activities is a series of problem-solving processes. The students constantly have to use newly acquired knowledge and skills to overcome subsequent challenges. It was found that it might be much easier for students to apply knowledge gained from the games to solve real-life problems, as games often offer a virtual environment with realistic situations wherein students can practice over and over without cost or penalty (Cheng et al., 2014). Currently, educators employed digital game by adding content of subject matter or information for education purpose. Several research presented empirical evidence that the education digital games have positive effect on student learning. It could improve not only learning achievement but also learning attitude and motivation to learn (Sung and Hwang, 2013).

In the past, game produce only for entertainment but recently educational researchers have attempted to adapt games for learning called educational games or serious game (Cheng et al., 2014). The games that compose of challenge, control, curiosity and fantasy can motivate persistence and enjoyment (Toro-Troconis and Partridge, 2010). The educators have developed games for three goals including: (i) students can learn from playing the game; (ii) the component of game can support learning; and (iii) students have motivation to learn when they learning by playing the game (McNamara, Jackson, and Graesser, 2010). Game-based learning is a kind of constructivist-based active learning. Based on the learning research, Watson, Mong and Harris (2011) found that using game in classroom made a shift of teaching from teacher-centered learning environment to student-centered learning environment.

2.2 Gender difference and Educational Digital Game

In the past decade, several researchers studied the interaction between educational computer game and gender differences. For example, Agosto (2004) found that both females and males at the preschool age showed the same enthusiasm in computer games. Papastergiou (2009) found that there were no gender differences in terms of science achievement of high school students when using computer game. They also showed better performance than those who did not use computer game. In contrast, Gee (2007) and Unlusoy et al. (2010) revealed that males show more interest in digital games than females. Therefore, among various human factors, gender difference plays an important role when playing digital game affecting learning performance (Paraskeva et al., 2010).

2.3 Students' Perceptions

2.3.1 Perceived Learning

Perceived learning relates to a retrospective evaluation of the learning experience and can be defined as a set of beliefs and feelings one has regarding the learning that has occurred (Caspi and Blau, 2011). The perceived learning is about the new information was obtained and person can get the new understanding, subjective evaluation of learning by learners themselves. Researchers mentioned that perceived learning is connected to emotion as flow, enjoyable , and satisfaction (Chu and Hwang, 2010). Regarding in context of educational computer game, when learners are immersed in game-based learning environment, they can judge themselves in the learning process and quality of how to get the knowledge from game, so game can help learned and practiced (Giannakos, 2013).

2.3.2 Perceived ease of use

Perceived ease of use, refers to the degree to which a person believes that using a particular system would be free of effort. The definition of ease that freedom from difficulty or great effort. All else being equal, we claim, an application perceived to be easier to use than another is more likely to be accepted by users (Davis, 1989).

2.3.3 Flow

Flow is a state of deep concentration in which thoughts, intentions, feelings, and all of the senses are focused on the same goal. The experience of flow would happen when person who take part in challenge situations or activities that need skills. Flow depends on a chance to concentrate, an immediate feedback, a sense of control, and a clarify goal (Barzilai and Blau, 2014). As such, if learners concentrate with the learning experience of educational computer game, the flow of learning would occur during playing the game (Meesuk and Srisawasdi, 2014).

2.3.4 Perceived Playfulness

Characterizing playfulness is difficult, because laymen and researchers use the term ‘‘play’’ in several ways. The trait of playfulness may be treated as a motivational characteristic. Individuals who ranked high in playfulness demonstrate better performance and higher affective response to computer training tasks. But playfulness may instead be defined as a situational characteristic of the interaction between an individual and a situation. (Lin et al., 2005)

2.3.5 Enjoyment

Enjoyment is the condition of having and using technology, e.g. educational computer game that is good or pleasant. The enjoyment of player is a key goal, related with an easy to use of game and enjoyment was found to have valuable in explaining objective to use applications (Giannakos, 2013). When learners which act as players of game fail to pass the game task, they would get disappointment and attempt to replay again. As such, the enjoyment can help reduce worry to learn and feel more confident when learners success. Accordingly, if the educational computer game can enjoy learners, then they would like to learn more and think positive to the subject (Meesuk and Srisawasdi, 2014)

2.3.6 Satisfaction

Satisfaction is the individual awareness of how well a learning environment supports academic success (Lo, 2010). It is relevant to instructional method that learners can think and learn, so their satisfaction can help to get how academic success. At the moment to learn with educational computer game, if it gets positive response from learners that means they reach to positive learning experience with also. In an addition, satisfaction can yield positive of learning performance and can improve learning outcome (Giannakos, 2013).

3. Method

3.1 Participants

This research was conducted to explore the effect of gender on perceptions toward instruction technology in problem-based gamming by using a survey research. The 106 students (37 males and 69 females) who are studying in ten grade, age ranging from 14 to 16 years old and study was carried out in the second semester of year 2015 in a local public school at the northeastern region of Thailand were recruited in this study.

3.2 Learning Materials

In this study, the design of the game, called “Immunology Game”, was related to content of adhesive humane immunology. That designed to comprise three missions of playing, each of mission provides problem situation to students. The Immunology Game is the first mission was created in style of shooting game. The goal of this educational game is to facilitate student getting the definition external defense mechanism as shown in Figure 1-3.

When the student starts the game she or he encounter with problem situation in the first mission. The problem is the girl children playing computer together with eating cookies as a result antigens or pathogens through to the body as shown in Figure 1.

Student is receive scaffolding for decision by he or she can see basic information of each pathogens that include name, picture, toxin and weakness before into game play. Then he or she into game play, in this part in which they have to fight pathogens that enter the body by choosing to use ammunition to destroy pathogens as shown in Figure 2.

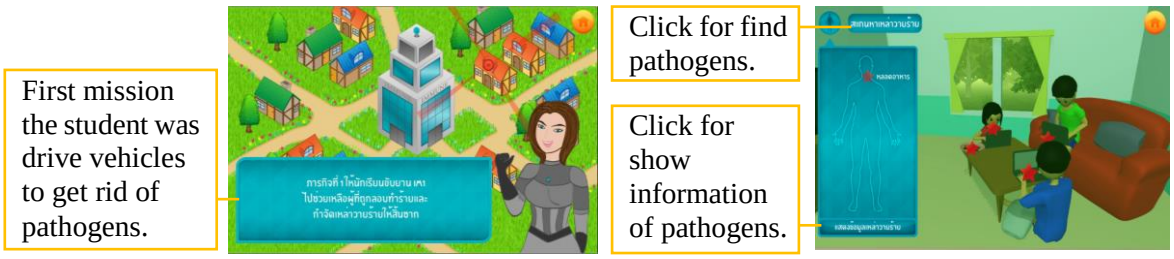

Figure 1. Shows home screen of first mission in the game (left) and first problem situation in first mission (right).

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Figure 2. Basic information each type of pathogens (left) and home screen of game play (right).

Finally, If student perform mission incomplete as a result, he or she is diseased or illness. On the other hand, student perform mission complete as a result, he or she is happy life as shown in Figure 3.

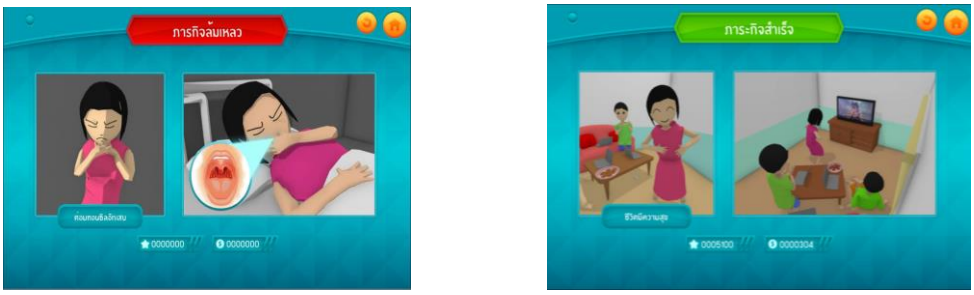

Figure 3. Student perform mission incomplete (left) and perform mission complete (right).

3.3 Research Instrument

3.3.1 Student's Perception

To study students' perception of the educational computer game, we adapted the questionnaire with 6 subscales consisting of perceived learning (PL) (three items), perceived ease of use (PEU) (two items), Flow (F) (three items), perceived playfulness (PP) (three items), perceived enjoyment (PE) (two items) and perceived satisfaction (PS) (five items) (Cheng, 2014; Barzilai and Blau, 2014), developed in Thai by Pinatuwong and Srisawasdi (2014). All of these 5-point Likert scale (1-strongly disagree; 2-disagree; 3-neutral; 4-agree; 5-strongly agree). For overall items have a very good reliability, see Table 1

3.4 Data Collection and Analysis

The intervention class consists of 106 students. The participants were exposed to play The Immunity Game for 20 minutes. After finishing the game, the students' perceptions were examined by the same questionnaire for 10 minutes. To examine correlation between genders and post perceptions on each subscale, MANOVA in SPSS was used.

Table 1: Scale and sample items of the perception questionnaire

Dimension	Items
perceived learning (PL)	The games increase my learning efficiency. The game will help me understand the things I learned.
Perceived ease of use (PEU)	The games are easy to use. Using the games to complete course related tasks are easy.
Perceived flow (PF)	I was very involved in the game. When I played I did not think of anything else.
Perceived playfulness (PP)	It is interesting to use games. I was totally immersed in the game.
Perceived enjoyment (PE)	I had fun playing the game for learning science. I feel relaxed to use games for learning science.
Perceived satisfaction (PS)	I like to learn new skills by using games. I would like to know if the innovative approach can be applied to other courses to improve my learning performance.

4. Results and Discussion

4.1 Investigating the Gender Gap on Students' Perceptions

In order to investigate the influence of gender on students' perceptions toward problem-based gaming (PBG), MANOVA test was used in this study as shown in Table 2.

Table 2: MANOVA results for correlation between genders difference and students' perception

Dimension	Gender	N	Mean	S.D.	F	Sig.	η^2
Perceived learning (PL)	Males	37	9.595	2.409	8.069	.005*	0.072
	Females	69	10.957	2.323			
Perceived ease of use (PEU)	Males	37	6.649	1.876	1.461	.230	0.014
	Females	69	7.043	1.419			
Perceived flow (PF)	Males	37	9.243	2.241	18.214	.000*	0.149
	Females	69	11.043	1.974			
Perceived playfulness (PP)	Males	37	10.378	2.564	5.857	.017*	0.053
	Females	69	11.551	2.272			
Perceived enjoyment (PE)	Males	37	6.784	1.858	2.178	.143	0.021
	Females	69	7.377	2.030			
Perceived satisfaction (PS)	Males	37	18.027	4.160	3.888	.051	0.036
	Females	69	19.623	3.870			

* $p < .05$

Considering Table 2, the results of participant (37 males, 69 Females) for MANOVA from genders' effect for perception toward instruction technology in problem-based gamming, six subscales score consists of PE, PEU, PF, PPF, PE and PS were used. The results showed that there

were three dimension of students' perception non correlation significant ($p > .05$) between genders consist PEU, PE and PS. The statistic MANOVA indicated that effect of gender on students' perception for PEU ($F = 1.461$, partial $\eta^2 = 0.072$), PF ($F = 18.214$, partial $\eta^2 = 0.014$) and PS ($F = 3.888$, partial $\eta^2 = 0.036$). The results suggested that both males and females were the same Perceived ease of use, Perceived enjoyment and Perceived satisfaction toward instruction technology in problem-based gamming. In contrast, there were three dimension of students' perception correlation significant ($p < .05$) consist PL, PF and PP. The statistic MANOVA indicated that effect of gender for students' perception on PL ($F = 8.069$, partial $\eta^2 = 0.072$), PF ($F = 2.178$, partial $\eta^2 = 0.149$) and PP ($F = 5.857$, partial $\eta^2 = 0.036$). In addition to comparison graph between mean value and dimensions can simplified for understanding as shown in Figure 4.

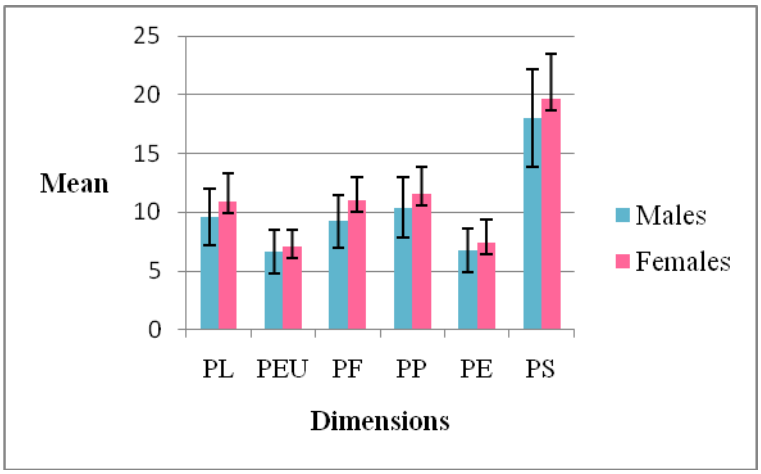

Figure 4. Compare genders difference of mean students' perception of each dimension.

The results suggested that males and females ware different in Perceived learning, Perceived flow, and Perceived playfulness toward instruction technology in problem-based gamming. Students' perception of each dimensions total 6 dimensions showed that female had better means perception than male perception as shown in Table 2.

5. Discussion and Conclusion

This study reported the impacts of students' perception toward instruction technology in problem-based gamming with gender difference. It was found that gender affect to student's perceptions including PL, PF and PP. While, genders non affects to student's perceptions including PEU, PE and PS. Although Gee (2007) and Unlusoy, et al. (2010) revealed that males are more likely to use digital game on learning than females. The main findings of this study showed that females had better perception than males with in the developed instruction technology in problem-based gamming.

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