The Relationship between Educational Serious Games, Gender, and Students' Social Interaction

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Abstract: Internet age students are increasingly interested in learning by playing. The majority of the current educational computer games suffer from the inapplicability of supporting the course materials' learning objectives. In consequence, the integration of educational video games into the curriculum usually met with resistance from some teachers, administrators, and parents. Multi-player educational serious games (MPESGs) are introduced as a new type of educational computer games. Educators and researchers increasingly believe in MPESGs as a tool for interactive learning. MPESGs might not only motivate students to learn, but also provide them with innovative ways to develop understandings of abstract concepts. In addition, the integration of MPESGs in learning environment might promote social interaction among students.

This study focused on exploring MPESGs as a new educational tool. A MPESG called *The Village of Belknap* was developed in Second Life to be used as a prototype in this study. Experimental results were carried out and the results indicated that the gender did not influence students' perceptions of social interaction during playing the game. In addition, the results revealed that the integration of the MPESG in the learning process did not lead to a significant difference in the perception of social interaction between the students who participated in the online session and the students who participated in the face-to-face session.

Keywords- Avatar, CVE, Educational Games, Role-Playing Game, Second Life, Serious Game.

1. Introduction

Since the 1970s video games became a significant source of entertainment supported by different devices such as mobile phones, computers, games consoles, and PDA. In addition, the new generation of young people spends a great amount of time in Collaborative Virtual Environments (CVEs) where they can meet their friends or making new friendship with people from all over the world. The availability of different online versions of CVEs as well as their interactive nature encourages several researchers to think about using CVEs as a platform to implement MPESGs. The use of CVEs can provide students with the chance of visiting

Since the 1970s video games became a significant environments and interact with unavailable events during playing the game.

After a comprehensive revision of the literature, the researchers in this study did not find a single study that compares between the impact of MPESGs on promoting social interaction among online students versus face-to-face students as well as examining if playing MPESGs influences the perception of social interaction of males and females differently.

The goals of this research are to answer the following two questions:

1. **Q-1**: Does the integration of MPESGs in the learning process lead to a significant difference in the perception of social interaction between students enrolled in online courses versus students enrolled in face-to-face courses?
2. **Q-2**: Does the gender of a student affect his/her perception of social interaction during playing the game differently?

This paper is organized into seven sections. The second section will present a comprehensive idea about the importance of social interaction, the relationship between gender and playing computer games, educational serious games, CVE, and Second life respectively. The third and fourth sections will introduce the methodology and the results. The fifth, sixth, and seventh sections will include the discussion, the limitation of the study and future research, and the conclusion.

2 Background

2.1 Social Interaction

Social interaction has been a critical component of the process of teaching and learning [1]. The learning theorists Bruner, Piaget, and Vygotsky introduced the philosophy that people do not learn in a vacuum but rather through interaction. Most learning theorists agree that social interaction plays a vital role in keeping the learning community effective. Also, social interaction is essential for knowledge sharing among learners. Therefore, the educators should pay close attention to the design of their courses in order to foster the cooperation of meaning, the validation of knowledge, and the construction of knowledge through social interaction.

Reference [2] argued that informal social interaction provides foundations for the community and that in turn supports the development of effective collaborative course-related problem solving, strengthens the community work idea, and reduces the feeling of isolation. Reference [3] observations of the social interaction activities in InfoPark, a text-based online community, indicated that informal discussions represent more than double the amount of social interaction as do course related discussions. The study in reference [4] stated

that "when learners perceive the level of interaction to be high, they will be more satisfied with instruction than when they perceive the level of interaction to be low" (p. 8).

2.2 Gender and Computer Games

Computer and video games have become among the most popular leisure time activities for people with different ages. Despite the use of computer games being on the rise, a significant difference between males and females in their tendency in playing computer games has been observed [5]. Although males and females can be equally skilled at using computers and computer games, males are more likely than females to choose to play with them. Several research studies reported that males showed more interest in playing computer games and play more frequently and for a long period of time than females [6] and [7]. Among secondary-school aged children, boys are at least three times more likely to use a computer at home, participate in computer-related clubs or school activities or attend computer camps [8].

The emergence of *entrepreneurial feminism* leads to increase the number of females who are working as game designers or producers. In consequence, 43% of all video game players in the US are female and 44% of all online-players are female [7]. For example, Matell's *Barbie Fashioner Designer* game that allowed players to make clothes for their Barbie Dolls, sold more than 500,000 copies [9].

In general, the increase in the number of females who are playing computer games and the increase in the number of females in the field of designing and producing computer games decrease the gender gap. Since playing computer games requires people to have computer related knowledge and technical skills, this can prepare both males and females to meet the need of the information age.

2.3 What Is Educational Serious Games?

Educational computer games are games that are designed to teach certain subject, expand concepts, reinforce development, and understand a historical event or culture, or assist in learning a skill [10]. Serious games are educational games "that do not

have entertainment, enjoyment, or fun as their primary purpose" [11, p.21]. The design of serious games adopted the format of the commercial games but with the focus on educational content. The idea of serious game was initiated by the founders of the Initiatives of Education Arcade and Serious Games. They suggested that the development of serious games should be a collaborative task among subject matter experts, educators, and commercial game developers in order to combine video game design with constructivist learning methods for non-entertainment purposes (Fig.1).

The use of serious games implies several educational advantages such as:

- Supporting the development of a number of various skills such as strategic thinking, communication, collaboration, group decision making, and negotiating skills [12], [13].
- Enhancing knowledge acquisition and retention rate [14], [15].
- Tailoring learning experience according to learner characteristics and learning style 16].
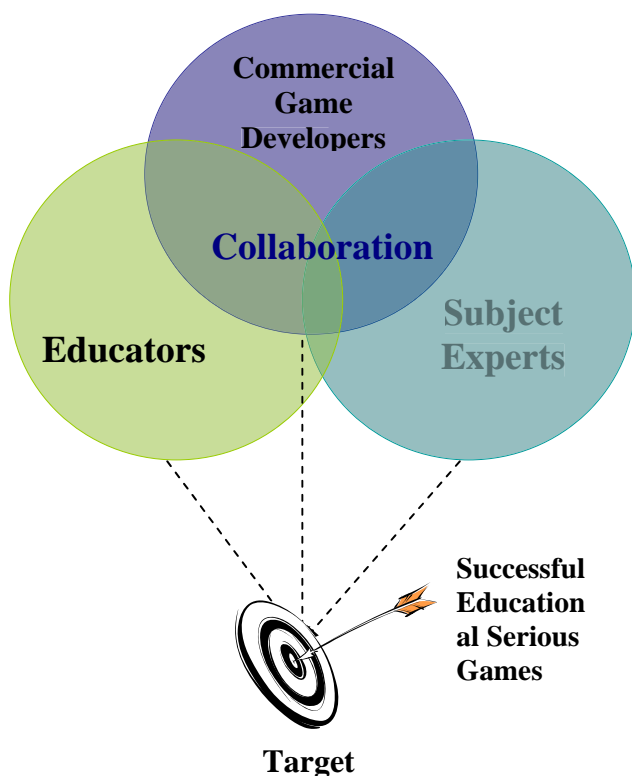- Facilitating learning to take place within a context that is meaningful to the game [17].

Fig. 1 Triangle of collaboration

2.4 What Is CVE?

CVE emerged as a new and interactive 3-D learning environment. CVE is defined as a computer generated multi-user three dimensional interface in which students can experience other participants as being present in the environment [18]. In such environments, students are situated in the same time as well as the same virtual space. Students also interact with each other and express their non-verbal behaviors through the use of their personal avatars.

2.5 Second Life

Second Life is an Internet-based 3-D CVE where we developed "*The Village of Belknap*" game. Linden Labs, the creator of Second Life, defines it as a "3-D online persistent space totally created and evolved by its users" [19]. In Second Life, students navigate, interact, and view the world through their personal avatars. One of the main advantages of Second Life is allowing students to change the appearance of the avatar any way they want. Students communicate via typed chat, voice chat and pre-recorded animations such as dancing, crying, and typing.

3. Methodology

3.1 Characteristics of the Sample

Twenty subjects from the University of Louisville participated in the experiment. Participants were 9 (45%) males and 11 (55%) females ranging in age from 18 to 23 years. They were of mixed age, gender and educational backgrounds. Participants were drawn from English 301, "British Literature" course. Participation was voluntary; incentives for participation were provided at the discretion of the instructor. Precipitants are characterized using the gender and age characteristics such as follows:

Gender. Of a total of 20 participants, there were 9 male students and 11 female students. In the face-to-face section condition, there were 4 males and 6 females. In the online section condition, there were 5 males and 5 females. The ratio between males and females in the two conditions was close to each other.

Age. Ages ranged from 18 to 23. The average age of students was 20.30 years (SD = 1.45). The majority of the participants (75%) indicated their age between 18- 20 and 25% were between 21-23 years

old. In the face-to-face section condition, there were 9 participants between the age of 18 to 20 and 1 participants of the age between 21-23 while in the online section condition, there were 6 participants between the ages of 18 to 20 and 4 participants between the ages of 21 to 23.

3.2 Experimental Design

In order to answer the first question, one-way ANOVA was used to analyze the collected quantitative data of students' perceptions of social interaction. The goal of using one-way ANOVA is to examine whether the average difference between the face-to-face and the online groups was statistically significant or not. The two levels of the independent variable were:

- Face-to-face section. This included the students who were enrolled in the face-to-face section and played the game.
- Online section: This included the students who were enrolled in the online section and played the game.

In order to answer the second question, one-way ANOVA was employed to analyze the data. The independent variable was the gender with two levels: Males or females. The dependent variable was the perception of social interaction.

3.3 Instruments

Authors will answer Q-1 using *The Relational Communication Questionnaire (RCQ)* developed by [20]. The questionnaire was used to collect quantitative data regarding students' perceptions of social interaction. The RCQ addresses the immediacy/affection, similarity/depth, receptivity/trust, composure, formality, dominance, and equality.

The RCQ questionnaire consists of 19 items with a five-point Likert scale with response options ranging from 1 (strongly disagree) to 5 (strongly agree). The questionnaire yields a total score that ranges from 19 to 95 with a higher score indicating a better perception of the quality of social interaction. The overall internal consistency reliability of the questionnaire is =.70. Alpha ranged from a low of .52 equality factor to a high of .81 for the immediacy/ affection factor.

Additionally, authors will address Q-2 using the collected information about the gender, age and experience using computers.

3.4 The MPESG Task and Scenario

Playing the MPESG was specifically integrated to help students understand the course material using an MPESG based environment called *The Village of Belknap* (Fig. 2 and Fig. 3). By completing the game, students will be able to describe a fourteenth-century village and the roles of its residents, reflect attitudes appropriate to the social role of their character, and make a historically appropriate argument about joining the Peasants' Rebellion.

Fig. 2 Snap shot of the Village of Belknap game

Fig. 3 Snap shot of the Village of Belknap game

Before starting the game, students were asked to:

- Choose a village identity for their avatar from the following list: king, queen, noble women, knights, miller, gentry merchant, gentry merchant wife, woman who runs the brewery, peasant farmers (both men and women); monk;
- Choose some appropriate fourteenth-century clothing for their avatar;

- Update their profile to reflect their new fourteenth-century role.

During the game students:

- Meet and chat with other villagers; click on the other avatars and read their fourteenth-century profiles; interact with the other characters in a way that is appropriate to the social role of their character in fourteenth-century English village culture.
- Create a note card. In order to learn how to create a note card, students should go to Bulletin Board and follow the directions. On their note card, they should describe a Ricardian belief about the social class structure (e.g., enclosure was a violation of the traditional rights of the peasantry). Then, they should post their note on the Bulletin Board.
- Go to the tavern at the top of the hill and sit down at a table. They discuss whether the men of the village should join the Peasants' Rebellion. Everyone should contribute to the debate, using arguments that reflect the various fourteenth-century attitudes toward justice, the social hierarchy, and the tensions of the times. The students should make an argument that your character would be likely to make.
- When the village has come to a decision, the students would learn about their fates by going to the Bulletin Board area and rolling the dice.

In order to monitor students' performance during the game, the instructor recorded students' game sessions including the chat and the instant messages. So conversations during the game are not private. In addition, the instructor took "snapshots" of the group to have a record of avatars and costumes.

3.5 Procedures

One week before playing the game, the instructor sent an email to the students to remind them with the time of playing the game and motivated them to participate in the survey. She explained to them the purpose of the survey. She also informed them that extra credit points would be awarded as an incentive. At the day of playing the game, the instructor sent to the students another email as a reminder. In addition, students were sent via email a hyperlink to the online survey deployed using Zoomerang, an online survey tool.

Participation in the survey was completely voluntary and there were no negative ramifications for students who chose not to participate. An announcement was also posted in Blackboard. The survey was completely anonymous, so students who participated in the survey were asked to inform the instructor of their participation via e-mail to receive the extra credit points. Students were given a week to complete the survey.

4. Results

Based on the literature review, the researchers expected that playing the MPESGs and the facilitation of more avenues of communication and interaction among students would enhance students' social interaction with their classmates. Authors conducted the experiments mentioned above and they analyzed the data using SPSS. Results are divided into two sections such as follows:

4.1 Type of the Section and the Perception of Social Interaction

Table I reports the descriptive data for students' level of social interaction which was measured in this study. Table I shows the mean, standard deviation, and minimum and maximum score for each condition.

The descriptive data shows that the participants' scores of the RCQ ranged from 55 (Min) to 80 (Max) among all participants.

- In the face-to-face section: the scores ranged from 55 to 78
- In online section: the scores ranged from 60 to 80.

The online group showed more consistent scores with standard deviation of 6.62 than the face-to-face group which had a bigger standard deviation of 9.07.

Table I. Descriptive results of the RCQ

	N	M	SD	Min	Max
Face-to-Face	10	63.20	9.07	55	78
On-line	10	67.60	6.62	60	80
Total	20	65.40	8.05	55	80

Fig 4 demonstrates the relationship between the mean value of students' responses and the social interaction using the two different sections. The figure shows that the students' perception of social interaction was higher in the condition of online section (M = 67.39) compared to the face-to-face section (M = 63.20). The results proved that the students' social interaction with their classmates was influenced by the type of the section.
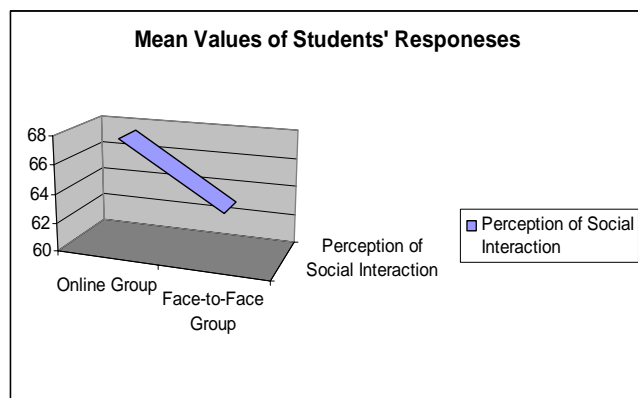

Fig 4. Mean values of students' responses to the RCQ

Although the results indicated that students in the online section experienced a higher perception of social interaction than the students in the face-to-face section, they did not show whether the difference between the mean values was statistically significant or not. Therefore, we conducted a *one-way between subjects ANOVA* to test the significance of the difference between the mean values (TableII).

Table II Results of One-way ANOVA Test

	Sum of Squares	DF	Mean Squares	F	Sig
Between Groups	120.05	1	120	2.0	.17
Within Groups	1073.70	18	59.65		
Total	1193.7	19			

The results of ANOVA test indicates that there was no significant difference between the perception of social interaction of students who were enrolled in the online section and the students who were enrolled in the face-to-face section. Although Table II indicated that there is a difference between the two groups, ANOVA test confirmed that this difference is not statistically significant. The findings revealed that both groups enjoyed their interaction with their classmates through playing the MPESGs. Both groups felt comfortable and more involved in the interaction process during playing the game.

4.2 Gender and Perception of Social Interaction

Table III presents the descriptive data for the males and females' level of social interaction which was experienced in the face-to-face section. Table III illustrates the mean and standard deviation for each gender. The males showed more consistent scores with standard deviation of 8.77 than females which had a bigger standard deviation of 10.01.

Table III Descriptive results of the face-to-face section

Gender	N	Mean	Std Dev
Male	4	64.25	8.77
Female	6	62.66	10.01

Table IV illustrates that the descriptive data for the males and females' level of social interaction which was experienced in the online section. Table IV demonstrates the mean and standard deviation for each gender. The males showed more consistent scores with standard deviation of 6.9 compared to

females which had a bigger standard deviation of 7.04.

Table IV Descriptive results of the online section

Gender	N	Mean	Std
Male	5	68	6.9
Female	5	67.2	7.04

Fig 5 describes the relationship between the mean values of students' responses to the RCQ questionnaire and their gender. In both the face-to-face section and the online section males (M $_{face-to-face}$ = 64.25, M $_{online}$ = 70.80) experienced a higher perception of social interaction than females (M $_{face-to-face}$ = 62.66, M online = 64.4). The figure shows that the difference between the males and females' perceptions of social interaction in the *face-to-face section* was *lower than* the difference between their perceptions of social interaction in the *online section*.

This finding indicates that gender's experience with the perception of social interaction was influenced by the type of the section.
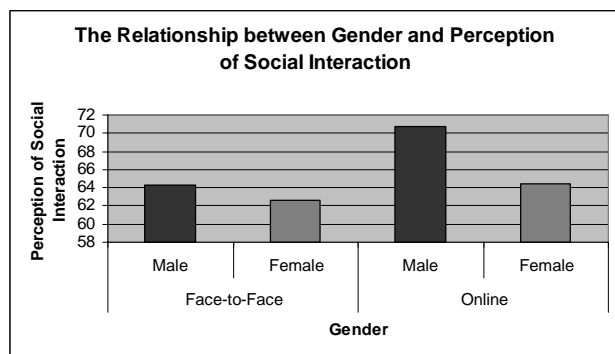

Fig 5. The relationship between the gender and the perception of Social Interaction

Moreover, the comparison between the responses of males and females with respect to their expertise in using computers for education or work, their experience in using a virtual environment, and their experience with video/computer games is presented in Fig 6. Fig 6 demonstrates that males reported significantly higher experience in playing video/computer games. In contrast, no gender significance differences were observed in using

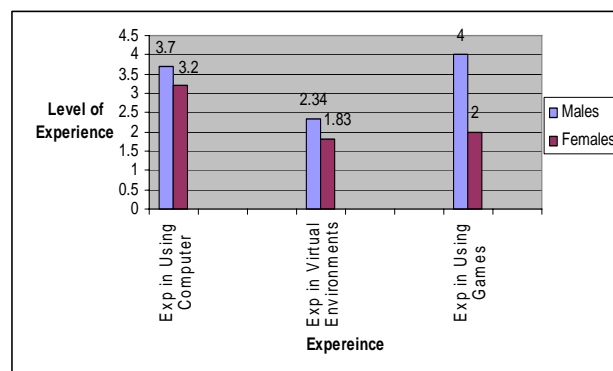computers for school/ work and using virtual environments.

Fig 6. The Comparison between Males and Females

At the final step of analysis, the influence of gender on the perception of social interaction during playing the game was assessed using One-way ANOVA. The result is presented in table V, which indicates that there is no statistical significant difference (*p= .34)* between the perception of social interaction of males and females during playing the game. The result illustrates that both males and females enjoyed playing the game and in consequence experienced high perceptions of social interaction during their communication with their classmates.

Table V. Results of One-Way ANOA (Gender and Social Interaction)

	Sum of Squares	DF	Mean Squares	F	Sig
Between Groups	61.66	1	61.66	.98	.34
Within Groups	1132.09	18	62.89		
Total	1193.75	19			

5 Discussion

This experiment examined whether playing MPESGs influenced the social interaction of students who were enrolled in the online section of the course differently from students who were enrolled in the face-to-face section of the course. In addition, this experiment tested the influence of

students' gender on their perceptions of social interaction during playing the game.

The results indicated that there was no statistical significant difference between the perceptions of social interaction of the two groups. In addition, the results revealed that there is no statistical difference between the perception of social interaction of males and females during their participation in the game.

In our experiment, finding no significant difference in social interaction between the two groups is supported by research results in [21] and [22]. Research conducted in [21] and [22] found that both students who played the MPESG experienced higher perceptions of social interaction than their peers who did not play the game regardless of the leering medium. Additionally, our experiment confirmed the importance of the existence of an active channel of interaction among the students whether in the online courses or in the face-to-face courses. Also, the results validated the claim regarding the importance of the existence of a shared place for online students to meet together. By providing places for social interaction and relationships beyond the workplace, multi-players games have the capacity to function much like the hangouts [23].

Moreover, the results demonstrated that online students found playing the game as a facilitating interactive opportunity that is not available by nature in online courses. They used the avatars to represent themselves to as well as to express their feelings. This means that online students found their social interaction through the game as an alternative to their unavailable face-to-face interaction. In addition, the use of the virtual environment provided students with the experience of being together in the same place which considered one of the main pre-requisite of a successful social interaction. In face-to-face section, the majority of students expressed that playing the game led to a strong positive impact on their social interaction with their classmates. Playing the game promoted students to extend their interaction with their classmates outside the walls of the classroom and may form a type of lasting friendship.

The conducted study found that females have fewer tendencies to play video/computer games than males. Males enjoyed playing video/computer games than females [24]. Therefore, computer games still dominated by males and still considered "boys toys". But at the same time, the review of other research indicated that the number of females who like to play games has increased [6]. From another perspective, the reported results in this study showed that males and females are using computers for educational and work purposes on a close level. The results of ANOVA test indicated that males experienced higher perceptions of social interaction than females but this difference was not statistically significant.

Regarding males, the fun and challenging nature of games attract them to spend several hours playing computer games everyday. In addition, males have more experience than females in how to navigate the virtual environment as well as how to control and move their avatars. This type of experience helped them to be familiar with the virtual environment of the game faster than females and in consequence to enjoy their interaction with their colleagues. The role-playing nature of the game that was employed in this study as well as males previous experience in playing massively multi-player online games promoted them to play the game and to experience a high perception of social interaction.

From females' perspective, the ability of females to select their avatars and to customize them the way they like encouraged them to play the game. In addition, the facilitation of social interaction through verbal and non-verbal communication with their colleagues, the absence of violent content, as well as the absence of sexual gender role stereotyping of game characters in the employed game in this study motivated females to play the game and to enjoy their social interaction with their colleagues. This means that as soon as females find positive values in the game, they got inspired to play the game.

6 Limitation Of The Study And Future Research

The major limitation of this study was that it only took into consideration the perception of social interaction of students who voluntarily accepted to participate in completing the questionnaire. This means that there is no accountability for the

perceptions of social interaction from the perspective of students who did not participate in completing the questionnaire.

Future studies may investigate several other issues. First, future research may explore how the use of MPESGs can influence students' learning performance. Second, the researchers may investigate how the role that students play in the game can affect their behaviors in their real lives.

7 Conclusion

The study demonstrated that social interaction for both face-to-face students and online students is a critical element in the learning process as well as in students' cognitive development. The results of this study indicated that teachers should not only present the information and materials to students but also to integrate technological tool such as educational multi-players serious games that promote social interaction and critical thinking among students as well as support them in achieving better learning performance.

In summary, this research demonstrated that facilitating new channels of social interaction is not only important for online students but also for face-to-face students. The limited amount of empirical research in the area of educational serious games, the relationship between playing games and promoting social interaction, and the impact of students' gender on their perceptions of social interaction during playing the game make this study one of particular importance to the literature.

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