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Abstract

Background and purpose: To evaluate student pharmacists' attitudes and satisfaction toward playing educational virtual games in the classroom.

Educational activity and setting: The study setting was playing virtual games in the classroom setting. First year student pharmacists participated in two Mimycx quests in the Healthcare Communication and the Psychiatry/Neurology courses. Students were randomly assigned into teams and worked together to complete the assigned quest games. Completion of the pre- and post-quest questionnaires via Qualtrics was voluntary.

Findings: A total of 79 student pharmacists played the Mimycx quests. Only 66 students completed both pre- and post-quest questionnaires. Students indicated their familiarity with game concepts related to the virtual environment and avatars used in the study. The change in their attitudes and satisfaction about the Mimycx virtual learning experience was significant between the two learning time points.

Discussion and summary: The use of virtual gaming technology could enhance student pharmacists' learning and engagement in the classroom. Students benefitted from increased familiarity with virtual, educational gaming concepts in their experiences with Mimycx although no statistically significant differences were found regarding their attitudes toward communication and teamwork.

Keywords: Gamification; communication; interactive learning; game simulations; quests

Conflict of interest: The authors of the study have no conflicts of interest to disclose.

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Background and purpose

Imagine learning about the risk factors and medications used to treat diabetes or hypertension in a virtual world, where there are three-dimensional avatars on a quest, working together to find the clues and solve health issues. The user is able to manipulate these animated figures to move, stand, sit, speak, and teleport to other regions within the virtual world via a computer keyboard. For many years, online learning programs and gaming technology have been developed for medical and nursing students to solve problems and interact with patient avatars in a simulated environment.¹ Healthcare simulations in medical and nursing schools have transformed much of their curriculum into virtual, three-dimensional lecture halls where learners can actively participate, collaborate as a team, and be involved in decision-making skills for the virtual patient.²⁻⁴

Traditional teaching-and-learning environments are often static, unchallenging, and, at times, boring, especially when compared with educational virtual games that compete as sources of active learning for students.⁵⁻⁶ Virtual worlds in game technology have been portrayed in literature and film, which can play a vital role in healthcare education because the technology can change the way people learn and live in the future.⁷⁻⁹ Furthermore, virtual worlds are currently used as educational spaces that continue to grow in popularity on campuses and professional settings.¹⁰⁻¹¹ There is a plethora of literature supporting virtual, three-dimensional game simulations as learning environments for students to effectively work together as a team to communicate and share ideas.¹²⁻¹⁵

The literature has shown that students can only remember 10% of what they read, but retain almost 90% of the information if they engage in the activity themselves, even as a simulation.⁸⁻¹⁰ The value and potential benefits of using game simulations as companions to classroom instruction are undeniably obvious. Game simulations present to learners realistic and compelling challenges, highly stimulating their information processing capabilities and capturing their concentration span for long durations.¹⁴⁻¹⁶ Furthermore, game simulations are effective partly because the learning takes place within a meaningful, simulated context.¹⁶ Learners actively interact with the content and role play skills associated with the goal of their virtual quest games. By allowing students time to interact with other avatars (e.g., patients, peers, or other healthcare professionals) in a safe and simulated environment, there is a decrease in student anxiety, an increase in competency in learning a new skill, and encouragement to cooperate and

collaborate.² High quality three-dimensional educational technologies, such as game simulations integrate principles of active learning with the tools to help students explore, create, imagine, interact, role play, and learn on a more effective, entertaining, and vivid platform.

By providing students a platform where they can interact with other avatars and practice their skills (e.g., communication, clinical, decision-making, and leadership), game simulation technology can keep students interested, engaged, and motivated in self-directed learning.¹⁷ Mimycx, sponsored by the American Association of Colleges of Pharmacy (AACP) and Professions Quest, is a multiplayer online role playing game that includes interactive quests used to teach health professional students critical thinking skills in a virtual medical environment. Each quest game has avatars engaged in virtual adventures that are case-based and health-related. The technology encourages real-time social interaction, communication and teamwork among the learners via verbal and text chatting functionalities.

There is a paradigm shift from the traditional Socratic method of education to one that is more active and interactive in nature, such as virtual games and simulations. Virtual games could also be part of the flipped classroom learning strategy, where technology and active learning are key elements. The purpose of this study was to evaluate the pharmacy students' attitudes and satisfaction toward playing educational virtual games in the classroom environment.

Educational activity and setting

This was a prospective study designed to compare the effectiveness of the Mimycx software in reinforcing relevant topics of communication and teamwork in two courses: Healthcare Communication and Psychiatry/Neurology. It was launched in the Healthcare Communication course and the Psychiatry/Neurology course of the Doctor of Pharmacy curriculum. The study was approved by the Chapman University Institutional Review Board. Two faculty investigators received training on the use of Mimycx software from the AACP Professions Quest group. The study participants included 79 pharmacy students enrolled in the first year of the Fall and Spring trimesters of 2015 and 2016, respectively. Students were randomized into teams of five players each, and one team comprised of four players. The student teams were assigned to play the Mimycx quest games called "Sick Beats" in the Healthcare Communication course and "House Call" in the Psychiatry/Neurology course. Consent was obtained when students voluntarily participated in the pre- and post-quest questionnaires via Qualtrics, a web-based tool. Students'

participation in playing the Mimycx quest games contributed to their overall participation course grade, which was described in the course syllabus as 10% for in-class participation and learning activities. The students' course grades were not affected by their performance scores from playing the quests. The pre-quest questionnaire included 10 questions and was deployed to students 48 hours prior to having them play the quest in each course. Twenty-four hours after playing the quest in class, the post-quest questionnaire was deployed to the students. A free response section was also included in the post-quest questionnaire for students to address the following: "What was the most important thing you learned?" and "Please share any suggestions or comments about this game." There was an incentive of two extra credit points given to students who completed the pre- and post-quest questionnaires in each course. The extra credit points went toward their course grade.

Flipped classroom learning was embraced and implemented in these courses, where much of the classroom time was used for interactive learning and discussions. In the Healthcare Communication course, students had already received lectures and case scenarios focused on challenges in healthcare communication and teamwork. They completed the pre-quest questionnaire that assessed their baseline knowledge and perceptions about virtual games and communication. In class, students were randomly assigned into teams to play the "Sick Beats" quest game. Their identities were de-identified throughout the game, and their individual anonymity was preserved within each team via an assigned pseudonym. Each student logged into the quest under his/her pseudonym, which only the study investigators had knowledge of. The "Sick Beats" quest took approximately 45 minutes to complete, which included a virtual tutorial. The tutorial introduced the students to their avatars and how to control them (e.g., walking, picking things up, and opening doors). Each student had their own avatar to control throughout the quest game. The quest theme focused on a mystery where a concert goer became ill from drinking contaminated drinking water. Students were encouraged to work together as a team and communicate using their avatars to solve the mystery. Real-time feedback with respect to points earned throughout the quest was given to students as they completed each task of the quest. The points reflected their individual and team performances. A similar format was used when students played the second quest game, titled "House Call", in the Psychiatry/Neurology course. This quest was intended to explore the students' communication and teamwork skills in a different game setting. The "House Call" theme focused on substance abuse by a

young female adult. Students were presented with an unconscious student found on the campus grounds, and they must investigate the cause of her unconsciousness by working together and solving clues. The quest took approximately 30 minutes to complete since students already knew how to control the avatars and declined the virtual tutorial session.

Analysis of the questionnaire results was performed after the students completed the two courses. Only students who voluntarily completed the pre- and post-quest questionnaires were included in the analysis. Students' perceptions and attitudes were evaluated on a 5-point Likert scale (strongly agree, agree, neutral, disagree, and strongly disagree) and a 4-point Likert scale (very familiar, somewhat familiar, not very familiar, and never heard of it). Collection of demographic data included the students' age and gender. The questionnaires were linked to the students' identification numbers for assigning extra credit points and were de-identified prior to analysis.

Findings

Sample characteristics

Of the 79 students, 13 did not complete all the questionnaires and were excluded from the analyses, producing a study sample of 66, with a mean age of 27.1 ($SD = 6.50$). There were more females (63.6%) than males (36.4%) in this cohort of students. See Table 1 for demographics.

Self-report familiarity with educational game terms

At all four questionnaire time points, students indicated their familiarity with game terms related to the virtual environment used in the study (Table 2). Prior to playing the quest games, familiarity with the presented terms (i.e., avatars, serious games, virtual team-based learning) was low, with majority of students indicating either "not very familiar" or that they "never heard of it." Stuart-Maxwell tests for marginal homogeneity were performed using the Stata statistical software package (Release 15).¹⁸ Between the pre- and post-quest of the "Sick Beats" game (Quest 1), a 24.2% increase to "somewhat familiar" was found for the term of "Serious games" [$\chi^2 (3, N = 66) = 19.9, p < .001$]. From this increased familiarity, an increase was seen again from pre- to post-quest of the "House Call" game (Quest 2), with 12.1% more students indicating that they were "very familiar" [$\chi^2 (3, N = 65) = 12.1, p = .007$]. Similarly, an increase in familiarity with "Avatars" was found, with 15.2% more indicating that they were "very familiar" [$\chi^2 (3, N = 66) = 11.4$,

$p = .010$] after playing Quest 1. Only 12.1% of students reported that they were “very familiar” with “Avatars” after playing Quest 2, which was not much of a further increase from Quest 1.

Post-test attitudes about the Mimycx virtual learning experience

Students were presented items regarding their attitudes about the Mimycx learning experience after participating in “Sick Beats” and “House Call”, Quest 1 and Quest 2, respectively (Table 3). Responses on 5-point Likert items regarding positive statements about virtual healthcare game environments showed a general trend toward agreement on post-quest for “Sick Beats” (Quest 1), with a trend towards disagreement after playing “House Call” (Quest 2). The change in attitude was significant for the statement, “Mimycx was a worthwhile learning experience,” with a 19.7% increase for those reporting disagreement or strong disagreement [$\chi^2 (4, N = 66) = 14.0, p = .007$]. There was a general response trend about teamwork, patience and flexibility with software glitches to the question, “What was the most important thing you learned?” Some examples of the students’ responses to this question included: “patience and flexibility because of the challenges to upload and to get the whole group on the same server group,” “you must be patient with electronics and people,” and “I learned that we all had to communicate with each other to keep everyone in sync to move along with the game.”

When students were asked about the Mimycx quests, 24.1% of students (Quest 1) and 15% of students (Quest 2) indicated that they were “fun and interactive” and that “game simulations should be used more in pharmacy education”. However, when asked how Mimycx should be used in other courses, the majority (63.6%) in Quest 1 indicated “It should be used in selected courses,” which decreased to 47.0% in Quest 2. Approximately 21% of students (Quest 1) and 48.5% of students (Quest 2) responded about Mimycx that “It should not be used in any course” [$\chi^2 (3, N = 66) = 9.02, p = .011$]. Regarding teamwork, 15.2% of students (Quest 1) and 24.2% of students (Quest 2) strongly disagreed that Mimycx quests “worked well in groups” [$\chi^2 (4, N = 66) = 4.86, p = .302$]. There was a general trend about the Mimycx software gaming issues when students were asked to suggest or comment about Mimycx and the quest games in the free response section of the post-quest questionnaire. Some examples of the students’ responses included: “I really think the technology part of the game needs to be improved so students can enjoy using this game as a tool for learning. Some students were kicked out from the game at the beginning and wasn’t able to even participate in the game due to username and password rejection after getting kicked out.” “The

software is glitchy and tends to kick us out having to start over or not even be able to complete the game.”
 “I see potential for these kinds of software/game learning, but the technology really needs to be improved.”

Discussion

Not only are virtual reality game simulations relevant and being used by the current generation of learners, they also provide a different approach for learners to critically think and retain the knowledge via a more enjoyable learning experience. This prospective study assessed the relationship between virtual gaming technology and its impact on the pharmacy students' attitudes about the use of virtual games in the pharmacy curriculum. This is the first study evaluating the applicability and effectiveness of a virtual gaming software, Mimycx, in terms of enhancing communication and teamwork among pharmacy students. Based on the literature, there is a difference in perspectives between males and females about 3D and 2D virtual gaming platforms. Males tend to prefer games that include post-apocalyptic fantasy or war storylines.¹⁹⁻²⁰ In contrast, females tend to prefer an authentic simulation game that involves close simulation of real-life activities, such as the Mimycx quests.²¹ We anticipated that there would be more female students in favor of playing the Mimycx quest games because they were real-life and health-focused, however, there was no difference between the two gender groups in favor of the Mimycx technology. The students' self-report of their familiarity with educational game concepts and terms, of “serious games” and “avatars,” increased after playing the quest games. Because of the students' exposure and experience with the Mimycx quest in the Healthcare Communication course, there was no additional increase in their familiarity of the same terms after playing the Quest 2 in the Psychiatry/Neurology course, except for the term “serious games.” This may be that they misunderstood the game terminology for the literal meaning of the game. A couple of the students' feedback was “what are serious games?” and “I thought this game is meant to be fun.” The students' overall positive attitude and enthusiasm about using virtual gaming software in the pharmacy curriculum significantly decreased after playing Quest 2, most likely from the continued technical issues with the software and not from the quest games.

More than 40% of the students for both Quest 1 and Quest 2 indicated that “It was not easy to navigate my avatar through the quest” (Table 3). Furthermore, students expressed, in the free response section of the questionnaires, that they did not feel that the Mimycx software enhanced their learning experience, especially in terms of teamwork. This was reflected when there was an increasing trend toward “strongly

disagree” that “Mimycx worked well in groups” from Quest 1 to Quest 2 (Table 3). Similarly, there was a negative correlation with using the Mimycx quest games to improve clinical decision making, communication and teamwork skills (Table3). Students also found it difficult to use a new style of learning reflected in a decreased percentage from Quest 1 to Quest 2 as being a “worthwhile learning experience” (31.8% vs. 18.2%, respectively, Table 3). Altogether, there was a significant trend among the students who “strongly disagree” that “Mimycx was a worthwhile learning experience.” This is most likely attributed to the technical issues they experienced playing the quest games in the two courses. Extra credit points were used to motivate the students to complete the pre- and post-quest questionnaires. There have been mixed reports about using extra credit points and rewards to enhance student’s learning, however, several researchers claim that such motivational mechanisms contribute to the student’s increased motivation and performance in the course.^{10,11,22,23}

This study had some limitations. At the time of using the Mimycx software, it was in beta test phase of development and has been only used in other schools and colleges in the US where the classroom sizes were smaller ranging between 30 to 50 students. Because the Mimycx quests had not been played all at one time in a larger class size, students experienced problems logging into the quest games after previously installing and downloading the game; some students were ejected from the virtual chat room and had to re-log into the quest; the speed of the quest either slowed down or froze for some of the students during their gaming experience; and some students could not see their teammates’ avatars in the virtual environment. There was also a software rebooting issue where the Mimycx host server could not support many students logging in at the same time. These technical issues were observed and verbally expressed during the students gaming in the classroom. This caused much frustration among the students. Another limitation was the absence of a control group to compare if there was any difference in communication and teamwork strategies with the student gamers. The technical issues were shared with the Professions Quest developer team for continued quality improvement of Mimycx.

Summary

The intention of introducing virtual games into the pharmacy curriculum was to actively engage students in a different learning environment and style. Our students benefitted from having an increased familiarity with virtual gaming concepts and terms from playing the Mimycx quest games. Aside from the

technical issues, several students still perceive that they could improve their communication and teamwork skills in participating in a virtual healthcare game environment. Virtual gaming could be an effective strategy to engage our young learners. Further development of similar gaming technologies need to be supported to promote a safe, fun and interactive environment for the pharmacy students to learn about healthcare topics and apply their communication and teamwork skills.

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