



The Impact of Escape Room Gamification Using a Teleconferencing Platform on Pharmacy Student Learning

Anthony Gerber¹ · Briann Fischetti²

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Abstract

Objective The purpose of this study is to design and implement a virtual escape room game using the Zoom video conferencing platform to enhance third professional doctor of pharmacy students' knowledge of self-management of sexual health and pregnancy prevention and to assess student's perception of the activity.

Methods Students were divided into five pre-assigned breakout rooms of five to six students each using the Zoom video conferencing platform, following the conclusion of the self-care sexual health and pregnancy prevention lecture. Once in the breakout room, students worked as a group to complete seven activities to gain access to a code needed to "escape the room." At the completion of the activity, students were asked to fill out a perceptions survey.

Results Twenty-six students participated in the virtual escape room activity, with all students completing the activity within the allotted time. Overall, students expressed positive attitudes toward the escape room activity, reporting it helped them check their knowledge of the subject, remain motivated, and connect with their classmates.

Conclusions Overall, the virtual escape room had a positive impact on student learning and application of subject material.

Keywords Escape room · Gamification · Self-care · Pharmacy education · Student satisfaction

Introduction

Gamification, a term coined in 2003 by Nick Pelling, refers to "the application of typical elements of game playing (such as point scoring and competition) to other areas of activity." [1] Since then, the term has been employed in many different facets of life including business, company training, and, more recently, education. Various colleges of pharmacy have been implementing game-based teaching into their curriculum with recent publications on the use of escape rooms in pharmacy curricula [3–9]. Marc Prensky in his book *Don't bother me Mom, I'm learning!* states students in our colleges today are digital natives and grew up using games and

simulation. He further mentions the constant communication between students and the need for instant gratification and reward. As demonstrated by Prensky, students today desire a multifaceted classroom experience and learn better through content that is animated and interactive [2]. A multinational systematic review of healthcare professions found that satisfaction rates were higher in the gamification groups compared to traditional learning and digital education modality groups [10]. The 2013–2014 American Association of Colleges of Pharmacy (AACP) Academic Affairs Committee report also promotes designing and implementing serious games to prepare future pharmacists for practice [11].

Escape room gamification has gained significant attention in pharmacy education reinforcing topics covered in pharmacology and pharmacotherapeutics. In fact, an in-person escape room focused on diabetes conducted at two separate colleges of pharmacy by Kavanaugh et al. showed a statistically significant gain in student knowledge and perceptions of the topic independent of baseline knowledge [6]. These activities are meant to promote teamwork by solving puzzles and detecting clues to escape a room. As a team, students are able to stimulate learning in an interactive and entertaining environment. Educational escape room activities allow

✉ Anthony Gerber
gerbera@nychhc.org

Briann Fischetti
briann.fischetti@liu.edu

¹ New York City Health + Hospitals/Coney Island, 2601 Ocean Parkway, Brooklyn, NY 11235, USA

² Arnold and Marie Schwartz College of Pharmacy, Long Island University, 1 University Plaza, Brooklyn, NY 11201, USA

students to have direct contact with one another, enhancing both cooperative and collaborative skills [7]. However, in an unprecedented era of physical distancing due to the coronavirus disease 2019 (COVID-19) pandemic, the majority of pharmacy education was done remotely via online videoconferencing platforms in place of in-person activities. This proved to be a challenge for academics who needed to maintain the same level of student motivation, persistence, and retention as in-person education. A virtual peer group escape room activity would engage students in learning and develop skills related to teamwork, critical capacity, and communication [12]. Additionally the learning opportunity would foster constructive interactions leading to observations of each student's leadership skills and styles [13]. There is a lack of data on increasing motivation, engagement, and interactions between students and the material itself when teaching online; however, as gamification has had success in the classroom, it is expected to also have a positive impact virtually as well.

This activity included designing and implementing a virtual escape room game using the Zoom videoconferencing platform to enhance third professional doctor of pharmacy students' knowledge of self-management of sexual health and pregnancy prevention. Following the activity, student satisfaction was assessed to gather feedback on the overall perception of escape room gamification on pharmacy education and learning.

Methods

All students enrolled in the Self-Care in Community Practice elective course participated in the activity. The sample of students registered was those interested in furthering their knowledge, skills, and attitude for practice in the community setting and other outpatient settings. Due to the COVID-19 pandemic, the course was conducted via Zoom virtual telecommunications platform. Traditionally, students would be provided a lecture on each unique self-care topic, followed by an active learning activity to review class material and apply what they learned. In lieu of a standard group activity, a virtual escape room activity was designed and administered during the allotted active learning time. The use of Google Slides and Google Forms was utilized to create the actual escape room as well as the individualized clues. A stock image of an outpatient pharmacy was used as the background image, while images of various items including medications, posters, and smart graphics were pasted above the background to act as clues. Each item was hyperlinked with a unique Google Forms URL, which upon clicking, opened a clue for students to solve. Each clue could culminate in a number that had to be put in the correct order to unlock a door and “escape the

room.” An unlimited time subscription to the Zoom virtual telecommunication platform was required to achieve this activity. The subscription was provided by Long Island University.

We designed the virtual escape room around the topic of sexual health and pregnancy. We chose to do the virtual escape room for the topic of sexual health as this may be a topic that is uncomfortable for some learners. We felt that an escape room may be a fun way to review this topic and increase student's level of comfort with the topic. Students were provided with an in-depth lecture for an hour and a half immediately prior to the escape room activity. Following the conclusion of the lecture, students were divided into five pre-assigned breakout rooms, with approximately five to six students in each room. In order to incorporate layered learning, students completing their advanced pharmacy practice experience (APPE) were incorporated into the activity and acted as escape room guides. A minimum of 6 proctors were needed to help guide students during the activity. Prior to the launch of the activity, a 1-h training session was provided to both APPE students and faculty going over each part of the activity. During this training, practice game sessions were conducted to review the activity and troubleshoot any issues that may arise. A separate reference book was provided at the conclusion of this session. Each breakout room had either a faculty member or an APPE student who would aid students if they were stuck on a certain section or could not locate the next clue. This was done to mimic a real-world escape room experience. Proctors were also there to ensure all students were participating in the activity and that groups were not guessing on multiple choice questions until they obtained the correct answer. If groups were guessing, the proctor would intervene and start a discussion to work through the problem. Approximately 20 h over a course of a week was required to create the activity and provide training to proctors.

Once in their individualized breakout room, students were provided with a URL to the escape room. One student leader from each breakout room was to open the link and share their screen with the group. Once the link was opened, a 60-min timer would activate, which notified students how long they had to complete the activity. Figure 1 displays the appearance of the escape room activity. The student leader would control which problem-solving activity the group would attempt. There were a total of 7 activities which students were to solve to gain access to a piece of the escape room code. Table 1 demonstrates the task and skills demonstrated for each clue. Activities included a combination of multiple choice questions, short-answer fill-ins, and ordering questions. Figure 2 provides examples of these different types of clues. Once all 7 clues were completed, students were then tasked to click on the locked door and enter the number code in the correct order to “escape the room.”

Fig. 1 The appearance of the escape room activity



Once all students escaped the room or an hour of time had passed, each student was redirected back into the main Zoom room and a debriefing session of each of the activities began. Faculty was present at this time to answer questions students had regarding the topic or escape room activity. Students were then asked to complete a 9-question survey developed by faculty via the Qualtrics platform to measure overall perceptions of the gaming activity. The questions in the survey were used to evaluate student's assessment of their own learning, attitude toward the learning activity, and team-based learning. The perception scale was a five-point Likert scale ranging from "1 = strongly disagree" to "5 = strongly agree." Institutional review board approval had been obtained from Long Island University. Data was analyzed by calculating descriptive statistics. In addition, a one-sample *t* test was used to assess student satisfaction levels using GraphPad Prism Statistics software v9.1. Our hypothesis was that the mean response per question would be 3.0 (neither agree nor disagree), which was used as the control value in the one-sided *t* test.

Results

Twenty-six students participated in the virtual escape room activity, with all students completing the activity in the allotted time. On average, it took each group approximately 45 min to "escape the room." Based on the data collected immediately after the completion of the activity, students, on average, expressed satisfaction toward the virtual escape room activity. Specifically, they reported that the escape room activity format helped them check their knowledge of the subject (mean 4.62; standard deviation [SD] 0.79; $p < 0.0001$), remain motivated (mean 4.69; SD 0.72), and

help them connect with their classmates to learn (mean 4.41; SD 1.19). Additionally, students reported that their knowledge on the subject improved following the activity (mean 4.73; SD 0.65), with the majority of students stating they enjoyed the activity (mean 4.77; SD 0.64) and would recommend this activity to other pharmacy students (mean 4.69; SD 0.79). Students also felt the hour time allotted to them was enough to successfully complete the activity (mean 4.85; SD 0.60). Table 2 outlines all survey questions and results.

Discussion

There are many published examples of educational games in pharmacy classroom education. However, to our knowledge, there are no published reports of virtual gamification attempts done via a telecommunication platform in pharmacy curricula. With the emergence of the novel COVID-19 pandemic, pharmacy faculty have had to adapt to think of new and exciting methods of getting information across to students. With more students entering pharmacy school familiar with video games and game-based learning, gamification serves as a unique benefit to the new generation of pharmacy students.

Students enrolled in our self-care course overall had positive perceptions of the escape room activity. Students felt the activity stimulated both self-learning and teamwork in an enjoyable learning environment. These results are similar to other published literature describing the use of escape room activities in the pharmacy curriculum [3–9]. What differs from prior publications is that our study was done entirely remote using a telecommunication platform. Upon discussion with APPE students who acted

Table 1 Activity tasks and skills demonstrated

Clue number	Skill demonstrated	Task	Type of question
Clue 1	Demonstrate the ability to counsel a patient on the proper use of over-the-counter vaginal products	Students were tasked to rearrange 7 steps in applying vaginal cream in the correct order	Ordering
Clue 2	Demonstrate the ability to identify commonly used over-the-counter items and their indications	Students were shown a picture of an over-the-counter medication or medical supply and were tasked to determine the proper indication	Multiple choice
Clue 3	Demonstrate the ability to identify signs and symptoms of disease states	Students were presented with a scenario and were tasked to identify the condition the patient was experiencing and causative organism	Short-answer fill-in
Clue 4	Demonstrate knowledge of common vaginal and vulvovaginal disorders and identify appropriate self-care treatment options	Students were shown a pre-recorded video of a patient encounter in a pharmacy and had to determine how to properly treat the patient	Video recall
Clue 5	Demonstrate the ability to assess the efficacy and safety and different types of barrier protection for sexual transmitter infections	A photo of 6 lubricates was displayed, and students needed to determine which of them was safe to use on male latex condoms as well as solve a problem regarding female condoms	Multiple choice and select all that apply
Clue 6	Demonstrate the understanding of disorders related to menstruation and their self-care treatment options	Students were presented with a patient case and tasked to determine the proper treatment options for a patient with dysmenorrhea	Short-answer fill-in
Clue 7	Demonstration understanding of common drug–drug interactions and drug–disease interactions	Students were shown a photo of either a medication or medical condition and needed to determine which over-the-counter medication was safe for patient use	Multiple choice

Description of each clue, skill demonstrated, task student had to solve, and type of question

as escape room guides during the activity, many felt the activity provided a unique way of learning new material and appreciated that the activity allowed them to become more involved in pharmacy academia.

In addition, virtual escape rooms have been trialed in other disciplines, including an emergency medicine residency program. Also challenged by distancing guidelines due to the COVID-19 pandemic, Cates et al. adapted an in-person escape room to a virtual format creating “Escape the Toxin: Online!” to test knowledge of toxicology in their residents. Similar to our format, Cates et al. used Google Forms and a Zoom platform. Overall, the majority of participants found the activity helpful [14].

One of the main limitations of this activity included that it was a small sample size. Although the perception of the activity was positive, it is only a small sample of 26 students and may not be translated to other cohorts of PharmD students. A larger student cohort may require additional facilitators and resources to successful implement such an activity. In addition, this activity was conducted in the spring semester of the third professional year. These students had completed the majority of their didactic curriculum and were relatively independent at the time of completing the activity. These results may not be translated to a cohort in early professional years, where they need more direction and guidance. Another consideration includes that a grade was not associated with this activity, which may have contributed to the survey results and played a role with participation of all group members. Despite many colleges returning to in-person instruction, virtual gamification may open opportunities for at-home learning in unique situations, such as campus closures due to weather and natural disasters. In addition, it can be used as a tool for colleges of pharmacy that conduct classes on more than one campus simultaneously.

There may be resistance to the use of gamification techniques with pharmacy educators who are not comfortable stepping out of their familiar teaching techniques. The incorporation of game-based learning into the pharmacy curriculum requires educators to advance their role and teaching methods beyond lecturing and computer-made slide presentations, which may be difficult. Sánchez-Mena and Martí-Parreño conducted a study of university professors and confirmed four major barriers to the implementation of gamification into their classroom: (a) lack of resources, (b) lack of interest, (c) subject fit, and (d) classroom dynamic [15]. To overcome these barriers, technology should be perceived as a tool rather than a complex system [16]. Teaching roles such as “motivator, integrator, debriefer, facilitator, and designer” are used in education on a regular basis. With gamification, these roles combined with the benefits of digital media create a collaborative, creative, and powerful learning tool to vitalize pharmacy education.

Example of Multiple-Choice Questions

Upon checking TQ electronic health record you notice she has filled various medications in the past year. Which of these medications would exclude TQ from self-treatment

- clonazepam
- Yasmin
- ibuprofen
- doxycycline
- Adderall
- lithium

Example of Short Answer Questions

HS's partner calls you at the pharmacy and states his wife is extremely sick, her blood pressure is very low, she has a high fever, and she complains of muscle and abnormal pain, as well as neurological dysfunctions. Upon further questioning you learn her menstruation cycle 2 days prior and she began to use a new brand of ultra absorbent tampons. What is HS likely suffering from? Please make sure no letters in the answer are capitalized

Your answer _____

Example of Ordering Questions

Please counsel the patient on the proper steps in applying a vaginal cream. * 7 points Each answer choice should only be selected once to move on

	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Insert applicator into the vagina and press plunger downwards	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lie down with knees drawn towards you	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wash reusable applicator with soap and warm water	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Squeeze cream until applicator is completely filled	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wash both your hands and vaginal area with mild soap and water	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use a sanitary pad to absorb leakage if desired	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Attach the applicator to the tube by turning the applicator in a clockwise manner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Example of Select All That Apply

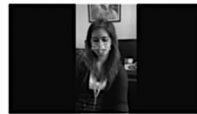
WW walks into the pharmacy and asks which of these are appropriate to use as lubrication on latex male condoms. Select All That Apply. Please answer with the letter of the item you believe is appropriate. All answers must be in alphabetical order, with no spaces or commas, and lowercase. (Example if you believe the answer is A,B,C and D please write "abcd")



Your answer _____

Example of Video Recall Questions

Please help Emma



What disease state is Emma suffering from. * 1 point Use the abbreviated terminology. Please make sure no letters in the answer are capitalized

Your answer _____

Fig. 2 Examples of these different types of clues

Table 2 Post-activity survey questions and performance

Question	Minimum	Maximum	Mean	SD
“Enough time was given to complete the activity”	2	5	4.85	0.6
“There was too much time for the activity”	1	5	3.12	1.05
“The activity format was appropriate to check my knowledge of the subject”	2	5	4.62	0.79
“I would recommend this activity to other pharmacy students”	2	5	4.69	0.77
“The activity was easy to navigate via Zoom”	2	5	4.5	0.97
“In general, I enjoyed this activity”	2	5	4.77	0.64
“The activity kept me motivated”	2	5	4.69	0.72
“I was able to connect with my classmates to learn”	1	5	4.41	1.19
“My knowledge on the subject has improved”	2	5	4.73	0.65

Demonstrates minimum, maximum, mean, and standard deviation of each post-activity survey question

Conclusion

This innovative virtual escape room appeared to have a positive impact on learning with the majority of students assisting them in applying their knowledge of the subject material. Additionally, this activity provided a resource for students to learn together as a group in a time of social distancing. Gamification activities over virtual communication platforms have created a new and unique way to stimulate

student learning and can be used in a variety of pharmacy learning moving forward.

Declarations

Conflict of Interest The authors have no relevant financial or non-financial interests to disclose, and no funding was received for conducting this study. *The Impact of Escape Room Gamification Using*

a *Teleconferencing Platform on Pharmacy Student Learning* was reviewed by Long Island University's Institutional Review Board's (IRB) administrative review process and considered to be an exempt methodology/approach as defined in 45 CFR 46.104.d.2. Ethical approval and informed consent are not applicable.

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