Evaluation of a Patient Education Game Design Activity

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Abstract

Background: Game-based learning has been used in pharmacy education settings with the instructor developing a game for students to play to enhance learning. However, there is a paucity of data about health sciences students designing a game themselves to further their understanding of a complex topic. The purpose of this study was to describe and assess a game design activity focused on patient education of anticoagulants in a pharmacotherapy skills laboratory setting.

Innovation: Second-year pharmacy students enrolled in a pharmacotherapy skills laboratory course worked in teams in a one-hour active learning activity to design a game intended to educate patients about their medication. A pre/post analysis of student attitudes about game-based learning and the activity, as well as knowledge, was conducted.

Findings: The large majority of students (80.5%) agreed that the activity was an effective way to develop patient education strategies. Through the survey and free-response questions, students reported that the game design activity facilitated positive group collaboration and allowed students to take the perspective of their patients. Students also requested additional time to complete the activity. Knowledge assessment scores of key patient education points increased from 66.5% prior to the activity to 71.5% one week following the activity ($p<0.05$).

Conclusion: The game design activity served as a novel teaching method for pharmacy students to actively learn about anticoagulant medications while developing an innovative patient education strategy. Although there was an increase in knowledge scores, students highlighted the impact on group collaboration and taking the perspective of their patients.

Keywords: active learning, game design, perspective taking, innovative learning, patient education

DESCRIPTION OF THE PROBLEM

Game-based learning is a specific type of active learning that has been used in pharmacy education where the instructor develops a game to build student skills and knowledge while using a fun, creative, and competitive platform.[1-3] In pharmacy education literature, these strategies have been reported to increase pharmacy student knowledge of course material.[3]

Students designing a game as an active learning activity is not game-based learning, as the learner is not the individual playing the game.[4] In order to design a successful game, the game designer (i.e., student) first needs to understand what information or knowledge is essential to the individual playing the game, requiring subject matter expertise.[5] Zairi et al. concluded that designing a game helped develop clinical reasoning, creativity, communication, and collaboration amongst the medical students developing a game.[6] Game design activities have also been incorporated into classes outside of the health sciences and higher education and the benefits mentioned are in alignment with Zairi's findings, including increased understanding of a subject, enhanced critical thinking and problem-solving skills, and incorporation of creativity and engagement.[7-10]

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STATEMENT OF INNOVATION

Anticoagulation is a complex topic for students and some pharmacy programs have dedicated entire elective courses to provide anticoagulant learning opportunities.[11,12] To further student understanding about anticoagulants using an innovative active learning strategy in the classroom, a game design activity was developed and implemented for students. The purpose of this paper is to describe and assess a game design activity focused on patient education of anticoagulants in a pharmacotherapy skills laboratory setting.

DESCRIPTION OF THE INTERVENTION

The Integrated Pharmacotherapy Skills courses at the University of Wisconsin – Madison are a four-semester sequence of one-credit standalone skills-based laboratory courses. Each of the courses is blended in delivery and contain approximately eight one-hour discussions and eight laboratory sessions throughout the semester. Students work in assigned groups of four to five individuals all semester. The goals of these courses are to support student readiness for Advanced Pharmacy Practice Experiences and to evaluate critical pharmacy practice skills.

The idea for this activity stemmed from a faculty member desiring to incorporate game-based learning to enhance student learning of anticoagulants. Recognizing additional expertise was needed to develop a quality activity, the faculty member collaborated with another pharmacy faculty member with expertise in game design and game-based learning, as well as an educational game designer on campus. After multiple brainstorming sessions, the activity was changed from an

DOI: https://doi.org/10.24926/iip.v14i2.5019

instructor-developed game to the game design activity completed by students (Figure 1), to focus on anticoagulation knowledge.

The activity was implemented in the spring 2019 semester with 143 second-year pharmacy students enrolled in the Integrated Pharmacotherapy Skills II course (Figure 1). The learning objective of the activity was for students to demonstrate content mastery by designing a game intended for patients to play to improve patient understanding of anticoagulant medications (i.e., apixaban or rivaroxaban). Thirty-two student groups were provided a worksheet to prompt them through game design concepts, requirements and decisions (e.g., gameplay description, project goals, use case [i.e., how the user interacts with the game], learning objectives of game, game design components including characters, scenarios, organization, how players fail/win, etc.). Students worked in their lab groups to design their game. A pharmacy resident or a third- or fourth-year pharmacy student, with no game design experience, was assigned to each group to be the anticoagulation expert, provide prompts to the group using a game design checklist to encourage discussion, and were instructed to not influence game design. Students were encouraged throughout the activity to use patient-friendly language and to take the perspective of their patients, as they would be the ones playing the game. The end of the activity consisted of the students presenting their game idea to the other groups, receiving feedback, making revisions, and then presenting their revised idea in its final state.

Data Collection and Analysis

A mixed methods approach was used to assess the game design activity. The pre and post survey questions utilized a 5-point Likert scale ranging from strongly agree to strongly disagree with additional questions in multiple choice format. The post survey also included several open-ended free response questions (favorite part of the game design workshop, one change about the activity, how this activity influenced understanding of anticoagulants, how group dynamic contributed to the game design, how participation influenced future patient education about anticoagulants, how a patient would benefit from a game-based approach to anticoagulation education). The pre and post knowledge assessment consisted of five multiple-choice questions developed by a faculty expert in anticoagulation and focused on main anticoagulant patient education points common to both medications. A timeline of one week was chosen for the post knowledge assessment to evaluate if students retained the information from the activity and based on convenience of the laboratory class schedule.

The pre and post survey and pre-laboratory assignment were required assignments for students that were graded for completion. The knowledge assessment did not have an impact on students' course grades. Students were excluded from analysis if they did not have matched pre/post surveys or a pre/post knowledge assessment. Students were also excluded from analysis if they completed a knowledge assessment for the incorrect medication, which occurred for one laboratory session as they were mistakenly given the wrong quiz.

The pre- and post-knowledge assessment scores were analyzed using descriptive statistics and a paired t-test with an alpha level of 0.05. The matched questions from the pre- and post-survey were also analyzed using those same parameters. R Version 3.6.0 was used for statistical analysis, following the conversion of the 5-point Likert scale (i.e., 5 corresponding to "strongly agree" and 1 corresponding to "strongly disagree"). The responses to the open-ended questions underwent content analysis and inductive coding by two members of the research team using NVivo Version 12.[13] Qualitative analysis was conducted by having each student response coded as individual nodes (i.e., themes of student responses). A master codebook was created by the first researcher with 84 nodes and definitions. The second researcher then used that codebook to separately code all the student responses to ensure accuracy. The two researchers met with two other members of the research team to address coding discrepancies and derive predominant themes reported in the results section of the manuscript. The kappa coefficient was calculated to be 0.77, demonstrating substantial agreement between the two coders. This project was reviewed by the University of Wisconsin - Madison Education and Social/Behavioral Science Institutional Review Board and determined to not be considered human subjects research based on federal regulations.

Findings

A total of 131 out of 143 (91.6%) students had usable pre survey results with 64.1% of respondents being female. A majority (84%) had previous experience with educational games, and 51.9% had designed a game previously. Additionally, 67.2% reported playing games at least 1-2 times per week.

A total of 138 students (96.5%) completed the post survey, and 80.5% of students strongly agreed or agreed that the game design workshop was an effective way to develop patient education strategies. A total of 127 students (88.8%) students had usable data that was able to be matched and were included in the matched pre/post survey question analysis (Table 1). There was a significant decrease for the survey item about designing games being helpful to understanding concepts (mean score 3.80 (pre) vs. 3.61 (post), p=0.036). There was a significant increase for recommending students create a game (mean score 3.05 (pre) vs. 3.41 (post), p=0.0037),the ability of game design to improve communication and teamwork skills (mean score 3.65 (pre) vs. 4.11 (post), p<0.01), and the enjoyment of when instructors try new activities in the classroom (mean score 3.96 (pre) vs. 4.13 (post), p=0.042). After the activity, 74.7% of students agreed or strongly agreed that designing a game helped them think about and understand the material in a new way and 89.1% of students agreed or

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strongly agreed that they engaged with their teammates to come up with an effective game design.

Students created many different games. One game idea included items, such as side effects or life events, falling onto the game character. The character was in charge of dropping the item into either the "bleed risk" or "clot risk" bucket. Another game idea included a character walking through a typical day and arriving at decision checkpoints (i.e., choosing items from a salad bar related to vitamin K content, deciding to go out for drinks with friends in the evening). Correct decisions would result in points displayed on a score board. Other games were similar to commercially available games such as Candy Land ™ or used virtual reality in a zombie world.

Five main themes were identified based on students' responses to the post survey open-ended questions which included: 1) positive group dynamics due to sharing of ideas, brainstorming, and/or collaboration; 2) more time needed for the activity; 3) a game-based approach is fun and/or engaging for the patient; 4) using different education and engagement strategies for patients; and 5) important counseling or education pearls of the medication. The second theme involved wanting additional time to complete the activity. Although some students noted that the short timeframe kept the classroom energy high, some students expressed feeling stressed.

Student pre- and post-knowledge assessment results on patient education concepts on anticoagulants were completed by a total of 104 out of 143 students (72.7%). The overall assessment score increased from 66.5% prior to the activity to 71.5% one week after the activity, which was statistically significant ($p<0.05$). Four questions had an increase in percent of correct answers (i.e., signs of venous thromboembolism, major side effects, initial therapy recommendations, storage) while one question had a decrease in correct responses (monitoring). The medication storage question was the only question to have a statistically significant increase in correct responses (60.6% vs. 72.1%, $p=0.033$).

CRITICAL ANALYSIS

The game design activity was an innovative active learning strategy used in a pharmacotherapy laboratory setting. While the initial intent of the game design activity was to increase student knowledge of anticoagulants, student free-response themes focused more on patient education through the use of games and the patient perspective playing the game and learning content, rather than increases in their own knowledge. The predominant theme of the free-response questions involved positive group collaboration. Theories of collaborative learning and team-based learning support that peers encourage and promote deeper critical thinking.[14-17] Throughout the game design activity, students worked with their team members in different ways than traditionally seen in an active learning classroom. Students collaborated not only on knowledge, but were required to use creativity to design their game and determine the best way to apply this information to educate patients.

Unique to this activity, students used critical thinking skills to make decisions about how the game would be operationalized, which held them accountable for the information and their gameplay decisions (i.e., what is being done in the game to help the player learn).[10] Designing a game requires students to revisit previous parts of the game and reanalyze the gameplay, which allows them to become intimately familiar with the information and content.[10]

Increased student performance was observed, with a statistically significant increase in pre- and post-knowledge assessment averages of 5%. This increase supports the intent of the project to increase student knowledge; however, there are limitations that should be considered. Students had a pharmacology exam with material regarding anticoagulant medications between the pre- and post-knowledge assessment, which was unknown to the authors at the time of the activity. The impact on the knowledge assessment of students studying for an exam containing the same medications, although a different focus area, cannot be measured. Additionally, the knowledge assessment had a small number of questions and may not have aligned with the game students designed.

Implementation of active learning has been shown to increase performance in pharmacy education.[18] In addition, this activity did not have a designated control group that participated in a more traditional laboratory activity, such as a case-based activity, rather than the game design activity. For this reason, it is difficult to conclude whether the new activity would increase student learning more than a traditional modality.

NEXT STEPS

Future directions of this project include changing the learning objectives from medication knowledge to a patient perspective-taking activity and assessing student understanding of engaging with patients during patient education. This change would place less emphasis on medication-specific information and more emphasis on patient education strategies. Because literature shows analyzing a game's conceptual design is a crucial first step in creating an effective game, at least two hours will be designated for students to complete the activity and provide enough time to fully generate game design ideas in future offerings.[19]

Teamwork is embedded throughout the Center for the Advancement of Pharmacy Education (CAPE) Educational Outcomes and ACPE accreditation standards.[20] While this activity was not interprofessional, it could be implemented in an interprofessional classroom and help prepare students to

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meet the Interprofessional Education Collaborative (IPEC) Core Competencies.[21]

SUMMARY

The game design activity was a novel active learning strategy focused on patient education of anticoagulants. Although there was an increase in knowledge scores, the survey and free-response answers emphasized an impact on group collaboration and students taking the perspective of their patients, rather than learning facts about the medications. Overall, the game design activity allowed pharmacy students to use creativity and innovation in a skills-based pharmacotherapy laboratory setting to learn about patient education and anticoagulants.

Conflicts of Interest: None

Funding/support: None

Acknowledgements: The authors would like to thank Michael Beall, Mohammad Akanda, and Dolyn Salm for their contributions to this project.

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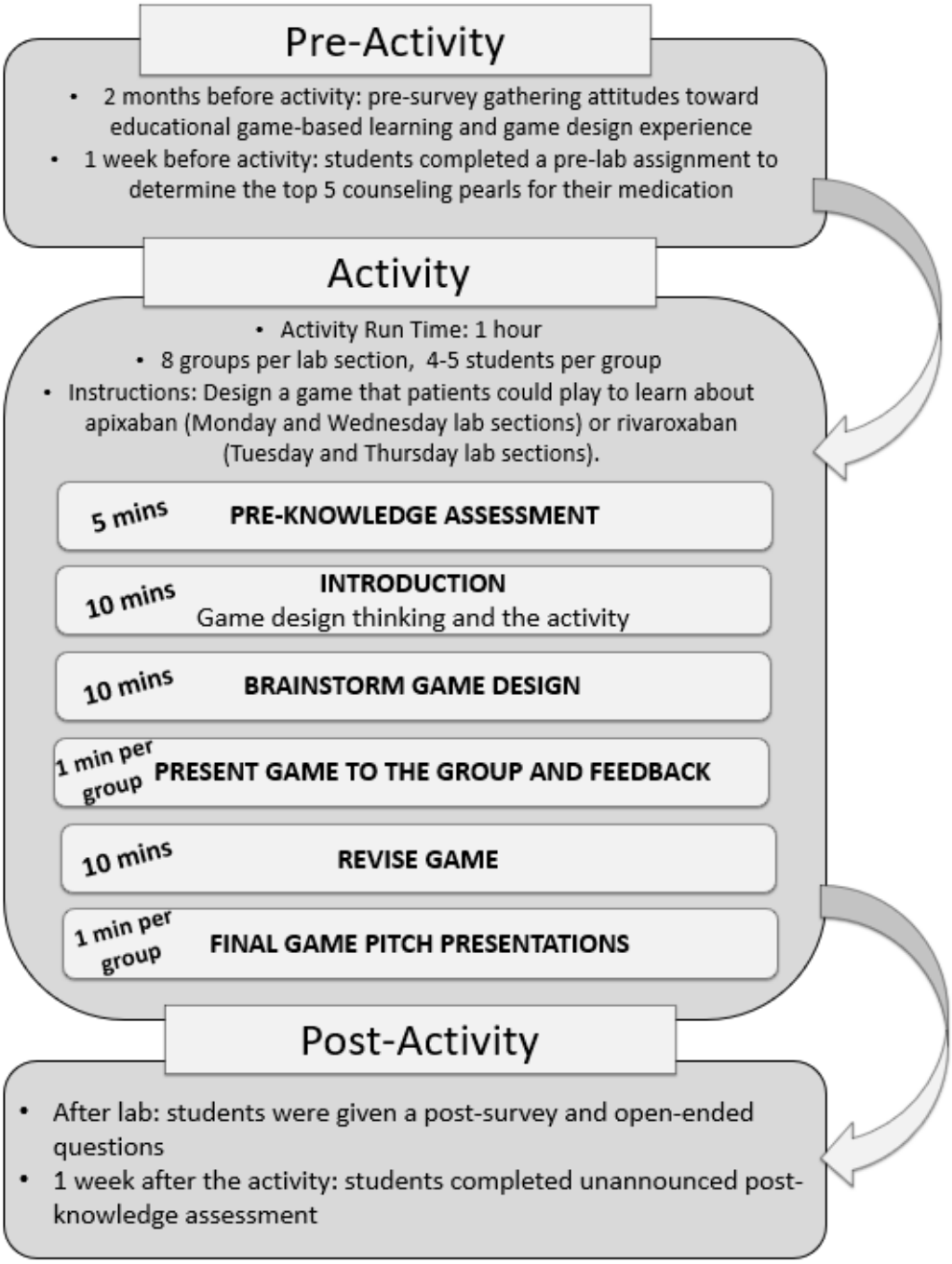
Figure 1: Game Design Activity Timeline



DOI: https://doi.org/10.24926/iip.v14i2.5019

Table 1. Student Perceptions Survey Results Pre- and Post- Matched Survey Questions (n = 127)

Question	Pre vs Post	Strongly Agree n (%)	Agree n (%)	Neither Agree nor Disagree n (%)	Disagree n (%)	Strongly Disagree n (%)	Mean[a]	*p* value
I feel that the use of games is helpful in achieving a deeper understanding of a concept	Pre	24 (18.9)	62 (48.8)	34 (26.8)	7 (5.5)	0 (0)	3.81	0.05
	Post	20 (15.7)	63 (49.6)	28 (22.0)	12 (9.4)	4 (3.1)	3.62	
I feel that learning through creating games is helpful in achieving a deeper understanding of a concept	Pre	25 (19.7)	60 (47.2)	35 (27.6)	6 (4.7)	1 (0.8)	3.80	0.036[b]
	Post	20 (15.7)	63 (49.6)	24 (18.9)	15 (11.8)	5 (3.9)	3.61	
I would recommend using games for a pharmacotherapy lab	Pre	27 (21.3)	56 (44.1)	33 (26.0)	11 (8.7)	0 (0)	3.78	0.075
	Post	26 (20.5)	54 (42.5)	33 (26.0)	11 (8.7)	10 (7.9)	3.60	
I would recommend having students create a game for a pharmacotherapy lab	Pre	11 (8.7)	33 (26.0)	43 (33.9)	31 (24.4)	9 (7.1)	3.05	0.0037[b]
	Post	24 (18.9)	41 (32.3)	34 (26.8)	19 (15.0)	9 (7.1)	3.41	
Completing a game with a group improves communication and teamwork skills	Pre	33 (26.0)	65 (51.2)	24 (18.9)	4 (3.1)	1 (0.8)	3.98	0.069
	Post	39 (30.7)	75 (59.1)	7 (5.5)	2 (1.6)	4 (3.1)	4.13	
Designing a game with a group improves communication and teamwork skills	Pre	21 (16.5)	58 (45.7)	33 (26.0)	12 (9.4)	3 (2.4)	3.65	<0.01[b]
	Post	38 (29.9)	74 (58.3)	10 (7.9)	1 (0.8)	4 (3.1)	4.11	
I enjoy when instructors try new activities in the classroom to teach material or clinical skills	Pre	32 (25.2)	64 (50.4)	25 (19.7)	6 (4.7)	0 (0)	3.96	0.042[b]
	Post	46 (36.2)	63 (49.6)	11 (8.7)	3 (2.4)	4 (3.1)	4.13	

[a]1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=strongly agree
[b]Determined to be statistically significant based on a *p* value of <0.05

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Table 2. Student Perceptions Post-Survey Results (n=138)

Question	Strongly Agree n (%)	Agree n (%)	Neither Agree nor Disagree n (%)	Disagree n (%)	Strongly Disagree n (%)	Mean[a]
The anticoagulation game design workshop was an effective way to learn about the medication we were assigned	17 (12.3)	51 (37.0)	25 (18.1)	37 (26.8)	8 (5.8)	3.23
The anticoagulation game design workshop was an effective way to develop strategies for patient education about the medication we were assigned	39 (28.3)	72 (52.2)	10 (7.2)	14 (10.1)	3 (2.2)	3.94
I prefer the game design workshop over a traditional activity, such as reviewing a patient case or a simulated patient encounter	25 (18.1)	35 (25.4)	42 (30.4)	27 (19.6)	9 (6.5)	3.29
I learned from my peers during this activity	33 (23.9)	67 (48.6)	21 (15.2)	13 (9.4)	4 (2.9)	3.81
After the game design activity, I felt confident about the medication pearls for our anticoagulant	12 (8.7)	49 (35.5)	28 (20.3)	39 (28.3)	10 (7.2)	3.10
I engaged with my teammates to come up with an effective game design	54 (39.1)	69 (50)	8 (5.8)	6 (4.3)	1 (0.7)	4.22
The objectives of the activity were clearly explained	31 (22.5)	69 (50)	24 (17.4)	13 (9.4)	1 (0.7)	3.84
Designing a game helped me think about and understand the material in a new way	43 (31.2)	60 (43.5)	18 (13.0)	14 (10.1)	3 (2.2)	3.91
Designing the game distracted me from understanding the material	15 (10.9)	43 (31.2)	29 (21.0)	43 (31.2)	8 (5.8)	3.10
I found it difficult to focus on learning because I felt stressed during the activity	12 (8.8)	31 (22.6)	29 (21.2)	41 (29.9)	24 (17.5)	2.75
I felt as if I had enough time to understand and complete the activity	12 (8.7)	50 (36.2)	29 (21.0)	38 (27.5)	9 (6.5)	3.13

[a]1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=strongly agree

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