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INSTRUCTIONAL DESIGN AND ASSESSMENT

A Bingo Game Motivates Students to Interact with Course Material

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Objectives. To create a bingo game that would increase student interaction with course material and provide students with options for demonstrating learning and earning extra credit.

Design. A bingo game was created in which each of the 25 squares contained an activity (eg, video, crossword puzzle, poem, quiz) that encouraged interaction with course material and appealed to multiple learning styles. Students who achieved bingo earned a 5-point (5%) grade bonus.

Assessment. All students enrolled in the *Introduction to Clinical Pharmacy Skills* course participated in the bingo game. The majority of students (74.6% in the fall and 81.9% in the spring) achieved bingo. Students who achieved bingo had an average course grade 7 points (fall semester) and 10 points (spring semester) higher than the average course grade from the prior 6 semesters.

Conclusion. The bingo game increased student interaction with course material throughout the semester and provided students with options for demonstrating learning.

Keywords: bingo, assessment, motivation, interaction

INTRODUCTION

The *Introduction to Clinical Pharmacy Skills* course is a required 2-credit first-professional year course consisting of two 50-minute class periods in a large lecture hall setting and one 50-minute small group recitation/ laboratory per week. Approximately half the class (about 130 students) takes the course each semester. Other required first-professional year courses include *Physiology I and II, Fundamentals of Immunology, Biochemistry/Molecular Biology I and II, Microbiology, Pharmaceutical Calculations*, and *Introduction to Communication*; students typically take 15-17 credits per semester.

The *Introduction to Clinical Pharmacy Skills* course is designed to provide the foundation for the first 2 outcomes from the Center for the Advancement of Pharmaceutical Education (CAPE) pharmaceutical care patient care-centered outcomes (ie, pharmaceutical care and communication skills).[1] The course objectives are listed in Table 1. Students admit that they wait to study for the course until just before examinations because most of their time is spent on "high-stake" courses (higher credit courses with more frequent examinations). This "test-to-test" culture has a negative impact on class attendance,[2] with students frequently cutting class, especially before and after examinations in other courses. Although most students pass the course, students do not seem to retain the material for application in upper-level courses.

Sutterluety recently described using a bingo game to decrease student procrastination.[3] The bingo game, designed for students in a required exercise physiology course, encouraged regular and consistent student interaction with course content. The game consisted of 25 squares organized in 5 horizontal and 5 vertical rows. Students had to complete 5 activities (eg, attend a review session, help another student understand a concept, participate in 4 days of resistance training, create a PowerPoint presentation) in a row (horizontally, vertically, or corner-to-corner) to achieve bingo. The "prizes," mostly grade-based, were awarded for the number of completed lines. Approximately 85%-90% of students participated over a 2-year period. Though data were not provided, the author stated that the bingo game decreased procrastination and increased understanding of course content, prompted more in-class questions, and provided student feedback.

The bingo game concept seemed like a realistic motivational tool for students in the *Introduction to Clinical Pharmacy Skills* course. Given the increased emphasis placed on assessment and evaluation of student learning by the Accreditation Council for Pharmacy Education's 2007 accreditation standards and guidelines[4] it also seemed like a good method for expanding the types of learning activities offered to students. Common to the variety of theoretical frameworks for student learning

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Table 1. *Introduction to Clinical Pharmacy Skills* Course Learning Objectives

1. Demonstrate an understanding of the health care environment.
2. Interpret and use common medical terms and abbreviations.
3. Interpret and assess common laboratory test results.
4. Interpret, assess and demonstrate basic physical assessment skills.
5. Obtain and document accurate and complete medication histories.
6. Organize patient information into standard presentation format.
7. Locate information in patient charts.
8. Develop prioritized patient problem lists.
9. Given specific disease and drug information, develop appropriate therapeutic and monitoring plans.

styles are activities that use a variety of senses, physical interactions with materials, and application of skills.[5-8] Though a variety of summative and formative assessment activities and active-learning activities were already included in the *Introduction to Clinical Pharmacy Skills* course, the activities had not been specifically designed to appeal to students across a broad range of learning styles.

Thus, the objectives for developing the extra-credit bingo game were (1) to increase student interaction with course material throughout the semester and (2) to provide students many different ways of demonstrating their learning in the course.

DESIGN

The *Introduction to Clinical Pharmacy Skills* course grade was based on a combination of summative (grades earned on the midterm and final examinations) and formative (a medication history competency and a physical assessment competency) assessments. Lecture attendance was strongly encouraged but not required; recitation/laboratory attendance was required. Extra-credit was earned for achieving bingo defined as earning 5 squares in a row vertically, horizontally, or corner-to-corner; there were 12 possible ways to achieve bingo (Figure 1). An anonymous survey instrument was distributed to students at the conclusion of the fall semester. Some bingo activities were deleted or added for the spring semester based on suggestions made by students on the anonymous survey. Students who achieved bingo earned a 5-point (5%) bonus added to the final course grade. This was a substantial incentive; 5% could move a student from one letter grade to another (eg, C+ to a B−).

The bingo activities were chosen to encourage students to review course material at least every 2 weeks (online self-assessment quizzes), to motivate students to perform better on the required graded activities (examinations and competencies), to appeal to students with different learning styles (posters, computer animations, 3-dimensional objects, poems, videos, crossword puzzles), and to encourage close attention to required readings and lecture material (identify textbook errors or errors made during class). The cumulative online self-assessment quizzes were made available for a few days approximately every 2 weeks. Once a deadline for an activity was passed, the activity was no longer available.

The activities were arranged on the bingo card so that achieving bingo required the student to accomplish time-consuming activities (eg, create a video) as well as more convenient activities (eg, online quizzes). Activities predicted to be more difficult to achieve (eg, computer animation, higher test scores) were placed in rows containing the free center square. Students were told that the instructor had the right to accept or reject products and that rejected products could be revised and resubmitted one time only. Products were accepted if the product, in the instructor's judgment, correctly represented a course concept.

Descriptive statistics were used to determine the mean number of bingo squares earned by students who did and did not achieve bingo in the fall and spring semesters. The two-sample *t* test for assumed unequal variances was used to compare the number of bingo squares earned by students who did and did not achieve bingo in each semester. Data for the fall and spring semesters were pooled and the two-sample *t* test for assumed unequal variances was used to compare the number of bingo squares earned by students who did and did not achieve bingo across the 2 semesters.

ASSESSMENT

Over the 2 semesters, students collectively earned 2506 bingo squares (Table 2). All students enrolled in the course both semesters completed at least one voluntary bingo activity. The majority of students achieved bingo (74.6% in the fall semester; 81.9% in the spring semester). The bingo extra-credit changed the letter grade (eg, C+ to B−) for 39% of students; only 4% of students who achieved bingo had no change in grade. Students who achieved bingo in the fall and spring semesters had an average course grade 7 points and 10 points higher, respectively, than the average course grade from the prior 6 semesters. Students who did not achieve bingo in either

Create a new one-way/two-way communications recitation exercise.	Achieve competency on the first attempt on the optional second physical assessment skills.	Score ≥85% on Exam #1.	Score ≥80% on the 4th self-assessment quiz.	Create a 20-question crossword puzzle using medical terms from the class list.
Score ≥80% on the 1st self-assessment quiz.	No unexcused recitation absences.	Create a 30-second video demonstrating one major course concept.	Achieve competency on the 1st attempt on the medication history homework assignment.	Write a 10-line poem about one major course concept.
Be the first to notify Dr. Tietze of an error in the required textbook.	Score ≥80% on the 6th self-assessment quiz.	FREE	Write out the answers to three sets of lecture objectives.	Score ≥80% on the syllabus quiz.
Create a 10-question quiz with answers.	Create a 3-D representation of one major course concept.	Score ≥80% on the 3rd self-assessment quiz.	Be the first to notify Dr. Tietze of a mistake she makes in class.	Score ≥80% on the 5th self-assessment quiz.
Create a 2'x3' poster illustrating one major course concept.	Score ≥80% on the 2nd self-assessment quiz.	Achieve competency on the 1st attempt on an optional second medication history.	Create a new group dynamics recitation exercise.	Create a 30-second computer animation presentation of one major course concept.

Complete 1 line (5 squares) horizontally, vertically, or diagonally by 5:00 PM, April 21, 2006, and earn 5 points to be added to the course grade. Submit the completed bingo card and the original or hardcopy of each non-grade or attendance-related product.

Disclaimer: *Dr. Tietze has the right to accept or reject products. All submissions will be reviewed after the April 21, 2006, deadline. Products that are rejected may be resubmitted once for credit. Students needing to resubmit products will be notified by e-mail.*

Figure 1. Spring 2006 Bingo Game. Detailed directions for earning each bingo square are provided in Appendix 1.

semester had an average course grade 12 points lower than the average course grade from the prior 6 semesters.

The mean number of squares earned by students who achieved bingo was significantly higher than the mean number of squares earned by students who did not achieve bingo in the fall semester (11.6 ± 1.8; range 8-17 vs. 6.5 ± 2.2; range 2-11; $p < 0.001$) and the spring semester (9.5 ± 1.6; range 5-13 vs. 5.1 ± 2.8; range 1-11; $p < 0.001$).

Table 2. Results of a Bingo Game Introduced to a Clinical Pharmacy Skills Course Which Required Students to Complete a Variety of Learning Activities to Earn Extra Credit

	Fall Semester 2005 (N = 130)	Spring Semester 2006 (N = 116)
Participated in bingo game,%	100	100
Number of bingo squares earned*	1472	1034
Students who achieved bingo, Mean (SD)	11.6 (1.8)†§	9.5 (1.6)‡§
Students who did not achieve bingo, Mean (SD)	6.5 (2.2)†‖	5.1 (2.8)‡‖

*Excluding the free bingo square
†$p < 0.001$ (*t* test; two-sample assuming unequal variances)
‡$p < 0.001$ (*t* test; two-sample assuming unequal variances)
§$p < 0.001$ (*t* test; two-sample assuming unequal variances)
‖Nonsignificant (*t* test; two-sample assuming unequal variances)

There was no difference between the number of bingo squares earned by students who did not achieve bingo in the fall and spring semesters (6.5 ± 2.2 vs. 5.1 ± 2.8; $p > 0.05$) though students who achieved bingo in the spring semester earned significantly fewer squares than students in the fall semester (11.6 ± 1.8 vs. 9.5 ± 1.6; $p < 0.001$).

At least 50% of students in the fall semester course earned bingo squares for each of the following activities: self-assessment quizzes, perfect recitation attendance, syllabus quiz, the first medication history, and the first physical assessment skill set. At least 50% of students in the spring semester course earned bingo squares for each of the following activities: self-assessment quizzes, perfect recitation attendance, syllabus quiz, first medication history, and second physical assessment skill set.

Less than 10% of students in the fall semester course earned bingo squares for each of the following activities: create a new one-way/two-way communication exercise, create a 30-second computer animation, identify a mistake made in class, identify an error in the textbook, and the second medication history. Less than 10% of students in the spring semester course earned bingo squares for each of the following activities: create a 10-question quiz with answers, identify a mistake made in class, create a 30-second computer animation, create a new group dynamics exercise, and the second medication history.

Student-suggested activities added for the spring semester included creating a 30-second video, writing a 10-line poem, creating a poster, and making a 3D representational object. The most popular of these activities was the 3D representational object (eg, dioramas, clay models, mobiles, papier-mâché), with 33% of the students in the spring semester earning a square for the activity.

Fifty-six (43%) of the fall semester students completed the anonymous survey instrument (Table 3). Ninety-six percent agreed that the bingo component of the course should be continued. Support for the individual bingo activities ranged from 100% for the online self-assessment quizzes to 28.6% for the computer animation activity. The majority of students felt that the bingo game helped them review (58.9%) and keep up (55.4%) with the course material. More than a third of the respondents felt that the bingo game took some of the pressure off the written examinations (46.4%), made the course more interesting (33.9%), and allowed them to demonstrate their knowledge and skills (33.9%). Suggestions for improvement included giving more points for completing more than 1 row of squares, have more frequent self-assessment quizzes, include a replacement square that could be used anywhere on the game card, and replace duplicate squares with other activities.

Table 3. Summary of Responses to Fall 2005 Anonymous Student Survey on the Value of the Bingo Game*

Survey Question	No. (%)
Did you attempt to achieve bingo?	
Yes	52 (92.9)
No	4 (7.1)
If you attempted to achieve bingo, did you achieve bingo?	
Yes	46 (88.5)
No	3 (11.5)
If you attempted to achieve bingo, how did bingo help you with the course?	
It helped me review the course material.	33 (58.9)
It helped me keep up with the course material.	31 (55.4)
It took some of the pressure off the written examinations.	26 (46.4)
It made the course more interesting.	19 (33.9)
It allowed me to demonstrate my knowledge and skills.	19 (33.9)
Other†	10 (19.9)
Should bingo be continued as part of this course?	
Yes	54 (96.4)
No	1 (1.8)
Which bingo squares should be continued?	
Self-assessment questions.	56 (100)
Free square.	55 (98.2)
No unexcused recitation absences.	54 (96.4)
Syllabus quiz.	52 (92.9)
Medication history competency.	50 (89.3)
Physical assessment competency.	49 (87.5)
Write out answers to lecture objectives.	46 (82.1)
Second physical assessment competency.	45 (80.4)
Second medication history competency.	41 (73.2)
Textbook error.	37 (66.1)
Mistake during lecture.	36 (64.3)
Midterm exam score.	35 (62.5)
Create a new group dynamics exercise.	30 (53.6)
Create a new one-way/two-way exercise.	29 (51.8)
Computer animation.	16 (28.6)

*Based on 56 respondents (43% of the students enrolled in the course)

†Other specific comments included: "It allowed me to set goals for things I wanted to achieve", "Better understanding of the material", "Allowed for application of skills", "Gave me a focus, a goal"

DISCUSSION

The 2506 bingo squares earned by the students represents significant student interaction with the course material. By design many of the activities were spread throughout the semester, though students did tend to wait until the end of the semester to work on product-specific

activities such as writing a poem or creating a video. Students who achieved bingo had higher average course grades than the course average for the prior 6 semesters with a point spread greater than the 5 points earned for the bingo game; students who did not earn bingo had lower course grades than the course average for the prior 6 semesters. Participation in the bingo game activities may have positively influenced overall course achievement, although other factors such as student selection, motivation, and timing of examinations in concurrent courses may account for the differences in grades.

All students completed at least 1 voluntary bingo activity, though not all students attempted to achieve bingo. Students who achieved bingo completed significantly more bingo squares than students who did not achieve bingo. Students who achieved bingo in the spring semester earned significantly fewer bingo squares than students in the fall semester, suggesting that students in the spring semester learned from the fall semester students to target the activities more selectively. The more popular bingo activities were the online self-assessment quizzes, syllabus quiz, perfect recitation attendance, and achievement of competencies on the first attempt. The popularity of these activities may have been related to perceived convenience, value to the students, or position on the bingo card. The less popular activities included the more time-consuming, creative, or skill-based activities though the submitted products were of high quality and accurate representations of major course concepts.

It is not known whether students would attempt to achieve bingo if the prize had less impact on the course grade. Nevertheless, 5 points (5%) added to the final course grade seemed a fair reward for the amount of work required to achieve bingo in this 2-credit course. Some students commented on the fall survey that the game was too easy but other students commented that the game was too time consuming. Several students proposed differential prizes based on the number of lines earned, suggesting that students might be willing to complete even more activities.

Adding the bingo game required no additional University resources but did require additional faculty time for tracking student accomplishments and for working with students on the formative activities. A web-based course management system such as Blackboard or Angel is helpful for automating student grades and for providing students with 24/7 time-limited access to online quizzes.

SUMMARY

The extra-credit bingo game was well received by students enrolled in *Introduction to Clinical Pharmacy Skills*. The majority of students earned the extra credit for achieving bingo. Students completed 2506 course-related activities with large numbers of students demonstrating learning in nontraditional ways, including creative visual/graphic and performance arts. Participation in the bingo activities may have had a beneficial effect on overall student achievement beyond the extra-credit points. Students who achieved bingo earned a significantly greater number of squares than students who did not achieve bingo. The bingo game accomplished the objectives of increasing student interaction with course material throughout the semester and providing students with choices and flexibility for demonstrating their learning in the course.

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Appendix 1. Directions for earning Bingo.

DIRECTIONS

All products must be original and created by the student attempting Bingo. There are no make-up or substitute assignments. All deadlines are final.

Crossword Puzzles: Submit the crossword puzzle, the questions for the crossword puzzle, and the answers. You may use commercially available computer software to assist in the creation of the crossword puzzle.

Animation Presentation: Submit a CD with the file, name of file, and software required for viewing the file. You may use commercially available computer software to assist in the creation of your animation product. Animate the visuals/graphics of the concept you are presenting, not just words.

Self-Assessment Quizzes: The self-assessment quizzes are available on Blackboard at specified times. The quizzes are open-book and you have 15 minutes to complete the quiz. You can only log into a quiz once. Notify Dr. Tietze if you are locked out of the quiz or encounter other Blackboard-related technological problems while taking the quiz.

10-question quiz: All quiz questions must be original. Your questions may test any course objective except acronyms and medical terminology. Note the lecture objective for each question.

One-Way/Two-Way Communications Exercise: Create an original exercise designed to replace the one-way/two-way communications exercise used during week 2 recitation.

Textbook Error: E-mail Dr. Tietze as soon as you identify an error in the textbook. Any type of error is acceptable (eg, typographical, conceptual, etc).

Mistake during class: Notify Dr. Tietze as soon as you identify a mistake she makes during class.

Group Dynamics Exercise: Create an original exercise designed to replace the group dynamics exercise used during week one recitation.

Second Medication History: You may interview anyone you have not already interviewed for his or her medication history. You may document the history using the free-style, form, or SOAP format.

Second Physical Assessment Skill Set: You will be given an opportunity to demonstrate a second randomly selected physical assessment skill set the same day you take your regularly scheduled physical assessment practical exam.

Video presentation: Create a video demonstrating any major class concept or skill EXCEPT physical assessment skills. Submit a CD with the file, name of file, and software required for viewing the file. You may use commercially available computer software to assist in the creation of your video.

Lecture objectives: Write out the answers to the lecture objectives. For objectives that state "Given. . ." provide one example. For objectives that state "Demonstrate. . ." document that the objective was demonstrated during recitation.

Poster: Illustrate one major course concept on a 2-foot by 3-foot poster. All content must be original (do not use copyrighted materials or illustrations provided in the lecture handout).

3-Dimensional Representation: You may use any material (eg, clay, paper, ceramics, papier-mâché, etc) to make your 3-dimensional representation of one major course concept. Your representation should be at least 6 inches tall.

Poem: Create an original 10-line poem about one major class concept or skill.