Integrating Immersive Experiences to Instruction Through Breakout EDU: Lessons Learned

Vincci Kwong, Judith Falzon, and Julie Feighery

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This study employed an escape room motif to engage students to use information literacy course material to solve puzzles. Students practiced research techniques in a classroom environment that bypassed their expectations of traditional course instruction. Instructor objectives were to increase student engagement with the course material, and to foster teamwork among students in a cooperative learning environment. Authors initially obtained 9 kits from Breakout EDU, a company specializing in immersive games. Games were devised for three of the course units, with each unit identifying 4-5 information literacy skills or concepts. The puzzles were focused on reinforcement of the key concepts. After each escape room class session, students completed a short survey. At the end of the semester students completed another survey about their experiences. Over 80% of students indicated the games helped them understand course concepts. Comparisons of final grades in the gamified courses with previous, non-gamified courses revealed that students achieved more A's and fewer D's and F's in the gamified courses. Future directions for study include flipping game design to student groups, and further analysis of correlations between concepts learned through traditional teaching techniques and those learned in Breakout EDU classes.

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ABSTRACT

This study employed an escape room motif to engage students to use information literacy course material to solve puzzles. Students practiced research techniques in a classroom environment that bypassed their expectations of traditional course instruction. Instructor objectives were to increase student engagement with the course material, and to foster teamwork among students in a cooperative learning environment. Authors initially obtained 9 kits from Breakout EDU, a company specializing in immersive games. Games were devised for three of the course units, with each unit identifying 4-5 information literacy skills or concepts. The puzzles were focused on reinforcement of the key concepts. After each escape room class session, students completed a short survey. At the end of the semester students completed another survey about their experiences. Over 80% of students indicated the games helped them understand course concepts. Comparisons of final grades in the gamified courses with previous, non-gamified courses revealed that students achieved more A's and fewer D's and F's in the gamified courses. Future directions for study include flipping game design to student groups, and further analysis of correlations between concepts learned through traditional teaching techniques and those learned in Breakout EDU classes.

Keywords: Information Literacy, Escape Room, Gaming, Student Learning, Library Instruction

INTRODUCTION

IU South Bend is a medium-size public university located in the northwestern part of Indiana. The university enrolls over 4500 undergraduate students and over 500 graduate students. Over 93% of students are Indiana residents, and 72% are traditional age students. Information literacy became part of the general education curriculum in 2005 and since then, students have been required to complete Introduction to Information Literacy (Q110), a one-credit undergraduate course to fulfill their general education requirements. While it is recommended for their first year, many students choose to postpone taking the class until their junior or senior year.

Based on our experience and in previous research (Olsen and Diekema 2012; Gross and Latham 2012) first-year students entering the class are very familiar with the basics of search engines (specifically Google) and thus often have a high level of confidence (typically over confidence) in their abilities to do academic research. They are comfortable with a few websites and databases learned in high school and are resistant to learning and practicing college level research techniques such as searching specialized databases, using limiters, checking authority, and learning citation skills. This inhibits students' growth towards analytical and research skill proficiency. We've discovered from comments in our evaluations and in discussions with students that some students who took the class during their junior or senior year felt they had already learned some of the research skills and techniques from other courses. These factors have contributed a negative impact on students' willingness to learn and engage in the classroom. Q110 instructors were looking for new methods to engage students after having experimented with flipped classrooms, small group discussion and other methods with limited impact. The authors' objective in shifting towards a game-based learning for the course was to optimize learning through an approach outside students' expectations.

Escape rooms are a popular group activity where people are locked in a room and given a series of puzzles and clues that will help them find their way out. Through escape room puzzles, students would experience research techniques in a new way. Escape room participants, even outside an academic setting, instinctively formulate hypotheses after analyzing the puzzles and generating possible solutions. They then test their hypotheses, and if necessary, reformulated approaches to solving the clues. This allows students to engage with specific course material linked to course learning objectives. Beyond helping them with their research skills, the authors wanted to create teamwork and a cooperative learning environment. These 'soft skills' are in demand not only in an academic environment, but also are important workforce skills. (O'Brien & Pitera, 2019).

LITERATURE REVIEW

Trudi Jacobson, head of information literacy at the University at Albany-SUNY, co-taught a required seminar for first-year students using Breakout EDU, a puzzle-based immersive learning platform. Jacobson found the Breakout session mirrored the inquiry necessary for research with reflections clearly showed that students experienced the emotional cycle and the inquiry mindset connected with the research process (Detwiler et al., 2018). In addition, the co-instructor of the class observed an immediate and marked change in the willingness of members of one particularly reluctant class to participate in class discussion (Detwiler et al., 2018). Librarians at the University of Tennessee, Knoxville successfully used Breakout EDU with First Year Seminar courses, where they found the students discovered an appreciation for librarians' ability to offer "just-in-time" instruction while students were playing the game (Ruffin & Miranda, 2018). In addition, the game resulted in an increase in the reach of their instruction efforts with FYS courses, as the number of librarian led instruction sessions jumped from 20% of FYS courses in 2015 to 60% in 2016 (Ruffin & Miranda, 2018). At Skidmore College, librarians used Breakout EDU in their freshman seminar library instruction sessions, where feedback from first year seminar faculty reporting that the game was a majority of the students' favorite part of the seminar (O'Brien & Pitera, 2019). Librarians at the University of North Alabama also implemented Breakout EDU games into their First Year Experience library orientation sessions, making use of false clues to lengthen the game (Pate &

Malone, 2018). Escape room exercises have been implemented in classrooms in other disciplines, particularly the health sciences. Guckian, Sridhar, & Meggitt, (2020) successfully implemented escape room exercises into their dermatology courses in medical school. In a survey of the escape room literature, Veldkamp, Daemen, et al (2020) found that part of what makes escape room exercises such powerful learning experiences is that they incorporate M.C. Linn's four principles of knowledge integration: "making learning accessible, making thinking "visible," helping pupils to learn from each other, and promoting autonomous learning" (Veldkamp, Daemen, et al 1222). Clarke, Arnab, Keegan et al (2016) found that through their creation of escape rooms in the college classroom led to game design thinking, which "help[s] students and teachers break out of the lecture/test model."

HOW IT WORKS

Breakout EDU (https://www.breakoutedu.com/) is the tool we utilized to implement the escape room experience for Q110. A teacher subscription plus kit costs $238, which includes the Breakout EDU kit and 12 months access to Breakout EDU subject packs. Each subject pack comes with Breakout EDU kit games developed for a wide variety of curriculums targeting some of the most commonly taught topics. In 2018, the authors obtained an internal grant to purchase nine teacher subscription plus kits, three kits for each instructor to implement the escape room experience in their classroom. While there are subject pack games that focus on library-related topics, they are mostly geared toward K-12 students. Additionally, the topics being offered by Breakout EDU do not align well with the learning objectives for Q110. As a result, the authors decided to build their games from scratch instead of using the games that came with Breakout EDU subject packs.

After reviewing the Q110 curriculum, the authors selected three topics that were the most challenging to past students to create new games. For each topic, 4-5 concepts/skills essential for students to master were identified. IUCAT, Indiana University's online catalog, was one of the selected topics. Concepts/skills that are essential for students to master includes: (1) interpreting catalog record for specific item; (2) identify location of specific item; (3) retrieving specific item; and (4) understanding of features offered by IUCAT. Clues/puzzles were then developed for which students utilize a specific concept/skill to resolve them to obtain a combination to unlock a corresponding lock. In the case of IUCAT, a 4-digit lock, a 3 digit lock, a directional lock, and a pad lock are used. For the 4 digital lock, the clue is designed for students to search for specific items and to identify their physical location in the Library. For the 3-digit lock, students need to have a good understanding of different components of a catalog record in order to identify the common components for a combination to unlock the lock. To resolve the directional lock, the students need to have a good understanding of what materials are contained in the catalog and the features being offered by the catalog. The clue of the final pad lock contains the call number for two book. To obtain the key from the instructor to unlock the pad lock, students need to retrieve the books from the stack. Once all the locks are opened, students were rewarded with a prize. A short paper survey was distributed to gather immediate feedback from students on their game experience. A debriefing followed each game, and the authors asked students which clues/puzzles they encountered were difficult to resolve. Then, the authors discussed the specific concepts/skills in further details.

A class of 24 students were divided into 3 groups with approximately 8 students per group. The class was given 25 minutes to resolve all clues/puzzles in order to obtain the prize locked in the box. Use of computers and mobile devices were allowed to look up information if needed. When students encountered issues or problems, they could use a hint card to seek assistance from the instructor. An online timer with music was used to track time.

WHAT WE LEARNED

To assess whether the implementation of escape room learning experience via the use of the Breakout EDU kits helped to increase interactivity and student engagement with the course materials, two different surveys were employed.

- At the end of each game, a paper survey with five questions was given to get immediate feedback on a specific game and gather any feedback to enhance the next game.
- At the end of the semester, an online survey with nine questions was distributed to solicit overall feedback from students regarding their escape room learning experience.

End of Game Surveys

A short survey, given on paper, was distributed at the end of each game to gather students' immediate feedback. Over the course of two semesters, we collected 130 responses for the IUCAT game, 123 responses for the citation game and 104 responses for the information evaluation and database searching game. Quantitative findings for three of the questions is provided in Table 1.

Table 1

Results from End of Game Surveys

Survey question	Name of games		
	IUCAT	Citation	Information evaluation and database searching
Before participating in the Breakout EDU game, all/some concepts are known to me.	56.60%	83.50%	78.20%
I strongly agree/agree the game helps me to increase understanding of concepts on the topic.	88.70%	84.10%	80.20%
I strongly agree/agree the time limit set for this game is reasonable.	82.40%	86.60%	74.60%

The other two questions in the short survey asked students what part of the game was most challenging and what suggestions they would make to enhance the game. There were a couple of feedback responses that were in common for all sections after the first game. They were 1) to

reduce group size and 2) to include lock instruction. To lower the ratio of students per box from 6-7 to 4-6, additional Breakout EDU kits were purchased. The authors would like to increase participation of students with the additional kits. Since students are new to the locks at their first game, there was feedback for providing instructions on how to operate the locks. While most students feel comfortable participating in the game, a few students indicated in the survey that they prefer not to participate in future games. As a result, those students who choose not to participate in the future games were assigned a traditional written assignment. Other comments we received included how fun the game was and suggested additional locks/clues for future games. As students participated in the second and third games, they became more experienced with the game boxes, and their self-reliance and confidence grew. There were fewer complaints regarding locks or clues. The instructor's job was now less to provide assistance and more to provide encouragement and support in the face of frustration.

End of Semester Survey

At the end of the semester, students were asked to complete an end of semester survey which was administrated online. Participation in the survey was optional, though the authors provided bonus points to encourage students to take the survey. Unlike the end of game surveys, the response rate for the end of semester survey is 29%, which is low. Over the course of two semesters, the authors received 45 responses. The end of semester survey contains 8 questions, of which the three questions in Table 2 aim to collect feedback regarding the effectiveness of the games.

Table 2

Survey Results from End of Semester Survey

Survey question	Strongly agree/agree	Neutral	Disagree/Strongly disagree
The Breakout EDU games increased interactivity and student engagement in class.	86.40%	13.60%	0.00%
The debrief/reflection time is an effective way to clarify difficult/challenging concepts.	80.00%	13.30%	6.70%
The Breakout EDU games developed my abilities and skills for the specific topics.	75.50%	13.30%	11.10%

One of the goals of implementing the escape room learning experience is to increase interactivity and student engagement in class. According to the student feedback, 86.4% of survey respondents either strongly agree/agree that we achieved this goal. While it is important to provide a fun learning environment for students, it is equally important for students to learn the skills for

the specific topics, and 75.5% of the survey respondents either strongly agree/agree that the Breakout EDU games helped to develop their abilities and skills for the specific topics. To ensure students master concepts/skills on a topic, debrief/reflection time was offered at the end of the game and it is satisfying to know that 80% of the survey respondents find the debrief/reflection time is effective in helping them overcome difficult/challenging concepts.

In addition to the three questions above, we asked students to rank the effectiveness of games in helping them to acquire and retain new knowledge/concepts. Of the three topics which we used as basis for the escape game learning experience, survey respondents indicated the citations game was the most effective one to help them in acquiring and retaining new knowledge/concepts. The next most effective game was the evaluation and database searching game, followed by the IUCAT game. As students completed all the topics in Q110, the authors wanted to find out if students would suggest other topics that would be good candidates for additional games. The topics mentioned most frequently were Boolean operators, followed by confirmation bias, the information cycle, CRAAP test and Google Scholar.

When asked whether the survey respondents would recommend the use of the Breakout EDU games in Q110, 84.4% indicated they are very likely/likely to recommend it. Positive experience with the Breakout EDU games was not only reflected in the end of semester survey, but also in the course evaluation and self-reflection as stated below:

- *The escape rooms were really helpful too. Teaching research concepts can be dry, but the escape rooms brought so much engagement to the classroom.*
- *All the break out game was so much fun.*
- *Enjoy the breakout game, that was a lot of fun.*
- *I also really enjoyed the breakout games we did in class because it provided us with a different way to learn about topics discussed in class.*
- *The break out games were fun but could use maybe a little more clarity on what they are the first time they are played.*

Grade Analysis

In addition to the feedback from students through the two surveys stated above, we also conducted a grade analysis to investigate whether the escape room learning experience impacts a measure of student learning. To do so, we compared the final grades of students from semesters when the game was implemented (i.e., Fall and Spring 2019) with semesters before the games were implemented (i.e., Fall 2017, Fall and Spring 2018). 20% of the final course grade is derived from a comprehensive final exam with identical questions for all Q110 classes.

Table 3

Comparison of Student's Final Grades Between Fall 2017 to Fall 2019

Semester	Final grades					
	A	**B**	**C**	**D**	**F**	**D+F**
Fall 2019	44.90%	27.60%	9.20%	8.20%	10.20%	18.40%
Spring 2019	35.10%	26.30%	17.50%	10.50%	10.50%	21.10%
Fall 2018	27.90%	20.90%	14.00%	18.60%	18.60%	37.20%
Spring 2018	31.30%	37.50%	16.70%	6.30%	8.30%	14.60%
Fall 2017	34.50%	24.10%	6.90%	13.80%	20.70%	34.50%

With implementation of the escape room learning experience, there was a higher percentage of students who received a grade of A in the course as shown in Table 3. The percentage of those who obtained a grade of D and F was reduced, with an exception in Spring 2018. The statistics for the Spring 2018 semester may not reflect the true impact of the escape room learning experience due to the fact that one session was linked with an entry-level writing course with a different teaching sequence on specific topics.

Feedback from Instructors

While the three instructors utilized the same Breakout EDU kits across all Q110 sessions, each instructor deployed the game differently. One instructor launched the game after a traditional lecture, one instructor introduced the game at the beginning of the class, and another instructor requested students to read the course materials before coming to class to participate in the game. Regardless of how the games were being deployed in class, all three instructors agreed that the classroom is more lively as students engaged and collaborated with each other to find solutions to the clues. One of the instructors found that observing students as they play the game was an educational experience and very beneficial. Unlike traditional assignment, instructor is able to gain direct insight on how students apply their knowledge to solve a problem. When most of the students failed to resolve a clue, it served as a good indicator that additional instruction is needed on specific concepts/skills.

CHALLENGES AND SUGGESTIONS

The authors experienced a learning curve with creating background scenarios, with game set-up and preparation of boxes. Other than reviewing different ways of setting up clues from the subject packs offered by Breakout EDU, the most helpful websites are 101 Best Escape Room Puzzle Ideas (https://nowescape.com/blog/101-best-puzzle-ideas-for-escape-rooms/) and Discover Ideas about Breakout EDU Games (https://www.pinterest.com/pin/407153622547326996/). When designing the clues/puzzles, keep in mind generational differences. For one of the clues, the authors utilized a traditional clock face with twelve numbers and two hands. While the instructors believe clock reading is a basic life skill, they were surprised to discover that many students were not able to read the traditional clock correctly as many of them grew up with digital clocks.

Manipulating the locks (one of the most compelling elements of the escape room) could be challenging, even with access to a dedicated Breakout EDU Lock Facebook group. Set up for the directional and letter locks often required extra attention to ensure the combinations are set correctly. As locks are one of the essential components of the game kits. While it is possible to obtain replacement locks from Breakout EDU, a lower cost alternative is to purchase locks (especially for 3 and 4 digital locks) through local stores. For directional and letter locks, Amazon is an option.

Locks sometimes got stuck which prevented students unlocking the Breakout EDU box. In such cases, once the correct answer was verified by the instructor, students were given alternate ways to finish the activity. As mentioned above, students may not be familiar with how the locks work as they participate in their first game, it is helpful to demonstrate to the students how each of the locks work, and from which direction they should read the combinations (left to right/top to bottom). This was particularly true for the directional and alphabet locks.

Finding the optimum setup for each class was a balancing act. Conversations with students during debriefing suggested some classes were more wary of elaborate setups using red herring clues, and hiding the boxes and sets of clues; some groups wanted more locks, others requested more scavenger hunt elements; while other classes preferred a more direct approach. Evaluating the mood and preferences of the group and responding accordingly was challenging.

The initial learning curve became less steep, as the authors became much more efficient at preparing the games. One efficiency was that not all boxes for the same class needed to have a unique setup. At first the authors were concerned that students might overhear each other discovering the clues, but they quickly realized the students were all focused on their own group and found that they could save time in setup by having all the boxes have the same clues.

Other feedback the authors received from students was related to teamwork. One aspect of the feedback concerned one or more team members who were not willing to participate in the game. One other feedback complaint regarded the students' division of labor. Teams would divide up tasks to speed up the progress so they could escape successfully. Unfortunately, since not everyone participates in solving all the clues/puzzles, some students felt they missed out on learning part of the concepts/skills they did not personally work on. It can be useful to include additional clues in order to provide more students in a team with more opportunities to master the concepts.

FUTURE PLANS

The authors' future plans include expansion of content. They will be updating clues, testing scenarios, and content to allow for a greater choice in units. Initially the boxes were used for review/reinforcement of concepts. The authors found that boxes can also be used to introduce units, where students discover and then apply the concepts as a team. The authors will also test the digital version of the escape room. Remote gaming will allow use of Breakout EDU while still maintaining social distancing. In the digital version, students play the game on their personal devices to solve puzzles remotely. Teamwork and collaboration are maintained through the use of Zoom and Google Meet during game play. BreakoutEDU has a Facebook discussion group and step-by-step tutorials on setting up this type of interactive remote gaming. The authors recently published an Excel schedule so the game kits can now be reserved by other Q110 instructors. Future plans may include publicizing escape rooms and providing support to professors in other subject areas.

Once students have gained experience with escape rooms, the activity can be reversed: students can work in teams to create an escape room box about a specific course learning objective. This would work especially well towards the end of the semester. Reversing game design would pose a new challenge to students' ingenuity. It would also serve as a check on students' understanding of major learning objectives of the course. The student designed boxes could be used in subsequent semesters. They could also be exchanged and critiqued by students within the same class. This would provide instructors with more (and different) feedback.

One of the demographic questions the authors noted that is missing from the online survey is class year. Having that information will enhance survey results to determine if there is any correlation on responses for specific questions to individual student's class year.

User surveys and grade analysis are both good instruments to evaluate the effectiveness of the escape room learning experience. In the future, the authors would like to investigate how the concepts/skills we introduced via the escape room learning experience impact their performance on the final exam.

CONCLUSION

As previously mentioned, target audience of Breakout EDU is mostly geared toward K-12 educators. While there are limited subject packs available for higher education, the Breakout EDU kit provides the basics for university/college educators to develop escape room games based on their instructional needs. Information literacy concepts serve as excellent content for escape room games. The trial and error experiences involved in solving the puzzles also serve as a good reminder for the students of the same kind of challenges they will experience in doing research.

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