

Escape the classroom: a game to improve learning and student engagement

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Abstract

This paper examines the impact of an interactive in person escape room game on students' engagement and learning in a first year quantitative module. Developed and implemented as a formative assessment and alternative method of revision, the game aimed to enhance student engagement and academic performance. Through a captivating Cluedo narrative and integrated hints, the game facilitated an interactive learning environment. Subsequent evaluations, including peer feedback, questionnaires, and focus groups, were conducted to evaluate effectiveness. The findings demonstrate that the game significantly reinforced students' engagement and learning. Moreover, it positively influenced their performance, motivation, teamwork, and communication skills. The interactive nature of the escape room game ignited students' enthusiasm and active participation resulting in an enjoyable and immersive learning experience. Overall, the game proved highly beneficial for the module, generating positive outcomes for the participating students.

Keywords: *escape room; formative assessment; game-based learning; educational innovation; teamwork; engagement.*

1. Introduction

Educational escape room games are increasingly prevalent as innovative tools within higher education, facilitating the integration of game-based learning into academic settings. These games serve as effective bridges between theoretical knowledge and practical application, enhancing the overall learning experience for students. In an era where student engagement, motivation, and active participation are pivotal to effective learning, gamification offers a dynamic solution that meets the changing demands to move away from traditional teaching. The shift away from traditional teaching methods towards more interactive and experiential approaches underscores the importance of incorporating gamified elements into educational settings. Educational escape room games, with their immersive and participatory nature, address

the evolving needs of students, providing an engaging platform that transcends the limitations of conventional instructional techniques.

Drawing from an extensive body of scholarly literature, it is evident that student engagement and motivation represent pivotal concerns in contemporary higher education. Martina and Goksen (2022) and Eukel and Morrell (2021) underscore the importance of addressing challenges related to student engagement and motivation, highlighting the potential of gamified interventions to enhance learning outcomes. Furthermore, studies emphasise the limitations inherent in traditional methodologies, which often struggle to generate active participation and meaningful learning experiences (Clarke et al., Sanchez, 2023).

One particularly innovative strategy involves the integration of educational escape room games into academic curricula. These engaging educational approaches diverge from conventional pedagogical norms, leveraging the principles of gamification to create interactive learning environments. Rooted in principles of problem solving and collaborative engagement, escape room games present students with challenges that demand critical thinking and collective effort for resolution (Fuentes-Cabrera et al, 2020; Lopez-Pernas et al, 2019).

This study investigates the integration of an in person educational escape room game in a first year quantitative module. By exploring the impact of the game on student engagement and learning outcomes, this research seeks to contribute to the broader discourse on gamified learning approaches in higher education.

2. Background

Over the past two academic years (2022-2023 and 2023-2024), an interactive escape room game has been implemented in a first year quantitative Introduction to Mathematics for Economics¹ module at the University of Birmingham Dubai campus. In the initial implementation phase, the game was introduced, followed by its continuation in the subsequent academic year with a different cohort of students.

The challenges encountered by first-year economics students in this module were multifaceted, including issues such as low engagement, motivation, different mathematical backgrounds and abilities among students, and overall low academic performance. The challenges were exacerbated by factors such as the condensed block teaching style and students' adaptation to university life.

During the academic year (2022-2023), a notable increase in the failure rate observed in class test 1 prompted the introduction of the game as additional support to learning. Class test 1

¹ This module has three summative assessments, class test 1, class test 2, and a final exam.

results revealed a significant proportion of failures alongside a remarkably high percentage of distinctions, illustrating the diverse backgrounds and distinct needs within the student cohort. Teaching within a small group setting, along with the predominant formation of student interactions in specific groups, prompted contemplation of alternative methodologies. Driven by the aspiration to strengthen student support, enhance interactive learning, and address the challenges faced, the implementation of the escape room game was introduced as an additional support mechanism and formative revision practice for the subsequent class test 2.

Motivated by positive feedback, which underscored notable improvements in teamwork and collaboration, communication, and student motivation, I implemented an improved version of the escape room game in the current academic year 2023-2024. Students expressed their appreciation for the game, describing it as a highly engaging activity and a fun way of revision.

3. Methodology

3.1. Design

I designed and implemented an in-person (pen and paper) educational escape room game as a revision formative assessment for class test 2 during 2022-23 and for class test 1 in 2023-2024. The format followed the structure of the summative assessment (4 questions from each topic with 5 sub-questions), and was optional, with a prior announcement for student registration to facilitate group formation.

The game occurred at the University of Birmingham Dubai campus and featured participants from diverse cultural backgrounds, maintaining a nearly equal gender balance. To ensure inclusivity and equality, [groups of four with one exception of a group of 3 due to total participants (n=31)], were formed based on students' varied mathematical backgrounds and exposure, degrees of studies, and gender. Information regarding students' mathematical backgrounds upon university entry and their current academic level was collected, facilitating the creation of groups with comparable abilities. Emphasising diversity within the groups aimed to ensure equal participation, problem solving, and competitiveness. The objective was to create groups with as equal capabilities as possible emphasising inclusivity in this activity and advancing equality. Additionally, attention was paid to forming groups comprising students who were not acquainted with each other to foster interactions among them.

3.2. Implementation

At the beginning of the game, students were prompted to assign a name for their group to create a sense of community and make the game more fun. The introduction of a captivating Cluedo story with hints made it more engaging and fun, with the students tasked to unravel a murder mystery by solving a series of interconnected challenging quantitative questions relevant to the

module material. Each question served as a clue, progressively unveiling the weapon, motive, clue and finally murderer behind the fictitious crime.

Incentivised student participation, I introduced a reward for the winning team, to boost motivation and engagement. The core objective of the game was for students to correctly solve all questions within the limited time to win the game, escape the classroom and win the prize. Progression through the game hinged upon accurately addressing the initial question and subsequently discovering the pertinent clue to proceed to the subsequent question.

This procedural framework remained consistent throughout the game, with each correctly answered question furnishing a crucial piece of information indispensable for unravelling the overarching mystery. Emphasising the interdependence of the clues, students were mandated to solve all questions with precision, discover the murderer and escape the classroom.

The questions of the game were designed to be challenging, as students collaborated in groups, aiming to stimulate critical thinking, problem-solving, and teamwork. The intentional difficulty level served the purpose of assessing their capabilities and promoting effective group work, leveraging their strengths. In alignment with the summative test rules, no formulas were provided, ensuring that students relied solely on their cognitive abilities and collaborative efforts to navigate through the challenges. In instances where students consistently struggled with a question, hints were offered to guide them toward a better understanding, encouraging continued engagement with the game.

The game was conducted in a big lecture theatre, with students initially positioned in the back rows at the commencement of the activity. All groups were simultaneously given the first question, initiating their journey through the game together. Upon successful solution of the question, groups were rewarded with a hint and subsequently progressed to the next row to tackle the next question. This sequential progression enabled students to monitor the relative advancement of other teams, intensifying the competitive aspect of the game. As the game unfolded, teams moved closer to the front rows of the lecture theatre, culminating in their eventual escape from the classroom upon successfully solving the final question where they reached the first row of the classroom. To facilitate the verification of answers and progression to subsequent questions, a designated representative from each group ran down to cross-check responses with the facilitator as quickly as possible, encouraging active participation through a dynamic approach. Across both runs of the game during the academic years 2022/23 and 2023/24, one team successfully completed the game within the time limit and escaped the classroom, closely followed by another team.

3.3. Evaluation

In the first run of the game, I conducted a quantitative analysis utilising a survey questionnaire. Also, the analysis involved comparisons of the performance of students on class test 1 before

the game, with student's performance on class test 2, for which the game was implemented as an alternative method of revision (Figure 1). Additionally, I compared the grades of students who did not participate in the game (control group) with those who did (treatment group). To gather further insights, I organised a peer group feedback session using Padlet. In the second run of the game, I employed a mixed methods approach. This included both quantitative and qualitative analyses conducted through questionnaires and focus group discussions, respectively. I applied thematic analysis for the qualitative data identifying patterns using the NVivo software.

4. Results

4.1. Discussion of the Results

Overall, the results of the game were very encouraging. Figure 1 illustrates a comparison between the mean scores and failure rates (%) in class tests 1 and 2 during the first run of the game in the academic year 2022/23. As depicted in the figure's data, when assessing performance across the two class tests, there was a notable increase in mean scores in class test 2 (for which the escape room game was designed as a formative assessment), rising from 62.88% to 68.5%. Additionally, there was a significant decrease in the number of failures, dropping from 20.6% to 2.94%. These findings strongly suggest that the game effectively supplemented students; revision efforts, contributing to improved performance.

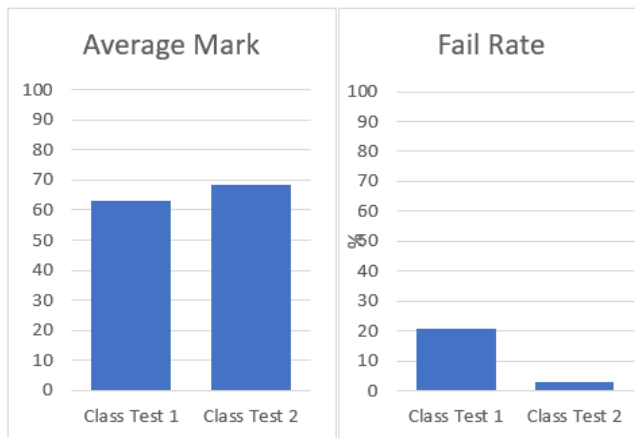


Figure 1: A comparison of the average mark and failure rates (%) in class test 1 and class test 2.

Tables 1 and 2 show the questionnaire results from the second run of the game in 2023/24. Table 2 provides additional findings regarding the assessment of the game across various dimensions. A majority of the students expressed that the game improved their communication

with their classmates and professor, made solving questions in groups more enjoyable compared to traditional methods, increased motivation for revision, and fostered a greater sense of inclusivity in the activity. Moreover, students reported that the game enhanced their understanding of the module content.

Table 1. Questionnaire Results

Questions	Results
This experience might make me more engaged with the module content	100%
The game enhanced my collaboration and teamwork skills	100%
The game has an educational value	100%
I completed the game within the time limit	9.68%
I used the hints provided during the game	45.16%

Table 2. Questionnaire Results

	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
Communication with my classmates and professor has improved			12.90%	38.71%	48.39%
It has been more fun solving questions with games in groups		3.23%	9.68%	41.94%	45.16%
This type of revision is more motivating			16.13%	41.94%	41.94%
I felt more involved in the activity		3.23%	6.45%	41.94%	48.39%
The game improved my understanding of the module content		10.00%	16.67%	46.67%	26.67%

Regarding the overall experience, some quotes from the participants: “The experience was fun and engaging. It was nice to work on some problems with a group of people. It was challenging at the start to coordinate who does what, but as it went on, we became better”. “The overall experience was very enjoyable. I had a lot of fun meeting new people, solving questions and working together. I found the system of moving down a row in the theatre very engaging as it encourages a lot of competitiveness”. “Overall experience was amazing. We had the revision and test of the course along with competition”.

On the question ‘What did you enjoy the most in this activity’ the students emphasised teamwork, collaboration, working with teammates, structure and design of the activity: styled as an escape room and meeting new people. Revised all topics in an engaging manner. And competition. The focus group confirmed the positive results and gave a more comprehensive understanding of the student’s experience of the game regarding five key areas: experience, engagement, challenges, learning and teamwork.

Thematic analysis conducted using NVivo software revealed several patterns from the focus group discussions. Collaboration and teamwork emerged as significant themes, closely linked with motivation. Students found motivation in teamwork, allowing them to meet new people,

understand different problem-solving methods, and strengthen interpersonal relationships. The diversity of backgrounds among team members provided valuable learning opportunities, enabling students to explore alternative approaches to problem-solving. The competitive aspect of the game added excitement and drive, making learning enjoyable and engaging.

Another prominent theme was revision and question difficulty. The game served as an engaging and effective revision technique, offering a more interactive and goal-oriented approach compared to traditional methods. Students appreciated the progressive increase in question difficulty, which effectively tested their knowledge and teamwork. The challenging nature of the questions was engaging and reflective of real-world problem-solving scenarios, facilitating diligent revision and practice.

Despite the potential biases, such as a few students choosing not to participate in the game, high grades were achieved in the class test, indicating the effectiveness of the game. In summary, the game increased student engagement and motivation and enhanced teamwork skills, learning and communication. It provided a unique and enjoyable revision tool before the class test, contributing to improved academic performance.

4.2. Improvements, Limitations, and Future Steps

Feedback from students highlighted some areas for improvement and suggestions to enhance the escape room game experience. One common suggestion was the need for more time to complete the game. Also, students found some questions to be quite challenging and suggested having a mixture of easier and more difficult questions to provide a better balance. They also proposed the idea of having shorter questions and the inclusion of more hints.

It is important to note that while the in-person escape room game proved to be effective and engaging in a small cohort, its scalability is limited. This is because the game relies on students working together in a physical classroom where there is a need for sufficient space. A solution to this limitation will be an online escape room game, where the number of students won't affect its applicability.

Future steps to enhance the positive outcomes of the game and support, access and monitor the progress of each cohort are going to be implemented. I am currently expanding the methodology and in the process of individual interviews of both cohorts to examine in depth their experience and whether the positive outcomes such as motivation, engagement and learning persist in other modules and as they are progressing with their studies.

5. Conclusion

In conclusion, the implementation of an in-person educational escape room game within a first-year quantitative module demonstrated positive outcomes in enhancing student engagement,

motivation, and learning. The game served as an effective revision tool, fostering collaboration, problem-solving, and communication skills among students. Positive feedback from participants underscores the value of incorporating gamified elements into educational settings to address the challenges of traditional teaching methods. Moving forward, the development of an online version of the game offers scalability and accessibility, opening avenues for further research and exploration into its impact on student learning outcomes across diverse academic contexts. By leveraging innovative approaches like educational escape room games, educators can continue to enrich the teaching and learning experiences of students in higher education.

References

- Bertoni, A., & Maffia, A. (2022). Promoting creative insubordination using Escape Games in mathematics. *International Journal of Mathematical Education in Science and Technology*, 1-11. doi: 10.1080/0020739X.2022.2113468
- Clarke, S., Peel, D., Arnab, S., Morini, L., & Wood, O. (2017). EscapED: A framework for creating educational escape rooms and interactive games to for higher/further education. *International Journal of Serious Games*, 4(3), 73-86. doi: 10.17083/ijsg.v4i3.180
- Doleshal, B. (2023). Escape the Semester: Game-Based Pedagogy in a Math Course for Non-Science Majors. *PRIMUS*, 33(6), 637-651. doi: 10.1080/10511970.2022.2122091
- Eukel, H., & Morrell, B. (2021). Ensuring educational escape-room success: The process of designing, piloting, evaluating, redesigning, and re-evaluating educational escape rooms. *Simulation & Gaming*, 52(1), 18-23. doi: 10.1177/1046878120953453
- Fuentes-Cabrera, A., Parra-González, M. E., López-Belmonte, J., & Segura-Robles, A. (2020). Learning mathematics with emerging methodologies—The escape room as a case study. *Mathematics*, 8(9), 1586. doi: 10.3390/math8091586
- López-Pernas, S., Gordillo, A., Barra, E., & Quemada, J. (2019). Examining the use of an educational escape room for teaching programming in a higher education setting. *IEEE Access*, 7, 31723-31737. doi: 10.1109/ACCESS.2019.2902976
- Makri, A., Vlachopoulos, D., & Martina, R. A. (2021). Digital escape rooms as innovative pedagogical tools in education: A systematic literature review. *Sustainability*, 13(8), 4587. doi: 10.3390/su13084587
- Martina, R. A., & Göksen, S. (2022). Developing educational escape rooms for experiential entrepreneurship education. *Entrepreneurship Education and Pedagogy*, 5(3), 449-471. doi: 10.1177/2515127420969957
- Rosillo, N., & Montes, N. (2021). Escape room dual mode approach to teach maths during the COVID-19 era. *Mathematics*, 9(20), 2602. doi: 10.3390/math9202602
- Sánchez, A. M. (2023). Using digital educational escape rooms as a motivational review tool for Economics. *The International Journal of Management Education*, 21(3), 100852. doi: 10.1016/j.ijme.2023.100852