

Applied Gamification Using Virtual Escape Rooms: Case studies in Entrepreneurial and Anatomy Classes

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Abstract

Escape Rooms (ERs) can be used as an experiential and engaging pedagogical asset, wherein students overcome challenges, find a solution and 'escape' the simulated or imagined setting before the recommended or required time elapses. Though they can provide an enjoyable and challenging collaborative learning environment, they require extensive organisation and resources. This paper presents the experiences and recommendations of educators in two third level institutions that implemented Google Form-based virtual escape rooms during the COVID-19 pandemic.

1. Introduction

Applied in the educational context, Escape Rooms (ERs) aim to immerse students on a mission to solve clues within a bounded space (usually in the classroom or online). Students are exposed to a narrative surrounding the nature of the challenge and must solve a series of sequential clues found within the space to escape. Educators form clues around their curriculum content, inviting their students to engage in problem solving and critical thinking in a novel format. They have been used in educational settings to allow students experience responding to a natural disaster, computer attack and emergency patient care (Taraldsen et al., 2022). While they can be used in many formats, the COVID-19 pandemic created a shift in the educational paradigm from in-person to learner-led virtual ER environments or Digital Escape Rooms (DERs) (Makri et al., 2021). These dynamic online learning experiences use a variety of free web-based applications to simulate a series of locks to be opened, puzzles to be solved and escapades to be carried out (Makri *et al.*, 2021; Vergne et al., 2020). Increasingly, they are highlighted as an effective way to integrate course material with active engagement, though more empirical work is required to attain insights on their effects on student learning (Taraldsen et al., 2022).

The following article represents the accounts of two university educators on their creation and use of the online escape room concept following a switch to online learning due to the

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COVID-19 pandemic (November 2020). This paper discusses the nature of the ER concept, details the elements of the two variations applied, and provides recommendations for educators embarking on such pedagogical novelties in future.

The use of the escape room in education

Game based learning (and particularly digital GBL) relates to the use of games (video games, serious games, simulations) to enable participants as players engage in active learning during or after their gameplay. As the principle goal of ER's and DER's is to allow students to acquire and apply their knowledge to move through the game levels, they can be classed within the GBL spectrum (Veldkamp et al., 2020; von Kotzebue et al., 2022). However, they are also used in gamification discourse as they often integrate gamified principles such as leaderboards, timing etc. (Makri *et al.*, 2021). Additional elements include rules, rapid feedback cycles, rewards (points) and the presence of challenge and competition i.e., leader boards and ranking (Buckley and Doyle, 2016). These can all be integrated into an effective ER if given careful consideration.

There has been an explosion in the array of studies adopting escape room methodologies (Figure 1). A scholarly search on Web of Science from 2019-2023 finds 713 academic articles on the topic. The systematic review written by Fotaris and Mastoras (2019), identified 68 studies noting educational ERs provide an enjoyable experience that immerses students as active participants in the learning environment. Additionally, learners are given the opportunity to engage in an activity that rewards teamwork, creativity, decision-making, leadership, communication, and critical thinking (López-Pernas *et al.*, 2019; Nadelson and Nadelson, 2020). Each of the puzzles included in the game can have different learning objectives and can include elements of teamwork, communication, skill application and topic content application (Eukel and Morrell, 2020). It can also be applied to subjects considered to be challenging or complex for students, with Fuentes-Cabrera et al. (2020) noting its positive effect on student motivation for mathematics, and the reduction of learner anxiety.

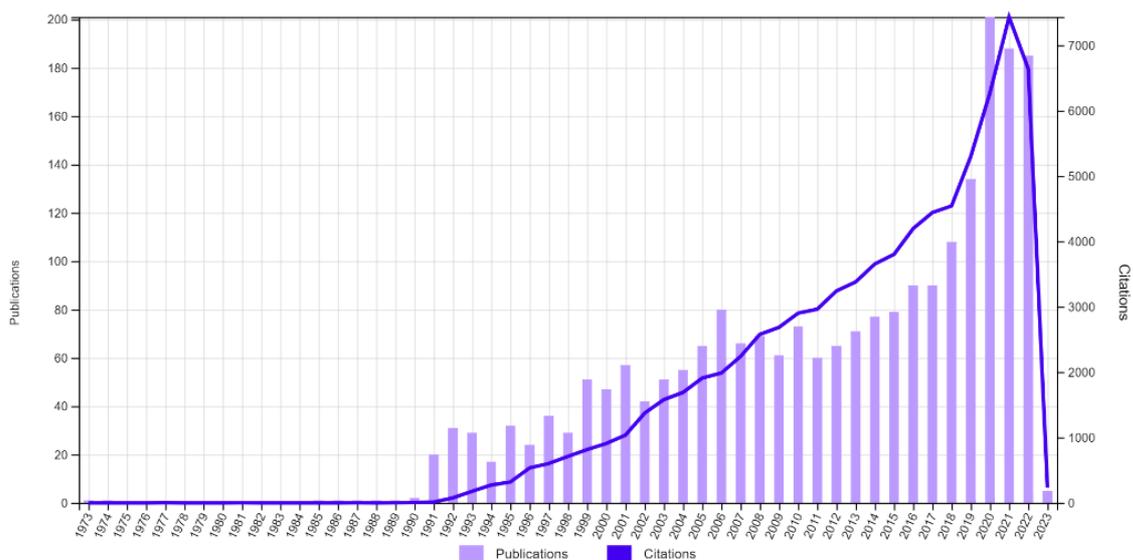


Figure 1. Popularity of Escape Room studies (Generated from Web of Science)

The below cases will explore the creation of two ERs for disparate student groups: an enterprise business class, and an anatomical sciences class. These games were developed by the coauthors of this paper, who had no prior experience of escape rooms. The experience and learnings of the developers will be shared, in the absence of student feedback data.

2. Case Overview

Case 1: Use of an Escape Room in an Entrepreneurial Classroom

In November 2020, first year students were completing their first semester in university entirely remotely, against a backdrop of a global pandemic. The onboarding of students and teachers alike to a fully online learning environment in such a short space of time meant that while many teachers developed their pedagogies admirably, students still lacked much of the socialisation and spontaneity of a live classroom experience. Sensing this in the group, our team of teachers working on the LIFE (Learning Innovation for Enterprise) module sought to find this group some levity, while providing them another opportunity to understand the new venture creation process.

The game (<https://tinyurl.com/EscapeEER2020>) was developed using Google Forms and was a Christmas themed game lightly based on the entrepreneurial process. The game was created by several members of the teaching staff and tested in advance with a group of teaching assistants and other staff. In terms of gameplay, the game was intended to be played in randomly chosen teams and be scored based on time and creativity (the enterprise concepts thought up by the teams).

Students were asked to sign up as individuals (to be placed in teams) or could register as a team online (via Eventbrite). To make the escape room more competitive for the students, a cash prize was offered to the winning team. Teams were emailed an online Zoom link, where the teaching team welcomed them dressed in festive attire and using celebratory virtual backgrounds. Students were allocated to breakout rooms in teams and sent the link to the game. The full challenge required teams to come up with a festive mobile app concept. The first of seven levels focused on team formation and intended to set the comedic tone of the game itself (Figure 2). One member of each team was asked to share their screen and move through the levels with all members viewing synchronously.

"On Dasher, On Dancer, On Prancer, On Vixen"



LEVEL 1: TEAM FORMATION

For any entrepreneurial journey to be successful, it needs a strong team. First off, we would like you to think of a team name, and show us who you are! Please type in a team name and upload a team photo.

The photo can be a screenshot of your team from Zoom or one you create. It HAS to be Christmas themed. Points and spot prizes for the most festive!! Get Moving!!

Image title



Figure 2. Level One of the “LIFE” Escape Room

After an initial photo challenge, students moved through levels 2-7 which related to: Opportunity Recognition, Idea Generation, Understanding the Customer, Financial Feasibility, Prototyping, and Pitching. Each level asked the teams to complete a simple, fun task (crossword, wordsearch etc.) and a challenge related to their mobile app concept. Some elements (Figure 3) required financial analysis and creativity challenges. The winners were released on Twitter and were contacted by email once the teaching staff had deliberated on the application concepts and calculated final scores.

In total, over 150 students participated in the festive escape room game. The students found it amusing yet played competitively and conscientiously. Some examples of the concepts ideated by the students for their festive application were a: virtual catwalk to model festive outfits with family, a local shop gifting connector, virtual Christmas crackers and a virtual reality Christmas jumper design company.

Income	Year 1	Year 2	Year 3
In-app advertising	€2,600	€36,000	€50,000
In-app purchases	€2,600		€15,000
Total:	€22,600		
Expenses			
App development	€30,000	€20,000	€15,000
App store costs	€100	€100	€100
Server costs	€2,400	€3,600	€5,000
Marketing/promotion	€5,000	€4,500	€3,000
Ongoing maintenance	€2,500	€5,000	€7,000
Total:		€30,100	
Cash Inflow:		€12,800	

What are the in-app advertising sales in Year 1? *

Your answer _____

Figure 3. Example Clue from the “LIFE” Escape Room

Case 2: Use of an Escape Room in a Science Classroom

In their gross anatomy dissection practical sessions, students work in small groups to explore specimens and consider problems. This approach fosters peer discussion and interaction to aid understanding. In March 2020, the Anatomical Sciences class switched to an online format and this collaborative peer learning environment was no longer available to students. To recapitulate some of this lost interaction and exploration of the study material, a virtual ER was developed using Google Forms. Assigned as an optional activity that students could complete in their free time, the escape room link was shared with the students in October 2020. It was suggested the students complete the activity collaboratively in a small group while in a video conference.

The ER theme was that of a fictional Belfast detective solving a series of murders (Figure 4), whereby the questions posed related to anatomy taught to the students in the five weeks prior. The ER is freely available via this link <https://tinyurl.com/Anatomyescape>.

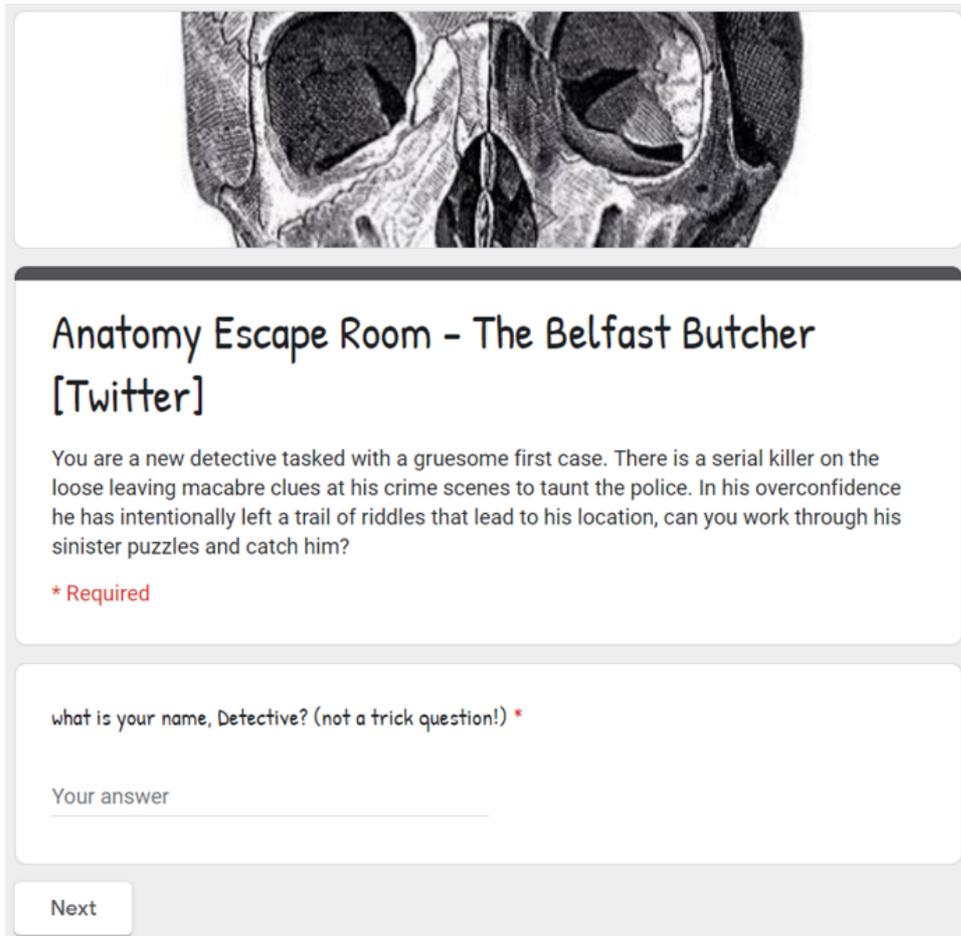


Figure 4. Introductory Page of the Anatomy Escape Room

The virtual ER was created in a simple sequential format. Students were presented with a question which they had to solve to proceed to the next question. The game clues were collected along the way in the form of images (Figure 5), links to websites, an embedded video, and Google map locations that aided them in answering the final riddle.

The escape room was tested by a group of three lecturers over a video conference prior to release to the students. This was an important step, as it helped to identify technical issues, and misleading questions or clues. To avoid frustration, sufficient clues were made available, along with links to specific reading material containing the answer. These were included to encourage exploration of the learning materials if groups become stuck on a question.

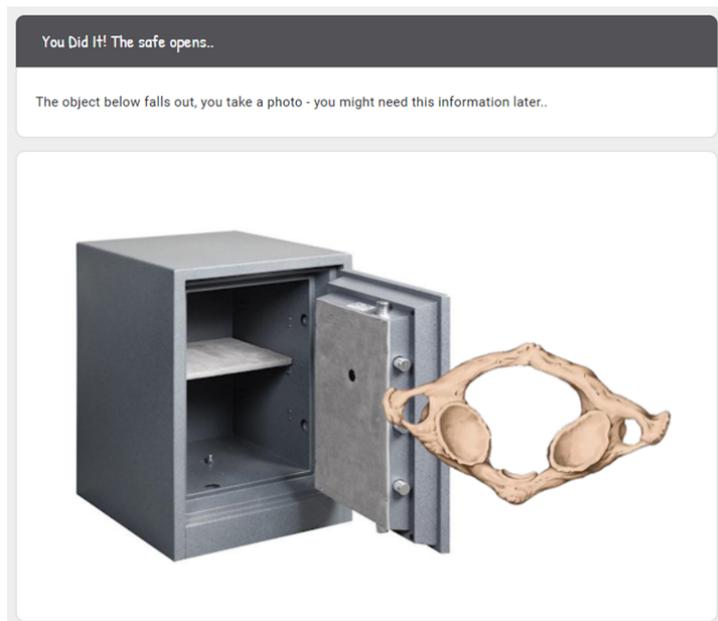


Figure 5. Example Clue from the Anatomy Escape Room

The students organically formed groups of three and approximately 9 of the 18 students enrolled in the class participated in this voluntary activity. It is possible to see the timestamp that the group completed the ER, but it was not possible to monitor how much time each group spent completing the activity as the starting time was not collected. Responses and submission timestamps are saved by Google Forms in a spreadsheet. In this case, the fastest group completed the ER within 40 minutes of the announcement of the game. No formal feedback evaluation was carried out, but those that completed the game reported it to be enjoyable. This gamified approach did not require any input from the lecturer after initial development, making it easy to scale to larger classes.

3. Findings: Recommendations from Educators

At the conclusion of the two case ER games mentioned above, we as the developers of the discrete games, discussed collectively our experiences, frustrations, and learnings. Taking insights from the retrospective action research processes, we engaged in multiple conversations about our roles in the process of ER creation from a practical standpoint, and the impetus behind our decision to create these (somewhat risky) endeavors as curricular additions during the pandemic. The retrospective action research links both to the experiential learning cycle (Kolb, 1984) and collective or collaborative unpacking, noting that one can theoretically begin their reflecting at any point in the plan-act-observe cycle. Following our discussions, we both compiled our notes in a shared document and again engaged in an online process of commenting and reflection using comments and other tools, before reaching our recommendations. Though delivering content from different specialisms, several key themes were experienced by both educators, pertaining to game design and gameplay.

Following the construction and delivery of these ER games, we present several recommendations:

1. **Team size:** For all students to contribute meaningfully, a group size of 2-5 students

would be recommended. With very small groups, progress may be impeded by a lack of divergent thought, but with very large groups (e.g. 10 people), the interactions tend toward one or two dominant speakers with the remainder becoming passive and unengaged (Fay *et al.*, 2000). In the entrepreneurial ER case described above, teams were limited to between 2-5 members. In case 2, the majority of those that completed the room organically formed groups of three.

2. **Timing and Time limit:** As noted by Fotaris and Mastoras (2019), to achieve the best learning outcomes for an educational escape room, lecturers and teachers must aim for a high ER completion and alignment with the learning outcomes of the course. To maintain the momentum of an ER, we recommend that the average team should move through an escape room in 30 minutes (with exceptional teams perhaps attaining times of 20 mins and struggling teams at 40 mins (thereafter receiving prompts/hints). Extended durations may fatigue the group and cause frustration, dissociation, and loafing.
3. **Troubleshooting:** One option is to add additional “hints” such as a link to a resource, to aid participants in understanding the topic they are struggling with. In a structured Zoom breakout room, the “ask for help” button may be used as a “phone a friend” option to contact the instructor.
4. **Music:** Embedding music into the game is recommended to help to create an atmosphere but must be tested carefully. Using multimedia content in the game (video and audio) may not transfer well over devices and may be affected by the broadband capabilities of the members. In the entrepreneurial ER, music was played in the opening/closing (main room) only, but a recommended playlist was sent to the teams (via the message function) should they wish to use it.
5. **Rewards:** As noted by previous scholars, including some kind of external motivation such as extra points for the team who finishes first, a grading allocation or a prize can help to increase the likelihood of students completing the full escape room and prevent them from skipping over questions (López-Pernas *et al.*, 2019; Veldkamp *et al.*, 2020). We would support this, where possible, for students to fully embrace the sense of fun required and note that the ER experience is a non-regular occurrence. However, if choosing to embed a prize or competitive element, more monitoring is required, and the game may need to be played by all teams/participants synchronously.
6. **Moving to a Live or Hybrid setting:** While many of the considerations would be the same, complexities in resourcing ensue in a physical location. Teachers need to monitor situations to ensure instructions are not tampered with when moving from group to group, and all facilitators are prepared accordingly. Digital elements (e.g., quick response “QR” codes, applications, virtual reality, augmented reality, embedded screens, speakers, etc.) can supplement the physical components in a live setting (Makri *et al.*, 2021) and connect the digital to the analog in a hybrid ER variation.

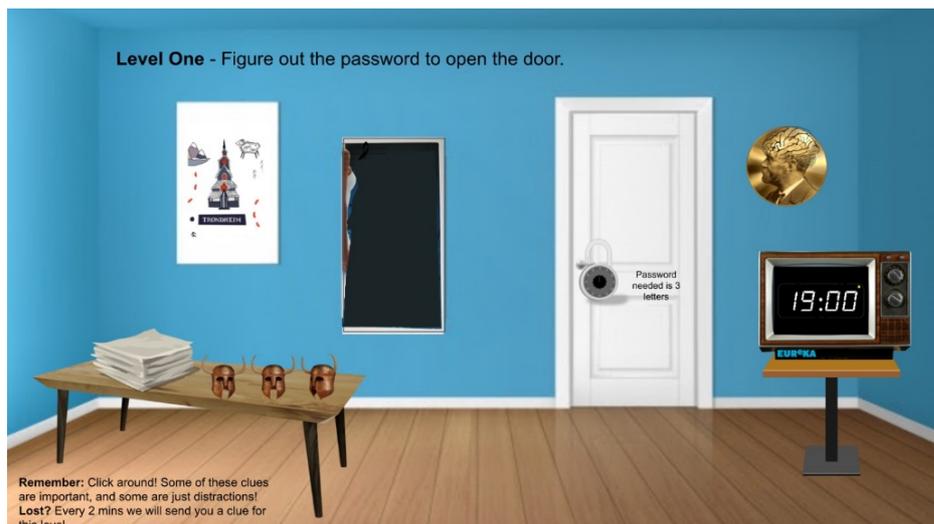


Figure 6. Use of Google Slides to Create a Virtual Escape Room

7. **Enhancing the Digital version (via Google Slides):** To develop an ER concept further, Google Slides can be used to simulate the ‘room’ itself and to add functionality such as a timer and hyperlinks to clues and resources. An example was used at the 2021 3E Entrepreneurship Educators Conference as an icebreaker exercise (Figure 6).

5. Discussion

Despite the success we experienced in our separate ER concepts, neither educator has utilized these escape rooms in the post-pandemic context. Reflecting on this, we have found a reduced need to introduce moments for informal learning and socialization within the learning context in our current teaching, which is mainly in the offline classroom environment once more. For adults considering online education, Capranos (2022) finds that there is a more positive perception of online learning post-pandemic, however most intending students still preferring a nearby university to attend events and connect with their professors. We think that the ER format could be effectively used in the distance learning context to great effect, to allow students who have less on-site interaction a chance to connect with one another in a less formal setting. Additionally, as an asynchronous activity (such as developed for case 2), the activity could be modelled into an enjoyable element of formative continuous assessment for the large class context.

Our article is thought to be of use to educators hoping to develop their own ER concept. It is recognised that our contribution is weakened by a lack of empirical data on their efficacy – an element that was not included amidst the chaotic backdrop of the covid pandemic causing disruption to students and staff alike. Taraldsen et al., (2022) in their systematic review noted that many similar studies of ER concepts lack concrete data collection, research design and findings. This is unfortunate, given the opportunity to build several research tools into the design of the ER itself. While our approach, retrospective action research, is strengthened by the triangulation of quantitative data (van Rensburg, 2023), it is thought particularly useful in contexts where unique insights by select individuals have been gained following dramatic events (Gummesson, 2003).

6. Conclusion

Pre-pandemic, many universities were already dealing with issues of scale and risks of ‘massification’ (Maringe and Sing, 2014; Saunders and Hutt, 2015), with increasingly large class teaching methods and pedagogies becoming a key requirement (Lyons and Buckley, 2020). Combined with the digital induction of the global student community, the usefulness of recorded lectures, carbon travel considerations and more - the hybrid student may well emerge as a fixture in the fast-approaching post-Covid teaching era. Students who attend much of their classes remotely, attending more sporadically to campus for required socialisation-based applied workshops. The ER scaffold may well aid this hybrid experience, using a mixture of analog and digital facets in gameplaying which can aid teambuilding and socialisation between peers (Makri *et al.*, 2021). As a bridging device, this form of gamification may also nurture the sense of relatedness, or the connection that the student has with the educator (Tan, 2018). The experience of both educators in this article was overwhelmingly positive for the use of our respective ER games. While perhaps simpler than some (for example Martina and Göksen, 2020), our smaller ER vignettes were very successful in recapturing energy, momentum, and levity amidst the tensions of the pandemic.

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