# Escape to Learn: Digital Escape Rooms and Universal Design for Learning.

Cormac Oliver Flynn

**Atlantic Technological University,** Cormac.Flynn@ATU.ie

**Abstract.**

Gamification is an increasingly popular strategy to foster engagement in education. This paper reflects on digital escape rooms in the learning environment and their alignment with Universal Design for Learning (UDL) principles. Four digital escape rooms based on different anatomy and physiology themes were developed as revision exercises for a first-year biomedical engineering class. Students self-organized into small groups and completed the activities. Results from feedback surveys revealed positive student experiences, with 91% finding the activity engaging and 86% indicating its positive impact on learning. 82% of students said that the digital escape room helped create a sense of community in the class. Students commented on the development of collaborative skills, quick thinking, and coping mechanisms under pressure. Discussion centres on the alignment of digital escape rooms with UDL principles, addressing multiple means of engagement, representation, and action & expression.

**Keywords:** Anatomy and Physiology; Digital Escape Rooms; Gamification; Universal Design for Learning.

## 1. Introduction.

Escape rooms are physical or virtual spaces where people work together to escape from by finding clues, solving puzzles, and answering questions. Escape rooms have seen increased use in educational settings in recent years (Sánchez-Martín et al., 2020; Makri et al., 2021). They are a social constructivist learning activity where students work together to build their knowledge (Ouariachi & Wim, 2020). There are also behaviourism aspects contained within them with students rewarded for solving a problem or answering a question (Zhang et al., 2018).


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There have been several reviews of escape room activities in educational settings. From a review of many studies, Veldkamp et al. (2020) provided guidelines for the use of escape room activities in the classroom. They conclude that debriefing sessions are important after the activity to facilitate learning. Taraldsen et al. (2020) reported positive experiences from escape rooms in educational settings.

There is a relative dearth of studies of escape rooms in context of Universal Design for Learning (UDL) (CAST, 2018). Stylianidou et al. (2020) reported increased engagement of seven- to eight-year-old students taking part in an escape room activity that was designed with the principles of UDL in mind.

The aim of this paper is to reflect on digital escape rooms in the context of the UDL guidelines. To achieve this aim, the objectives are to run a series of digital escape rooms in a first-year biomedical engineering class and get feedback from students on their experiences on the activities. The rationale for using digital escape room activities was to offer an engaging, hands-on approach to learning, encouraging active problem-solving and collaboration among students, which are all characteristics of UDL. The interactive nature of digital escape rooms has the potential to make complex physiological concepts more tangible and memorable, fostering a deeper understanding. The purpose of this reflection was to allow educators to consider the pedagogical impact of incorporating escape room activities into their teaching practices.

# 2. Methodology.

## 2.1 Digital escape room creation.

Four digital escape rooms were developed as team-based revision exercises in a first-year anatomy and physiology class. The themes of the escape rooms were tissue types, the cardiovascular system, the nervous system, and the digestive system.

Each digital escape room activity consisted of a combination of Google Sites, Google Slides, and Google Forms. A brief paragraph at the top of the Google Site provided context for the escape room. A Google Slide embedded in the site contained an image of a room with artefacts and the escape door. One artefact in the room had a Google Form hyperlink attached to it. The Google Form had about ten questions related to the topic of revision. Students needed to answer all questions correctly before getting the code to the escape door.

The artefacts around the room functioned as either clues to the questions on the Google Form or as irrelevant distractors. Hyperlinks attached to the artefacts led to different media including music videos, movie trailers, jigsaws, crosswords, and Wikipedia articles. An example of a digital escape room can be found at this link Escape Room Example.

### 2.2 Deployment of the digital escape room activity.

At the start of the session, the instructor introduced the escape room activity to students in the classroom. Students self-organised themselves into groups of two or three and entered the digital escape room when provided with the link.

During the activity, the lecturer observed the students in terms of engagement and provided support where needed. When a group escaped from the room, they messaged their details to the instructor along with the escape code.

After the activity, there was a debriefing session where the students reviewed the questions and clues. After the first escape room activity of the module, the instructor invited the students to complete an anonymous survey to provide feedback on their experiences (see Appendix). The survey was designed using Microsoft Forms. It consisted of a series of statements that responders indicated their level of agreement with. These statements were designed to measure how much students perceived the escape room activity to be engaging, to be helpful with learning, to be accessible, and to be able to create a sense of community. Among a series of open-ended questions was one designed to measure emotions felt during the escape room activity. Two cohorts were surveyed – one cohort from the 2022-2023 academic year and the other cohort from the 2023-2024 academic year. The institute's research ethics committee approved the survey.

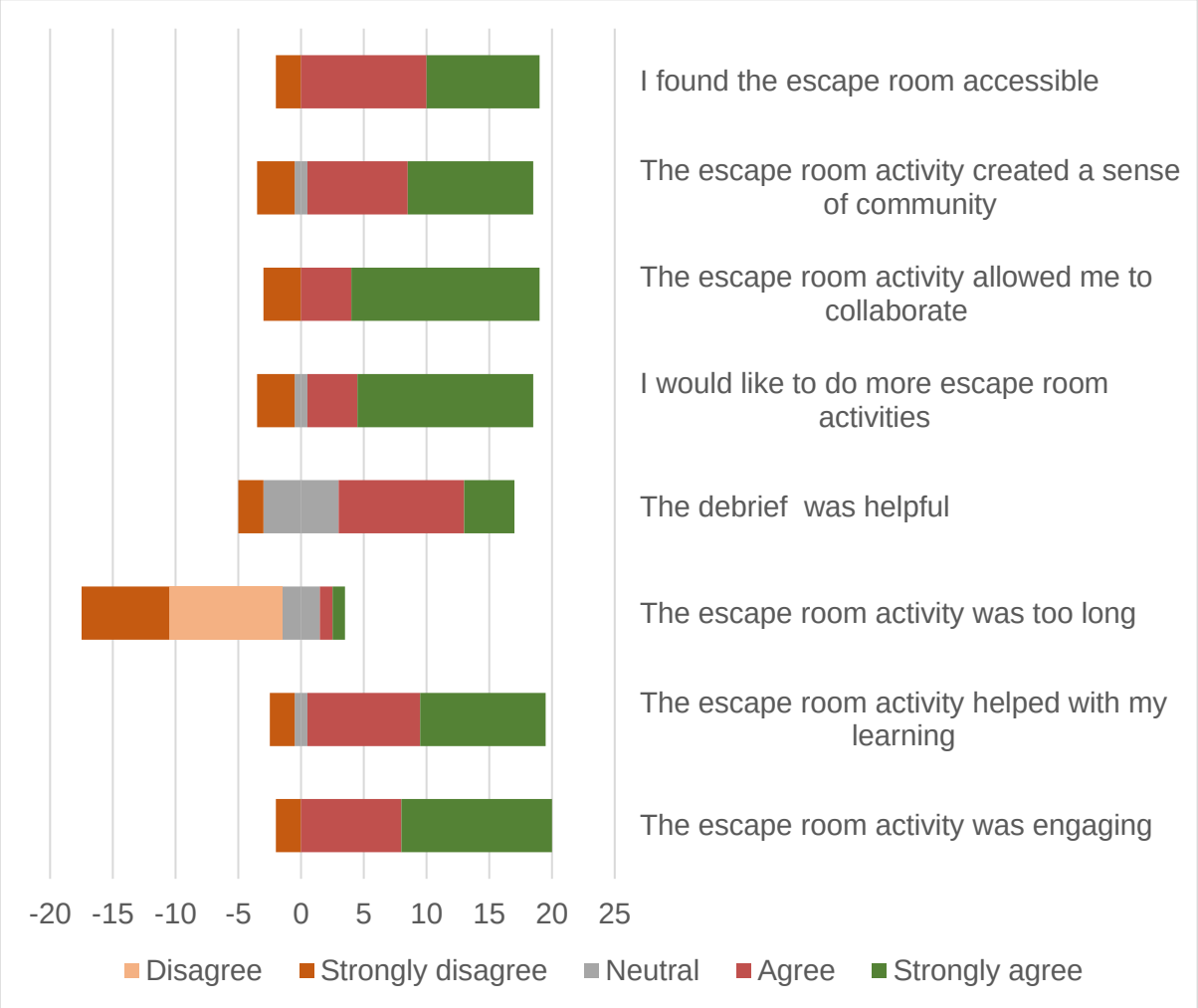
## 3. Results.

During the activity, the instructor observed all groups to be engaged with the escape room. The instructor provided hints to any groups who struggled to answer questions or interpret clues. Most groups completed the escape room activity within 40 minutes with winners completing it in under 25 minutes.

Twenty-two students from the two cohorts submitted responses to the debriefing survey. Most students were positive about the escape room activity (Figure 1). Ninety-one percent agreed

that the escape room activity was engaging, and eighty-six percent agreed that the activity helped with their learning. Eighty-two percent of respondents would like to do more of these activities. Eighty-six percent agreed that the escape rooms allowed collaboration with peers and eighty-two percent agreed that the activity helped create a sense of community in the class. Ninety percent found the digital escape rooms accessible.

**Figure 1: Student responses to Likert questions in the survey.**



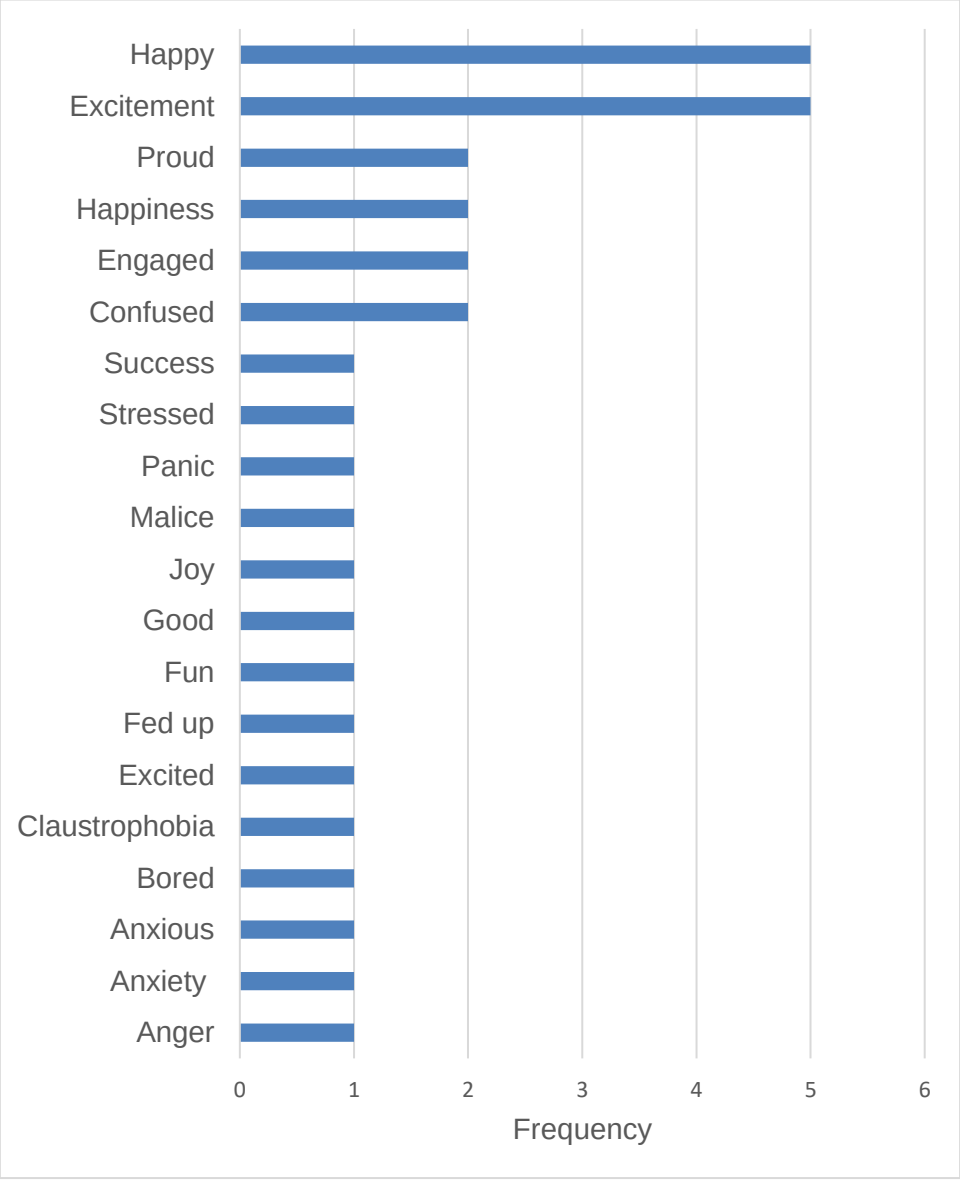

Responding to detail what they liked most about the activity, students mentioned the interactivity of the escape room and the opportunity to work in groups. One student commented that "*it was a break from the tedious usual learning and concentration and more like problem solving which engineers will have to do anyways*."

Students recorded emotions felt during the escape room activity (Table 1). Positive emotions

such as happy and excitement featured most frequently in responses. Students also used words such as panic, stressed, anxious, anxiety, and anger when expressing emotions felt. One student reported a range of emotions "*excited, proud, happy, confused*."

Students felt that they developed skills related to teamwork, collaboration, and communication by taking part in the escape room activity. They mentioned that the activity developed skills in quick thinking and working under pressure. The average student rating of the escape room activity was 4.6 out of five.

**Table 1: Frequency of emotions expressed by students after the escape room activity.**



# 4. Discussion.

Gamification in education has increased in recent years (Sailer & Homner, 2020). This increase reflects a shift towards more engaging and inclusive learning environments. Using digital escape rooms in education aligns with the three principles of UDL in many ways.

## 4.1 Multiple means of engagement.

Most students thought that the digital escape room activities were engaging. Students needed to use their imagination to use clues to answer questions and escape (CAST UDL checkpoint 7.2). Interpreting clues and answering questions allows students to self-assess their knowledge on the module topics (CAST UDL checkpoint 9.3). They are preparing for summative assessments in a fun and engaging game-based environment. The debriefing session after the activity would also allow them to reflect on their knowledge.

Students reported that they had to be quick thinking while working under pressure. While positive emotions were expressed (happy, excited, proud, joy), there were also negative emotions expressed (anxious, stressed). These experiences are an opportunity for students to develop their coping skills in the safe environment of a formative assessment activity (CAST UDL checkpoint 9.2). Emotionally engaging learning experiences tend to be more memorable and impactful. In a review by Tyng et al. (2017), it was highlighted that emotions facilitate the efficient retrieval of information, but it may not always be enhancing. Further research into digital escape room design to create emotional experiences that enhance learning and memory would be worthwhile.

Digital escape rooms offer opportunities to create community and collaboration within the classroom (CAST UDL checkpoint 8.3). Most students who responded to the survey agreed it did. Survey comments also indicated that they developed their teamwork skills during the task.

## 4.2 Multiple means of representation.

The digital escape room activity provided students with an opportunity to revise content and transfer knowledge. The knowledge transfer was enhanced with the debrief after the activity (CAST UDL checkpoint 3.4). The clues in the escape room used multiple media, such as videos, jigsaw puzzles, images, music, and text (CAST UDL checkpoint 2.5). Support provided

by the instructor throughout the activity clarified the content (CAST UDL checkpoints 2.1 and 2.2).

### 4.3 Multiple means of action & expression.

Taking part in the digital escape room enhanced a student's capacity to monitor their progress in the module (CAST UDL checkpoint 6.4). Their ability to interpret the clues and answer the questions provided feedback to them on how well they knew the content. The variety of clues and questions allowed students to demonstrate different skills and actions (CAST UDL checkpoint 5.1).

In conclusion, digital escape rooms offer an engaging and inclusive educational strategy aligned with UDL principles. The positive feedback and observed benefits in skill development suggest their potential in fostering a collaborative community in the classroom. While these digital escape rooms were based on themes within anatomy and physiology, the activity could be used in any subject area. Examples from the fields of medicine, mathematics, and engineering are available in the literature (Percival et al., 2023; Babo et al., 2022; Sánchez-Ruiz et al., 2022). Future research in this area would include a deeper exploration through focus group interviews of the emotions felt during the escape room activity and how they impacted on the learning experience.

The digital escape room activities were introduced into the anatomy & physiology module as a fun means of fostering collaboration and community during the class-time. While UDL was not embedded explicitly in the design of the activities themselves, this reflection highlighted the many aspects of the activities that can be linked to the UDL guidelines. Future work would consider a redesign where all the components of the game are explicitly considered through the UDL framework.

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# 6. Appendix: Survey Questions.

Indicate your level of agreement with the following statements on the escape room activity.

| | Strongly disagree | Disagree | Neutral | Agree |
|---|---|---|---|---|
| The instructions for the activity were clear. | ◯ | ◯ | ◯ | ◯ |
| The escape room activity was engaging. | ◯ | ◯ | ◯ | ◯ |
| The escape room activity helped with my learning. | ◯ | ◯ | ◯ | ◯ |
| The escape room activity was too long. | ◯ | ◯ | ◯ | ◯ |
| The debrief after the escape room activity was helpful. | ◯ | ◯ | ◯ | ◯ |
| I would like to do more escape room activities in this module and others. | ◯ | ◯ | ◯ | ◯ |
| The escape room activity allowed me to collaborate with my peers. | ◯ | ◯ | ◯ | ◯ |
| The escape room activity helped to create a sense of community in the class. | ◯ | ◯ | ◯ | ◯ |
| I found the different components of the escape room (clues, questions) easy to access. | ◯ | ◯ | ◯ | ◯ |

What did you like most about the escape room activity?

What emotions did you feel during the escape room activity?

What skills do you think the escape room activity developed?

How would you rate the escape room activity?