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CLINICAL TEACHER'S TOOLBOX

THE CLINICAL TEACHER

Building digital escape rooms for learning: From theory to practice

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Abstract

Digital games are increasingly used to support learning across a diverse range of cognitive, affective and psychomotor domains in health professions education. Game-based learning will likely become an important competency for educators. However, educators can perceive game building as out of their reach due to a lack of expertise in digital technology. This toolbox offers advice to health professions educators who would like to build a simple game for learning known as a digital educational escape room.

1 | INTRODUCTION

Online or digital games are rapidly emerging within health professions education. This phenomenon is in part due to the 'rising tide' effect of a global gaming industry that is growing dramatically and projected to reach a value of $321 billion by 2026.[1] At the same time, studies highlight the capacity of digital games to motivate and engage learners, and facilitate learning across a wide range of cognitive, affective and psychomotor domains.[2] An appetite for games also stems from students' increasingly high expectations for quality and variety in online learning environments.[3]

Studies highlight the capacity of digital games to motivate and engage learners.

It is likely that game-based learning will become an important competency for educators. However, there are perceived barriers.

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Educational games have a reputation for being costly and time consuming to produce,[4] and educators can perceive that they lack the technology skills to build effective games.[5] A potential solution may be the wide range of low-cost, game-building resources that have become available in recent years. These technologies allow educators without programming skills to create games that they can tailor to their own teaching context.

In this toolbox, the authors draw on the game-based learning literature, as well experience of building several digital games, to offer guidance to educators who would like to build their first game for learning. Here, we describe the use of an online content-authoring tool to build a simple digital educational escape room. An escape room is defined as a 'live-action team-based game where players discover clues, solve puzzles, and accomplish tasks in one or more rooms to accomplish a specific goal… in a limited amount of time' (p. 1).[6] When such games are used to support learning in virtual or online settings, they are often referred to as digital educational escape rooms (DEERs). DEERs can be created relatively easily on low budgets, and have wide applications in health professions education,[7–9] making them an excellent 'starter' game for novice game builders.

2 | BUILDING YOUR GAME

In building a game for learning, it is important to reflect on what you want to accomplish and how a game will facilitate this. Consider what you want the game to do: Is there an aspect of your teaching that you would like to improve? Is there a concept that students continually find hard to grasp? What aspects of a game environment would you like to harness? For example, the authors used a DEER to create a learning environment that would evoke feelings of uncertainty for the players, and provide a facilitated space for shared reflection around uncertainty and its management.

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Clarity on your aims also helps you to decide who will be on your design team. Although it is possible to create a DEER on your own, team-led designs usually lead to more robust games. Design teams offer a valuable opportunity for inter-professional and educator–student collaboration, with students—the game users—bringing particular insight into how a game might work in practice.[10]

TABLE 1 Sample design-thinking schedule for building a digital educational escape room (DEER)

Week	Theme for week	Tasks for the week
1	Getting started	• Design team is established • Opening conversations held around DEER aims and how it will meet the needs of users (i.e., the opening 'design challenge') • Team members play online escape rooms together as ice breaker and for game design inspiration
2	Discovery and empathy	• Team members explore the issues which will be addressed by the DEER by meeting with experts and reviewing current literature • Design team engages in field work to explore the needs of potential game users, for example, by talking to students or other educators (also known as 'empathy interviews')
3	Definition and interpretation	• Design team discusses and organises their findings so far, identifying key issues for the DEER to address (i.e., 'affinity mapping') • Team members begin thinking about potential themes and narratives for the room as an individual process
4	Ideation #1	• Design team shares ideas for themes and narratives and discusses merits of each • Design team is broken into small groups to begin creating simple puzzles
5	Ideation #2	• Team members share and play-test each other's puzzles • Team members use a storyboarding exercise to compare different DEER themes and narratives and select a favourite
6	Building our prototype	• Puzzles are refined according to play-test feedback and then added to the Genially platform • Team members decide on the 'flow' of puzzles (i.e., the sequence in which they will be played)
7	Play-testing and refining	• An initial prototype of the game is play-tested by the design team and 'critical friends' (i.e., colleagues, friends and family) • The team discuss feedback from the game play and refine the prototype accordingly
8	Evaluation and further refining	• A further prototype of the game is evaluated with groups of end-users

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Design teams offer a valuable opportunity for inter-professional and educator–student collaboration.

Game design is a creative, dynamic and non-linear process, so it is important to adopt a structured approach. We used a design-thinking approach, whereby we aimed to develop a deep understanding of the end-user that informed the creation of a prototype game that could be tested and iterated. Design thinking follows five phases: empathise, define, ideate, prototype and test.[11] In building a game, you can adapt each phase to the specific requirements of your project. For example, games can be developed over a few days or across several weeks, depending on your timeline (Table 1 shows a sample design-thinking schedule for building a DEER). This approach provides the design team with a structure in building the 'nuts and bolts' of their educational game and making key decisions in relation to pedagogy, game elements and technology.

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2.1 | Pedagogy

As with any teaching innovation, DEERs must be underpinned by solid pedagogical principles. A key anchor point for your game, is its specific learning outcomes: what will the students know or be able to do as a result of playing? Will your game focus on *what* students learn (e.g., core content), or on *how* they learn it (e.g., communication and

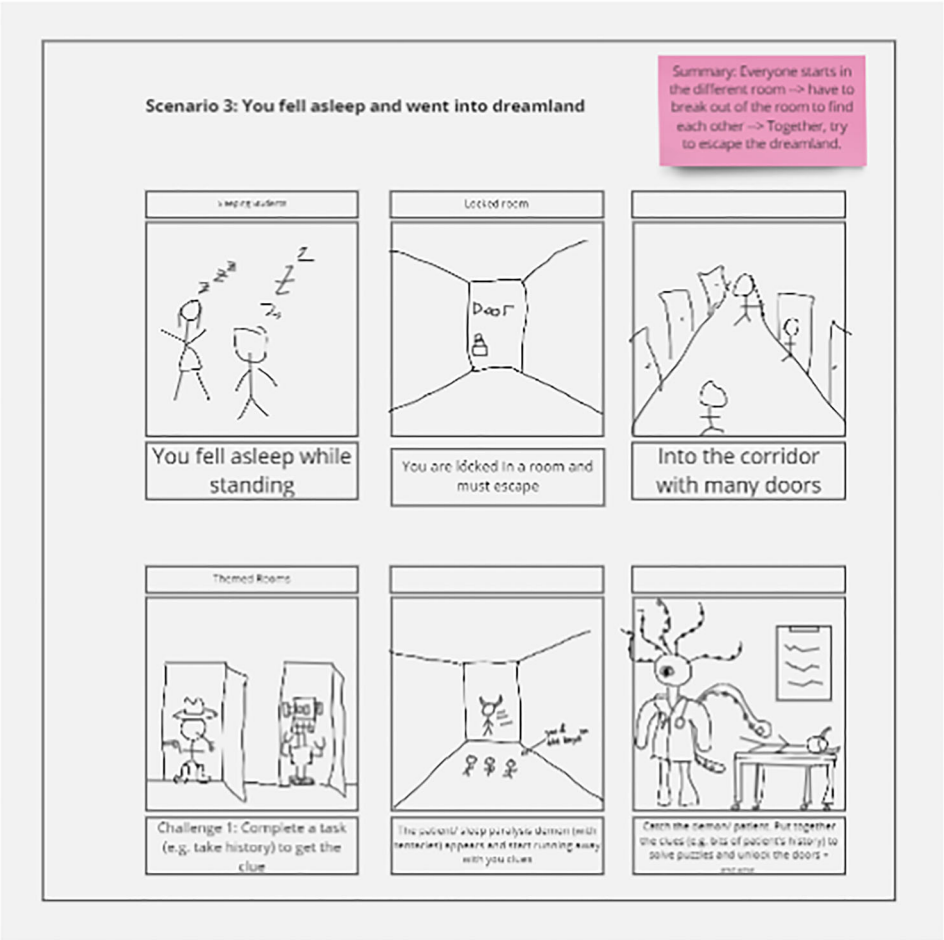

FIGURE 1 Digital educational escape room (DEER) themes can be mapped out visually or 'storyboarded'.

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problem solving)? Students are more likely to value games that closely support their coursework, so ensure that the DEER learning outcomes align with the curriculum. Also, consider what learning theory you will use to connect game play to learning. A wide range of theories (e.g., adult learning and experiential learning) can be applied to escape games.[12] We used community of inquiry, a collaborative-constructivist theory of online learning, to inform our game's design.[13] This theory highlights the importance of discourse in facilitating online learning, thus guiding us to build a prototype game that used online breakout-rooms to facilitate small group discussions. In addition, the theory helped us to see the value of adding a post-game de-brief to consolidate learning.

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2.2 | Game elements

Well-designed DEERs are both educational and enjoyable to play. Game design invites us to create an immersive learning environment for the player through creating emotive themes and narratives. Although the theme is the overall 'look and feel' of the escape room (e.g., an alien landscape or a viral outbreak), the narrative is a more defined description of the storyline and characters. Devising these elements is a fun and highly creative process, and design thinking invites us to 'go wild' with imagination. Our design team built a narrative by first coming up with ideas individually, before sharing these and then voting for a favourite (Appendix S1). The chosen narrative was further developed by the team. In practical terms, we 'storyboarded', or sketched out, the ideas (Figure 1).

Design teams must also create puzzles, another core game element for DEERs. At its most basic structural level, a DEER consists of several puzzles, with players using clues (keys), to solve puzzles (locks), to 'escape' the game. In the online setting, puzzles tend to include codes, crosswords, riddles and maths or pattern-based puzzles (Figure 2). Design teams can develop their own 'home-made' puzzles or use one of the many freely available online puzzle-building websites (e.g., Jigsaw Planet, Breakout EDU). Creating puzzles can be tricky, and it is often difficult to know whether a puzzle works well or not. If puzzles are too easy and under-challenge your players, they

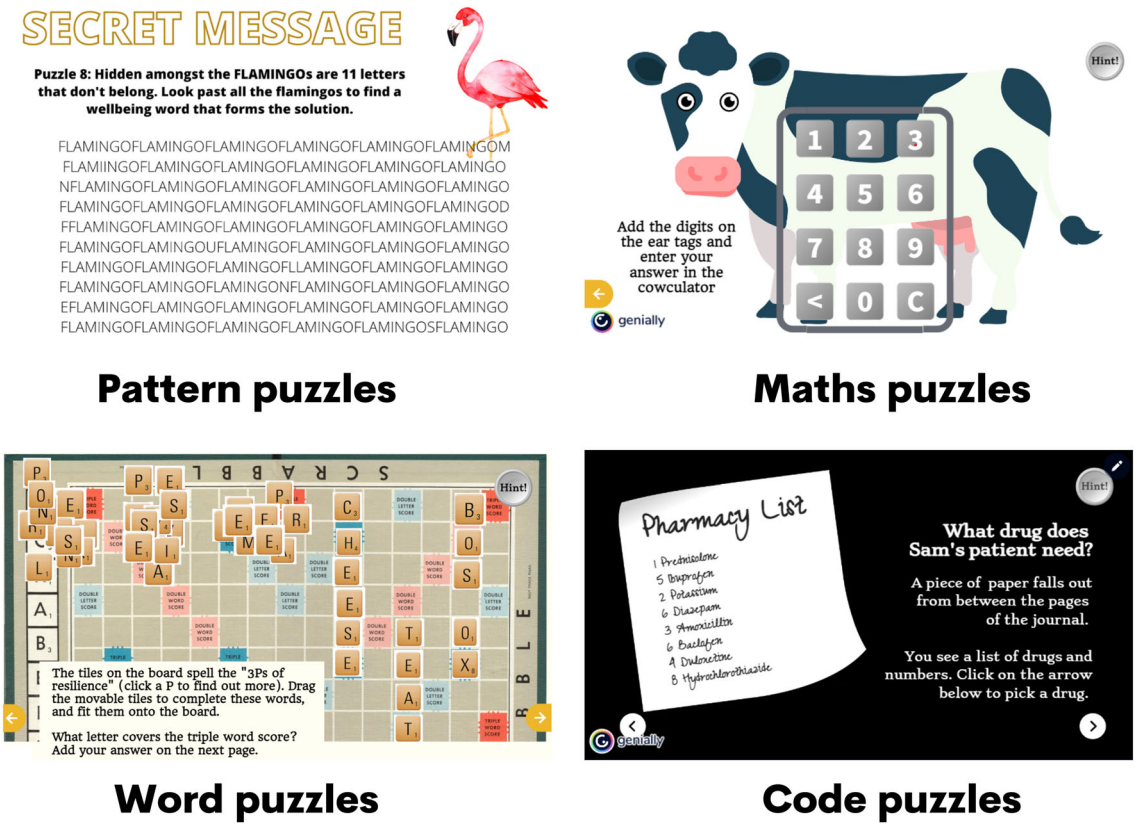

FIGURE 2 In the online setting, puzzles can include codes, crosswords, riddles, and maths or pattern-based puzzles.

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may lose interest. When they are too difficult, learners can become frustrated and discouraged.[14] Puzzles should be tested and iterated. In practice, our team broke out into small groups and created puzzles, which they then swapped and play-tested. The small groups used a reflection template (Appendix S2) to trigger deep thought around puzzle characteristics, such as difficulty level, hint strategy and educational blueprint, and to ensure puzzles were aligned with the DEERs learning outcomes (Appendix S3).

A further game element to consider is timing; the duration and pace of a game can influence the overall learning experience. For example, a game with a 30-min limit, and a 'first team to escape wins' strategy will result in a fast-paced activity with a level of pressure and competition. For deeper, discussion-based learning, it may be helpful to add a looser time limit and avoid a competitive strategy.[15]

2.3 | Technology

There are a wide range of digital technologies which can support DEER building. We used the content-authoring tool Genially (Madrid, Spain) which offers ready-made and customisable escape game templates. The DEER is built through creating a slide deck on the platform, with individual slides connected through hyperlinks and interactive buttons. Thus, game players can click on slide 'hotspots' and follow different game pathways. Puzzles were built by creating imagery into the Genially slide deck. Here, the visuals aimed to support the DEER's theme and narrative and create a sense of immersivity for the player (Figure 3). It is also necessary to decide on how technology can be used to bring game players together. We wanted our students to engage in real-time communication, choosing the web-conferencing software Microsoft Teams (Redmond, WA, USA) to support this.

The first iteration of your game will not be perfect, and it is a good idea to test your ideas early and often. Once we had added puzzles to Genially, we tested the game within the design team to highlight any technology issues, or broken links. We also invited 'critical friends' (i.e., colleagues, friends and family) to test the game and give us feedback. After incorporating suggested changes, we play-tested a further iteration with several groups of students. The more diverse the cohort, the better (e.g., aim to include play-testers who are not keen on online games as they often offer the most valuable insight). During these play-test sessions, a member of the design team can sit in as a silent observer or game-play can be recorded. Feedback from play tests can be used to refine and improve the prototype, resulting in a game that can be rolled out with your learners. Once your game is in situ, you can evaluate it through either qualitative (e.g., focus groups or interviews of game users) or quantitative (e.g., pre- and post-game surveys) approaches.[16,17] Evaluation helps us to understand how a game facilitates learning in a real-world setting and informs further iterations and refinements.

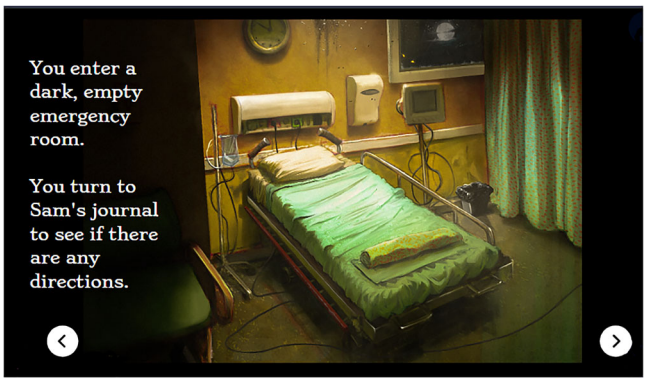

FIGURE 3 Digital educational escape room (DEER) visuals support the game's theme and narrative, and create a sense of immersivity for the player.

Evaluation helps us to understand how a game facilitates learning in a real-world setting, and informs further iterations and refinements.

3 | OPPORTUNITIES AND CHALLENGES

The design, build and evaluation of educational games can be complicated and time consuming, with multiple stakeholders engaging in a variety of creative tasks. However by employing a structured approach, design teams can create a lasting educational tool, which can be refined and re-used with future student cohorts. There is also potential to scale up digital escape rooms for use with large class sizes. This means that DEERs offer an opportunity for educators to 'frontload' their time and effort when teaching in online or blended learning settings.

Design teams can create a lasting educational tool which can be refined and re-used with future student cohorts.

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4 | CONCLUSIONS

Digital educational escape rooms are a flexible, versatile strategy that can support active, collaborative learning in the online space. They also provide a valuable opportunity for authentic, educator–student and inter-professional collaborations that can result in educational resources that are uniquely tailored to a teaching context. There are an increasing number of digital tools and technologies that can help educators and students build online escape games without technical expertise. Finally, DEERs entail multiple design choices around pedagogy, game elements and technology, and it is recommended that game design follows a structured process, involving early and frequent testing.

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ETHICS STATEMENT

Ethical approval for this study was granted by the RCSI Research and Ethics Committee, RCSI University of Medicine and Health Sciences (ID: 202103004).

CONFLICT OF INTEREST

The authors declare that there are no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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