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TWELVE TIPS

Twelve tips for creating an escape room activity for medical education

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ABSTRACT

Communication, teamwork, and resilience all require active practice by healthcare teams. Games such as escape rooms can add variety, interactivity, and value to teaching sessions. Escape room activities typically include a variety of sequential puzzles that lead participants to break free of a room, or can be adapted into an 'escape box' challenge where participants work to successfully unlock a box. Escape room or escape box exercises can help healthcare teams develop and enhance team skills, as well as reinforce medical knowledge. We developed an escape box session to teach and reinforce organizational Safety II principles and the resilience potentials: monitor, respond, learn, and anticipate. We report 12 tips to effectively organize and develop an escape room or escape box activity for multidisciplinary healthcare teams.

KEYWORDS

Education environment;
communication skills;
methods; professionalism

Introduction

An escape room consists of a time-limited setting where teams of participants solve puzzles and riddles in a closed space with a particular theme, with the aim of 'escaping' if they successfully achieve predetermined goals (Rosenkrantz et al. 2019). Escape rooms have grown in popularity in recent years, for both educational purposes and team building. Medical escape rooms have been described for a variety of learners including nursing students (Adams et al. 2018; Gomez-Urquiza et al. 2019; Barker et al. 2020; Morrell and Ball 2020; Morrell and Eukel 2020), pharmacy students (Clauson et al. 2019; Wilby and Kremer 2020), and learners in undergraduate and graduate medical education, including radiology (Jambhekar et al. 2020), surgery (Kinio et al. 2019), internal medicine (Diemer et al. 2019), emergency medicine (Zhang et al. 2018), and dermatology (Guckian et al. 2020). Medical escape rooms have been utilized to teach and reinforce a variety of topics including discussing cancer diagnosis (Wilby and Kremer 2020), cardiovascular physiology (Morrell and Eukel 2020), and fluids and electrolytes (Barker et al. 2020).

In true escape rooms, participants solve puzzles and gather clues with the aim of finding the key or solution to break out of the room. This format may not be logistically possible in a medical education setting, but the same concepts can be applied to have participants 'escape the box' to unlock a desired object. An escape box is a portable version of the popular escape room concept that provides many of the same concepts and challenges (Monaghan and Nicholson 2017).

Escape activities are particularly effective tools for inter-professional education and for teaching teamwork (Zhang

et al. 2018; Clauson et al. 2019; Rosenkrantz et al. 2019; Friedrich et al. 2020) and communication skills (Diemer et al. 2019; Zhang et al. 2019; Morrell and Eukel 2020), which are a critical component of patient safety and a core competency for medical practice (Kohn et al. 1999; AHRQ 2020; Edgar et al. 2020). Participants must practice effective knowledge sharing and task delegation while being open to team member ideas in order to solve puzzles and progress through the activity (Morrell and Eukel 2020).

Enhancing a medical team's communication skills can improve resilience and adaptability among its team members. This resilience, as demonstrated by the ability to adapt team functioning to sustain essential operations under both expected and unexpected conditions, is critical in complex adaptive systems such as healthcare (Hollnagel 2011; Horsley et al. 2019). In the past, healthcare quality and safety work has utilized a Safety I approach, which focuses on minimizing adverse events or investigating system failures, asking: 'why did this error occur?' (Fairbanks et al. 2014; Braithwaite et al. 2015). In contrast, Safety II analyzes how systems work well, uncovering guided adaptability in fluid situations (Hollnagel 2018; Provan et al. 2020). The Safety II strategy of examining adaptations that ultimately led to success in a complex system, asking: 'how did this process go well?' is increasingly recognized as being critical in healthcare quality and safety initiatives. Our team used an escape box activity to reinforce Safety II and resilience principles during a multi-day resilience engineering and safety course for physician, nursing, and administrative leaders at a large tertiary care children's hospital. Here, we summarize tips for developing an escape room or box from our shared experience designing,

implementing and evaluating an escape box activity for medical education.

Tip 1

Form a design team

Creating an escape activity is an exercise in creativity and adaptability in itself. The first key to producing an outstanding escape room experience is to assemble a diverse collaborative team (Clauson et al. 2019; Diemer et al. 2019). This workgroup should inspire innovation through open-minded brainstorming and clear team communication.

Our multidisciplinary team deliberately included members with expertise in simulation, education, patient safety and quality, and organizational resilience. Having a multidisciplinary team not only enables incorporation of different perspectives, but also allows for division of tasks. Our team brainstormed themes and worked cooperatively from a shared document and website, then assigned specific tasks to individual team members. Team members also served as facilitators during the escape room activity. Their familiarity with the tasks and content matter made them ideal guides to assist learners during the event without compromising the challenge.

Tip 2

Define the learning objectives

As is true when developing any curriculum, clear goals and objectives are critical to ensuring that the content is delivered effectively (Thomas et al. 2015; Clauson et al. 2019; Barker et al. 2020). Why are your learners entering this escape room? If the goal is clinical knowledge based, make a list of the facts and skills learners should demonstrate. Avoid introducing new material that is unfamiliar to the learner. Escape room activities have proven effective for application of previously taught information (Morrell and Eukel 2020). Since effective teamwork and communication are inherent to a successful escape room experience, include team-based skills in your learning objectives (Zhang et al. 2018).

We defined cognitive, affective, and behavioral objectives for our escape activity. We wanted to reinforce key resilience engineering principles from previous didactic sessions. For example, participants applied the concept of psychological safety by providing reassurance and negotiating a safe environment to a new team member in possession of a necessary clue for team progression. Organizational resilience also emphasizes collaboration both within and between teams. To reinforce this behavior, we incorporated cross collaboration between teams as a requirement for task progression.

Tip 3

Determine logistics

Once learning objectives are defined, carefully consider resources and logistics (Zhang et al. 2019; Wilby and Kremer 2020). First, consider the participants: In what ways are your learners diverse? How large should each team be?

How will team membership be determined? Second, consider timing: How long will each group have to complete the activity and how long will the debriefing last? How many sessions will be necessary to involve all participants? Will these sessions occur in tandem or simultaneously? Finally, consider the physical environment: Where will this activity take place? Is there a physical space available for an escape room activity? Or will learners gain access to a locked box with the desired prize in an escape box activity?

Given our large number of learners, we elected to form multiple teams completing tasks in parallel in the same large room. This format not only kept team size manageable to encourage individual participation, but also fostered a competitive spirit and lent more authenticity to the idea of rushing to break the box. Participants numbered off into one of five groups to encourage heterogeneity. As previously noted, keeping the teams in the same physical space allowed for collaboration between teams, one of our key learning objectives. We allowed one hour for completion of the tasks and 30 minutes for debriefing immediately following the activity.

Tip 4

Craft a story

Next, create a story to provide a consistent, immersive narrative for the activity (Monaghan and Nicholson 2017; Gomez-Urquiza et al. 2019; Rosenkrantz et al. 2019; Guckian et al. 2020). A theme is a necessary component for maintaining the fiction contract with your participants (Rudolph et al. 2014). Use your narrative to determine the ultimate end point of the escape room activity: escaping the room or breaking a locked box with the desired prize. Refer to the learning objectives to determine if a fictional narrative or a realistic patient scenario would be most appropriate. Realistic clinical scenarios may lead participants to be more invested in 'treating' their patient, and the stepwise reveal of clues mirrors the diagnostic process (Monaghan and Nicholson 2017).

Since several of our participants had no formal medical education, we elected to create a more inclusive hospital-based scenario instead of a clinical scenario. An evil mastermind plans to unleash a virus-induced zombie apocalypse throughout the hospital (Supplementary Appendix A). Five teams working in silos in one large room had identical locked boxes and puzzles to complete. A single locked box located in the center of the room contained the only available antidote, and participants were given one hour to complete the tasks or become zombies.

Once learning objectives, logistics, and a storyline are determined, the next three tips (5, 6, and 7) will occur in tandem as you construct challenges for your learners. These tips represent the bulk of your work as a team.

Tip 5

Brainstorm tasks and props

Allow your creativity to shine when developing puzzles and tasks. Start by reviewing previously published medical escape rooms, online blogs, and social media videos for

Table 1. Escape activity resources.

Breakoutedu.com	Free escape room game ideas and a paid subscription service for premium access.
Lockpaperscissors.co	Free downloadable guide for creating an escape room, list of game ideas, downloadable games for purchase
https://nowescape.com/blog/101-best-puzzle-ideas-for-escape-rooms .	List of puzzle ideas

Table 2. Puzzle resources.

Word Search	http://puzzlemaker.discoveryeducation.com/WordSearchSetupForm.asp https://thewordsearch.com/maker/ .
Crossword Puzzle	http://puzzlemaker.discoveryeducation.com/CrissCrossSetupForm.asp https://worksheets.theteacherscorner.net/make-your-own/crossword/ .
Word Scramble	https://www.education.com/worksheet-generator/reading/word-scramble/ .

examples of tasks and props. [Table 1](#) lists resources for creating puzzles and tasks. [Table 2](#) lists websites that generate free custom puzzles.

Tasks can be categorized as physical, mental, or a combination of the two (Jambhekar et al. 2020). Diverse tasks target a variety of learning approaches and are more likely to engage multiple team members (Morrell and Eukel 2020). Examples may include a picture that reveals a clue when placed in a frame, a message left in permanent ink when the dry erase marker is erased, or a code revealed when props are arranged in correct order. Keep a list of potential props and puzzles that correspond with your theme and create tasks that align with your learning objectives (Morrell and Eukel 2020).

In keeping with our theme, we used hospital and lab related props during our tasks, such as tongue depressors, white lab coats, safety goggles, pencils, scissors, and rulers. Our scenario of an eccentric evil mastermind with a secret hospital laboratory allowed for additional unusual props such as Rubik's cubes, two-way radios, invisible ink, word searches, and crossword puzzles. We selected props that would pair with tasks and learning objectives without disrupting the fiction contract for the learners.

Tip 6

Keep it simple

Avoid unnecessary complexity as you begin pairing locks with puzzles, props, and learning objectives. The challenge for each task is to create an appropriate level of difficulty without introducing unnecessary ambiguity. We recommend using each prop once in the escape room such that each prop or puzzle is retired once solved. Avoid ambiguous clues such as two objects that connect to reveal a clue unless the overlay or connection is unmistakable. The most diabolic tasks sometimes have the answer hiding in plain sight.

Also, resist the urge to include every potential task in the final educational product. Additional tasks require more time and may detract from the experience if not paired with a specific learning objective. Instead, keep a list of these surplus puzzles, tasks, and props for future escape room activities.

Keep a list of potential locks to pair with these tasks. A wide variety of locks exist: combination, directional, letter and/or number, and simple key locks. We recommend using a variety of locks and puzzles to maintain novelty. For example, the combination for a directional lock could

be hidden in plain sight in a word search. The letter combination to another lock may be highlighted in invisible ink under a black light, or the location of a concealed key may be exposed upon completion of a puzzle. We recommend maintaining a master list of locks and combinations, as well as scanning and maintaining package inserts that instruct how to reset each lock.

Tip 7

Construct a blueprint

Participants should have to solve every puzzle in order to escape the room and meet the learning objectives. One strategy is to design tasks linearly so that tasks cannot be completed out of order (Morrell and Ball 2020; Guckian et al. 2020; Morrell and Eukel 2020). The completion of one task reveals new clues and puzzles to solve, perhaps by opening a locked box or receiving new directions. Alternatively, multiple puzzles could be completed out of order such that the output from each task is necessary to solve the final puzzle. Maintaining an updated blueprint from the beginning of the project can help manage and visualize the overall flow.

We began by selecting tasks from our brainstorm list (Tip #5) that fit each learning objective and incorporated Safety II principles. We organized the blueprint into stages and matched each task with learning objectives, relevant course presentations, resources needed, and desired output (key or lock combination) to help guide the flow of the activity ([Supplementary Appendix B](#)). We positioned less challenging tasks early in the activity, based on the concept of Flow in game theory: if a task is too easy, players lose interest but if the task is too challenging, players become frustrated. Increasing complexity as players improve maintains engagement (Csikszentmihalyi 1990; Monaghan and Nicholson 2017; Morrell and Ball 2020).

Tip 8

Create a facilitator guide

Use the blueprint to create a facilitator guide that includes the learning objectives, orientation, task progression, answers to each task, potential clues, and lock combinations (Jambhekar et al. 2020; Rosenkrantz et al. 2019). Learner orientation should introduce the task, establish rules and boundaries, and set the time limit for successful completion (Rudolph et al. 2014; Barker et al. 2020). Scripted orientation ensures consistency and completeness

for each group of learners. Write clues for each stage and define the rules for revealing these clues. Does the guide offer a clue if the team appears stuck or at the request of the team? A written guide with defined rules prevents facilitators from unintentionally harming the educational benefit of the game by spoiling the struggle of the learners. At the same time, having preset time frames for providing clues ensures that learners stay on track and can progress through the escape room and fulfill the learning objectives.

Have a plan for participant failure (Wilby and Kremer 2020). Decide whether the facilitator will disclose answers by guiding the participants through the uncompleted tasks or will review learning objectives in the debriefing without revealing the escape room secrets. Also decide if there will be consequences for errors made. For example, miscalculating a medication dose could result in a two-minute penalty while participants review correct dosing calculations with a facilitator (Monaghan and Nicholson 2017).

Double-checking the inventory for each escape event is crucial. Consider keeping extra supplies and creating a backup plan in case of misplaced or malfunctioning equipment. When inventorying your supplies, use the facilitator guide to group props according to task order. Include lock combinations in the facilitator guide as an added failsafe against operator error. The facilitator guide should also provide instructions for resetting the escape activity for future participants.

Tip 9

Set the stage

Now that you have created a detailed blueprint and facilitator guide, it is time to set the scene for your participants. Use theatrics and staging to embellish the space and add realism throughout the game to immerse participants in the experience (Guckian et al. 2020). Some escape activities utilize an introductory video to begin participant immersion in the storyline and provide necessary pre-briefing (Clauson et al. 2019; Gomez-Urquiza et al. 2019; Rosenkrantz et al. 2019; Morrell and Ball 2020). Consider a clock or countdown to promote a sense of urgency (Diemer et al. 2019).

The initial scene should include all items necessary to complete the first task. For added complexity, consider including props from subsequent tasks in the initial scene that may hint at future puzzles (Friedrich et al. 2020). For instance, including a two-way radio with a missing battery pack prompts learners to search for the battery. It is more challenging for learners to be presented with multiple objects in the initial scene and gratifying to complete tasks and eliminate clues along the way.

As noted above, we utilized a fanciful narrative where participants must save the hospital from a zombie-inducing virus. The zombie-virus evil mastermind herself challenged participants to find the antidote using chilling theatrics in a darkened room. We utilized props and puzzles that enhanced the context of the narrative and incorporated actual hospital elements, such as an official memorandum regarding the zombie-virus signed by hospital executives.

Tip 10

Plan for pilot testing

Given the complexity of an escape room activity, it is important to test the puzzle mechanics, difficulty level, and relevance to learning objectives (Clauson et al. 2019; Gomez-Urquiza et al. 2019; Barker et al. 2020). Find participants with no knowledge of your planning but with a similar skill set to your learners to test your escape room. Monitor their progress, seek their feedback, and adjust your escape room based on these results.

To pilot our escape box, two volunteers with similar skill sets as the participants sequentially completed the activities with set time limits. During debriefing, one task was noted to be too indistinct, so additional clarifying information was incorporated. Based on the feedback, written clues were added to the escape activity at the beginning of each stage to decrease task ambiguity, and set time frames were created for when facilitators should provide additional verbal hints.

Tip 11

Debrief the participants

Facilitated debriefing upon completion of the escape room allows for reflection-on-action as described in Kolb's experiential learning cycle (1984). Debriefing is an important part of the learning process as it prompts discussion among the participants and allows for clarification of the key learning objectives (Monaghan and Nicholson 2017; Zhang et al. 2019; Barker et al. 2020; Friedrich et al. 2020; Jambhekar et al. 2020; Morrell and Ball 2020). Participants may desire feedback on observed team-based skills in addition to review of the puzzles (Zhang et al. 2018). We recommend a structured debriefing based on the key learning objectives, which should include team-based skills.

There are several debriefing strategies available (Sawyer et al. 2016). Begin with a reaction phase to allow participants to express and defuse heightened emotions. If time allows, guide the participants in reviewing the events of the escape activity (Eppich and Cheng 2015). Prepare debriefing questions for the participants that review your learning objectives. Did the team get through a task but not understand how or why? Use the discussion to clarify your teaching points.

Prepare questions that address team-based skills such as leadership, delegation, effective communication, situational awareness, and task assistance. Use open-ended questions to prompt dialogue such as, 'Tell me about how you delegated tasks.' Several escape activities have used the Plus/Delta model for debriefing, asking 'What went well?' and 'What would you do differently?' (Diemer et al. 2019; Zhang et al. 2019). We also recommend use of the Advocacy Inquiry model from Debriefing with Good Judgment according to the facilitator's ability (Rudolph et al. 2006). Scripted debriefing allows facilitators to select appropriate prompts and edit as needed. Conclude the debriefing by summarizing key learning objectives.

Table 3 organizes some of these debriefing strategies with examples. Use this guide to select the strategies that best fit your learning objectives and to script open-ended questions.

Table 3. Debriefing guide.

Reaction		How do you feel now?
Events		Would someone review the sequence of puzzles and tasks for us? Does anyone have something to add? Anything we missed?
Analysis	+/-Δ	What went well? What would you do differently?
	Open-ended	What surprised you? Did a leader emerge? How did you delegate tasks? What kind of communication challenges did you have?
	Advocacy/Inquiry	(Preview) I'd like to talk about selecting antibiotics. (Advocacy) I heard you choose an antibiotic for your patient without checking the culture results for antibiotic sensitivities. I am concerned that prescribing that antibiotic would not treat your patient's infection. (Inquiry) Can you tell me more about that?
	Direct Feedback	Isotonic fluids include normal saline and Lactated Ringers. Closed loop communication ensures that the message is consistent between sender and receiver.
Summary		Today you worked as a team to treat a patient with sepsis by solving an escape box. We reviewed the recognition and treatment of sepsis, which was woven into the puzzles. You beat the clock to win in the same way you will beat the clock to save real patients. We reflected on effective teamwork such as task delegation, clear communication, and being open to new ideas.

Tip 12

Learn from your participants

Complete Kern's curriculum development cycle with adjustments based on both instructor observations and learner feedback (Thomas et al. 2015). Review the team's performance and feedback to make changes to your escape activity. Monitor the tempo of the team's progression to determine if the tasks are too easy or too ambiguous, and modify as needed (Jambhekar et al. 2020). For example, instructors might notice that teams need additional hints to complete certain tasks, and adjust accordingly.

We sought verbal feedback immediately after the activity, followed by written feedback as part of overall course evaluation. Adjustments to the escape room are planned for future iterations, and we will continue to seek feedback to further hone the exercise.

Conclusion

In the increasingly complex world of healthcare, innovative educational methods are needed to address new challenges to improve patient safety and provider performance, particularly in teaching individual and organizational skills such as teamwork, adaptability, and resilience. Escape rooms are problem-based, interactive, and immersive activities that allow teams to practice managing and adapting to unexpected situations. We encourage educators to use

this guide to create memorable and fun escape activities that reinforce didactic principles and strengthen team building.

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