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Design, Development, and Evaluation of escape rooms in medical education: Protocol for a Scoping Review

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Abstract

Background: Serious games encompass a wide range of educational approaches, including e-learning, edutainment, game-based learning, and digital game-based learning. These games align with the digitalization of education and offer innovative opportunities for learning and assessment in medical education. Among these serious games, escape rooms stand out as they combine mental and physical challenges to enhance critical skills relevant to everyday life. They foster logical thinking, require careful analysis of situations, and demand problem-solving abilities within the constraints of time and pressure. Additionally, escape rooms provide a suitable environment for developing communication, leadership, and problem-solving skills through collaborative efforts towards a shared objective. This study aimed to explore the various applications of escape rooms in the context of medical education.This scoping review aims to help inform those who wish to develop effective escape rooms interventions.

Objective: In this review, the development, design, and assessment of escape rooms in medical education are examined. Studies examining escape rooms in medical education are the main focus of this article, which aims to pinpoint important aspects of their conception, implementation, and assessment.

Methods: This scoping review will adhere to the Joanna Briggs Institute's methodology, ensuring standardized conduct and reporting. The search strategy involves three steps: identifying terms and keywords, conducting a systematic search across selected databases, and examining reference lists for additional material. The databases used include MEDLINE, PubMed, Scopus, EMBASE, Web of Science, Google Scholar, and ProQuest Dissertations and Theses. The review aims to follow predefined inclusion criteria and will document any modifications made to the search strings. The review's methodology and search strategy aim to promote consistency and comprehensiveness in identifying relevant literature.

Results: The data collected in this systematic scoping review on escape rooms in medical education will be presented in diagrammatic or tabular formats, complemented by a narrative summary. The report will be structured into two sections: the selection process with a PRISMA flowchart, and the results addressing the review questions. The aim is to provide comprehensive and visually supported findings in a scoping review report.

Conclusions: This review will help guide scholars looking to build escape rooms interventions toward evidence-based practices in design and evaluation.

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Design, Development, and Evaluation of escape rooms in medical education: Protocol for a Scoping Review

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Abstract

Background: Serious games encompass a wide range of educational approaches, including e-learning, edutainment, game-based learning, and digital game-based learning. These games align with the digitalization of education and offer innovative opportunities for learning and assessment in medical education. Among these serious games, escape rooms stand out as they combine mental and physical challenges to enhance critical skills relevant to everyday life. They foster logical thinking, require careful analysis of situations, and demand problem-solving abilities within the constraints of time and pressure. Additionally, escape rooms provide a suitable environment for developing communication, leadership, and problem-solving skills through collaborative efforts towards a shared objective. This study aimed to explore the various applications of escape rooms in the context of medical education.This scoping review aims to help inform those who wish to develop effective escape rooms interventions.

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Introduction

Serious games have gained immense popularity in recent times by combining entertainment and

cognitive aspects. Understanding this concept may initially pose a challenge, but examining the individual terms, "game" and "serious," can provide deeper insights.

According to the Oxford Learner's Dictionaries [1], a "game" is defined as an enjoyable activity with rules and potential for winning or losing. This definition highlights the physical and mental engagement offered by games. However, another definition portrays games as competitive sports, which is misleading in the context of gamified learning that emphasizes collaboration to achieve collective goals. Similarly, "serious," like "game," has multiple definitions, and it is crucial to identify the correct interpretations for a thorough understanding [2]. An incorrect interpretation of "serious" as "bad or dangerous" can lead to misconceptions, although serious games are widely accepted as effective learning methods. In this context, "serious" implies the need for careful consideration and importance. Therefore, serious games serve purposes beyond entertainment, enabling experiences that may be challenging to create in the real world due to safety, costs, time constraints, etc. They can be significant without being solemn, interesting without being hilarious, earnest, and purposeful without being humorless, and challenging without being frustrating [3]. This unique oxymoron encapsulates the modernization of education.

Serious games encompass a broad subject that overlaps with more contemporary forms of education, such as e-learning, edutainment, game-based learning (GBL), and digital game-based learning (DGBL) [3]. E-learning, described as a revolution by Allison Rossett, utilizes interactive technology to facilitate learning and performance improvement, a concept that has become familiar, especially due to the impact of COVID-19 [4]. Edutainment, an ancient form of education, aimed to blend education with entertainment. However, its long-term negative effects were overlooked in the rush to adopt this seemingly harmless technological trend, leading to its loss of purpose and obsolescence [5]. Examples of edutainment include TV shows featuring educational characters (e.g., "Barney," "Dora the Explorer") and educational board games (e.g., "Scrabble," "Sudoku," "Monopoly").

Game-based learning borrows gaming principles and applies them to real-life settings to engage users, as proposed by Annie Pho and Amanda Dinscore [6]. This subset of serious games employs gaming models to achieve key learning outcomes through engagement, motivation, role-playing, and repeatability. Examples of game-based learning activities include escape rooms and role-play scenarios.

Digital game-based learning goes beyond game-based learning and incorporates educational content or learning principles into video games to engage learners, as explained by Heather Coffey [7]. DGBL also integrates immersive learning elements to create virtual learning environments. Examples of DGBL include video games like "The Sims," virtual escape rooms, and extended reality experiences involving virtual, augmented, and mixed reality [8].

With the rapid digitization of technology and the recent introduction of gamification, serious games have proven to be effective learning tools. An investigation conducted by Linda Stege, Giel van Lankveld, and Pieter Spronck compared the effectiveness of serious games and written texts in supporting learning processes [9]. They found that serious games can be more effective than texts but not necessarily more motivating than textbooks. Serious games can be considered prosperous due to their captivating and cognitive nature, their ability to engage players instantly, and their capacity to construct intricate learning experiences. [10]

Escape rooms have experienced a remarkable surge in popularity within the past decade, serving as a recreational pastime for leisure purposes. More recently, they have found utility in educational settings as a form of game-based learning (GBL) and digital game-based learning (DGBL). Escape

rooms entail a collaborative endeavor where a group of individuals faces a challenge, seeking to overcome it by discovering hidden solutions and earning rewards upon success [11].

Escape rooms offer a variety of puzzles and can be structured in three different ways: linear path, open path, and multilinear path [11].

- The linear path follows a predetermined sequence of tasks, serving as a supervised training method and representing the simplest form of an escape room.
- The open path design presents a series of puzzles that can be tackled in any order, making it more intricate than the linear path. It lacks a clear indication of where to start, allowing for multiple pathways leading to a single solution. The puzzles are interconnected through a metapuzzle.
- The multilinear path design is the most comprehensive and challenging type of escape room. It combines elements of both linear and open paths, enabling parallel execution of puzzles and offering multiple starting and finishing points based on player decisions.

Furthermore, escape rooms integrate mental and physical components to reinforce critical skills applicable to daily life. They stimulate logical thinking and reasoning, demanding careful analysis of situations to solve different stages within a time-sensitive and pressurized environment. Moreover, they provide an ideal platform for developing problem-solving, communication, and leadership skills through collaborative efforts aimed at achieving a shared objective.

Integrating escape room simulations into education solidifies previously acquired knowledge by applying it to virtually realistic scenarios. The gamification approach to learning enhances students' engagement in practical tasks, thereby facilitating the attainment and internalization of essential learning objectives [12]–[14].

Objectives

The objective of this review is to map the elements that drive the design, development, and evaluation of escape rooms in medical education. We define “escape room” as a physical or digital adventure game where participants are locked in a themed room and must solve puzzles and find clues to escape within a time limit. As such, only studies that describe a usage of escape rooms in medical education settings are considered for review. Studies that use escape rooms for other applications will be excluded. For those included papers we will seek to chart the elements that drive the design, delivery, and evaluation of such interventions, including their platforms and designing frameworks.

Methods

To ensure standardized conduct and reporting of the scoping review, this review will follow the guidelines outlined in the Joanna Briggs Institute's methodology for scoping reviews [15,16]. This approach is recommended by Tricco et al. [17] and endorsed by the institute to promote consistency in scoping review practices.
Additional information and clarity can be found in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist.

Search strategy

We will review the literature in three steps in accordance with the inclusion criteria, using the Joanna Briggs Institute's systematic scoping review methodology [15].

- First, we will investigate terms and keywords for the searches, we will then run an initial search.

- Second, a systematic search will be carried out across the chosen databases utilizing the identified terms and keywords, followed by the organization and systematization of the obtained results.

- In the third step, the reference lists of the identified papers will be thoroughly examined to identify supplementary material that may not have been captured during the initial search. The inclusion or exclusion of literature will be based on our review's objectives and predefined inclusion criteria.

The following databases: MEDLINE, PubMed, Scopus, EMBASE, Web of Science, Google Scholar, and ProQuest Dissertations and Theses will be among the sources of information used in this systematic scoping review. An example of the initial search keywords and search strategy for PubMed database is presented in Table 1. Table 1 presents a sample search strategy, and any modifications made to the search strings will be meticulously recorded in the final scoping review.

Search strategy	Database	Results
(“escape room*”[Title/Abstract] OR “escape game*”[Title/Abstract] OR “puzzle rooms”[Title/Abstract] OR “gamified learning”[Title/Abstract] OR “adventure games”[Title/Abstract] OR “game-based learning”[Title/Abstract] OR “educational games”[Title/Abstract] OR “simulated game”[Title/Abstract] OR “serious escape game”[Title/Abstract] OR “breakout room”[Title/Abstract]) OR “breakout box”[Title/Abstract]) AND (“medical education”[Title/Abstract] OR “linear path”[Title/Abstract] OR “multilinear path”[Title/Abstract] OR “open path”[Title/Abstract] OR “learning outcomes”[Title/Abstract] OR “educational interventions” [Title/Abstract] OR “simulation”[Title/Abstract])	PubMed	172

Study Selection and Extraction criteria

Our review will include a wide range of studies on the use of escape rooms in medical education to thoroughly examine the body of literature already in existence. Both published and gray literature will be covered by the review's scope. We'll pay special attention to studies that make use of escape rooms as a key method of distributing or delivering medical education. Studies that outline game-based learning interventions but do not use escape rooms as their main distribution will be disregarded. A time frame will be set that includes papers published from 2016 to the present, considering the development and widespread use of gamification. The review's primary focus will be on English-language studies. Iterative changes to the inclusion and exclusion criteria, which are listed in Textbox 1, may be made as needed.

Summary of inclusion and exclusion criteria

Inclusion criteria

- Literature focusing on medical education that incorporate escape rooms as a delivery method or utilize specific forms of escape games.
- Studies that provide insights into the design, implementation, or evaluation of escape room interventions in medical education.
- Studies published from the year 2016 onwards.

Exclusion criteria

- Studies that describe educational interventions but do not have any context of escape rooms.
- Studies solely mentioning other uses of escape rooms
- Studies in languages other than English.

Textbox 1. Summary of inclusion and exclusion criteria.

The bibliographic system Zotero will be utilized to gather and upload all identified citations and duplicate entries will be removed. Two independent reviewers will assess the titles and abstracts of the selected papers against the inclusion and exclusion criteria outlined above in textbox1. The assessment process will be documented following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) template for inclusion flow [18].

Potential papers meeting the inclusion criteria will undergo a detailed assessment by two independent reviewers. Reasons for excluding studies will be recorded and reported in the final publication of the scoping review.

As shown in Textbox 2, the data extraction tool specifically developed for this review, will be employed to extract relevant information from the included papers. The data extraction tool will be adjusted and refined as needed during the data extraction process, and any modifications will be detailed in the final report.

Data extraction tool

Study design

- Authors
- Date of publication
- Country
- Aim of the study
- Participants involved: Number and type.
- Data collection method

Concept and study context

- Designing framework
- Study duration
- Outcomes
- Limitations

Textbox 2. Data to be extracted

The extracted data will encompass pertinent details about the population, concept of designs, context, study methods, and key findings related to escape rooms in medical education.

Ethics and Dissemination

No ethics approval was needed to conduct this study. The final scoping review will be published in a peer-reviewed journal with a high impact factor as part of the review's future dissemination.

Results

The collected data will be organized and presented in diagrammatic or tabular formats, aligning with the objective of exploring the use of escape rooms in medical education within the context of this systematic scoping review. Additionally, a narrative summary will accompany the presented results to provide further context and support the review's objective. These compiled findings will be published in a scoping review report.

The findings derived from the extracted data will be presented in two main sections. The first section will detail the selection process and will incorporate a PRISMA flowchart to illustrate the inclusion and exclusion of studies. The second section will encompass the results specifically related to our review questions.

Discussion

The results from this scoping review will aim to inform a variety of stakeholders. Such knowledge may improve the development process and results for future escape rooms. The review may also inform educators and instructors about the possible success of their escape rooms and the effects of involving game-based learning in their curriculum development processes. The results from the review might also address any challenges explored in designing such educational interventions. Identified knowledge from this review would be valuable for medical education to improve any gamification involvement in the development of educational activities instead of such involvement being minimized or downgraded.

Given the potential for escape games to provide serious content for educational purposes, this subject is extremely pertinent. The goal of this review is to create a piece of writing that will assist in directing those looking to construct escape rooms toward evidence-based design and evaluation practices, allowing the reader to also see what designs are employed and through what framework. By highlighting the current trends of the specialties targeted and revealing either an excess of focus in some or a gap in others, this review also has the potential to influence future directions of game-based learning integration in medical education. This may lay the groundwork for future research to examine the specifics of research in game-based learning interventions in more detail.

Conclusion

This review will be among the most current and comprehensive systematic scoping reviews, aiming to generate knowledge about the utilization, design, and evaluation of escape rooms in the context of

delivering medical education content. Our primary objective is to reveal valuable insights and address significant research questions through meticulous analysis. Furthermore, this review will identify any existing research gaps and emphasize the potential necessity for future systematic reviews in the field of escape room development.

Acknowledgements

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Conflicts of interest

None declared.

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