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NARRATIVE REVIEW

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Gamification in physiotherapy and rehabilitation education: a narrative review

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Abstract

Background For learning activities that commence and continue with the effect of motivation, novel and entertaining learning methods are developed by considering needs. As a result of the student-centered learning approach gaining importance, gamification has emerged that transfer game components to subjects. Gamification in education health professions improves students' knowledge levels and clinical skills. Therefore, gamification techniques are integrated into physiotherapy education. This review aims to examine the effects of gamification techniques in physiotherapy and rehabilitation education.

Summary Educational escape rooms reinforce academic achievement by enabling students to use their problem-solving skills in subjects; it provides the evaluation of practical skills by reducing anxiety and stress levels of physiotherapy students in exams. Educational board games motivate physiotherapy students, facilitate recall of information, and increase academic achievement. Online quizzes encourage physiotherapy students to study day to day in their subjects, increasing their achievement and participation in subjects. Gamified websites and gamified physiotherapy case studies motivate students, while virtual reality-based games used in practice subjects facilitate the learning process.

Key messages

Educational escape rooms, board games, and online quizzes are commonly used within the context of gamification in physiotherapy education. With the contribution of gamification, physiotherapy students learn their subjects with fun and improve their clinical skills and academic achievement. In the future, there is a need for interventions revealing the potential and long-term effects of gamification, and comparing it with traditional education.

Keywords Gamification, Physiotherapy, Higher education, Students

Introduction

Learning is an innate human activity that begins and continues with the effect of motivation [1, 2]. Innovative universities change to satisfy the needs of education and training [3]. Unfortunately, the majority of students are distracted during almost half of the class time [4], and educational materials (presentation, clinical case, etc.) are not found interesting enough by them [5]. Nowadays, student-centered learning is adopted to solve problems like the deterioration of interaction between students and instructors and the decrease in interest and attention [6]. While virtual classrooms during the pandemic period

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increased the current lack of interaction, it also led to the rapid development of adaptation to virtual classrooms [7]. In addition, active learning that supports students' participation in lessons has managed to maintain its importance from this period to the present [4]. Student-centered learning, which enables students to actively learn knowledge, experience, and beliefs, emphasizes that it is more effective in learning skills and academic achievement compared to traditional learning in which the knowledge is transferred directly by the instructor [8]. Due to the targeting of better learning and more productive lessons, the traditional learning approach is now moving away [9].

Instructors need interesting, creative, and entertaining course content for students who are very familiar with technological advancements [5]. Therefore, problem-based learning activities, flipped learning and gamification techniques have been used to present creative and entertaining lesson content [10–12]. However, there is more attention to gamification techniques due to their impact on student participation in different educational settings [13, 14].

Gamification refers to the use of elements in game design in non-game contexts like education and marketing [15]. Gamification in educational activities motivates by supporting success, struggle, competition, and cooperation in the learning process [16]. Game-based education creates interaction between psychological/emotional, cognitive, and social processes [17]. Positive emotions (having comprehensive knowledge of a subject, etc.) are associated with learning similar experiences at the psychological/emotional level. While problem-solving and decision-making are experienced at the cognitive level, it becomes easier to construct information by interacting with classmates at the social level [18, 19]. Gamified education, which is more common in computer and information technologies, can be applied to the whole curriculum, in all or part of the courses in various fields such as mathematics, medicine, biology, psychology, and language [20–22]. Gamification techniques are integrated into health profession education by focusing on information content and holistic case management [19]. Whereas improving the knowledge, clinical reasoning, and reasoning of health students, it also increases attendance and satisfaction in lessons [23–25]. Considering the mentioned effects, gamification has been attempted in physiotherapy education, which is a profession focused on holistic patient management. The first step towards gamified physiotherapy education was taken by implementing applications for undergraduate students at several grade levels. Although gamified education has started to be used in physiotherapy courses, there is no review examining gamification methods used in physiotherapy. Due to the significant developments in the field of gamification in health professions, it is thought that a current review will contribute to gamification research in physiotherapy education. This narrative review aims to examine gamification methods applied in physiotherapy undergraduate education, the content of methods, and the effects of gamified education on students. By addressing the following points, this review will contribute to the effective integration of gamification techniques into physiotherapy education, ultimately improving the learning experience and academic outcomes for physiotherapy students:

- Comprehensively analyze the impact of various gamification techniques on learning experience and academic performance
- Providing educators with practical information on the application of gamification activities in physiotherapy education
- Presenting an outline of recommendations to educators and institutions for the effective inclusion of gamification techniques in the physiotherapy curriculum
- Emphasizing the development and integration of gamification techniques in physiotherapy education to keep up with new developments in health education
- Announcement that there is a need for studies comparing gamification with traditional learning methods in physiotherapy and examining the long-term effects of gamification in education.

Gamification in education (game-based education)

Gamification in education is an innovative teaching approach in which game components (scores, leaderboards, awards, etc.) are included in the education process to improve academic performance and learning skills [15]. The concept of gamification in the academic field emerged first in the late 1990s, but it did not become widespread in education and training until 2010 [26]. Since the main goal of this approach is to provide education for students, game components are used to enhance learning rather than creating games [27].

The terms game-based education, serious games, and gamification can be confused semantically. Gamification is the adaptation of game structure, strategies (rules, rewards, etc.), and visual and game-thinking elements (game cards, game boards, etc.) to daily or non-game contexts (education, marketing, etc.). In terms of this concept, game components can be used without game design purposes [14, 28]. While learning purpose is more dominant in serious games, it also has the purpose of creating games [27]. Game-based education utilizes

game-like elements and structures, but unlike others, it converts the entire learning process into a game [29]. The following methods are widely used among instructors for game-based education: set goals, give feedback, show progress, award badges, increase difficulty levels, create stories, earn points, and present leaderboards [30].

The main purpose of gamification methods in education is to enable students to participate in active learning that motivates and connects them to lessons [31]. The active involvement of students in learning supports their experiences in their lessons more positively [17]. Moreover, students have more obtains in lesson participation, learning, and remembering information through gamification [32]. It provides a chance to interact more between students and instructors through brainstorming, debate, or open-ended reasoning questions [33, 34]. Motivation is the most significant element of game-based education because of directly related to teaching-learning, supports students positively in lessons, and ensures participation in educational activities [35]. During gamification lessons, students can immerse themselves in-game experiences [26]. Therefore, they can learn with more enjoyment and more interaction with both instructors and classmates [36]. Game elements advance achievement by enabling students to be more engaged with a task in the course, on the other hand, social comparison in educational games improves social connection and relationships among classmates [37]. Game-based education also promotes creative thinking [38–41]. Since information should not be forgotten during educational games, students exhibit their knowledge as critical thinking and thus improve their clinical reasoning [9, 42]. Eventually, game-based education has better outcomes on retention of knowledge, motivation, meaningful learning, critical thinking, reasoning skills, and academic achievement compared to instructor-centered (traditional) learning [43].

Gamification in health sciences education

It has been shown that gamification techniques in education lead to promising outcomes, but the research that incorporates gamification in health professions education is still insufficient [30]. In the previous studies that used gamification in health education, there are limitations in terms of the absence of a control group, short-term intervention, and evaluation with scales without validity and reliability for each language [30]. Although game-based learning has been reported to be beneficial for the general population, health professionals, and other undergraduates, its effect on knowledge retention, practical skill, and professional competence level of health students has not yet been clarified [44]. A recent study reported that gamified electrocardiography training in medicine can increase diagnostic accuracy and improve the ability to interpret clinical data [45]. On the other hand, it has been reported that gamified flipped classrooms can improve nursing students' skill knowledge and self-confidence during laboratory clinical practice [46]. In general, the direct effects of gamification in healthcare professions on clinical skills are not yet clear compared to its effects on the academic process. The potential advantages of gamified education on clinical skills in healthcare professions are presented in Fig. 1.

Nowadays, instructors have started to apply more game-based approaches in lessons for health professions education. Within the context of health professions, medical and nursing studies demonstrate superiority in numbers compared to studies in physiotherapy, pharmacy, speech-language, and dentistry [27]. Gamified education in health professions can generally be performed in basic theoretical subjects such as anatomy, biochemistry, and pharmacology in practical subjects such as ultrasound, auscultation, and evidence-based practical training. Furthermore, gamification can be integrated into undergraduate, internship, and residency in medicine [27].

Gamification methods in physiotherapy and rehabilitation education

The following gamification methods such as educational escape rooms, educational board games, and quizzes on online question platforms (Mentimeter, Kahoot!, Quizziz) are applied in physiotherapy and rehabilitation education. Table 1 presents the available gamification studies in physiotherapy education.

Educational escape rooms

Educational escape rooms are team games that require students to solve puzzles and codes in four basic rooms in a limited time in a story designed following the content of a lesson. Escape rooms offer students an opportunity to develop collaboration and problem-solving skills with classmates [52]. The story of educational escape rooms should connect elements in the room and encourage students to continue to the end of the game [53]. During escape rooms with varying difficulty levels, students make decisions based on the interaction between the lesson and story and challenge their mistakes in the learning process [53].

Each step of escape games should have a different area that gives meaning to the game story, so educational escape rooms consist of four basic rooms (Fig. 2) [52]. The pre-game room is a meeting area to introduce a game story, watch the introductory video, and provide more gamification by immersing students in a game [54]. The game room is the main area where students are the main characters of educational stories and solve

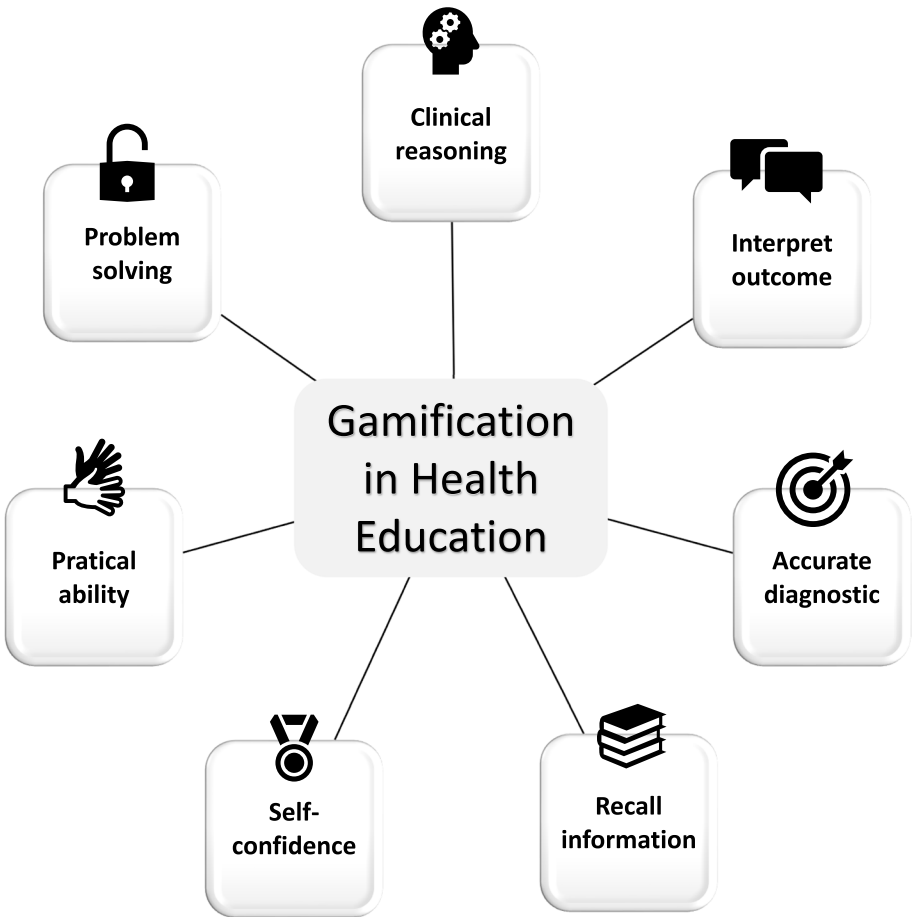

Fig. 1 Clinical potential advantages of gamification in health professions education

puzzles and codes [52]. The debriefing room is a distinctive element of educational escape rooms. After the escape room is completed, skills and attitudes are shared between students and the instructor in the debriefing room, so that students learn additional information. In addition, instructors have a chance to evaluate students' level of knowledge acquisition. during meetings in this room [52].

The escape rooms are substantial for the education of health professions where clinical practice is at the forefront. Educational escape rooms immerse students directly in-game activity [55], and it enables them to learn through teamwork, satisfaction with the course, and increasing motivation [9]. Based on all these reasons, educational escape rooms should be applied in practical and theoretical courses to teach and develop clinical skills in health students [17, 56–58].

Educational escape rooms are created in physiotherapy lessons by equipping rooms with cameras and microphones and creating puzzles using various materials like locks, cryptex, test tubes, and flashlights [54]. During escape rooms, physiotherapy students can be asked to solve puzzles about theoretical and practical subjects, collect clues, and make a diagnosis on a simulation model in about 60 min. Physiotherapy students who are satisfied with the inclusion of escape rooms in lessons do better in exams [54]. Although the sample size in the relevant study was low and there was no blinding, the design and methods of the study make the results reliable and effective. Additionally, these results do not contain any bias and are consistent with the evidence obtained from existing studies.

On the other hand, practice exams through escape rooms allow physiotherapy students to exhibit their practical skills as in traditional practice exams, reducing their anxiety and stress levels [47]. Physiotherapy students express their experiences related to the escape room practice exam, which requires solving clinical cases within 30 min, creative thinking, mastery of the subject, assimilation, enjoyment, and action [47]. Ultimately, instructors can utilize escape rooms as an alternative method for physiotherapy practice exams. In

Table 1 Overview of studies applying gamification techniques in physiotherapy education

Study	Country	Sample size	Subject	Gamification technique	Intervention	Main results
Ferrer-Sargues et al. (2021) [54] (Observational study)	Spain	3rd and 4th grade PT students: EERs group ($n=58$) Control group (non-participating EERs) ($n=117$)	Cardiovascular Physiotherapy	EERs education *(Game name: Escape-cardio)*	Students participated in 1of 8 different sessions distributed along the term Groups of 2 or 3 PT students 90 min/session	Marks and number of correct answers in the final exam ↑ (more in the EERs group than control) All in the EERs group are satisfied with the escape room.
Molina-Torres, Sandoval-Hernández et al. (2021) [47] (Comparative study)	Spain	1st grade PT students ($n=56$)	General Procedures in Physiotherapy-I	Evaluation with EERs	All students first took the traditional assessment and then EERs assessment. 4 clinical cases in EERs assessment Groups of 4 PT students 30 min/session	Similar marks from traditional and EERs practice exam STAI and PSQ scores were lower in EERs assessment. GAMEX scores were high in terms of enjoyment, absorption, creative thinking, activation, and dominance dimensions.
Molina-Torres, Rodriguez-Arrastia et al. (2021) [48] (Comparative study)	Spain	3rd grade PT students: Experimental group ($n=29$) Control group ($n=30$)	Physiotherapy in Geriatric and Adult Psychomotricity	Board game-based education *(Game name: Physiotherapy Party)*	Experimental group received gamification lessons. Control group received traditional lessons (non-gamification). A total of 16 theoretical lessons Groups of 5 or 6 PT students	Final marks and attendance were higher in experimental group than control group. GAMEX scores were high in all the dimensions, except negative effects.
Cortés-Pérez et al. (2023) [49] (Experimental study)	Spain	1st, 2nd, 3rd and 4th grade PT students ($n=313$)	Physiotherapy Fundamentals ($n=76$) Kinesitherapy ($n=85$) Special Massage Therapy ($n=81$) Abdominopelvic Physiotherapy ($n=71$)	Kahoot! and Reward Cards	Randomly selected theoretical contents were reinforced with Kahoot! tests (least 8 questions), while the other 50% of the contents were not reinforced (traditional lesson). 15-week period	In all subjects, the number of correct answers in reinforced content ↑ More than 90% of students considered *Kahoot!* is useful and motivating. *Kahoot!* motivated more than 65% of students to study daily.
Valenzuela-Pascual et al. (2022) [50] (Quasi-experimental study)	Spain	Undergraduate PT students ($n=60$)	Pain neurophysiology within the context of Physiotherapy in Clinical Specialties Course	Gamified Web platform (included notes, videos, and clinical cases)	Gamified website accessible from any electronic device to view videos, download PDFs, or take online quizzes. Chronic low back pain and quiz sections of the website were gamified.	Knowledge about the neurophysiology of pain ↑ Students' motivation and satisfaction ↑
Shahmoradi et al. (2020) [51] (Experimental study)	Iran	3rd grade PT students ($n=31$)	Physiotherapy in Neurological Disease	Virtual reality-based game (five game forms: spacecraft, falling snow, butterfly, tubes, sorting of home)	Exercises for patients were taught through games. Equipment: Kinect sensor (Xbox 360), laptop, deep sensor RGB camera, multilayer microphone	Students' perception of learning and satisfaction ↑

Table 1 (continued)

Study	Country	Sample size	Subject	Gamification technique	Intervention	Main results
Chong (2019) [19] (Mixed method study)	Hong Kong	3rd grade PT students ($n = 100$)	Neurological Physiotherapy-II	Gamified virtual case studies	Six gamified sessions → 6 multi-media clinical cases 2-h/session Four tutorial groups Gamification mechanics such as leaderboards, scoring, and prioritization were embedded in cases.	Students' motivation, self-efficacy ↑ The most motivating mechanic → Leaderboards

EERs Educational Escape Rooms, *PT* Physiotherapy, *STAI* State–Trait Anxiety Inventory, *PSQ* Perceived Stress Questionnaire, *GAMEX* Gaming Experience Scale

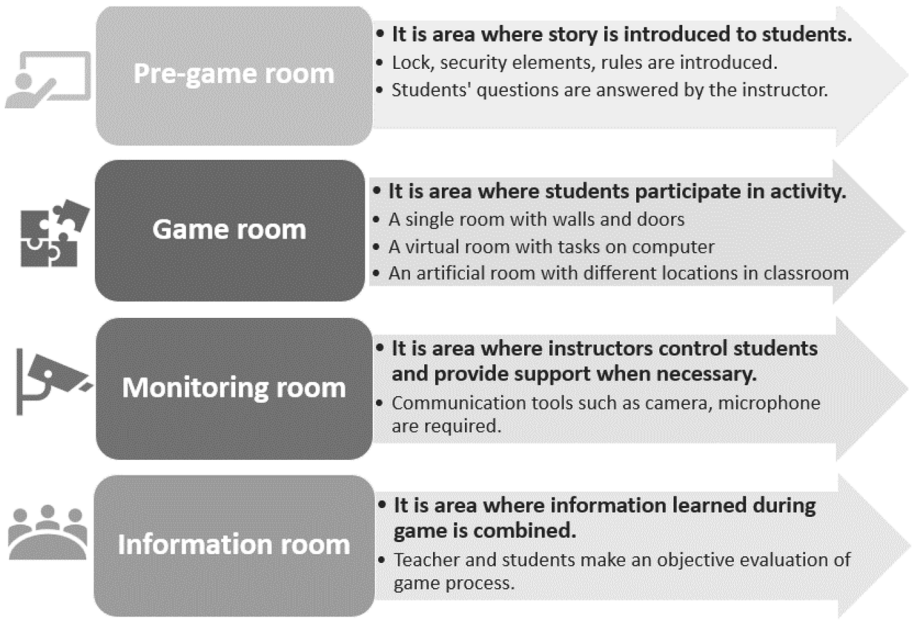

Fig. 2 The four basic rooms in educational escape rooms and their general characteristics

this evaluation study, a suitable method was applied, results were obtained using reliable scales, and statistical analyses were conducted under the design of the study. Although the fact that the participants were selected from a single center and class reduces the applicability of these results to the general physiotherapy population, it is currently the first study comparing different evaluation methods in the physiotherapy literature.

Educational board games

Board games that children and adults play as leisure activities are adapted for gamification in physiotherapy education. In educational board games called "Physiotherapy Party", students answer game cards containing questions about lessons through mime, forbidden words, and drawings [48]. While game cards are prepared by students to practice and memorize the basic concepts, equipment such as a game board, dice, hourglass, card box, instructions are provided by instructors. Lessons combined with board games enhance academic achievement and increase the attendance rate of physiotherapy students. The gradual and meaningful learning during board games enables students to achieve higher success in their exams [48]. These enjoyable and competitive games improve the learning process by facilitating recall and application of knowledge. Although creating educational board games requires instructors to spend extra time, it motivates physiotherapy students to engage in active learning [48]. In the mentioned study, which was conducted without randomization of a small sample size but according to an appropriate procedure, the intervention created a significant difference in the experimental group.

Quizzes on online question platforms

Online quizzes are an educational gamification technique that transforms the classroom into a quiz show and enables students to participate in lessons as competitors. Kahoot! is the first student response system that has been developed for game-based learning and has an increasing number of users worldwide [59]. With 70 million monthly users, Kahoot! ensures that students are actively involved in education [59, 60]. After creating a user account on Kahoot! website, the instructors can prepare quizzes to apply in face-to-face or distance courses. Students can participate in quizzes anonymously via smartphone, tablet, or computer by entering the code shared by the instructor. Kahoot! offers question options such as four-choice tests, true/false, puzzles, word cloud, open-ended questions, and brainstorming within the context of test information and comment collection [59]. Sharing the ranking of students with all students after the quizzes positively supports learning [61]. In addition, the results of all competitors are automatically saved to Kahoot! account, so instructors can get feedback on the intelligibility level of topics. These results are suitable for use in various evaluations and projects [49, 62].

According to a systematic review of 93 studies, Kahoot! has positive effects on learning performance, classroom dynamics, student and teacher attitudes, and student

anxiety [63]. It increases the motivation, participation, and learning levels of students through enjoyable and social activities [59]. Besides supporting the self-learning process [64], Kahoot! using in histology, anatomy, and health education increases collaborative learning, subject knowledge, interest, and participation in lessons [65]. Kahoot! motivates medical students to study, focus on important concepts, and reflect on what they have learned, so it is recommended to be an assessment tool in medical courses [66]. It is recommended to be integrated into the nursing education curriculum as it is practical, supportive of learning, and preparing for practical lessons [67]. Despite the mentioned positive effects on health students, there are also studies reporting little or no effect of Kahoot! [63].

Although other gamification techniques require less time than the preparation process and use technological devices that students are familiar with, using Kahoot! in physiotherapy education is limited. In a 15-week pilot study, quizzes were applied over Kahoot in physiotherapy classes, and prize cards were given to the winners to keep the students studying and motivated [49]. Thanks to Kahoot, it has been shown that students study day-to-day subjects and get higher grades in exams. Moreover, physiotherapy students have reported that Kahoot! is a useful and motivating education method [49]. In this long-term study, conducted with the participation of a high number of physiotherapy students from different grades and subjects, the evaluations were created following the hypothesis of the study and the results obtained are consistent with the existing evidence.

Other gamification methods

In addition to the escape room, board games, and online quizzes, different gamification techniques are also used for game-based physiotherapy education. A gamified website with notes, videos, and clinical cases designed to better learn pain neurophysiology is enjoyed by physiotherapy students in their lessons [50]. It has been reported that this entertaining and educational website is a valid method that can effectively teach pain neurophysiology [50]. The above study focused on a specific population and topic and provided evidence consistent with similar studies. However, participants were not selected according to inclusion criteria and potential confounding factors were not taken into account.

Virtual reality games applied for rehabilitation in different disease groups have started to be used in physiotherapy education. Exercises for the upper extremities can be taught to physiotherapy students through virtual reality games such as catching snowflakes and chasing butterflies [51]. Virtual reality games facilitate the learning process of students and support their better understanding, especially in practice education [51]. The intervention used in this study was evidence-based and systematically created. Small sample size, failure to evaluate possible bias during data analysis and selection, and failure to generalize the results reduce the quality of the study. Therefore, its results should be approached with caution.

Clinical cases planned can be gamified by using gamification components such as leaderboard, quiz, scoring, award, and prioritization. Leaderboard is the most motivating gamification technique, as it visualizes the progress of gamified clinical cases [19]. During gamified education, physiotherapy students' positive experiences and motivation are usually determined by realistic experience, classroom activities and designs, and gamification components [19]. The mentioned mixed-method study was of high quality because the research design, methodology, data collection, and process of obtaining themes from the analysis were carried out appropriately.

Discussion

Gamified education, particularly in health sciences and physiotherapy, is a relatively recent promising approach to enhance learning outcomes. Gamification in education involves incorporating game elements into the learning process to motivate and engage students [15]. This innovative approach has gained popularity as educators recognized its potential to enhance student participation and knowledge retention [26]. One of the primary goals of gamification methods in education is to promote active learning and enhance student engagement. It has been shown that active participation in subjects positively affects students' learning experience [17]. Additionally, it allows interaction between students and instructors through brainstorming, and open-ended reasoning questions [33, 34]. The potential revolutionary changes that gamification can create in physiotherapy education are presented in Table 2.

Gamification in health sciences education has the potential to revolutionize traditional teaching. Furthermore, gamified education can be effectively applied in the theoretical and practical training of physiotherapy. In physiotherapy education, where clinical practice is essential, educational escape rooms, board games, and online quizzes help to develop collaboration, problem-solving, critical thinking, and academic achievement [48, 52, 63]. For gamified education, it is recommended that board games and escape rooms be the first choice in physiotherapy. When the benefits of escape rooms, board games, and Kahoot! are compared, physiotherapy students perceive board games as the most enjoyable approach. Moreover, the escape room is the best approach in terms of absorption, creative thinking, activation, and dominance [68]. The current studies that enable the mentioned results have been the precursors

Table 2 Potential revolutionary changes related to gamified physiotherapy education

Engagement and motivation	➢ Gamification promotes active participation and engagement by integrating interactive elements, narratives, and challenges into the learning process.
	➢ It can motivate students to actively involve themselves in lessons, leading to a deeper understanding of physiotherapy concepts and practices.
Practical development	➢ Gamification encourages students to apply theoretical knowledge in game scenarios, thereby enhancing their problem-solving and clinical decision-making skills.
	➢ Game context can provide a safe environment for students to practice various physiotherapy techniques, improving their confidence and competence in real clinical settings.
Stress and anxiety	➢ Gamification methods can help alleviate stress and anxiety commonly associated with exams and practical assessments.
	➢ By creating a more relaxed and enjoyable learning environment, it can promote a positive mindset toward learning.
Collaborative learning	➢ Certain gamification techniques, such as multiplayer games, can foster teamwork and communication among students.
	➢ Collaborative learning environment can encourage knowledge sharing and the development of interpersonal skills that are essential for an effective interdisciplinary approach in physiotherapy.
Monitoring and feedback	➢ Gamification tools can provide immediate feedback on students' performance, allowing educators to track individual progress and identify areas that require further attention.
	➢ The real-time assessment enables personalized learning paths that cater to each student's specific needs and learning styles.
Technology and innovation	➢ The incorporation of gamification in education encourages the integration of modern technologies (virtual reality, simulation-based learning) fostering a dynamic and technologically advanced learning environment.
	➢ This integration can prepare students to adapt to technological advances in healthcare and stay updated with the latest developments.
Professional career	➢ While gamification improves the quality of physiotherapy education, it also better prepares students to meet the evolving demands of healthcare.
	➢ It ensures that physiotherapy students are equipped with the necessary knowledge and skills to be successful in their professional careers.

of gamified education in physiotherapy. Each gamification technique, which varies in terms of sample size and duration, indicates that gamification is feasible and adaptable in different undergraduate education levels and physiotherapy branches. However, the lack of a control group in most of them, the use of scales that are not valid and reliable in all languages for outcome measurements, or questions created by researchers led to the need for future studies. Since there are no longitudinal gamification studies in the physiotherapy literature and current studies last less than a semester, it remains interesting to evaluate the long-term effects of gamification in physiotherapy education. Besides, it is still ambiguous whether gamification techniques are suitable for physiotherapy graduate education.

While gamification methods offer significant benefits in physiotherapy education, several practical challenges should be addressed during implementation [49]. Primarily, creating effective gamified experiences requires careful planning and alignment with learning objectives. Additionally, instructors must strike a balance between entertainment and educational value to ensure that students perceive these gamification techniques as meaningful and relevant to their subjects. Considering the studies in nursing and medical education, physiotherapy instructors may not have sufficient knowledge about gamification. The use of evaluation methods such as marks and student comments by instructors after gamification may not adequately reflect knowledge and skills acquired through gamified experiences. Therefore, raising awareness about gamification methods and removing barriers to their implementation may support the dissemination of gamified education in physiotherapy. Besides, developing evaluation tools for gamified learning is considerable to more accurately evaluate the effects of gamified education.

This review has some limitations. Firstly, there was no critical or biased assessment of the included studies, indicating that this review offers a narrative synthesis of current findings. It can guide physiotherapists to gain insight into gamification practice, as it provides a comprehensive overview of gamification methods used in physiotherapy. Furthermore, integrating evidence from observational, comparative, and experiential studies to support gamified physiotherapy education enhances the reliability of statements in this review. Secondly, various gamification methods (especially escape rooms, board games, and online quizzes) applied in physiotherapy education have been tried to be emphasized, however, other possible gamification methods that may be relevant and useful for physiotherapy have not been discussed. The effects of novel gamification methods can be examined by conducting future studies that integrate gamification methods applied in health sciences education into

physiotherapy education for the first time. Thirdly, it has been stated that gamification methods give promising outcomes in physiotherapy education, but insufficient research may limit the generalizability of outcomes. Addressing these limitations and conducting more rigorous research would strengthen the evidence base for the use of gamification methods and encourage instructors to integrate gamification into physiotherapy education.

Conclusion

This review provides physiotherapy instructors with an opinion about gamified education and the administration of gamification methods in courses. Gamification methods offer opportunities to transform traditional education approaches into engaging and interactive learning. By integrating game elements into the curriculum, instructors can motivate students, leading to improved academic achievement and clinical skills. During the physiotherapy undergraduate education, gamification techniques such as escape rooms, board games, and online quizzes are used in theoretical and practical lessons and exams. The tendency of physiotherapy students to learn through games should be preserved by the instructors. In the future, there is a need for long-term interventions with a control group that examines the effect of gamification on learning outcomes such as professional competence. Further research and evidence-based practices will undoubtedly contribute to the significance of gamification in health sciences and physiotherapy education.

Implications of physiotherapy practice

- Gamified physiotherapy education increases students' academic achievement by supporting their theoretical and practical problem-solving skills.
- Gamified practice exams enable physiotherapy students to demonstrate their practical skills without experiencing anxiety and stress.
- Physiotherapy students who actively participate in enjoyable and educational subjects may easily remember subject knowledge and transfer it to clinical practice during internships.
- Increasing the quality of lessons with innovative approaches like gamification may provide better-equipped physiotherapists and, as a result, more successful treatment management.

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M.D.: conception, writing, editing, and final approval of the manuscript and accountability for the work. T.K.: conception, critical manuscript revision, and final manuscript approval and accountability for the work. Both authors read and approved the final manuscript.

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Competing interests
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