DOI: 10.15584/978-83-8277-356-9_3

Clinical escape room from theory to practice: the experience of an Italian nursing bachelor degree

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Abstract

Introduction: The clinical escape room (CER) is a strategy, applied in the adult education, in various contexts and based on different settings or thematic areas. It is developed in a room or series of rooms, where inside students, solve a problem or a puzzle that may lead to the discovery of a key, or a numerical combination to unlock a lock. The CER supports learning in the clinical-care field combining knowledge, skills and fun, stimulates new knowledge, trains students to works in a group and develops skills in different contexts.

Aim: The main aim of the chapter is to summarize our experience regarding the CER.

Material and methods: A total of 55 students participated in the CER, divided into 11 teams of five members each.

Results: On average it took 56.6 minutes (min 50–max 66), a value that did not differ greatly from what was hypothesized in the design phase. At the end of CER, the students' responses freely at the question from a form for guarantee the anonymity.

Conclusions: An activity considered in its digital version involving students during the period of social isolation. Having considered the potential of escape rooms and the curiosity for novelty, the CERs as a possible future strategy to support continuous training.

Key words: escape room; game; learning; nursing students and simulation

Introduction

Due to the intrinsic characteristics that distinguish it, the game represents a stimulus for learning, not only in the developmental stage but also throughout

life, including in undergraduate and continuing education settings. It is well known that the contribution of play and movement, albeit in different ways, implies cognitive and creative activities that may trigger learning [1]. The game manages to simultaneously involve and motivate, leads to surprises and is able to bring illusions to life; it trains you to adapt to situations or rules and offers the possibility of developing new skills [2]. No game is to be considered trivial, it always has a purpose and can include a rewarding or successful aspect. even for adults. In addition to providing a sense of achieved competence and social usefulness (especially if played in a team), the game can contribute to self-esteem with respect to one's own abilities and resolution skills [3]. However, there is a risk that some individuals will attribute greater importance to the social expectations derived from the assigned tasks (obtaining better results than others) than to the personal aims achieved (achieving personal learning goals) [4]. There are games that are defined as 'serious' when they are aimed at the application of imagination, or lead to exploration, encouraging individuals to prepare and finally to follow precise rules. Participants are aware that they will have to solve problems and/or face new situations. Accessing this type of game involves exploring multiple options or paths, including developing innovative visions [2]. It has been investigated whether game-based learning is linked to different outcomes leading to perceptual and cognitive results, rather than behavioral or motivational ones.

Many reference theories, research questions and studies have been presented/conducted to date by different authors [5]. The question naturally arises, then, as to whether game-based learning or game-based learning situations could be more useful, especially if they involve situated experiential learning. Games do not always involve materials stored in cardboard boxes or traditional shapes and volumes; there is a type of game that involves particular places and a level of interaction that comes close to the real world or takes its inspiration from the real world. Specifically, we are referring here to the recreational activity known as 'escape room' (ER) in its different presentations, where intuition and logic are combined. It must be said that ER is nothing new; conceived as a game, it has transformed into a strategy applicable in adult education in various contexts and based on different settings or thematic areas. It involves a room or a series of rooms in which a one-way path is reconstructed, characterized by stages whose overcoming is linked to the resolution of problems of different natures and levels of difficulty, with a view to discovering a material pass such as a key or a numeric code for opening a padlock that allows the participant to open the exit door. Inside the room, resolving a problem or a puzzle can lead to the discovery of a key, or the result of a calculation could provide the unlocking of a numeric combination padlock. This activity usually involves group

participation, problem solving and teamwork; in fact, each participant makes the knowledge and skills in which they are most expert available to their team, all in a limited time frame as the team that takes the least amount of time to complete the entire journey wins. So-called 'penalties' may be foreseen for incorrect choices or failure to resolve the problems faced.

Here, the idea was to create an escape room activity to support learning in the clinical-care field, combining knowledge, skills and fun–hence the creation of a clinical escape room (CER) designed for nursing students in order to stimulate new knowledge, train students in teamwork and develop skills in relation to situations in different healthcare contexts.

Over time, ERs have become increasingly popular types of games, representing a novelty for those who are looking for interactive and movement games. Added to this is the fact that the evolution towards digital has marked new possibilities in terms of access to the game, remote participation and interaction even remotely. A catalytic effect was determined by the need generated during the period of social isolation between 2020 and 2021 caused by the COVID-19 pandemic. Although the current technologies applicable to games allow you to enter a virtual gaming context from your mobile device wherever you are, the sensations and immersive power determined by one's physical presence in a certain environment are probably difficult to achieve.

In an ER, the aim of the game is to exit the room or rooms by solving puzzles and riddles in the shortest time possible. An ER represents a physical and mental challenge in realistic environments, with or without the support of innovative technologies; they can essentially be defined as live role-playing games or themed entertainment events [6]. The evolution of ERs is demonstrated by the increasingly numerous locations that have arisen in recent years in various cities. Adapted individual rooms or abandoned premises have given way to custom-designed structures, sometimes with long-term exhibitions as in Milan, Paris, Budapest or Toronto (however an ER remains active for a maximum of 2 or 3 years). Almost all ERs, as has happened with the best video games, present a sort of normal expiry, accompanied in this case by the progressive experiences of the participants. The attractiveness and potential of an ER do not depend exclusively on the number of rooms or the duration of the route, but these are factors to be added to various material variables. The level of immersion is limited by the availability of sensitive effects in the scenario (for example, linked to variations in lighting or sound), by the presence of themed objects (real or simulated) and by the appearance of characters (actors). The game is engaging if the setting in turn is refined and enthralling. Participants tend to initially explore the room in a timid, indecisive and superficial

way, but as time passes, they usually become more aggressive, looking for possible clues everywhere [6].

The success of the game in terms of its positive impact on the participants depends on the details in the preparation and on the emphasis conveyed during the presentation of the story (real-life situation, even a clinical one), the mission or case being addressed, as well as on the engagement of a facilitator – serving as a kind of 'Charon' – who enables participants to move between successive rooms. The emotional and relational involvement between subjects then contributes to the immersive value of ERs. It is not just about putting pieces together but about living a challenging adventure together with other people sharing ideas, experiences, problems and solutions [7].

Each ER is characterized by a series of puzzles, of different types and levels, the solution of which requires multiple skills, both cognitive (through calculation, memory, knowledge) and physical (technical skills), rather than communicative or relational ones. The solutions to the puzzles can lead directly to the solution for the exit or may only provide useful elements regarding the escape but require further effort, i.e. identifying or applying the connection between the solution of the puzzle itself and its use; for example, a number may be found but then it becomes necessary to understand what to do with this sequence: use it for the lock, rather than adding it to another number or transforming the numbers into letters of the alphabet to find where the key is hidden.. Some solutions can be used immediately, others come in handy later, so they represent something to keep and use when needed. In the setting of the development nothing is left to chance, therefore nothing is inserted arbitrarily into the environment. Every element, whether fixed or mobile, must be considered potentially useful; in fact, due to its characteristics, position or functioning, it exerts an interest in the possible physical or rational connection with other available elements. The individual puzzles together with the progressive solutions and the progress along the path help to stimulate the search for new knowledge or consolidate previously acquired knowledge, allow the development of reasoning and promote technical skills.

The value of an ER in terms of learning does not end with passing the tests encountered and the end of the path but finds further consistency only after the exit in being able to receive feedback. In addition to this, a score can be applied based on the time taken and the errors made, thus allowing a ranking to be drawn up.

A valid application strategy includes a structured debriefing session, with or without video support, for a guided re-elaboration of what happened. In fact, it is well known that after each experiential activity it is advisable to ensure that a debriefing takes place; this also applies in the case of ERs for which dedicated sessions

can be activated [8]. A structured and guided debriefing is an important strategy for engaging students in learning and is relevant even in simulated training. It is during such a debriefing that the players (as the learners), even in the case of a CER, are made aware of the learning that occurred during the course of the game; furthermore, they are helped to make connections with previous knowledge and in general with the development of skills in which the specific ER fits. ERs still represent, to some extent, a novelty; most of the available literature in fact focuses on describing their implementation and management rather than on analyzing the effects on those who experience them–in other words, the participants. Those who study changes in ER players state that following these activities, an increase in knowledge and enhanced learning skills are noticeable in adult subjects [9].

The design of a CER also requires considering the elements described above as valid for a generic ER, adding, or rather adapting, contents, settings and exit solutions to the clinical-care context. The education of nursing students involves a natural evolution in terms of knowledge and skills, but also respect for opportunities for clinical learning and therefore for direct experiences in different clinical contexts. The creation of a CER, if aimed at them, must also take these variables into account and, consequently, require adaptation based on the profile, level and achievable aims with respect to the professional area of competence and the year of the student.

Participating in a CER as a nursing student means living an experience that represents a stimulating resource for individuals' learning. If we then consider that the participants are adults and the learning process coincides with concrete interests (represented in this case by escape) as well as educational-professional ones, students are put in a position to learn as they are placed in real situations (involving their physical presence) and not purely theoretical ones [10].

Thus, the design of an ER presents some standardizable and common elements, regardless of the game theme; however, customized designs offer more value than large-scale products. It would be appropriate to know the characteristics and training needs of the participants, even more so when an ER takes on an educational purpose [11]. Knowing and using the participants' previous clinical experiences represents a particularly useful assessment phase in order to select objectives and work out ways to achieve them.

Developing a CER requires clinical knowledge and a wealth of technical skills that guide the design and creation of scenarios and riddle, suggesting puzzles, pitfalls and escape routes. Key figures in the implementation of CERs include developers, clinical experts and tutors, who are in charge of the students' learning process.

It is well known that competitive contexts push people towards overcoming difficulties and limits dictated by the knowledge they possess [10]. The development of critical thinking, an orientation towards problem solving and teamworking skills together with creative talent summarize the decisive elements for overcoming crises in different working contexts; consequently, education should also cover these competencies, thereby enabling students to experience and develop them.

The development of some skills such as those indicated above can be supported by traditional strategies but also by innovative, original and apparently less stressful ones. With ERs it is possible to enable students to develop transversal skills such as communication, leadership and teamwork. Moreover, games, unlike other more traditional activities aimed at learning, have the power to arouse positive emotions capable of expanding cognitive resources and are able to improve the level of attention, promoting decision-making and problem solving [12].

Aim

The main aim of the chapter is to summarize our experience regarding the CER.

Material and methods

There were considered some elements on designing a CER planned with in-person methods, suggesting that material and human resources should be taken into maximum consideration: the drafting and sharing of game rules, the winning criteria and any scores to be attributed together with the criteria for proceeding. Last but not least, the path must be defined, the different ways of exiting the rooms and environmental safety. Finally, it will be necessary to take care of the technologies to be used and the documentation to support the implementation.

To participate in a CER, it may be beneficial to register, perhaps via a link. This can be open or linked to groups of students, in which case it is advisable to use temporary or fixed access codes for compilation. In order to facilitate the organization, it is advisable to activate some sort of pre-registration at least one month in advance of the opening date of the CER. In this way, students are allowed to reflect in advance on the learning aims, and define the composition of the teams, which usually occurs autonomously. Each individual team is usually made up of 5 members, one of whom plays the role of team leader; it is advisable for the groups to also investigate the availability of a reserve figure, in case one of the team members is unable to participate.

The name of the team is communicated by interested parties at the time of registration. Access is free and participants must attend the operational briefing 30 minutes before the booked time. The entire process lasts approximately 60 minutes.

During the operational briefing, the rules for gaining access to the rooms, the functioning of some devices, the security measures of the entire route (for example, rapid opening of the doors, which are never completely blocked) and the options available for requesting support are shared with the staff. As explained at the time of registration, it is recommended to wear comfortable clothes compatible with the expected scenarios. On this occasion, the methods for attributing any points and the 'penalty' measures such as in the event of necessary unlocking with a guided exit from the room or in the case of damage to the setting or devices are declared. Penalties can be of a temporal nature (addition of minutes to the escape timing) rather than material (a beneficial object is removed) or sensitive (obligation for a member to wear a sensory or movement deterrent/limiter) for the rest of the route. Clear and shared instructions must be provided to participants regarding the use of the various devices. If video recordings of the activity are planned (for example for the debriefing), specific consent must be prepared for the participating students as per current legislation.

It is possible to design the evaluation at two levels: one of a playful nature, which can result in a score that is useful for defining the position in a ranking, independently of the evaluation of learning; the other is of an educational nature, more in the form of formative feedback than a summative evaluation. As already reported, the team that takes the least time to complete the entire course wins. The main criterion is therefore temporal; however, variants and integrative elements can be introduced that, for example, take into account transversal aspects and meta-competences. Examples of team performance evaluation sheets include the role of the team leader, the involvement of all group members, unforeseen and original strategies for solving problems or puzzles, resource management. If unblocking aids or similar are provided, these are associated with a time penalty that impacts the final result. For example, in the case of an unlocking aid, five minutes are added to the total time taken; the same penalty applies if objects that should have been kept and delivered at the end of the route are broken or left behind in a room. This situation could include the breakage of a test tube with a blood sample taken from a mannequin, or the forgetting of a radiological report or a card showing the trend of vital parameters. In some cases, bonuses are foreseeable, which can be spent at certain stations; this mechanism is then used to identify critical points or difficulties to highlight during the debriefing session.

Each ER, as conceived by the developers with all its different aspects, is characterized by a variety of necessary resources. The same ER could, however, be

designed with different levels of quality, realism and immersion–choices guided in particular by the set objectives. Many ERs that can be practiced today in various countries are identified as recreational activities available for a fee and subject to commercial logic; consequently the resources vary based on the interest and user base, the possible investment, sustainability and maintenance over time There seems to be no evidence or described experiences of ER recycling available yet regarding locations, scenarios and materials.

To activate an ER, a suitable environment in terms of size and division of spaces must be designed, one that is easily accessible, free of architectural barriers, and possibly subdivided into small confined areas that can be closed off by doors or elements that restrict the passage if not open. Depending on the location, it could be an environment dedicated to the activity (for example, a permanent display of the ER) or adapted (e.g. a classroom). Regardless, the environment should meet the requirements for creating a route. The rooms can remain unchanged, and only the elements aimed at the gaming activity need to be added, or they can be completely adapted with respect to horizontal (floors) and vertical (walls) characteristics and present furnishings, various objects or devices. In particular cases, the scenario can benefit from real or simulated locations already prepared for other purposes; an example of this is the implementation at a real simulation centre in the healthcare sector. The possibility of setting up a CER directly in a clinical simulation centre offers various opportunities and advantages: a) the scenario is ready for specific use and therefore usable without requiring major modifications; b) the centre is usually equipped with an audio/video system through which the game master can control and manage the live proceedings; c) the location is mostly characterized by a series of rooms (simulation rooms) that can easily be adapted to the CER route; d) in most cases the centre is equipped with a debriefing room where the final reflection session on the activity carried out can be held. In this context, it is plausible to think that CERs are identified with a particular form of simulation.

As previously reported, the ER can be developed in a single room with different stages within it or be divided into multiple rooms located in one or more buildings. Single-escape room CERs are more developed in Asia, according to the study by Nicholson [6].

The CER is characterized by the creation of a one-way path with clinical scenarios in the case of both adjacent and communicating rooms (Photograph 1), through which a sequential path is created, and in which the rooms are non-communicating and distributed along a corridor resulting in an open model (Photograph 2). In this last case, where entry and exit from the room coincide (same door), the developer will have to take into account the necessary indications, human resources and

technologies to ensure the entry, the closing and the consecutive exit, thus allowing participants to follow the path. The logistical characteristics of the setting influence these design choices. Before the players enter, they are informed through a diagram or plan about the characteristics of the itinerary to be undertaken.

In order to guarantee exit from the single room only after solving the puzzle, different types of locks are used (Photograph 3); they can be key and numeric combinations. Each exit door can have one or more padlocks depending on the expected level of difficulty and consequently on the number of physical and non-physical passes to be found for the exit (for example the key to a padlock rather than a phone call to the simulated care-giver capable of opening the door from the outside). They can be considered tests or puzzles in amounts equal to the number of participants in order to promote the active participation of all members of the team and enhance the contribution of each one. Each developer can set a maximum time spent in the room, at the end of which support interventions are provided by the gamemaster to unlock the static nature of the game.

In the case of both dedicated and adapted environments, the safety rule applies. No door must ever be completely and irreversibly blocked. The closing methods must still leave the possibility of rapid opening if necessary. Quick-opening techniques must be illustrated at the briefing and repeated before the start of the game. An applicable strategy is to adapt each closure with ring devices fixed with Velcro (Photograph 4). This technique allows opening with key or combination, offers a certain resistance to movement; however, if necessary it absolutely guarantees rapid opening by pulling in any direction. It can be easily repositioned and removed at the end of the activity; it is also reusable and has a relatively low impact cost. A supervisor throughout the activity guarantees every form of response in the case of need with respect to escape routes or inconveniences with the devices and materials made available. Before starting, however, all information relating to environmental and health safety will be provided (behavior in the event of fire, useful telephone numbers, internal emergency system).

In an ER, students usually have to find the physical or other key to open boxes, cabinets or doors. This involves having to look for clues and work on their characteristics, meaning or relationships. They can be called upon to solve physical or graphical puzzles, identify codes or build something. There may be different activities with which players will interact during the gaming experience. Puzzles to solve may require individual or a mixture of individual and multiple effort (on the part of each member) or involve teamwork. Alongside the use of technologies, it is always possible to refer to techniques or types of puzzles, which for feasibility and sustainability can be used at various levels and even by novice ER developers.

Below are some examples of puzzles or situations characterizing the discovery of the object or the escape solution. Sometimes the solution is found simply by tidying up (Photograph 5).

PUZZLE: The composition of a puzzle whose pieces are made to be found by the students in a given place can directly offer the solution, or part of it, to open the passage to another room, or represent the basis through which to solve a specific task reported on the back of the puzzle whose original image does not necessarily have to be of a clinical nature (but could make the team relax and have fun for a moment). The puzzles help to make the gaming experience more interesting and challenging by requiring composition and coordination skills with respect to the contribution of the participants, who can decide how to organize themselves by defining roles and sequences (Photograph 6). This activity should include an adequate work surface in terms of size, height, position and lighting, allowing all subjects to interact and contribute actively, while always guaranteeing access even to people with physical limitations (for example, access to a person in a wheelchair). An application example can be represented by a therapy puzzle, where a therapy prescription is inserted on the back of the original image (depicting characters from famous cartoons): only the total assembly of the tiles can allow complete reading with the indication of the drug to be prepared and this will allow the process to continue.

INSIDE BLACK BOX: In order to stimulate the curiosity and dexterity of the students, along the lines of the mystery box attributable to the Montessori method, an operational puzzle can be envisaged that exploits the characteristics of an *Inside Black Box*, through which the participants experiment with their sensory, tactile and imaginative abilities [13]. Through this system, the memory of what has been learned, seen and felt in classroom, laboratory or clinical settings is stimulated; this represents an opportunity for involvement and leaves room for creativity. At the same time, this strategy can stimulate ideas for learning or in-depth knowledge of the devices used in clinical care. The method essentially involves a closed box with two narrow openings through which students can insert only their hands and search among the objects available inside for the components of a specific device that must be reconstructed without relying on sight (for example, setting up a device for dispensing oxygen therapy with bayonet coupling) (Photograph 7). Confounding elements can complicate the mandate or, vice versa, ease the tension (for example, with the introduction of children's objects, kitchen accessories or acoustic toys). At the end of the set-up, you are asked to deposit the device in a space accessible via a one-way door on the back of the box, and this step can directly (mechanically/electronically) or indirectly (sheet with written instructions) provide the necessary element to continue.

DISTORTED SKILL TABLE: The challenge to be faced in this case consists in recovering the information or the physical key by passing a test of a dual nature, i.e. cognitive and technical. To be precise, students are invited to carry out a specific mandate despite the momentary distorted abilities generated by the setting and materials made available to solve the puzzle. The example could consist of having to follow instructions regarding a medication prescription received via audio through headphones and characterized by environmental acoustic disturbances. The prescription requires the application of calculations in non-optimal conditions, and the preparation of the simulated medication can only take place through a vision limitation system. This last part can be activated through a box with a blurred lens (Photograph 8a) or through the use of simulators of visual and/or movement deficits such as glasses reproducing diabetic retinopathy or gloves that generate hand tremors (Photograph 8b). Only the achievement of administration through the correct route can enable the solution and therefore the exit from that room.

CROSSWORD PUZZLE: Among puzzle games, crosswords that require you to insert words into a given grid are very well known and widespread. In this case, participants must solve one or more free-form crosswords created ad hoc characterized by topics that can be traced back to clinical pictures or healthcare problems identified by characteristics of the CER or relevance in the real world. Once students have completed the compilation, using the instructions provided, they can obtain the code or instructions on how to open the exit route. The process may involve individual work for each member, or working in pairs, with the option or not of being able to access consultable sources. To create crossword puzzles, educators can rely on specific generators available online, sometimes for free; they require upstream planning with the prior formulation of the definitions to be included. They can benefit from customization and be written in multiple languages. This activity allows you to share thematic knowledge, request help from other team members and reformulate priorities based on the evolution of the game (Photograph 9).

e-STATION: The estimate symbol (℮) is associated with masses or volumes, as can be read on the packaging of products marketed in European Union (EU) countries, to certify compliance with the criteria defined for estimating the content. In the context of assistance, it is sometimes necessary to estimate water balances, body weights, heights or other measurements necessary for the assessment. Even in an ER, situations can be introduced that involve the estimation of volumes or weights (Photograph 10), whose numerical value represents the unlocking code of a padlock (for example, a non-graduated bag with 500 ml of liquid inside, once the content has been estimated, offers a numerical solution equal to five-zero-zero as an unlock for the exit).

EVIDENCE POCKET: In a CER, puzzles can be introduced whose resolution requires an evidence-based approach starting from a real situation (Photograph 11). For example, scientific articles are provided on a specific research question and participants are asked to identify the best solution to the problem by consulting the available bibliography; the exit pass may be included in the selected article (for example, p-value of statistical significance reported in the results or emphasized in the conclusions). Themes or topics that may have already been addressed in the classroom or that characterize clinical internship activities are selected.

MANNEQUINS: In the rooms, low- or high-fidelity mannequins (therefore life-size human simulators) or procedural simulators (consisting of simulated anatomical parts) can be placed, on which to act to identify the escape mode. In particular, keys or codes are inserted into anatomical locations that can be explored during a physical examination, when posture changes or by activating prevention or intervention measures in the event of a health emergency. For example, a paper code can be inserted into the mannequin's mouth and this will only be found in an attempt to guarantee the patency of the airway at a given moment. Another case is represented by the key placed in the diaper of a mannequin simulating a bedridden and non-self-sufficient person who complains about the loss of urine in the absorbent device worn; only attention to the comfort of the simulated person will be able to offer the element for the way out. Technical tests on specific trainers are also considered, such as the placement of a peripheral venous catheter or blood sampling via venipuncture (Photograph 12). The carrying out and conclusion of the envisaged mandate leads to the envisaged pass (such as a numerical code inserted into the medication applicable after positioning the venous catheter or glued onto the syringe containing the correct drug to be administered).

In order to implement an ERC, it is necessary to have a set of figures to pave the way without losing useful elements and data for a possible ranking:

1. The leader is responsible for welcoming, preparing and training participants, explaining and illustrating the rules to be followed and teaching safety principles.
2. The controller, whose job it is to check the correct direction and sequence of the rooms, especially if they are not physically in sequence for logistical reasons. He/She assists the game master, without interfering with the game, by observing and noting elements and data that will be useful in formulating the final score.
3. The unscrambler, who takes care of tidying up rooms, materials and renewing consumables, including rearranging keys, passes and locks before the next team arrives, especially if the frequency of access is concentrated over a period of time.

4. The debriefer, who leads the debriefing session at the end of the course and offers a set of take-home messages that can be developed for the context of the game and based on the actions, reactions and experiences of the participants.
5. The gamemaster may be assisted by one or more controllers who, without interfering with the game, observe and record, on screen or in person, elements and data useful for the formulation of the final score.
6. The mole, i.e. a member of the team chosen by the gamemaster or introduced into the scenario with the task of interacting with the players only at the remote instruction of the gamemaster or on the basis of specific situational criteria; his intervention can also be activated by radio or telephone or by pre-arranged signals.

The CER can benefit from audio-video technological support capable of allowing control of what is happening in the rooms (alternatively the presence of an employee inside will be necessary); furthermore, the recording, if foreseen, can be used in the debriefing session, as well as providing the developers of that CER with useful elements for improvement. In the event that the CER is activated at an existing simulation centre, this will already be equipped with the necessary systems (Photograph 13). In order to witness the event or collect more details, it is plausible for the participants to use wearable action cameras, ensuring targeted editing only at the end. A sequence of photos can be provided upon exit as a souvenir of the immersive experience just ended, to which a final group photo is added. Each strategy just described must provide the necessary authorizations according to current legislation. Video and photographic recordings by participants are not usually permitted or expected, so as not to reveal the secrets that govern the ER activity itself. From the moment the course starts, when the participants enter the first room, each team is followed and observed in person. The observation makes use of annotation sheets, which at the end can provide the necessary data for calculating the score obtained by each individual team as well as representing a precious source of suggestions for any improvement actions with respect to puzzles, devices, exit mechanisms and levels of difficulty.

Results

Our experience of CERs with third-year students saw clear progress between the first and second edition, in which we managed to implement some improvements compared to the first edition. Furthermore, a more detailed data collection was activated for the second edition. Twelve groups of students signed up for the

second CER, one of which announced it was withdrawing a few hours before the start. Therefore 11 teams participated, one of which was made up entirely of students from the Erasmus project from different European countries and attending the course in that period at our headquarters. For this team, all information, texts and written parts were specifically translated into English in order to facilitate inclusion. Indications were also provided regarding the functioning of some devices used exclusively in the local clinical sites present within the path so as not to generate different levels of difficulty. The routes were prepared together with the assembly of all the materials in the preceding days, and the simulation centre was booked and used for the entire established day. The teams arrived in a staggered manner and participated in the briefing, during which instructions and the rules of the game were shared. Common elements were also provided, such as a backpack with materials that could be used during the journey. The CER took place at CSAF, the Simulation Centre of the Udine Teaching Hospital and the University of Udine commonly used by nursing students for clinical training prior to their internship.

A total of 55 students participated in the CER, divided into 11 teams of five members each. Among the participants, 48 (87.2%) were female; the composition of the teams was found to be mixed gender for six teams (50.0%), while the others included only female students.

To foster a cooperative environment, the composition of the different teams was decided independently by the students, who were asked to give a name to their team. These organizational aspects, as emerged during discussion meetings at the end of the experience, immediately increased their engagement, helping to create a spirit of belonging to the team.

The times recorded by each team were logged. On average it took 56.6 minutes (min 50–max 66), a value that did not differ greatly from what was hypothesized in the design phase. The groups' departures were spaced by at least 15 minutes in order to allow the progressive rearrangement of the scenarios. All situations were addressed and no technical problems occurred, except in one case in which a group, in a hurry, on leaving a room took away with them the key used to open the padlock; immediately a member of the organizing staff took steps to replace it with the reserve one that was already available on site as foreseen in the development phase. There was no damage to the structures or devices, there were no problems for the participants and no injuries during the course. Since the rooms were not completely soundproofed, the voices or excited shouts of the members of the various teams could also be heard several times in the transit corridor at moments of excitement or anger at not being able to find the solution, or vice versa of exultation at having managed to quickly solve the puzzle (Photograph 14). During the course it was also

permissible for students to use smart devices, for example to consult sites, scientific articles or updated data with respect to particular treatments or definitions, rather than to perform calculations. In at least two cases the team leader seems not to have actively carried out his function, but in both cases the rest of the group managed to compensate with proposals, decision-making or autonomous interventions. These elements were then taken up again during the debriefing phase, where they represented a valid basis for reflection. Upon leaving, all the teams immortalized the moment with a souvenir photo at the finish line.

To collect feedback from the students and stimulate reflection on what they experienced, at the end the students were asked to answer freely a question selected from a list of ten in total. The questions were sent using an electronic response collection form guaranteeing the students' anonymity. In total, 37 responses to the questionnaire were received. The table below (Table 1) lists the ten questions, the number of students who chose to answer each one and a sentence that summarizes the content of the answers.

Table 1. Table of questions and themes that emerged from the questionnaire

Request	No. of responses (%)	Theme
What inspired you to participate in the CER?	3 (8.1)	Getting involved
What was the most exciting room in the CER and why?	5 (13.5)	Playing as a team
What was the toughest challenge you faced during the CER?	7 (18.9)	Acting in the dark
According to what logic was the team leader of your team chosen?	3 (8.1)	Having peer leadership experiences
What emotions did you feel during the journey?	3 (8.1)	Feeling suspended between joy and fear
Were you able to have good collaboration as a team? With what strategy?	6 (16.2)	Making your talents available
What climate was created in the team before the start, at the start and at the end of the CER?	3 (8.1)	Moving from tension to harmony
What advice would you give to anyone wanting to participate in the next CER?	2 (5.4)	Listening
Would you recommend that first-year and/or second--year students participate in a CER and why?	2 (5.4)	
Would you like to be involved in designing a CER for first-year nursing students?	3 (8.1)	Perceiving the training scope of the CER
Total	37 (100)	

Legend: CER–The clinical escape room

What inspired you to participate in the CER?

The motivations that pushed the students to participate in the CER are linked to the desire to get involved; in particular, the three students (8.1%) who answered the question underlined the desire to be able to self-evaluate various skills, such as speed in decision-making relating to pharmacological therapy (calculation speed), technical-gestural skills and knowledge possessed in reference to certain 'general' topics.

What was the most exciting room in the CER and why?

A total of five students (13.5%) responded to this question. The rooms of the CER that drew the most enthusiastic response were those in which students were asked to work more as a team in order to solve the exit question. Specifically, the room called 'chain reaction' and the room with the crossword were the ones where the students said they had to resort to greater collaboration and discussion around all the components.

What was the toughest challenge you faced during the CER?

For the seven students (18.9%) who responded to this question, the most difficult challenges were those that required them to act in the dark, especially managing a procedure (such as setting up the therapy or assembling the flow meter) without having direct visual control. This theme also summarizes the sensation experienced and reported by two students who wore the headband with the word to be guessed in the 'chain reaction' room: having to guess a word based exclusively on the clues provided by their teammates made them feel a little 'helpless,' without being in full control of the situation.

According to what logic was the team leader of your team chosen?

The choice of the team leader was based on taking into account the peer leadership skills already demonstrated by that person within the group, both in the strict sense as a team that participated in the CER and in a broader sense. In fact, as reported in one response, the choice of team leader was obvious as one of the team members also held the role of student representative for the third year of the course.

What emotions did you feel during the journey?

The students were suspended between joy and fear in carrying out the CER. The three students (8.1%) who answered the question underlined how the whole experience oscillated between these two emotions: on the one hand, the fear of not finishing the tests in time; on the other, the joy of finding the key for moving on to

the next station. This emotion goes hand in hand, as reported in one response, with the pleasure of being in tune with the members of one's work team.

Were you able to have good collaboration as a team? If so, with what strategy?

Making one's talents available is the theme that best summarizes the answers to this question. In fact, all six students (16.2%) underlined how collaboration within the team was achieved thanks to the fact that each member supported the others, making their talents and their certainties available. The strength and cohesion of the team resulting from each member recognizing themselves as bearers of something 'useful' for the group represented the most effective strategy for overcoming moments of doubt, effectively moderating the perception of difficulty.

What climate was created in the team before the start, at the start and at the end of the CER?

As with the emotions felt, and with respect to the climate perceived in the team, the three students (8.1%) reported an evolution that consisted of moving from tension to harmony. In fact, while at the beginning there was a certain tension in the group linked to the uncertainty regarding what to expect from the experience, by the end of the CER, thanks to teamwork and the awareness of having 'gone out together,' this had given way to harmony.

What advice would you give to anyone wanting to participate in the next CER? Would you recommend that first-year and/or second-year students participate in a CER and why?

From the answers of the four students who selected these questions, it emerged that they would suggest should take their advice and sign up; this experience, in fact, represented an excellent opportunity to test one's ability to work in a team while recognizing how important it is to be able to find mediation across conflicting opinions. This element also represents the main reason why students would suggest to their classmates from previous years that they should participate in a CER.

Would you like to be involved in designing a CER for first-year nursing students?

Perceiving the educational significance of the CER emerged as the main reason why third-year students would be willing to plan an experience of this type for their classmates. One student in particular underlined how he would consider it useful, after having designed the CER, to also organize debriefing sessions with students from previous years with the aim of sharing both the doubts and difficulties experienced and the awareness gained after the experience of the CER (Photograph 15).

Discussion

Two online CER editions and two physical ones have been activated since 2020 in the Udine University Bachelor of Nursing degree. The remote ones were dedicated to second year students, while the in-person ones were for third year of the course students. For each edition a logo was created, printed and provided to each participant (Photograph 16a). Participation in the CER was voluntary and recognition of the time spent as an elective activity was expected.

Both editions were developed by tutors and teachers of the Nursing degree after consulting literature on the topic and reflecting on what is available online regarding international ER experiences, even if not necessarily of a healthcare nature. The editions were carried out at the reference simulation and higher education centre (Centro di Simulazione e Alta Formazione di Udine–CSAF), thus exploiting locations already available with a clinical setting. The availability of healthcare-related devices and equipment allowed a greater degree of experiential immersion (Photograph 16b). The structure made it possible to generate a mixed-path ER, i.e. partly open, partly sequential, while still defining a starting point and an arrival point.

We have fulfilled several learning aims in these two editions, in particular regarding the need to always guarantee video or in-person control for all participating teams. Furthermore, we realized that it is essential to provide logistical and material recovery support in numbers adequate for the planned shift of game, and therefore for the number of teams registered and the time interval in which to carry out this activity. We have had confirmation of the surprising, entertaining and at the same time applicative impact of some puzzles or situations reconstructed in the rooms. In particular, we have detected greater interest and group involvement in the rooms containing Inside Black Box, Distorted Skill Table and Crossword Puzzle. However, these perceptions should be confirmed with appropriate data collection in order to accumulate evidence.

Each degree in healthcare sciences may activate its own escape creativity group for the creation of a CER and the involvement of students in its development and management with a view to activities intended as peer-to-peer education aimed at students from previous years. The design of a CER requires, as described above, knowledge of the contents of the disciplines characterizing the thematic area of the game (story, situation or clinical case). A first step could consist in the creation of a digital CER to then be transferred to a real context This first step requires minimal economic and material resources, although it does require development time commensurate with the knowledge and expertise of the developers. The digital version can be created very simply through platforms already available at the organization

(for example, Drive or Forms) and prepared on the basis of consecutive modules with passage blocks. For the second phase, which is probably the most ambitious and impactful one, set in a real location, it is suggested to explore the availability of simulation centers capable of hosting these activities and providing support in terms of logistics, devices, audio/video systems and, if necessary, simulation instructors to conduct targeted debriefings.

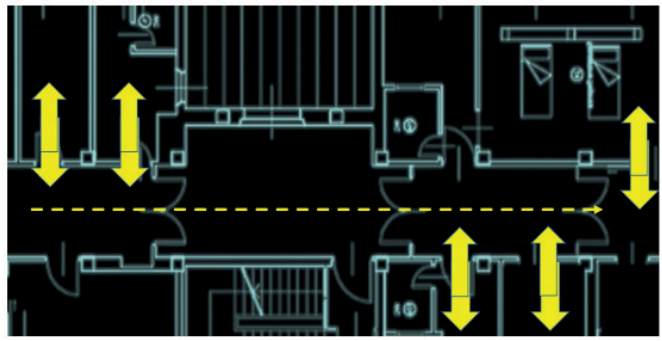
Conclusions

An activity considered in its digital version involving students during the period of social isolation due to the pandemic has become a structured learning opportunity to be undertaken in person. After an initial rather empirical approach supported only by reading some documents available online, we have continued the initiative with an approach based on the available evidence. Hence a literature search for studies regarding the method and contents of CER has been conducted adapted to address the training needs identified.

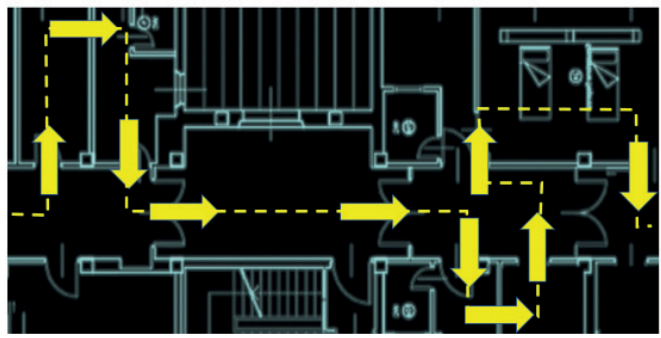
The interest on the part of the students and the success of the two editions have led to the consolidation of a small group of tutors and teachers interested in further developing the educational initiative, seeking new elements of improvement and starting to investigate publications on the topic more assiduously. We are currently involving some third-year students in a project called Simulation Experience, which includes, among other things, their creation of a CER for a peer-to-peer approach. At the same time, other versions of a digital CER have been implemented to support laboratory learning activities.

This propensity led us to ask ourselves what data it would be useful to collect in order to contribute to fuelling new reflections and knowledge about the CER, highlighting the need to perhaps systematically introduce interviews with participants in order to gather their experiences. Having considered the potential of escape rooms and the curiosity for novelty, some interest has also emerged on the part of clinical professionals who are starting to see CERs as a possible future strategy to support continuous training. As already hypothesized by Nicholson (2015), perhaps we will have to rethink ERs by attributing to them a broader and more flexible meaning with the transition towards escape games (EGs). Notwithstanding the introduction of advanced technologies (for example, virtual or augmented reality), in-person team play offers an atmosphere and harmony that are difficult to achieve and experience remotely or only through IT devices and multimedia connections.

Photographs of the students' work in progress.



Photograph 1. Map of a one-way path with clinical scenarios

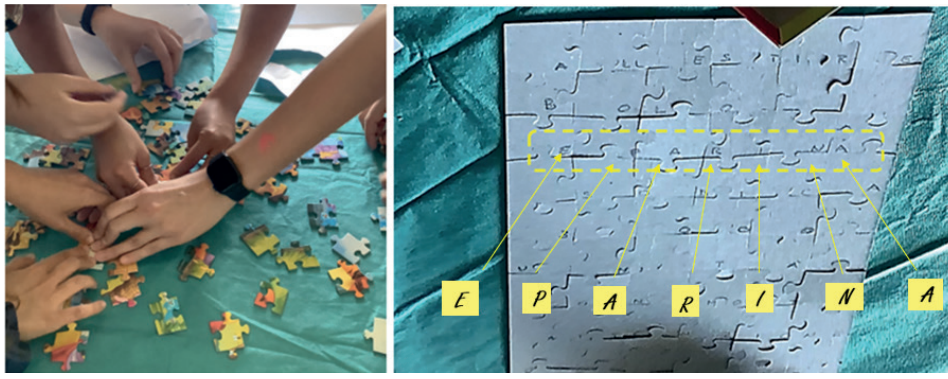


Photograph 2. Map of a sequential path with clinical scenarios

Photograph 3. Types of locks: with key (left) and with numeric combination (right)

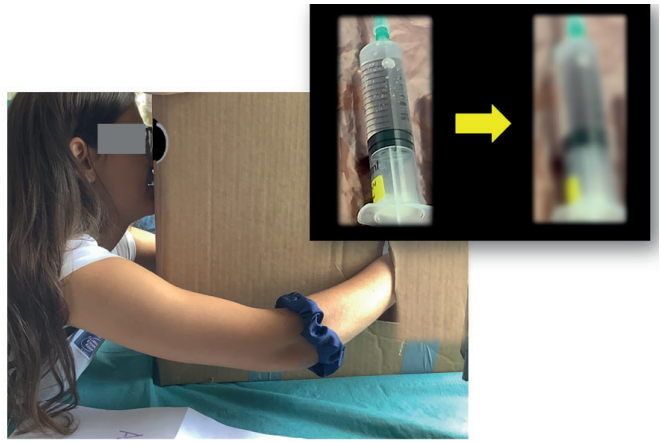
Photograph 4. Closure with ring devices fixed with *velcro*

Photograph 5. Example of puzzles: the solution is found by tidying up



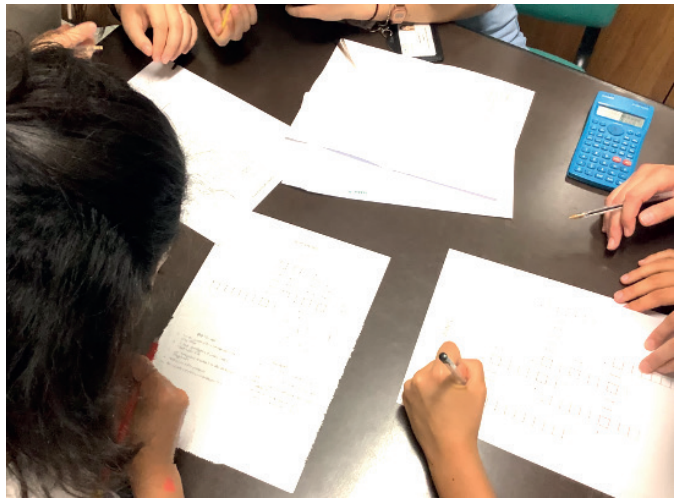
Photograph 6. Example of puzzle with key solution on the back
(*Prepare a bolus of heparin 3000 units*)

Photograph 7. Example of black-box: setting up a set for dispensing oxygen therapy with bayonet coupling



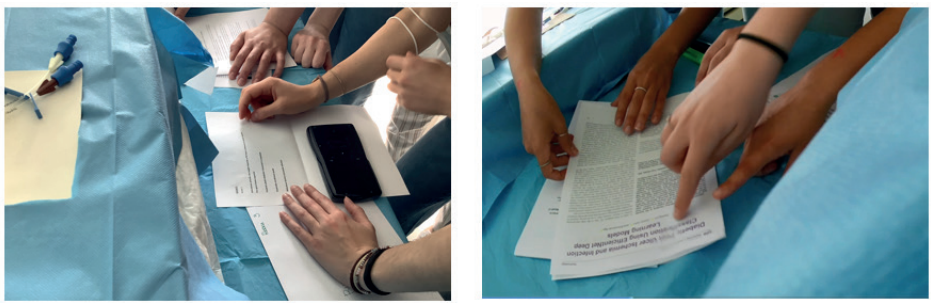
Photograph 8a. Box with a blurred lens: left is normal vision, right is student vision

Photograph 8b. Glasses and gloves used to reduce students' vision and sensitivity



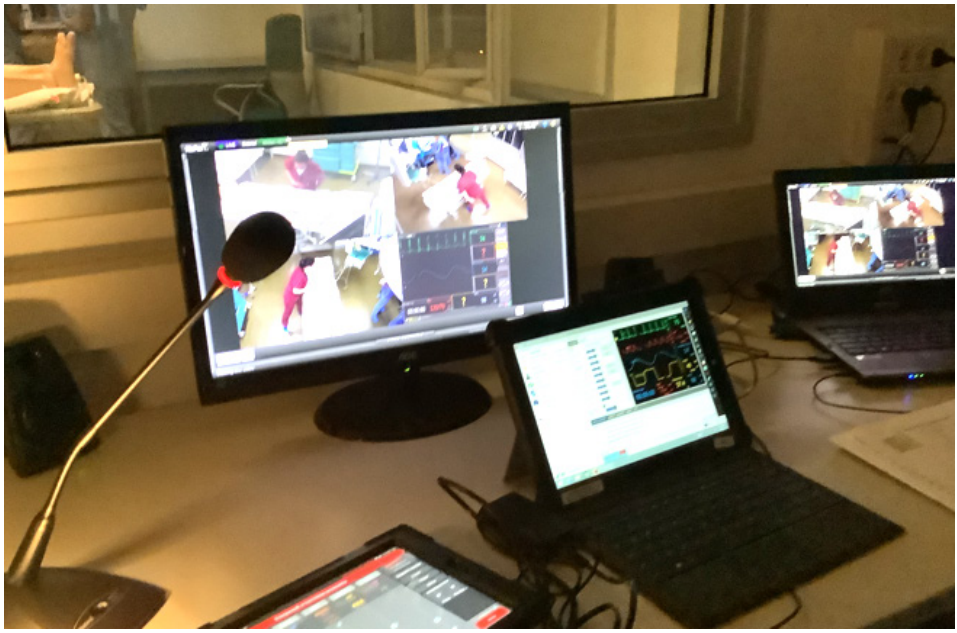
Photograph 9. Students solving crossword puzzle

Photograph 10. Example of ℮-station: estimation of volumes



Photograph 11. Evidence Based scenario

Photograph 12. Scenarios with high fidelity mannequins and skill-trainers



Photograph 13. Directing system within a simulation centre

Photograph 14a. Logos of CER first and second edition

Photograph 14b. Two moments of the oxygen therapy scenario

Photograph 15. Students at work in a scenario

Photograph 16. Students collaborate in solving a clinical question in a scenario with low-fidelity mannequin

References

1. Valentini M, Morbidelli V. Gioco e movimento, stimolatori di apprendimenti in età evolutiva. Formaz Insegnam. 2017;15(1):355–372.
2. Rasmussen R, Kristiansen P. The Lego® Serious Play® method for business. Milan: Franco Angeli. 2015.
3. Mason L. Psychology of learning and education. Bologna: Il Mulino. 2013.
4. Mason L. Psychology of learning and education, paperback. Bologna: The Mill. 2019.
5. Stiller KD, Schworm S. Game-based learning of the structure and functioning of body cells in a foreign language: effects on motivation, cognitive load, and performance. Front Educ. 2019;4(18).
6. Nicholson S. Peeking behind the locked door: a survey of escape room facilities. 2015. Retrieved from: http://scottnicholson.com/pubs/erfacwhite (12.07.2025).
7. Clarke SJ, Peel DJ, Arnab S, Morini L, Keegan H, Wood O. EscapED: a framework for creating educational escape rooms and interactive games for higher/further education. Int J Serious Games. 2017;4(3):73–86.
8. Jørgensen T, Rosenkrantz O, Eberhard KE, Jensen TW, Dieckmann P. Perceptions of medical students on narrow learning objectives and structured debriefing in medical escape rooms: a qualitative study. BMC Med Educ. 2024;24(1):403.
9. Mijalsk M, Cieśla M, Gromadzka M. Escape room as an adult education tool. Homo Ludens. 2020;1(13):163–178.
10. Pezzoli M. Soft skills che generano valore: le competenze trasversali per l'industria 4.0. Milan: Franco Angeli. 2017.
11. Morrison GR, Ross SJ, Morrison JR, Kalman HK. Design effective instructions. Hoboken (NJ): Wiley. 2019.
12. Plass JL, Mayer RE, Homer BD. Handbook of game-based learning. Cambridge (MA): MIT Press. 2020.
13. Randolph JJ, Bryson A, Menon L, et al. Montessori education's impact on academic and nonacademic outcomes: a systematic review. Campbell Syst Rev. 2023;19(3).