Key Words

Escape rooms, simulation, innovative pedagogy, paramedicine, non-technical skills, gamification

Key Points

- An escape room activity can help to develop non-technical skills which are the skills that help to develop technical skills and reduce errors within the workplace.
- The escape room achieves high levels of student engagement and satisfaction.
- 100% of the students indicated that they would recommend this activity and asked for further similar events.
- Allows the students to learn and develop their skills in a safe environment.
- An escape room can reinforce prior learning with 90% of students reporting that it helped with their knowledge of ECG's.

Abstract

Paramedicine is a rapidly evolving profession and teaching strategies need to be just as creative and forward thinking to meet the ever-changing demands of the role. Educational escape rooms incorporate a variety of learning environments where students participate in different simulation-based activities, based on solving puzzles, retrieving codes which results in finding a 'prize'.

A mixed method action research study was undertaken to ascertain if an escape room can be used to increase student engagement and attainment for year one students studying a paramedic science degree, at a university in the UK. Results obtained included; 100% (n=52) stating they would recommend this activity. 100% (n=52) agreed that it helped them to review their teamwork skills and 98% (n=52) stated that it improved their communication techniques.

Non-technical skills enable the development of technical skills and knowledge within the workplace. They have been shown to be an overarching factor in good practice and help to reduce errors. An escape room activity is arguably an effective teaching method, when used as an educational tool and the challenges are based on the learning outcomes.

Introduction

Higher Education (HE) has experienced rapid developments recently, partly due to Covid-19 (Ekanayake, 2023), and changes to work-practice and qualifications. This is particularly evident in the health profession. This paper explores how an 'educational escape room' can be used as an innovative approach when teaching year one paramedic students.

Educational escape rooms incorporate a variety of learning environments. The exact structure will vary depending on the course, the number of participants and learning outcomes. For the paramedic students involved in this project, The escape room challenged them to a series of simulation-based activities, testing their patient assessment skills, clinical knowledge, communication and teamwork. Each completed task revealed a puzzle code, once these were collected, if solved correctly, would lead them to find the 'prize'.

The focus of the project centres around student engagement, and student attainment of skills and knowledge. Action research, using both quantitative and qualitative methods for the data collection will be utilised and emerging themes explored.

Literature Review

The healthcare system in the United Kingdom is rapidly evolving, resulting in a dramatic evolution in paramedicine, over the last ten to fifteen years (Nixon, 2017). According to Eaton et al. (2021) in 2017, the overwhelming majority of 999 calls were for the management of chronic conditions, acute mental ill-health, minor illnesses, injuries, and social care issues. Whereas only 8% of calls were for life threatening emergencies. This change in focus, recognised by the Health and Care Professions Council (HCPC, 2018) has resulted in an increase from two to three years of university study for paramedic students. Alongside this is a recognition that the pedagogical approach to paramedicine needs to also evolve towards more inventive teaching strategies, to meet the ever-changing demands of the profession (Brull and Finlayson, 2016).

The European Commission (2017, cited by Serrano et al., 2019), has recently acknowledged that there is an “urgent need to boost digital skills and competences” with a particular focus on plugging skill deficits, particularly through innovative teaching technologies and the integration of new modes of learning and teaching across the higher education system. Technology Enhanced Learning (TEL) according to Dunn & Kennedy (2019) can be classed as any form of e-learning, including online classrooms, educational platforms, interactive whiteboards, podcasts and simulation activities. The UK government published their report ‘Realising the Potential of Technology in Education’ (DFE, 2019), outlining the expected development and implementation of TEL within all educational settings, arguing that TEL provides access to education for everyone, increases inclusion and improves student outcomes and employability. Furthermore Davies *et al.,* (2017) concluded in an earlier study that universities can benefit from investing in technology enhanced learning (TEL) as it can improve the learning experience of the students, increase employability and has some financial advantages.

Kolb (2014) defines experiential learning as learning from life experiences, where the student is engaged directly with the realities of the subject being studied. The emphasis is placed on in-context action rather than classroom-based activities. Beardon and Wilson (2013) argue that experiential learning can help to bridge the theory to practice gap which works in a bi-directional manner. Therefore, learning the theory enables students to participate in the practical application of the knowledge. When this experience differs from how the student feels it should have gone, the underlying concepts are revised, through active reflection. As Race (2020) highlights, by utilising experiential learning, students demonstrate their understanding of a specific topic by solving problems.

According to Ryan and Deci (2000) the quality of performance can be dependent on the motivational factors on which the learning has been undertaken. Intrinsic motivation has no rewards and is undertaken due to an enjoyment of the subject and a desire to learn more and meet challenges. Conversely, Ryan and Deci (2020) explain that extrinsic motivation is goal driven, with a focus on achievement, often for career or personal development. This type of motivation frequently relies on input and enthusiasm from the teacher to achieve a high level of satisfaction. Paramedic students fall into both categories according to Weber et al. (2021). They demonstrate

extrinsic factors with the ultimate goal being to qualify as a paramedic at the end of the course, but they also have an underlying intrinsic desire to know more, to know why and to become better clinicians.

Jang *et al.,* (2010) argue that students are more likely to develop lasting skills if they are enthusiastic about participating and are engaged in activities in which they can work autonomously. De Byl's (2012) study on technology and game-based assessments discovered that increased student involvement and subsequent enjoyment could lead to improved motivation. However, to ensure deeper learning outcomes, the gamification approach needs to be founded in pedagogical roots. Gamification, according to Deterding (2011, p1) can be defined as, "The design, implementation and use of game mechanics in nongame context" (cited by Varannai et al., 2017) and is used in HE to improve students' motivation and engagement in their studies, often underpinned by an element of competition (Goshevski et al., 2017).

Educational escape rooms incorporate a variety of learning environments which, according to Gomez-Urquiza *et al* (2022) reflect the unpredictability of health-related careers. The varying tasks within each section of the escape room can expand a students' knowledge, reinforce technical principles and high levels of performance. It is a method by which lecturers can encourage students to communicate and become active learners. Thomas (2018) describes how simulation-based learning allows for authentic training and the development of skills within a safe environment. Garwood (2020) states that it is a challenge to create a stimulating escape room activity, but it can promote enthusiasm which will arguably reinforce learning and develop an understanding of new concepts. In addition, describing how creative scenarios, directly linked to student outcomes encourages engagement, promotes teamwork, problem solving and critical thinking.

When creating an educational escape room, Zhang *et al.,* (2018) advises a hybrid learning environment that incorporates both physical and digital activities. This can be a challenge and some facilitators may be discouraged due to the perceived complexity of the task. However, Garwood (2020) highlights that puzzles do not need to convolute to achieve a high level of student engagement and satisfaction with suduko and playing cards being suggested as easy to find puzzle solutions. The first

step to designing an escape room, according to Douglas & Hargadon (2001) is immersion, whereby a student is drawn into their surroundings and the task at hand. Consideration is then given to teamwork, communication and finally the ultimate goal which completes the planning process. In addition Garwood (2020) outlines how the use of a countdown clock can enhance an escape room, adding a pressure that clinicians may face in medical environments. However, this can also become overwhelming and lead to frustration, so additional clues can be provided as part of the experience to reduce this anxiety, thus retaining high levels of motivation.

Commented [RAL1]: What do you mean here? This is not clear at the moment

The use of educational escape rooms is a relatively recent pedagogical approach, and this piece of action research provides interesting data which can be transferred to other subjects.

Methodology

This piece of action research aimed to explore the impact that an educational escape room has on student attainment and motivation. As an early career academic working in HE it is important to improve my own practice through the creation, implementation, and evaluation of innovative teaching approaches.
A purposive sampling method was utilised, thus ensuring that the sample was drawn from a group of participants, aligned with the aims and objectives of the research (Myneni, 2007), which according to Kelly (2010) can improve the rigour and trustworthiness of the results. Although it can be challenging to make generalisations to an entire population from this type of approach, it is possible to make logical and analytical justifications to generalise the research to a relevant group (Holloway and Galvin, 2016). The sample consisted of year one paramedic science students enrolled at an HEI in the UK. Pre- and post-event questionnaires were distributed for completion and the data was analysed to identify themes in the responses.

Ethics

The research study adhered to BERA (2018) guidelines, participants consented to participate, had the option to withdraw consent, and have their responses removed from the data at any time. Questionnaire responses were completed anonymously, data was stored on a secure server, and the documents were password protected.

The project adhered to the Data Protection Act 2018 and GDPR requirements. Additionally, this research study followed the university ethics policy, ensuring that approval was gained prior to any data collection.

Results and discussion

Of the 96 first year student paramedics, 84 participated in the educational escape room experience, and 55 completed the pre-event questionnaire (Appendix 1). Only 40% (n=55) of participants had previously taken part in an escape room, either as an educational, or leisure activity. Many of the participants will either not have known what to expect or could have been biased by a previous positive, or negative experience. This potentially could result in disengagement, or a lack of motivation due to preconceived ideas of the experience (Roschelle (2007). However, most participants were looking forward to the experience, with an average score of 4.16 out of 5. 98% stated that they prefer to learn in practical scenarios which supports the findings of Hernandez et al. (2019) who highlight that simulation-based activities are a more effective way of reinforcing learning, as opposed to didactic methods.

When questioned about what they hoped to achieve, two main themes emerged. The first theme focussed on the development of non-technical skills, which were perceived to underpin the paramedic role.

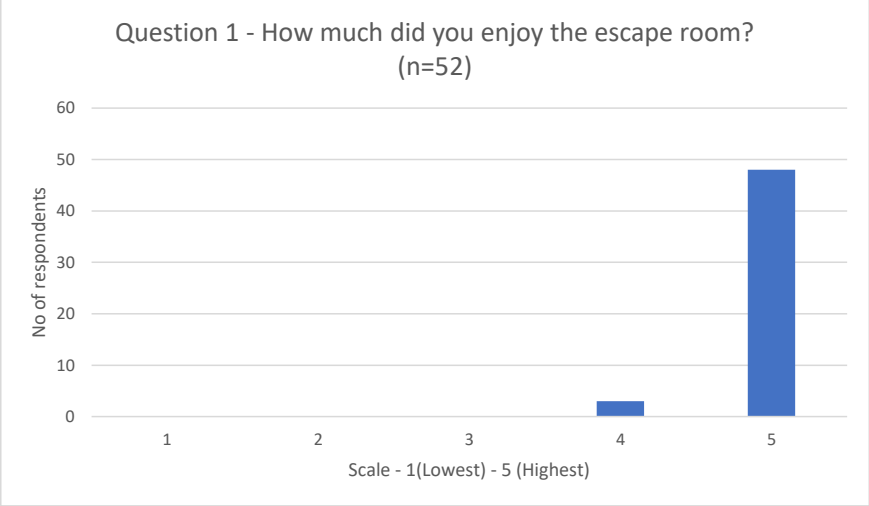
> 'Gain a better understanding of where I need to improve and develop as a team member and with communication so I can become a better-rounded clinician' (Participant 39)

The second theme focused on the learning experience which incorporated gaining knowledge, building confidence, and working under pressure. This correlates with Garwood (2020), who argues that an escape room can help prepare students to deal with stressful situations, like real-context work environments.

> 'A chance to apply knowledge under pressure in a safe environment' (Participant 34)

Of the 52 participants who answered the post-event questions (Appendix 2) an overwhelming majority (100%) would recommend this activity to other students and an average of 4.94 (out of 5) rated it as an enjoyable experience (Graph 1).

This arguably demonstrates a high level of enthusiasm and satisfaction which as Jang et al., (2010) discuss can lead to a greater depth of understanding and the development of lifelong skills, when students are engaged and invested in their learning.



Graph 1: responses (n=52)

The questionnaire posed two open questions ‘What did you enjoy most from the escape room?’ and ‘Is there anything that you would like to see changed?’ This allows participants to give a greater depth of answer, resulting in rich data (Cohen et al., 2018). Three themes emerged (table 1).

Emerging theme	**Coding**
Development of non-technical skills	Teamwork Communication
The learning experience	
The format	

Table 1

Theme 1: Development of non-technical skills

According to Thomas (2018) non-technical skills can be defined as the personal, cognitive and social skills that complement technical competence thus ensuring safe

and efficient practice. Within paramedic training this incorporates, teamwork, communication, leadership, reflection, briefing and debriefing. The room scenarios and challenges were developed around the learning outcomes for the module 'Introduction to non-technical skills and simulation'. The Health and Care Professions Council (2018) emphasises the importance of these skills in their standards of proficiency that all paramedics must adhere to. It is therefore important that students have the opportunity to develop these skills in realistic, but safe environments.
94% of participants agreed that the escape room activity helped to develop their scene safety, tested their teamworking capabilities (100%) and 98% confirmed that it reinforced their communication skills (Table 2).

> 'Loved the team work, enjoyable way to review my skills and communication ability' (Participant 33)

Overall, 46% (n=24) of respondents cited the development of personal non-technical skills as the element they found to be most beneficial.

> 'It was a really fun way to review how my clinical skills have improved. It was a fun and interactive way to put our teamwork and communication skills into consolidation' (Participant 32)

This reinforces the views of Veldkamp (2020) who state that a well-designed escape room can promote collaboration and teamwork. Furthermore, Cain and Piasick (2015) highlight that creative scenarios which are directly linked to the learning outcomes are more likely to increase student engagement and enforce a deeper understanding of the subject. Leadership and reflection were also identified by the students as two skills that they were able to focus on whilst undertaking the different challenges. Shields & Flinn (2012) report that there is a poor understanding of non-technical skills within paramedic practice. However, it is a component that has been identified as a factor in complaints, clinical errors and fatal accidents. Thomas (2018) adds that non-technical skills are pivotal for good practice in any workplace, emphasising that these are the skills that allow for the development of technical skills and knowledge.

Theme 2: The learning experience

The learning experience or experiential learning has been defined by Beard & Wilson (2010) as learning that not just occurs when a student reads or writes about a subject, but it develops when they are exposed to the realities of the material being

studied. Within healthcare, simulation-based education is considered an effective method of reinforcing learning, according to Riaz (2022), when combined with didactic sessions, reflections and placement experience.

The participants enjoyed that it was a practical experience. It helped them develop skills and achieve goals. They found it challenging, but it was still an effective way to learn, reflect and learn to work under pressure. This correlates with Beardon and Wilson (2013) who argue that experiential learning can bridge the theory to practice gap. An escape room can arguably reinforce the underlying knowledge, yet challenge students to apply it within a safe environment.

Morley (2020) highlights how an exceptional experience can build confidence which goes beyond technical competencies, to the extent that progress is noted by both the student and the lecturer. A large proportion of the participants expressed enthusiasm about the event, at the time and subsequently.

> 'All of it, brilliant learning tool' (Participant 18)
>
> 'The whole learning experience. Learning so much' (Participant 34)

Bates (2016) emphasises that it can be a challenge to create a positive learning experience that allows for creativity and growth. However, these results demonstrate that an escape room can be a positive experiential learning experience that goes beyond the activity, promoting reflection and engagement. This activity enables the students to develop revision plans and reinforces a constructivist approach (Gomez-(Urquiza et al., 2022).

Theme 3: The format.

The environment and the format that is created for this type of event is of great importance. As part of the escape room service users were asked to play the role of patients to allow the students to participate in, as real to life scenarios, as possible. Whilst the students all had their favourite room, the students specifically commented that they enjoyed the variety.

> 'I can't believe how realistic it was, I honestly thought she was having a stroke!'
>
> 'The first one, the stroke lady and autistic son. Very realistic and useful, allowed us to use our communication skills, history taking skills, observations and manual handling' (Participant 39)

When designing a successful escape room, immersion is critical and students must be drawn into the scenario (Douglas and Hargadon, 2021). Garwood (2020) agree that an escape room does not have to be complicated for it to be effective. A two-patient scenario is something that would normally be used within practical sessions. However, the addition of a time limit, with a password for the diagnosis, the activity becomes more engaging.

> 'Very realistic environment, service users were excellent and made the scenarios feel real. They interacted well and helped enhance the experience. I feel I learn better by doing so this was a great experience for me' (Participant 50)

ECG RESULTS

The same 5 ECG rhythm strips were presented to the students pre and post event. There was an increase in correct answers for 4 out of the 5 questions, with the percentage increase ranging from between 14.6% - 26.2% (Table 3). The fifth rhythm, atrial fibrillation, showed a 15.4% decrease in correct answers. In respect to the assessment of ECG knowledge, 90% indicated that the escape room had helped them to review their understanding of ECG's.

One aim of the research was to ascertain if an escape room was an effective way of assessing attainment. Unfortunately, this part of the questionnaire resulted in incomplete results, due to the way the questionnaire was constructed and is a limitation of the research. Bell (2016) highlights that if a participant is confused or frustrated, they may abandon finishing the questionnaire, which the author feels occurred with some of the ECG questions.

However, positives can be taken from the results as 4 out of the 5 rhythms assessed resulted in an increase in correct answers in the post event knowledge check. It also identified that the students were having difficulty differentiating between two rhythms. This resulted in a tutor lead revision session at the start of the following seminar, the same week, which was of benefit to, and appreciated by all students.

Conclusions and Recommendations

This action research study explored the way an educational escape room can increase student engagement and attainment for first year paramedic science students. Implementing an escape room was very well received by the students. They all found it a positive learning experience that they would recommend and have asked if they could have more similar events.

The results emphasise that this is a valuable tool for reinforcing the understanding of non-technical skills which are transferable and will aid the development of both technical skills and knowledge within the workplace. Additionally, it helped them to assess their understanding and identify areas for additional study. They enjoyed being out of their comfort zones and were able to test clinical abilities in a safe environment, which is pivotal to bridge the theory to practice gap. It is argued that by utilising this innovative learning experience, the students will be better prepared for the unpredictable experiences that face a newly qualified paramedic.

An escape room does not have to be complicated; it is flexible and adaptable and could be utilised in other modules within the paramedic science course.

This research clearly demonstrates that an educational escape room is a valuable learning experience where students gain vital knowledge, understanding, and enthusiasm for the subject. It is for this reason that the author believes that this should not just be considered for practical based courses. Moving forwards, these findings will be disseminated with the aim to establish links with different subject areas within the university, leading to further research around the use of educational escape rooms. Further data also needs to be collected before a definitive answer can be achieved, in respect of attainment.

Please choose a suitable image (all have provided their consent)

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Table 1 Pre event Questionnaire, questions 2-4 responses (N =55)

Question	Mean	Strongly (%) Agree	Agree (%)	Neutral (%)	Disagree (%)	Strongly (%) Disagree
How much are you looking forward to the escape room?	4.16	43.6	30.9	23.6	1.8	0
Do you think this will be a valuable learning experience?	4.29	50.9	32.7	12.7	1.8	1.8
How well would you say that you work under pressure?	3.73	10.9	52.7	34.5	1.8	0

Strongly Agree = 5 Agree = 4 Neutral = 3 Disagree = 2 Strongly disagree = 1

Table 2 Post event Questionnaire – questions 3- 7 responses (N =52)

Question	Agree (%)	Neutral (%)	Disagree (%)	Not Answered (%)
The escape room was an effective way to review my scene management.	94.2	5.8	0	0
The escape room was an effective way to review my teamwork skills.	100	0	0	0
The escape room was an effective way to review my communication skills	98	0	2	0
It was difficult for me to focus on learning because I was feeling stressed or overwhelmed.	9.6	17.3	73.1	0
The escape room was an effective way to review my knowledge of ECGs.	90.4	3.8	0	5.8

Table 3. ECG recognition results pre and post event

ECG Rhythm	Pre event number (%) (n=55)	Post event number (%) (n=52)	Difference (%)
Sinus Bradycardia	55.5	71.2	15.7
Bradycardia	36.4	19.2	16.6
Incorrect	9.1	3.8	5.3
Did not answer	0	5.8	5.8
Sinus Tachycardia	56.4	71.2	14.6
Tachycardia	20.0	25.0	5.0
Incorrect	23.6	0	-23.6
Did not answer	0	3.8	3.8
Atrial Fibrillation	72.7	67.3	-15.4
Incorrect	27.3	26.9	-0.4
Did not answer	0	5.8	5.8
Ventricular Tachycardia	67.3	88.5	21.8
Incorrect	27.3	7.7	- 19.6
Did not answer	0	3.8	3.8
Normal sinus Rhythm	52.7	78.9	26.2
Sinus Rhythm	20.0	13.5	-6.5
Incorrect	27.3	3.8	-23.5
Did not answer	0	3.8	3.8