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Design and preliminary evaluation of an educational escape room for teaching TRIZ

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ABSTRACT

CONTEXT
TRIZ (a transliteration of the “Theory of Inventive Problem Solving”) comprises of a toolkit of problem solving and creative thinking techniques originally designed by Genrich Altshuller. Currently, we teach TRIZ within a 3rd year Systems Engineering subject using traditional means (lectures and some problem solving tasks). Educational escape rooms are a recent pedagogical innovation which weaves learning into a series of themed puzzles which students attempt as teams. Educational escape rooms are an active learning approach and have been shown to improve student engagement and facilitate team-based problem solving.

PURPOSE OR GOAL
Although the Systems Engineering subject receives positive student feedback, we have been investigating ways to improve student engagement, as written feedback has commented that the activities “can be at times repetitive”. In the past we have applied educational escape rooms within more analytical subjects (e.g. digital logic, microcontrollers, programming) and wish to test their applicability into a problem solving subject which is more concept oriented. Hence, we wish to use these educational escape rooms to apply TRIZ to practical problem solving within a more engaging and team-based format.

APPROACH OR METHODOLOGY/METHODS
We designed a series of three TRIZ puzzles each having multiple parts. The respective puzzles focus on: 9-Boxes, the Contradiction Matrix and finally Inventive Principles. Pre-testing educational escape rooms before deployment is an important task and so we have endeavoured to Alpha test our escape room with four separate testers to provide feedback on puzzle suitability and to get feedback on suggested improvements. We evaluate results for our Alpha testers with post-activity feedback discussions.

ACTUAL OR ANTICIPATED OUTCOMES
The key outcome of this study is a validated tool which can be used in the classroom to strongly engage students whilst teaching TRIZ concepts. The feedback received from Alpha testers was that some puzzles were either too cryptic or still a little ambiguous and so revisions to these puzzles have been made to make them more straightforward for use in the classroom. A follow-up study will be published when testing is conducted with students in Semester 2 2022.

CONCLUSIONS/RECOMMENDATIONS/SUMMARY

Educational escape rooms are proving to be a powerful game-based learning pedagogy to engage students and encourage team-based problem solving. This is the first TRIZ based escape room and one of only a few less numerically analytical engineering escape rooms in the literature. The feedback from Alpha testing will help focus puzzles to ensure they are solvable, suitable and engaging before eventual deployment in the classroom.

KEYWORDS

Game Based Learning, Educational Escape Rooms, Gamification, TRIZ

Introduction

Recreational Escape Rooms (RER) are a relatively new concept, originating in Japan around 2007 before quickly becoming popular activities all around the world (Nicholson, 2015; Wiemker et al., 2015). Recreational escape rooms are immersive group activities, where a group of participants are 'locked' in a themed room or cluster of rooms for a set time interval. Participants work together to solve cryptic puzzles and typically unlock a series of locks to escape. Surveys of recreational escape rooms have demonstrated that they are frequented by both males and females in near equal proportions and are popular for date nights, corporate bonding, among families and friends as fun activities (Nicholson, 2015).

Educational Escape Rooms (EERs) are an even newer trend with early papers reporting use in the classroom appearing around 2017 (Eukel et al., 2017; Vörös & Sárközi, 2017). Breakout EDU (which uses combination locks and lock-boxes) started prototyping with escape rooms in 2015 (Nicholson, 2018). These EERs find their roots in recreational escape rooms, involving a time-limited, team-based puzzle solving activity, and expand this into the realms of Game Based Learning (GBL) to infuse educational content within the puzzles to encourage active learning. In contrast to recreational escape rooms, which are designed for fun, these educational escape rooms are designed as engaging, team based active learning experiences.

Both RERs and EERs have a unifying narrative which tie each of the puzzles together and move the puzzles from being just isolated questions which need to be solved into an interactive game. These narratives can be presented in different forms including written text, videos, or even virtual reality (David et al., 2019).

Escape rooms, both educational and recreational have over time blossomed into three distinct forms, each with different levels of user interactivity. Recreational escape rooms have devolved into three distinct forms: escape rooms in a physical room, table-top escape rooms and online escape rooms. Although the physical room escape rooms still prove to be the more popular recreational escape room modality, restrictions around COVID have encouraged the use of the table-top and virtual rooms which can be played at home. Table-top escape rooms typically come in a box and include all the puzzles, narratives and props required to 'escape the activity'. Examples of table-top escape rooms include the "Escape the Room", "Escape Room the game" and "Unlock" series.

In contrast to recreational escape rooms, most implementations are online or table-top rather than physical rooms due to the significant cost and scalability of getting classes of students through a single escape room in small teams. The table-top escape rooms require some form of puzzle solution validation (so the participants know if they have got the correct answer). Two common approaches have been using physical combination locks or an electronic decoder system (Nicholson, 2018; Ross, 2019).

In contrast to exams, which are also time-limited problem-solving tasks, educational escape rooms are generally open-book, team-based activities, which seek to foster active learning. Often these educational escape rooms don't contribute to formal grade assessments (or when they do would be considered low-stakes assessment). Hence, these escape rooms can be considered as formative knowledge checks rather than summative assessment (as the traditional exam or test would be).

One key aspect required for games in general, and which transfers over to educational escape rooms is the need for playtesting. Playtesting is important at multiple levels to ensure a coherent game and learning experience before it reaches the end users. Typically, this testing would first involve Alpha testers, who have domain knowledge experience and who can provide feedback on puzzle suitability, correctness, abstractness and if the puzzles are even solvable (Ross, 2021). One of the key problems faced by many escape room designers to make too many logical leaps and in doing so make puzzles that are far too difficult. These Alpha testers are often colleagues or other educators with a good level of understanding in the relevant domain. It is also good practice to do some Beta testing with small groups of students (e.g. students who graduated from a class the previous year). This Beta testing may further clarify if the escape room is pitched at the correct level of difficulty and if the puzzles encourage group interactivity.

EERs have been applied across a wide breath of fields including nursing, computer science, engineering and medicine (Adams et al., 2018; Guckian et al., 2020; Hacke, 2019; Ross, 2020). The EER literature has shown that appropriate use of these techniques can have a significant positive impact on student engagement, peer learning, and that most students prefer these approaches to more traditional problem-solving tasks (Guckian et al., 2020; López-Pernas et al., 2019). On the negative side a minority of students have been frustrated (due to group dynamics or insufficient time), but which may still yield a positive effect of driving them to study further on material they were unfamiliar with (Hermanns et al. 2017).

This paper further expands the field to teach students some of the key concepts within TRIZ. TRIZ is an English transliteration of the Russian acronym "Teoriya Resheniya Izobreatatelskikh Zadach", which is translated into English as the "Theory of Inventive Problem Solving" (Ilevbare et al., 2013). TRIZ was developed by Genrich Altshuller and colleagues after studying thousands of technical patents and has been adopted to help study problems and identify solutions by many companies around the world (Altshuller, 2002; Ilevbare et al., 2013). Hence, TRIZ forms a set of tools to guide the problem-solving process based on higher level conceptual solutions to conceptual problems (Gadd, 2011).

Currently some of these TRIZ concepts comprise two weeks (out of 12 weeks) in a Systems Engineering subject taught to 3rd year students at La Trobe University. Based on student feedback and lack of familiarity with TRIZ after the course it was determined that an activity was required to engage students and get them to practice applying TRIZ concepts.

This paper is organised as follows: First, we detail our escape room puzzles and the escape room format in our methodology section. Second, we present feedback and modifications based on our Alpha testing. Finally, we conclude in how we plan to use and evaluate these within the classroom environment.

Methodology

EERs are game based learning activities which comprise of puzzles, puzzle validation (e.g. locks or decoder boxes) and a theme or narrative which provides context to the game based approach. This section first describes the progressive narrative used to tie the activity together, followed by the format the escape room is administered in and finally the three puzzles corresponding to each stage within the escape room activity.

The narrative designed to accompany the puzzles was a written narrative which revolved around an unconventional job interview for the 'Phoenix Foundation' think-tank (borrowed from the MacGyver TV series). The concept was that students were participating in an assessment centre interview and had to demonstrate their problem solving and teamwork skills to show their suitability for the job.

Within the classroom environment students would be grouped into groups of 3-4 and sit together around a table to complete the activity. Each puzzle (1, 2 and 3) is printed out and stored in a separate sealed envelope which they need to each open and solve sequentially. An escape room decoder box is provided to each group which performs timekeeping, gives clues and validates student answers (Ross, 2019). Every 5 minutes the decoder box provides the participants with a clue (in the form of the next number sequence in the puzzle being revealed). In contrast to the student teams, the Alpha testers each attempted the activity alone – as we were more interested in puzzle suitability rather than aspects related to team dynamics and cooperation.

Four Alpha testers were used to provide feedback on the puzzles and suitability for the classroom. The first Alpha tester was an engineering senior lecturer who had been exposed to TRIZ, but it was over a decade ago. The second Alpha tester was a former computer science senior lecturer (now a senior software developer) who had worked with TRIZ but it was over a decade ago. The third Alpha tester was a retired professor and a certified TRIZ Master. The final Alpha tester had significant experience in designing and participating in escape rooms but had no experience in TRIZ. Testers 1, 2 and 4 were provided with some pertinent lecture videos and a brief explanation of key TRIZ techniques before doing the TRIZ escape room to acquaint themselves with the sort of principles in the activity. Testers 1 and 4 were the only participants with previous EER experience. Excerpts of each puzzle is provided for brevity.

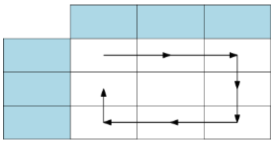
Puzzle 1 (9 Boxes)

The first puzzle is based around the TRIZ nine-boxes tool (also called nine-windows or nine screens principle). Nine-boxes can be used in either the problem space or the solution space to consider the broader aspects of a problem in time (past, present and future) and scale (super-system, system and sub-system). The standard representation is to use a 3x3 matrix with the present time and system scale in the middle as shown in Figure 1.

The narrative for this section is as follows:

"This first puzzle contains some sort of a grid of 9 boxes with a bunch of empty boxes (along with a whole lot of little bits of paper). Maybe if you can put them in the correct position you will be able to unlock this first puzzle."

	Past (before the bird has pooped)	**Present (during pooping)**	**Future (after poop is on car)**
Super System: Street			
System: Car		*Problem:* Our boss comes in with bird poop over his car every day. There are powerlines over where he parks and the birds sit there and poop away. This damages his paintwork	
Sub-system: (glass, paint)			



• Park undercover • Powerlines could go underground • Build carport • Eliminate Birds 2	• Put a cover on car to prevent poop 8	• Self-cleaning or repelling coating on paint and glass could deflect poop 1	• Collect bird poop and reuse as fertiliser in the garden 3

Figure 1: Puzzle 1 – A 9-Box Matrix along with four items to be positioned

To solve this puzzle, participants need to place each of the cut-out numbered solutions in the correct matrix squares and then read them clockwise in the provided order (only half of these solutions have been provided in this example). This will generate a number which can be entered into the decoder box. For the readers clarity the solutions should be placed in the following matrix segments:

- 2 – Super System - Past
- 8 – System - Past
- 1 – Sub System – Present
- 3 – Super System – Future

Puzzle 2 (Contradictions Table)

The second puzzle is based around understanding the basic use of the TRIZ contradictions table. The contradictions table (Figure 2) comprises of 39 technical parameters mapped along the horizontal and vertical axes. This table helps an engineer determine which TRIZ inventive principles may be used to improve one of the parameters along the vertical axis without degrading one of the parameters on the horizontal axis.

For example, to improve the weight of a moving object (1) without degrading the speed (9) the intersection between these two should be a cue for engineers to investigate principles: 2 (Taking out), 8 (Anti-weight), 15 (Dynamics) and 38 (Accelerate Oxidation). This mapping helps identify all the known ways of improving technical parameters without degrading another technical parameter.

Improve this one without making this one worse

39 Technical Parameters

Contradictions

		Weight of moving object	Weight of Stationary Object	Length of moving object	Length of Stationary object	Area of moving object	Area of stationary object	Volume of moving object	Volume of stationary object	Speed	Force (intensity)	Stress or pressure	Shape	Stability of the object's composition	Strength	Duration of action of a moving object	Duration of action of a stationary object	Temperature	Illumination Intensity	Use of energy by a moving object	Use of energy by a stationary object	Power	Loss of energy	Loss of substance	Loss of information
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	Weight of moving object		-	15 8 29 34	-	29 17 38 34	-	29 2 40 28	-	2 8 15 38	8 10 18 37	10 36 37 40	10 14 35 40	1 35 19 39	28 27 18 40	5 34 31 35	-	6 29 4 38	19 1 32	35 12 34 31	-	12 36 18 31	6 2 34 19	5 35 3 31	10 24 35
2	Weight of stationary object	-		-	10 1 29 35	-	35 30 13 2	-	5 35 14 2	-	8 10 19 35	13 29 10 18	13 10 29 14	26 39 1 40	28 2 10 27	-	2 27 19 6	28 19 32 22	19 32 35	-	18 19 28 1	15 19 18	18 19 28 15	5 8 13 30	10 15 35
3	Length of moving object	8 15 29 34	-		-	15 17 4	-	7 17 4 35	-	13 4 8	17 10 4	1 8 35	1 8 10 29	1 8 15 34	8 35 29 34	19	-	10 15 19	32	8 35 24	-	1 35	7 2 35 39	4 29 23 10	1 24
4	Length of stationary object		35 28 40 29	-		-	17 7 10 40	-	35 8 2 14	-	28 10	1 14 35	13 14 15 7	39 37 35	15 14 28 26	-	1 40 35	3 35 39 18	3 25	-		12 8	6 28	10 28 24 35	24 26
5	Area of moving object	2 17 29 4	-	14 15 18 4	-		-	7 14 17 4		29 30 4 34	19 30 35 2	10 15 36 28	5 34 29 4	11 2 13 39	3 15 40 14	6 3	-	2 15 16	15 32 19 13	19 32	-	19 10 32 18	15 17 30 26	10 35 2 39	30 26
6	Area of stationary object	-	30 2 14 18	-	26 7 9 39	-		-		-	1 18 35 36	10 15 36 37		2 38	40	-	2 10 19 30	35 39 38		-		17 32	17 7 30	10 14 18 39	30 16
7	Volume of moving object	2 26 29 40	-	1 7 4 35	-	1 7 4 17	-		-	29 4 38 34	15 35 36 37	6 35 36 37	1 15 29 4	28 10 1 39	9 14 15 7	6 35 4	-	34 39 10 18	2 13 10	35	-	35 6 13 18	7 15 13 16	36 39 34 10	2 22
8	Volume of stationary object	-	35 10 19 14	19 14	35 8 2 14	-		-		-	2 18 37	24 35	7 2 35	34 28 35 40	9 14 17 15	-	35 34 38	35 6 4		-		30 6		10 39 35 34	
9	Speed	8 28 13 38	-	13 14 8	-	29 30 34	-	7 29 34	-		13 28 15 19	6 18 38 40	35 15 18 34	28 33 1 18	8 3 26 14	3 19 35 5	-	28 30 36 2	10 13 19	8 15 35 38	-	19 35 38 2	14 20 19 35	10 13 28 38	13 26
10	Force (Intensity)	8 1 37 18	18 13 1 28	17 19 9 36	28 10	19 10 15	1 18 36 37	15 9 12 37	2 36 18 37	13 28 15 12		18 21 11	10 35 40 34	35 10 21	35 10 14 27	19 2		35 10 21	-	19 17 10	1 16 36 37	19 35 18 37	14 15	8 35 40 5	
11	Stress or pressure	10 36 37 40	13 29 10 18	35 10 36	35 1 14 16	10 15 36 28	10 15 36 37	6 35 10	35 24	6 35 36	36 35 21		35 4 15 10	35 33 2 40	9 18 3 40	19 3 27		35 39 19 2	-	14 24 10 37		10 35 14	2 36 25	10 35 3 37	
12	Shape	8 10 29 40	15 10 26 3	29 34 5 4	13 14 10 7	5 34 4 10		14 4 15 22	7 2 35	35 15 34 18	35 10 37 40	34 15 10 14		33 1 18 4	30 14 10 40	14 26 9 25		22 14 19 32	13 15 32	2 6 34 14		4 6 2	14	35 29 3 5	
13	Stability of the object's composition	21 35 2 39	26 39 1 40	13 15 1 28	37	2 11 13	39	28 10 19 39	34 28 35 40	33 15 28 18	10 35 21 16	2 35 40	22 1 18 4		17 9 15	13 27 10 35	39 3 35 23	35 1 32	32 3 27 15	13 19	27 4 29 18	32 35 27 31	14 2 39 6	2 14 30 40	
14	Strength	1 8 40 15	40 26 27 1	1 15 8 35	15 14 28 26	3 34 40 29	9 40 28	10 15 14 7	9 14 17 15	8 13 26 14	10 18 3 14	10 3 18 40	10 30 35 40	13 17 35		27 3 26		30 10 40	35 19	19 35 10	35	10 26 35 28	35	35 28 31 40	

40 Inventive Principles

1	Segmentation
2	Taking Out
3	Local Quality
4	Asymmetry
5	Merging
6	Universality
7	Nested Doll
8	Anti-Weight
9	Prior Counteraction
10	Prior Action
11	Cushion in Advance
12	Equipotentiality
13	The Other Way Round
14	Spheroidality - Curvature
15	Dynamics

Figure 2: Subsection of Oxford TRIZ Contradictions and Inventive Principles Tables (Gadd, 2011)

A gripping tool has been modified so that it is shorter. Unfortunately, now the force that it can exert has decreased. (1st Principle)	1
A hedge trimmer has been upgraded so now it is significantly stronger, but now it is significantly heavier (3rd Inventive Principle)	2

Figure 3: Puzzle 2 samples involving a scenario which need to be solved using the TRIZ contradictions table.

The narrative for this puzzle was as follows:

“Your team congratulate each other on unlocking the first puzzle involving looking at potential solutions across the 9 boxes. Next you are presented with a series of problem statements where one physical characteristic is improved while another is degraded. Possibly you can discover some inventive ways to improve these problems. A TRIZ contradiction matrix has been provided to aide in finding solutions.”

The first scenario (in Figure 3) involves length of a moving object (3) and force (10) which results in possible solutions of: 17, 10 and 4. The question indicates the 1^{st} principle should be selected so the answer is 17.

The second scenario (in Figure 3) involves increasing strength (14) and not increasing weight of a moving object (1) which yields possible solutions of: 1, 8, 40, 15. The question indicates the 3^{rd} inventive principle should be selected so the solution is 40.

Puzzle 3 (Inventive Principles)

The final puzzle involves identifying which of the 40 TRIZ inventive principles (the first 15 are shown in Figure 2) is present in a design. This puzzle is pictorial – showing an engineered device which many students will be at least familiar with. Two examples are shown in Figure 4.

	
4 (Telescoping Ladder)	2 (Strip Door Curtain)

Figure 4: Puzzle 3 samples which involve identifying a relevant TRIZ inventive principle for a design.

The narrative for this puzzle was as follows:

“Having successfully identified possible solutions using the TRIZ matrix you tear open the last puzzle and see a whole series of pictures. One of your team-mates suggests that these might each relate to a TRIZ inventive principle – but can you work them all out in time to progress to the next stage of the interview?”

The first example involves a telescoping ladder which can extend or retract by each segment fitting into other segments. The TRIZ inventive principle which this maps to is the nested doll (Inventive Principle 7) which takes inspiration from a Russian Matryoshka doll).

The second example involves a door designed to form a barrier to flies and to some degree thermal changes which can be passed through easily without requiring opening. The TRIZ principle here is segmentation (Inventive Principle 1) where the door is broken up into small segments.

Results and Evaluation of Alpha Testing

In this section we present the feedback and results from each of the Alpha testers separately for each of the puzzles. As a result of tester feedback, we made changes between each of the tests to clarify the puzzles.

Puzzle 1 (9 Boxes)

Tester	*Feedback*
1	*Half of the boxes could easily be classified in more than one box. Could not complete puzzle. Solutions identified as ambiguous were re-written to improve clarity.*
2	*Was unsure about three boxes and was able to solve with a few hints – particularly around past/present/future timelines. Further re-wrote solutions to reduce possibility of confusion.*
3	*Was not able to solve puzzle as normally uses 9-boxes as a form of predicting what comes next in mapping the problem space rather than mapping a potential solution space. In discussions it seems there are some differences between classical TRIZ approaches and the Oxford TRIZ approach that the authors have followed in teaching.*
4	*Was only unsure about two of the tiles but was able to reason to a solution with no incorrect guesses. They took approximately five minutes to complete puzzle with no hints or clues. Hence, with the improvements we can reasonably expect teams of students to be able to solve this puzzle.*

Puzzle 2 (Contradictions Table):

Tester	*Feedback*
1	*Too cryptic, needed to show tester how to solve the first part of the puzzle – then they were able to do it. Some of the scenarios were a little vague and could arguably be classified under two different technical parameters – these were re-written. The TRIZ contradictions matrix was too small to see – needs to be A3 rather than A4 size.*
2	*Agreed A3 matrix was required. Unsure about how to start but once hints were provided was able to solve all puzzles easily.*
3	*Puzzle was very confusing – didn't know what needed to be entered or how this should be attempted. This participant didn't have the benefit of a supervisor in the room to provide hints. As a result of this feedback the narrative has been changed to give more specific directions and the directions within each solution has been changed from "(1st Principle)" to "(Select 1st Principle)" to make it more explicit that participants need to select a specific number from an ordered list. Further the puzzles were changed from a past tense to a present tense to highlight that TRIZ should be used within the design process rather than trying to fix up a design change that has failed.*
4	*Took an approach of quickly circling key words within descriptions and then looking for them in the TRIZ contradictions table. Solved puzzle in 10 minutes with no incorrect guesses or questions. Suggested for a group environment multiple contradictions tables would be helpful to allow different group members to work on different parts of puzzle. Felt the terminology "Select 1st Principle" was slightly ambiguous but still relatively easy to work out. Suggested including a small graphic (which will be added) which shows*

participants the ordering (i.e. what 1^{st}, 2^{nd}, 3^{rd} corresponds to as not all readers read from left to right).

Puzzle 3 (Inventive Principles)

Tester	*Feedback*
1	*Some examples were clearer than others. One example involved a hit-and-miss fence which was unfamiliar and too cryptic. This example was replaced with the segmentation example. Suggested re-ordering puzzles so the hardest ones were first where automated clues were able to help them be solved.*
2	*Two of the puzzles were harder to classify, specifically a multitool which was classified by the participant as merging (rather than universality) and the ladder which was unknown (the TRIZ nested doll terminology was confusing). The nested doll principle is specifically discussed in the lecture material so for most participants this should be more obvious.*
3	*Felt puzzle was too confusing and there wasn't enough information to know how to proceed. The narrative has been adjusted further to provide more hints in how to solve the problems.*
4	*Completed puzzle in 11 minutes with three incorrect guesses. Felt this puzzle was tricker than the previous two and had specific trouble with two pictures – a Strip Door Curtain (segmentation) and a multi-tool (universality). These puzzles were the first two puzzles presented and as the decoder box automatically provides clues every 5 minutes were the first to be revealed.*

Overall/General Feedback

Tester	*Feedback*
1	*Start with 1 puzzle and follow all the way through – this might give a more genuine feel of application – rather than a whole series of examples that don't connect.*
2	*Really enjoyed the activity and started seeing lots of different applications for educational escape rooms in other fields. Suggested this would be a great way to engage students with TRIZ.*
3	*Felt it was smart to use technology like this to engage students but the tasks were too confusing. Suggested that the chosen areas of TRIZ (9 boxes, contradictions table, inventive principles) are too difficult for undergraduate students to successfully learn, apply and master as they don't have the background experience to apply these tools properly as described in (Belski, 2015). Suggested that for undergraduate students simpler TRIZ concepts to generate many potential ideas like the STC (Size, Time, Cost) and IUR (Ideal Ultimate Result) tools would be more useful. These tools are taught in the course but were considered a little more difficult to integrate into an escape room format. Although being able to solve the escape room wouldn't teach students to become proficient TRIZ users – it does help them practice some of the fundamental steps for some TRIZ heuristics.*
4	*Felt that the activity was quite achievable and made some small suggestions in improving the narrative for readability and flow.*

The Alpha testers have helped shape the puzzles into a solvable form and have provided overall positive feedback to this approach to teaching. As the alpha testers were not students who have been participating in the class, it will be instructive to analyse the progress of the students compared to the progress of the Alpha testers after this is deployed in the classroom.

Specifically, the Alpha tester feedback has shown some of the dangers in having some elements of the puzzles a little too cryptic (or relying on assumed patterns like picking the correct number in the box from puzzle 2). Having uncovered some of these assumptions we can easily tweak puzzles to make ordering more explicit (e.g. using arrows to show direction). This escape room is different to many other STEM escape rooms (which are more computation based) in that it relies more heavily on comparative reasoning and evaluating the degree to which different options should be classified in different ways. In this way some of the questions may be slightly more frustrating (more akin to a multiple-choice question worded as “which of the following statements is most true”). The Alpha testing has uncovered some of this potential ambiguity (particularly in puzzles 1 and 3). The changes we have made focussed on minimising the number of different potentially ‘correct’ options that students need to choose between.

Conclusion

This paper describes the implementation and alpha testing of the innovative educational escape room pedagogy for teaching TRIZ. Escape room development is often an iterative process which involves testing and tweaking puzzles to that they are not too cryptic and are fit for purpose in terms of delivering teaching outcomes. As with many escape room implementations the initial puzzles were too hard and too cryptic but have been modified to be more achievable and suitable for the classroom environment.

Four alpha testers each individually completed the escape room which allowed us to make changes and improve the clarity and experience of the escape room for each successive tester. Feedback from the alpha testers has been incorporated into new puzzles which is planned to be tested in the classroom with students in Semester 2, 2022.

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