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Escape  Stay

Escape to Stay - make VET your first choice

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Intellectual Output 1

Preparation for White Paper

"What makes vocational training attractive?" -
Improving the image of VET with effective
educational Escape rooms

National report ŠCNG

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Developed by Uroš Polanc – School centre Nova Gorica

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Information on the focus group

Participant	Gender	Background	Org. type
Ajda	F	Head of People Operations	Digital studio for IT solutions
Elvis	M	CEO, offering internship to students	creating solutions in the field of particle accelerators, IoT, smart cities and MedTech
Adrijana	F	VET ambassador	VET provider
Alen	M	Experienced game developer	Learner
Rok	M	Mentor to VET students in an internship program	Development of sensors for smart homes
Ana	F	Career counsellor	VET provider
Tina	F	The organizer of the talent hub (summer camp focused on discovering personal talents and developing them)	Business solutions
Tomaž	M	VET teacher	VET provider
Marko	M	Escape room expert/developer	Gamification

The labour market needs in Slovenia

The research has shown that the most needed profession right now but also in the near future are technical professions like programming engineer, physics and mathematics expert, mechanical engineer, electrical engineer, etc. Professions needed today and in the future are all related and have to develop according to industry and its rapid development. All mentioned professions are wanted with a university degree or higher because companies require a more and more educated workforce to complete more and more complex tasks and innovate on a higher level. We have found out that also jobs of future will require workers with different and more vast knowledge, this means in the future and already in some cases now it is not enough that you have a university degree in electronics, but you are also expected to know your way around programming and much more. This is because today's and future technology is evolving in a way that more and more products consist or require a vast variety of skills to develop or manufacture. This problem is partially solved by having a team of experts, but we have seen that companies are actively looking for workers with vast knowledge rather than workers with very specific skills. We found out that in Slovenia more and more companies need higher educated and more skilled workers. From this, we can conclude that the demand for different types of workers will increase over years. To adapt to these changes/new trends, the escape rooms,



we are going to develop, will include different challenges connected to different specialities which are required from the labour force. The variety of challenges that we will provide in the escape rooms will help our visitors to more easily decide on a field of study and in this way realize their interests, potentials and goals sooner.

Escape rooms in Slovenia

In Slovenia, escape rooms are mostly created with the goal of entertaining customers and providing them with a great experience as well as boosting teamwork, communications skills, problem-solving abilities, thinking outside the box and creative thinking. With this said we can conclude that there is still a lot of room to create and promote escape rooms that have also an educational and informational purpose for the VET sector. We have come across some reports of escape rooms used in school, mostly in primary education. The purpose of these rooms was to make the learning of just one subject more fun, e.g. math, or the room was organised like a field day where pupils had a chance to participate and experience something new. Escape rooms were also organised for medical professionals with the goal of team building, but we weren't able to find more detailed information. We have found research papers where it is proposed to use escape rooms for promotional and educational purposes.

Soba pobega kot učenje računalništva (Escape room for learning computer science) – research paper (<https://mladiraziskovalci.scv.si/ogled?id=1741>)

The School centre Velenje published a research paper where students created an escape room with the intent to promote their IT school program as well as teach IT science. Students prepared an escape room with different challenges related to their school program. From the research paper findings, we can summarise that the escape room was an effective method of informing and educating visitors. In the paper, they report that the students who visited the escape room were also more effective afterwards in regular lecture. In the paper, they state that they could not interest a lot of students to try the escape room after classes, on the other hand, there was a lot of interest in trying it during classes.

Zabavna matematika v "sobi pobega" (Fun math in the "escape room") -magistrate work (http://pefprints.pef.uni-lj.si/5813/1/magistrska_naloga_-_zabavna_matematika_v_sobi_pobega.pdf)

This paper was published by the University of Ljubljana Faculty of Education as a magistrate work. In this research paper, the researcher prepared an escape room for pupils of primary education level. The theme and challenges were all related to what pupils learn in the math classes. The researcher presented mathematical challenges with a fun twist and prepared a sequence of challenges that had to be solved one after another, she achieved this with each challenge rewarding you with a clue to the next one. Pupils, the researcher was working with, were balanced between genders assuring that the results were not to one side. She also presented it is important to offer pupils different types of challenges because how different pupils solve challenges varies. From the findings of the researcher, we can see that all the pupils enjoyed this type of experience and all seen values in teamwork and collaboration. This example once more proves the effectiveness and strengths of escape rooms used in a VET environment for promotional and educational purposes.



Conclusion

From all the examples of escape rooms used in Slovenia, we found that the vast majority of escape rooms are still mostly used for entertainment, this is of course great, but we can enhance this experience and incorporate educational elements. From all examples of escape rooms, we can find very positive user reviews and also see that users recognised not only the fun element but also teamworking, out of the box thinking and creative problem-solving. This means that escape rooms in general are already a great concept that can be very effectively and positively used with different goals.

Escape rooms outside Slovenia

From articles and researches, we found online mostly from the USA. We can find that educational escape rooms are way more widely popular and can be found in different institutions with any number of goals.

What makes VET attractive?

The greatest strength that VET can give any student from any sector is the ability to make something of his own like software, piece of furniture, robot and so on. Also, within the focus group, we have recognised this as the primary strength, as VET can offer and also what a lot of students look forward to, the ability to make something with your hands. This can be easily applied to any type of VET. Within the focus group, it was suggested that all the challenges and props should be made by different VET students as an additional way of learning, promotion and example of what you can learn on different VET programs. As an attractive property of VET is also a high demand for the labour force in sectors like computer science and mechatronics. This means after finishing your base education you are more likely to find a good job in the field you are interested in. For some, it is also an advantage that VET schools, do not require as much “paperwork” like seminar assignments and technical reports but instead offer more practical, challenge-based work and hands-on approach.

Focus group findings on escape rooms

Important elements of an escape room

Here we will describe a few of the key elements every escape room should include based on the opinion of our focus group.

- **Teamwork.** Every escape room should be designed with a focus to encourage teamwork. So the players have a chance to talk and collaborate between them. An escape room must be made so that there is always something to do for each player or that players have to work together to finish one task.
- **Clear goal.** A clear goal has to be defined for every escape room; this goal has to be clear to the players so there is no confusion of what they have to do to complete the escape room. Like, find a key or combination to leave the room, or to obtain a certain object.
- **Story.** No escape room is complete without a good story. Stories give the room and challenges meaning and enables players to better connect and immerse with the whole experience. The story also makes everything more memorable and can help with the creation of the whole room.

- **Theme.** Of course, the whole room must have a common theme that is also connected to the story. This means that it is not enough to just have a room, place in a few locked boxes and puzzles and you have an escape room. We must ensure that we equip the room with the necessary scenery, so we reinforce the theme we want and the story we are telling. This means if our story is happening in a WW2 underground bunker, we should equip the room with some gadgets and equipment from that time, like weapons, maps, water canteens, etc.
- **Challenges.** Every escape room has challenges that players have to solve to achieve the final goal. Challenges usually are finding a hidden object, solve a shorter puzzle, recognition of continuing pattern, codes, room orientation, a combination of objects with similar properties. All the challenges are usually simple and require only a bit of creativity and thinking outside of the box to solve. So, anyone can come and solve the room without special knowledge or education. Sometimes some escape rooms include challenges that require specific knowledge, in this case, the knowledge is provided somewhere in the room itself, or that challenges have more ways that can be solved.
- **Limited time.** Usually escape rooms also include a time limit in which players must complete the escape room. There are also rooms without a time limit.
- **A lot of fun.**

Time

The duration of escape rooms varies from room to room. Mini escape rooms can last from 10-15min, there are also rooms that can last for an hour or more. In our case, we would suggest having it last around half an hour, plus extra ten minutes for introduction and rule explanation and afterwards feedback and experience gathering. If the room time is too short, then it is hard to do a nice presentation of all the themes we want to include. On the other hand, if the room is too long, then it limits us how many learners can visit it in one day, for example when schools have their open days.

Player number

Escape rooms usually have from 3 – 8 participants/players. This is because you need at least a few people for a team. If the group is too large there is trouble with the whole group participating and working together and also the room must be much bigger and have more challenges. We recognise it would be easier and more convenient for schools to allow a whole class at once to play (around 20 learners) in the room since this is how extra activities are usually offered to learners. We think it is best to keep the player number between 3-5 because this is a good-sized group, and it is very manageable. It is important to define the player number at the start, so we can prepare the challenges accordingly.

Difficulty

As explained before the difficulty of an escape room cannot be too high and players should not require any extra knowledge to finish the challenges in time. We must prepare our challenges in a way that we keep in mind who will mostly play in our escape room, so everything is designed for them. We must consider what are their interests, what knowledge they have and how they think and solve problems.

Game master

An important part we must think about is a game master or for short GM. This is someone responsible for the game, who knows it inside out and will always be present when a team is solving the room. His job is to oversee the game, make sure everything is going smoothly and can give hints to players if necessary. GM can be included as an outside party, usually done in a way that he is out of the room and observes the team through cameras and talks to them, e.g. with a walkie-talkie. In this way, he is not part of the room but just oversees the process and in case of trouble, he can intervene. Another possibility is having a GM who is part of the escape room. He is presented as a character in the story and has some sort of background and connection to what is happening. He still knows how the game works, can give tips and helps in case of problems. Both choices have their strengths and weaknesses. In our case, we decide to go for a mobile room. In this case, it will be easier to choose the second option where GM is part of the story and can be inside of the room. Because of this, we do not need to set up cameras every time and don't need a separate room to monitor the game from. Everything is done in person and is part of the story.

Story

We agreed that for a good escape room we need a good story that will lead students through the room and the challenges presented in it. A good story and a good environment allow students to get fully immersed and have a better experience. We have to consider the environment our escape room will be set up in. Firstly we have to consider the primary location and also where it can be placed in case of mobile rooms. For this, we think it is a good idea to take a generic classroom as a base for our escape room. We should design our stories and challenges so they can fit physically and thematically in classrooms anywhere. For example, if we try to make a story around a space station that is damaged, and students would have to fix the station through challenges to save everyone, it would be very challenging to make this experience very immersive. We would need a lot of props and environment changes to turn a classroom into a space station. This example is expensive, time-consuming and hard to realize. In our case, it is better either to focus on a story that involves a school or a classroom or on a task or an end goal of an escape room. A good example of the final task is to defuse a bomb that will destroy the world. Students must solve a series of challenges to save the whole world. In this case, it is not such a problem where exactly they defuse this bomb, there is more focus on tasks.

Story ideas

Within the focus group, we got a few suggestions for escape room stories.

Story example:

69 years ago, there was an evil scientist who created a doomsday device capable of ending life as we know it. For decades top scientists around the world tried to stop it but with no success. All they figured out is that the youngest most brilliant minds could solve it and save the world. Therefore, agents of top-secret society tasked with protecting humanity have brought the device and fragments from the old evil scientist lab to your school to try to stop the device and save humanity. Are you and your team up to the challenge to save humanity?

Variation one:



One of the most brilliant scientists in the world has been kidnapped by an evil organization that forced him to create a horrible device that can end life as we know it. But luckily the scientist left behind his journal and clues on how to disable this device. Are you and your team up to the challenge, do you think you can decipher his journal and find all the clues to disable the horrible device?

Variation two:

A few months ago, scientists discovered a strange device buried deep in the arctic ice. They have traced its origin to be out of our galaxy. They tried for months to figure out what it is or what it is supposed to do, but with no success. Can you and your team figure out the great mystery of this strange device?

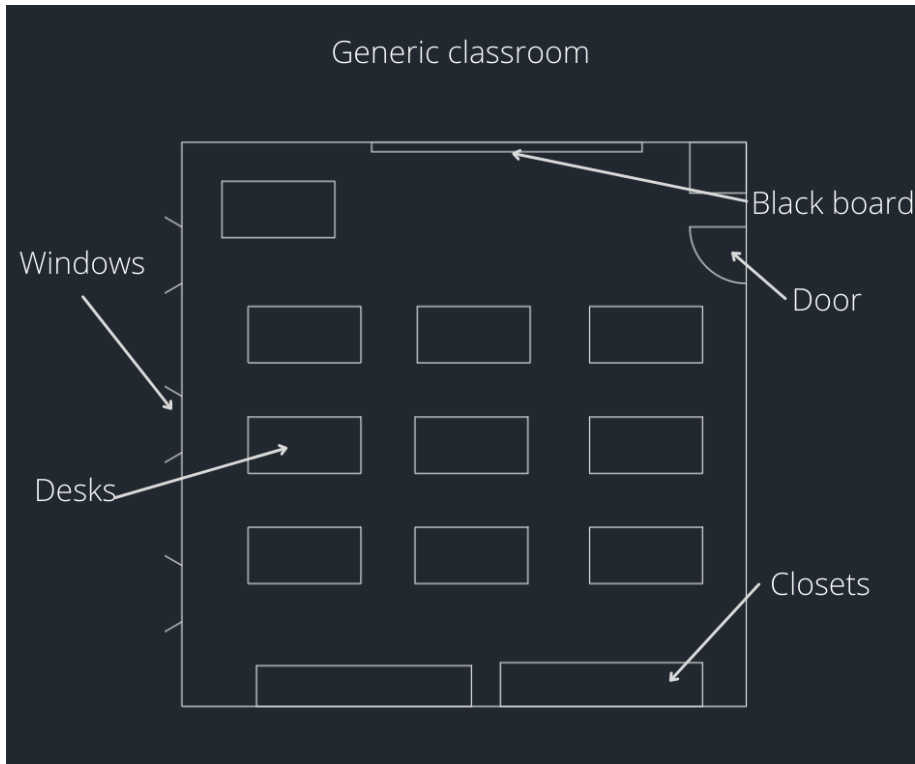
GM suggestion:

For suggested stories, we can include GM as a lab assistant, someone who was with the scientists helping them doing trivial tasks. So, he/she has some kind of idea of what is happening, but he/she was never allowed in on secrets and therefore does not have the knowledge to solve the problems by him/herself but can only give tips and context to players.

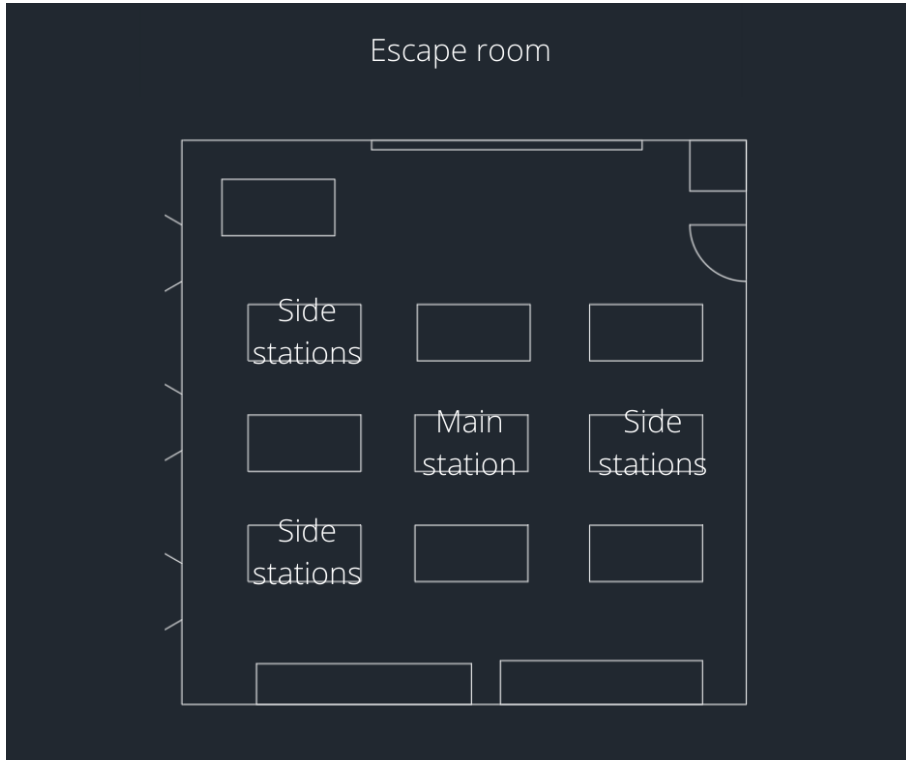
Mobile escape room environment suggestion:

Since we plan to make a mobile escape room and the most likely place it will be set up is a classroom, we must plan accordingly. We propose that we use as many elements in a generic classroom as possible. A suggestion is shown below:





Picture 1: Generic classroom



Picture 2: Escape room placement



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Room ambient:

To enhance the ambient in the proposed room placement, we were thinking to work with lights. The whole classroom should be darkened (be without lights and windows should be covered). The only light will be a portable standing lamp in the middle that is open and illuminates the main puzzle (we could also have more lamps, for each station one that players will have to turn on themselves). Players will then have to move the light around from station to station to highlight each station separately. If we have more lights, they can highlight only the stations as part of the escape room. Darkness will also enhance the emersions and focus of players. This is also good for the UV light puzzle.

Challenge ideas**Broken drawer puzzle**

A flush drawer that can only be opened when you screw on a handle, that you have to find alongside a screwdriver.

Materials:

- Wooden drawer set with a tight fit so they cannot be opened without handle
- Loose handle with screws
- Screwdriver

Input:

- Find or unlock handle, screws and screwdriver

Output:

- Anything

Puzzle laser shapes

For this puzzle, we need 4 objects of different shapes, with a laser or pointer mounted on them (the number of objects can vary depending on the length of the result we want). In our environment we will place different outlines of objects, 4 of these will match the shape of our shapes. The objects can be hidden in the room or locked behind other puzzles. Once participants find the pieces, they must place them on matching outlines and the laser will point to different numbers on walls or ceiling or other objects. Our objects can be numbered or the order in what they must be discovered can determine the sequence of the answer. With this, we must find 4 pieces then arrange them properly and out of this, we can get another code answer or something similar.

Whit suggested story these shapes can be made into robots that the scientist made to help him work. But now they are all broken down and serve no purpose, of course for the puzzle but players do not know this.

Materials:

- Shapes wood/metal/plastic



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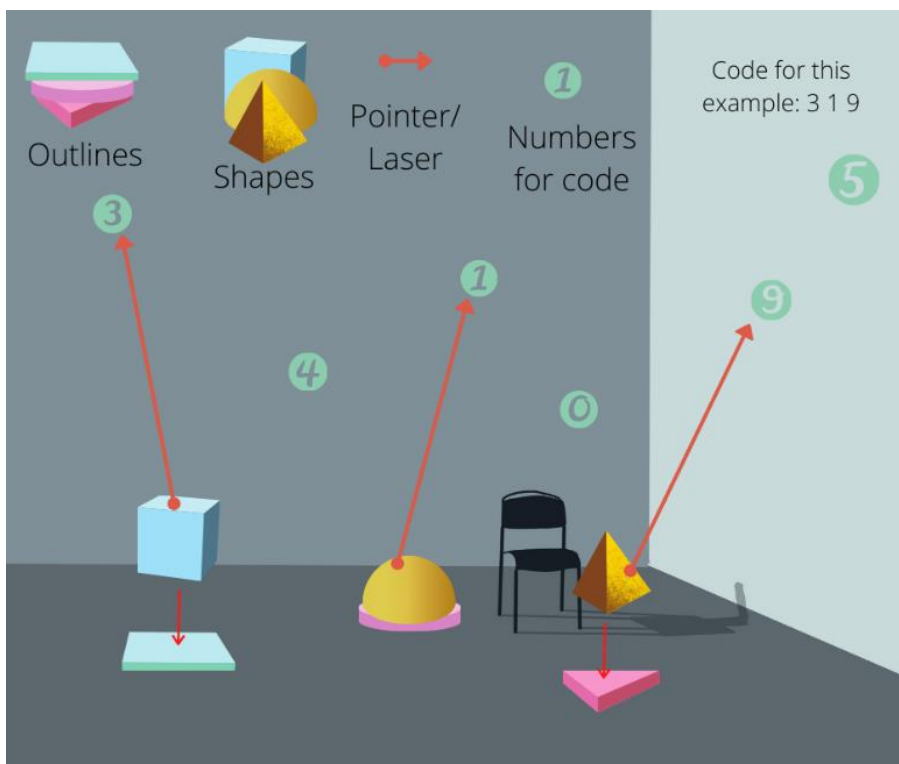
- Lasers
- Stickers with object outlines
- Stickers with numbers

Input:

- Find shapes
- Unlock shapes with keys or codes

Output:

- Code



Picture 3: Puzzle laser shapes

Puzzle matching points

In this puzzle, we would need a wall projector and a laptop. On a wall, we will place an incomplete picture of dots that has no meaning. Participants will have to open a laptop and projector (we could hide some power or connection cables). And on the laptop, they will have to find the other part of the picture. By projecting the second picture to the wall, two pictures will merge and reveal a code that can be used in other puzzles.

This puzzle can be presented on a laptop of the scientist and locked behind some password. It would also be great if we can make a look-alike hacking interface so the computer can only be operated in

command prompt with a black background and green letters. Players must type then down some commands to operate the laptop.

Materials:

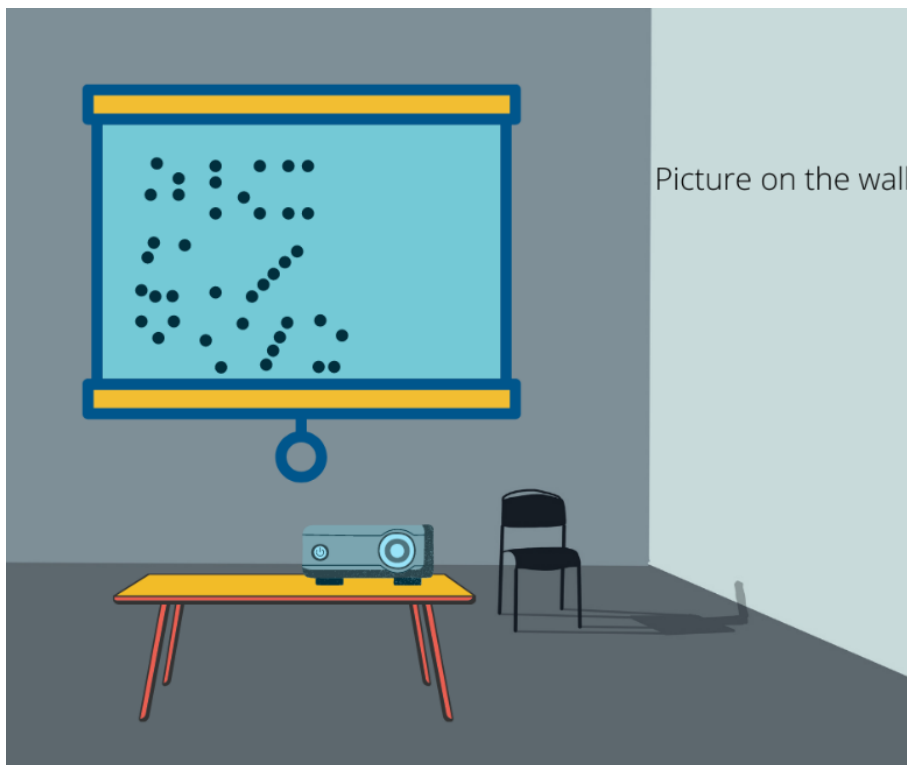
- Paper with dots
- Laptop with 2nd picture
- HDMI cable
- Picture projector

Input:

- Code to access laptop
- Cable to connect a laptop to a projector

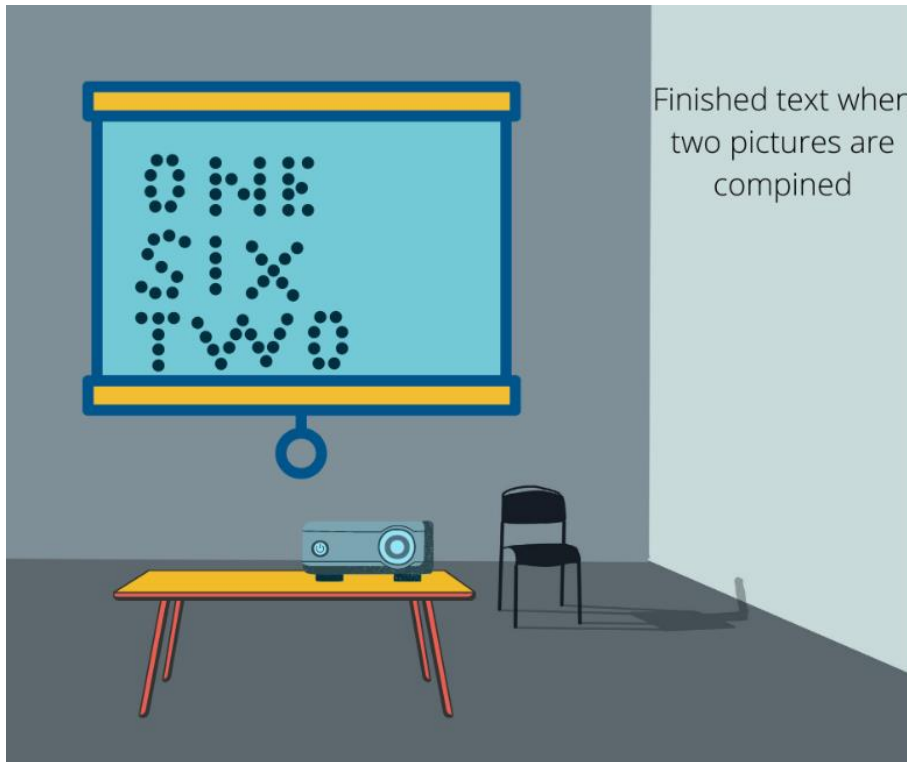
Output:

- Code



Picture 4: Puzzle matching points 1st picture





Picture 5: Puzzle matching points final picture

Puzzle cable connection

For this puzzle, we will need a closed box with 8 connection sockets. Inside the box will be some electronics that will detect when two right holes are connected. With this puzzle, participants will have to connect the right two connection sockets with a cable. When they connect all four, a light will open to indicate the right solution. Participants will get hints from other puzzles on what two holes must be connected. We can add additional connection sockets so players can't guess the right combination.

Materials:

- Box or structure from wood or metal
- 8 or more connector sockets
- Cables that fit the connectors
- Light
- Microcontroller
- Backside connection cables
- Power supply/batteries

Input:

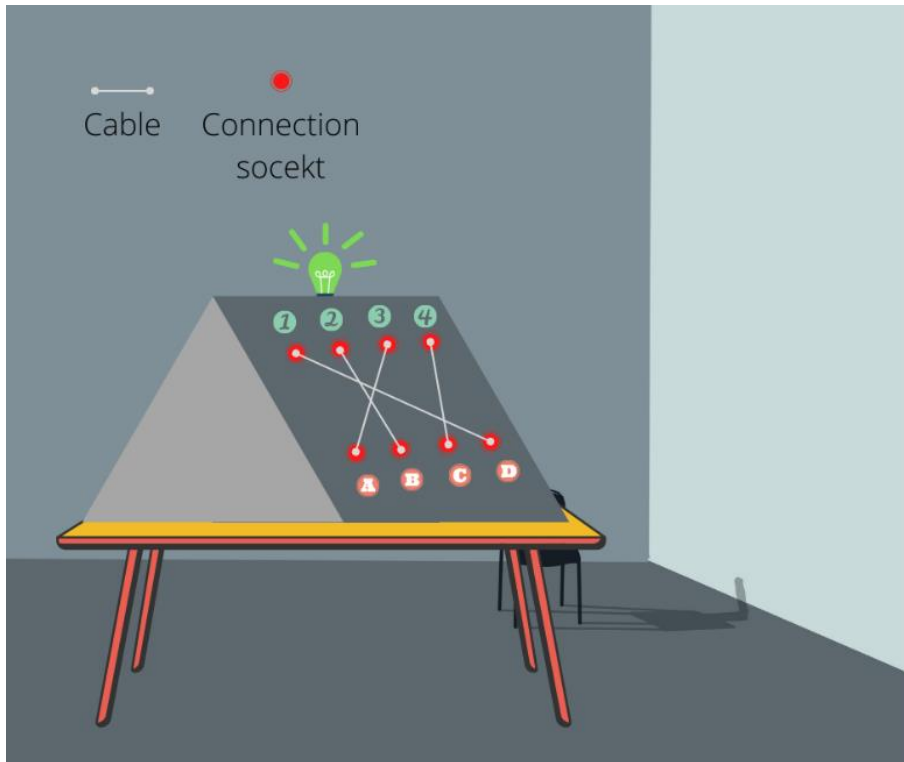
- 4 or more codes like A4, B6, etc.

Output:

- Boolean



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Picture 6: Puzzle cable connection

Puzzle magnet labyrinth

We can make a wooden labyrinth that has a see-through top so players can see what it has inside. The labyrinth cannot be picked up and moved. But instead, players have to use a magnet to pick up a key and move it through the maze.

Materials:

- Wood
- Plexiglass
- Magnet

Input:

- No input or requirement to find a magnet

Output:

- Key or magnetic item

Puzzle Pythagorean theorem

For this puzzle, players would have to assemble both possible assemblies of pieces once with the C in the puzzle other with A and B in the square. With this puzzle, players can see how the Pythagorean

theorem works. This can play just as a distraction puzzle, meaning players do not get anything if they complete it. It is in the room just so it reinforces the theme and wastes time for players.

Materials:

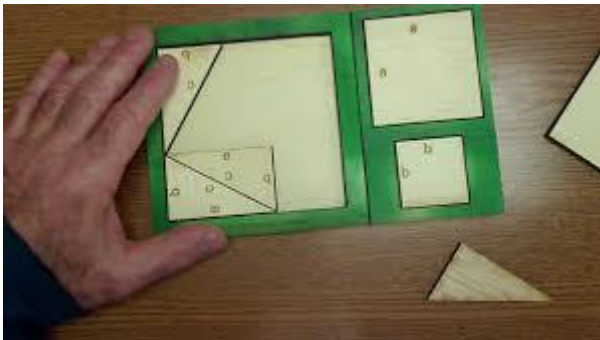
- Wood that can be laser cut

Input:

- Missing piece

Output:

- Nothing or some symbols that they assemble on the backside of the shapes



Picture 7: Puzzle Pythagorean theorem (<https://www.youtube.com/watch?v=6nOs7YzWbRq>)

Colour math puzzle

For this puzzle we can have 4 different coloured pictures, on each picture, there are mathematical equations. When these equations are solved, they give a result that can be used as a combination to open some locks. In the room, we can then have 3 different locks that require a number combination to open. These locks can be coloured to match specific picture form where players get the code to open that lock.

Materials:

- Pictures
- Locks

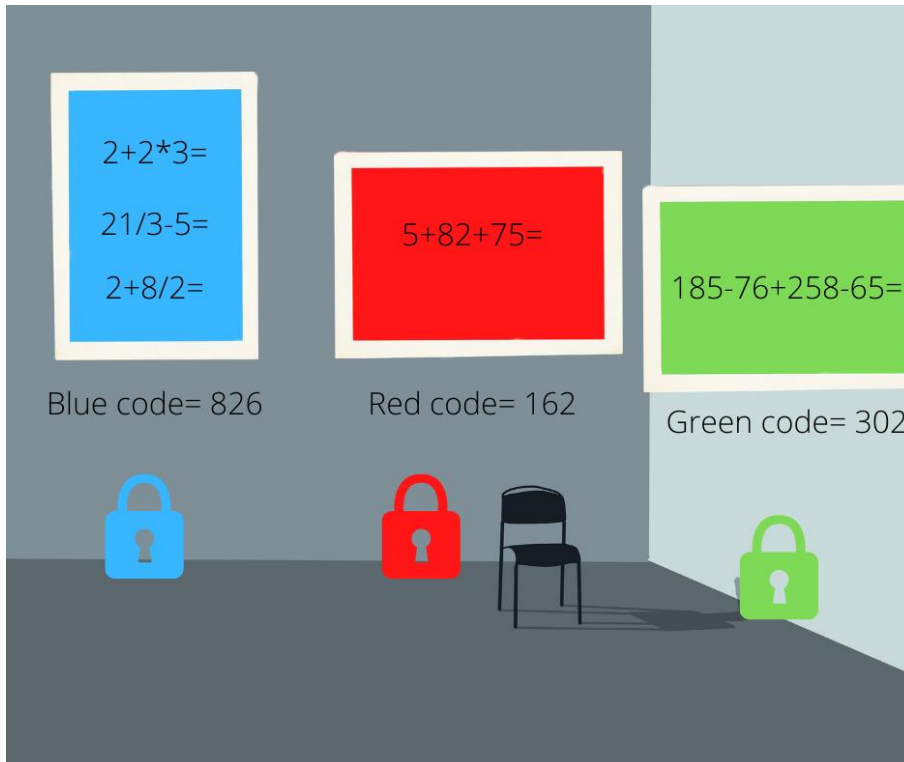
Input:

- None

Output:

- Different codes, or objects





Picture 8: Colour math puzzle

Code wheel Puzzle

In this puzzle, players will have to find and assemble the code wheel. This code wheel can be used to decipher some symbols into numbers. After players find the code wheel, they will have to put it together and they have to figure out the right symbol and number to be aligned in order to be able to correctly decipher the symbols.

Materials:

- Wooden wheels to assemble the code wheel

Input:

- Find the wheels
- Code for the right alignment

Output:

- Decipher many codes



Picture 9: Code wheel Puzzle (<https://cutt.ly/CIUmJsZ>)

World map with points

For this puzzle, we can use the world map or world globe and make a pattern on it. For example, represent how someone or something was travelling. We can connect places with years to get a code. This puzzle is heavily connected to the story that we have. For our example, we can show how the scientist was travelling around the world and in what years. Then we can have a lock that has some connection to a place this scientist has visited and the year he visited it is the lock code.

Materials:

- Map with points and information

Input:

- Story clues

Output:

- Codes
- Patterns



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Picture 10: World map with points (<https://cutt.ly/tIUEbhq>)

Jigsaw piece puzzle

This is a simple puzzle; players just must assemble pieces. We can hide a piece of the puzzle to give it importance or there is a board that the pieces must be assembled on and a few pieces can be missing that reveal numbers on the board that can provide a code. Or when the whole puzzle is assembled it can also reveal a code or clue. This puzzle can also be made with no purpose just to waste players time. This puzzle can also be upgraded with electronics in a way that allows the recognition of when the puzzle is correctly assembled and provide an electrical output that can activate something else.

Materials:

- Jigsaw pieces

Input:

- None just the pieces themselves

Output:

- Code
- None
- Clue

Gear transmission/ratio puzzle

This puzzle will show how gear transmission and ratio works with a simple gear arrangement with a high gear ratio. In this puzzle, we can hide a key or an item in a locked box that can only be open by turning gears. There will be an exposed gear that will start turning the mechanism that opens the door, but this process will take a lot of time and work. The players will have to find or connect the right gear so the change the gear ratio in their favour and will need less time to open the box.

<https://www.youtube.com/watch?v=LU77kPf25Yg>

A similar box like in the video can be made for the final puzzle to open, referring to the final story example where players have to open a mystery box. For this, we can have a puzzle with gear transmission as a normal puzzle, and to open this final box players would need to assemble a final key that they would get a piece from other side puzzles.

Materials:

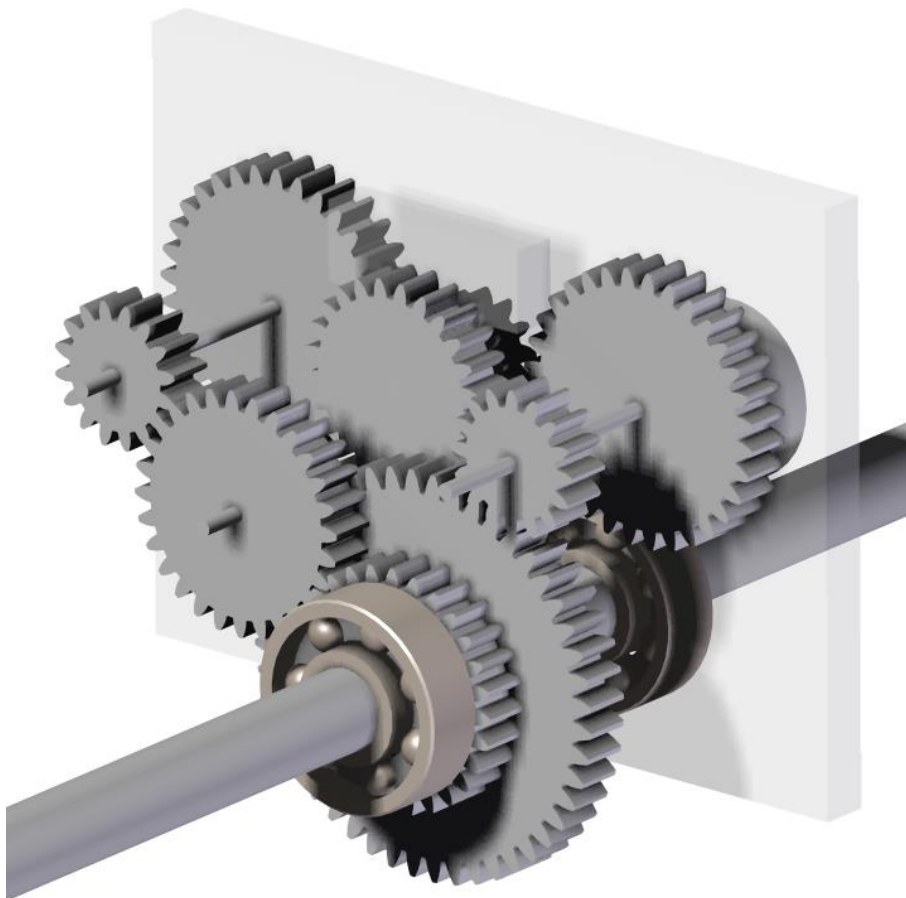
- Box with a gear mechanism

Input:

- Special gear key or more pieces to assemble the key

Output:

- Code
- Object



Picture 11: Gear transmission/ratio puzzle (<https://cutt.ly/5lB1zQO>)

UV light puzzle

For this puzzle, we can write something invisible that requires players to use a UV lamp to see it.

Materials:

- UV lamp
- Invisible ink

Input:

- Use of UV lamp in the right place

Output:

- Code
- Clue



Picture 12: UV light puzzle (<https://cutt.ly/GlBgoq3>)

AR decoding puzzle

We think it would be good to include a tablet in the escape room that players can use to help them solve different puzzles in the room. With the use of a tablet, we can connect the digital with the real environment with the use of AR and VR technologies. The tablet can be used as a deciphering tool for a code that players get in symbols and the tablet converts it into numbers that players can use. With the use of AR, we can make a whole puzzle that is virtual and has to be solved on the tablet itself.

Tablet can also be used to help in telling the story. Players can look at objects with a tablet's camera and this can trigger the storytelling or some background info of that item. In our example, the tablet can be interpreted as the scientist journal. As we look through it, it reveals some pieces of the scientist past and as we go through the room and objects, we can unravel the story. It would be good that this storytelling with the tablet is a recording of the scientist speaking. In this way, the whole group can hear it and interact with the tablet. Using this tool we enhance teamwork.

Materials:

- Tablet

Input:

- Enciphered codes
- QR codes
- Pictures
- Objects

Output:

- Deciphered code
- Clue
- Story elements



Picture 13: AR decoding puzzle (<https://appsandapplications.com/ar-puzzles-never-lose-a-piece-when-building-puzzles-in-virtual-reality-space/>)

Web page puzzle/clues

If players will have access to a laptop or tablet that has a web browser, we can also make a website that has either a puzzle or a clue, players can use in the escape room. For this, we think we shouldn't give players access to the internet as it could distract them too much and we think the internet is too open for an escape room. Instead, we could provide an IP address somewhere for players to connect to via any web browser that would load up the page we want them to go to.

Materials:

- Web browser to access the web page

Input:

- IP address

Output:

- Code
- Clue
- Story elements
- QR code

Tablet/Laptop password puzzle

If we include a tablet or a laptop into the escape room, we can lock them so that players will first have to figure out the password to unlock the device before using it. The tablet can be set to the pattern lock so we can instead of code use the pattern from somewhere else to unlock it. For example, we can map out the pattern on the world map puzzle that they have to repeat into the tablet. In this case, if players can figure out the pattern the GM can point out that the scientist used this tablet when he was travelling all over the world.

Materials:

- Tablet or laptop

Input:

- Code or pattern

Output:

- Enables use of an item

Nicola Tesla and magic numbers

In this puzzle, we wanted to present famous inventors like Nicola Tesla and include their work or saying into the escape room. This puzzle can be used with the Tablet/Laptop password puzzle. When players open the laptop, it will be locked behind a password and the password hint will be “magic numbers”. Also, somewhere in the room, it will be a picture of Nicola Tesla and on it, we can write “Magic numbers ___”. And if the players use a UV lamp on the picture it can reveal the numbers or if they look at the picture with a tablet then it can trigger a story of who was Tesla. And in the story, we can mention that he believed in the three magic numbers that are 369.

Materials:

- Picture

Input:

- Nothing
- Tablet
- UV light

Output:

- Code
- Clue





Picture 14: Nicola Tesla and magic numbers

Box with a lot of cables

With this puzzle, we wanted to give players a lot of different things to look at and figure out which to use. We connected this puzzle with the puzzle matching points, where players need to connect the projector to a laptop to display a picture. In the box, we want to put a lot of different cables like USB, Ethernet, VGA, and more to distract players. Among these cables, we will also include an HDMI cable that can be used to connect the laptop and projector to solve Puzzle matching points.

Materials:

- Box with a lot of cables

Input:

- None

Output:

- HDMI or other cable needed for other puzzles

The useless machine translates rotation to linear movement

This is not a puzzle but more a distraction for players. This kind of puzzles are good if we have more players so there is a lot of things to do not necessarily useful, but they help with distracting players and keeping them involved in the room. We can prepare more puzzles like this. For this one we had

in mind a machine that also shows a bit of mechanical movement to players with the translation of rotating movement to linear movement.

Materials:

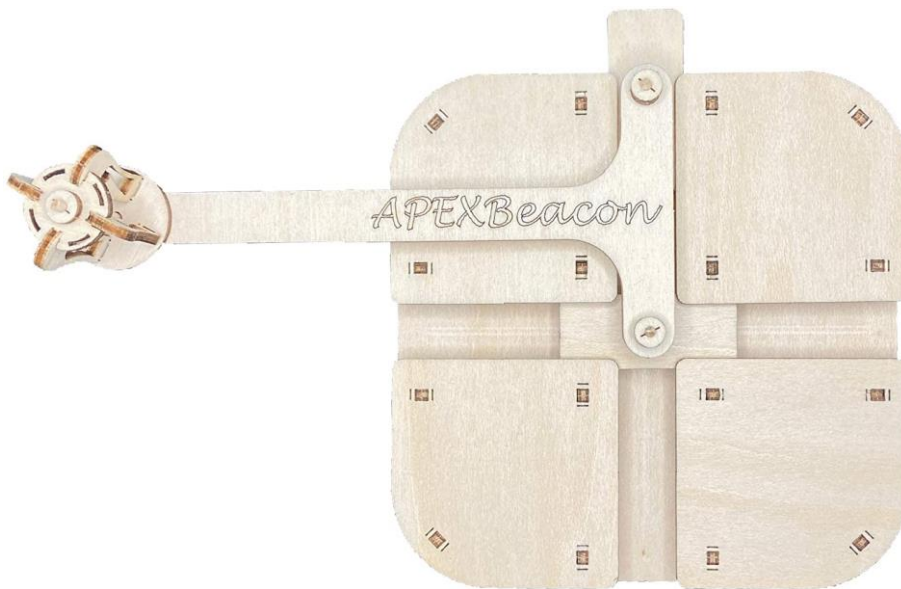
- Machine

Input:

- None

Output:

- None



Picture 15: Useless machine translate rotation to the linear movement (<https://cutt.ly/3lBnpy5>)



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