

STEAMER

ESCAPE ROOMS ADAPTED FOR SCHOOL
EDUCATION ON STEAM



PEDAGOGICAL GUIDE



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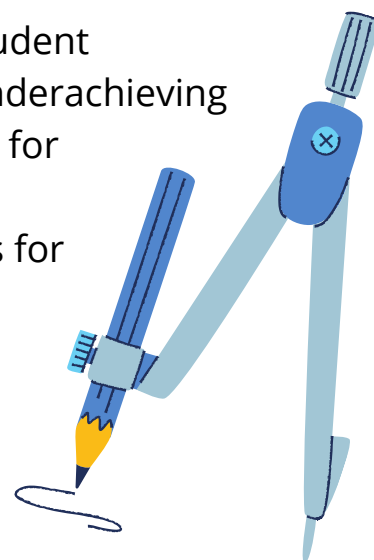
INTRODUCTION

1 The project

The STEAMER project starts from an important observation based on official research and analysis: STE(A)M education is insufficient for our fast-paced society.

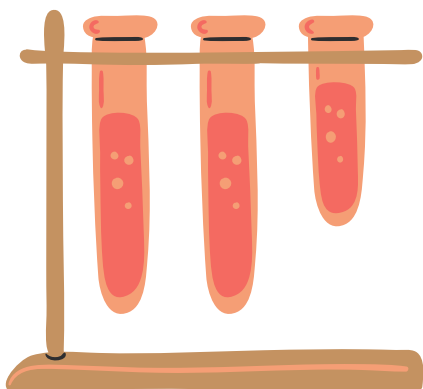
According to the PISA results (Program for International Student Assessment - 2018), 22.2% of 15-years old European are underachieving in math and 20.6% in science demonstrating a critical need for improvement.

In addition to being the basis of many strategic professions for our society, we must remember that STEAM is not only an important current cultural aspect but has also been a key factor in the creation of Europe as a culture over the centuries: from the ancient Greek to the Enlightenment, to the modern scientific programs.



The main objective of the project is thus to boost STEAM education by creating a framework, various tools, and practical examples of Escape Rooms adapted for school education in STEAM, tailored for the teachers and educators of secondary education in order to provide a new range of possibilities to teach STEAM and potentially other subjects.

The framework will take its roots in Game-Based-Learning which was developed to help students approach school subjects with greater enthusiasm and effectiveness.



Thus, starting from the premises of the Escape Room and its entanglements with logical applications, this project also aims at raising learners' awareness of the European cultural aspects of STEAM and positive scientific role models.



The framework will integrate inclusive elements for disadvantaged learners, specifically the ones with **Specific Learning Disorders**. The grades of these learners tend to be lower than average in STEAM, not because of a lack of capability but because of their **difficulties with some aspects of the formal approach to education** (especially in mathematics). The project will also **support teachers in developing innovative teaching methods to engage students in the subjects of STEAM** through practical experience which would, in result, engage learners with Special Learning Disorders (SLDs) further.

This pedagogical guide is the first output of the project and aims at helping teachers in the process of using pedagogical Escape Rooms as a gamified gateway to STEAM skills.

After an introduction to the nature of the escape room game and its origin (Part 0: **Introduction**), the guide introduces the following aspects:

- Part 1: Why Escape Rooms are useful for STEAM education
- Part 2: How to integrate ER in the school curricula
- Part 3: How to capitalize on previous knowledge of the students and how to valorize the skills and knowledge developed during the Escape Room
- Part 4: How to animate an Escape Room
- Part 5: How to integrate different profiles of students



Each chapter is designed to answer step-by-step basic questions that the teacher may ask themselves during the process of implementing pedagogical escape rooms. These chapters will be followed by a conclusion. Now, let us move on to defining the concept of Escape Room.



2 What is an Escape Room?

"You may find yourself inside the Tomb of Pharaoh Tutankhamun, having only one hour to find the key that opens his legendary treasure. Or you may get trapped like Alice in Wonderland, having only 60 minutes to find out the exit and return to the real world. Or you may be kidnapped by a tribe of indigenous people in the middle of the jungle, and you need to escape before it is too late! After making sure it is not a dream, there is only one explanation: you're in an escape room and you're about to experience a unique and immersive experience, as if you were in a movie!"

This seems nice and exiting, but what exactly does it entail?

Scott Nicholson - Professor of Game Design and Development at Wilfrid Laurier University in Brantford, Ontario - describes an escape room as **"a live-action group game, in which participants physically interpret the characters with their own actions."**

The goal of the players is to search for clues and solve puzzles, within one or more rooms, to achieve a specific goal or, more generally, to get out of the room. Moreover, there is the time factor that must be considered, making the game even more compelling and challenging.

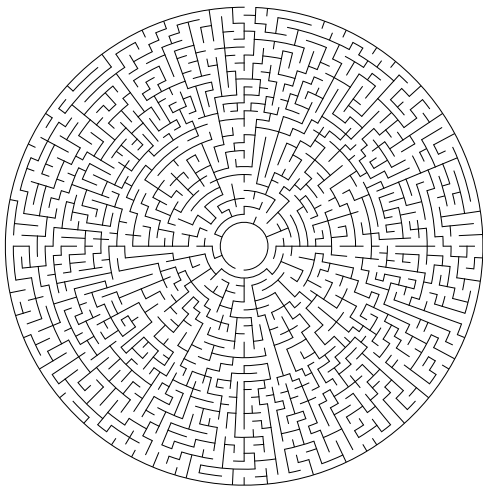
Each escape room is characterized by a given **narrative context** that defines a setting and involves players within a story, where they assume **a role and a mission** (which can be linked to the search for the exit door of the room, a certain precious object, the solution of a problem, etc.).

The setting can take players back in time, to a fictional place, into the home of some mysterious character; it can evoke a fairy tale or even get inspiration from a movie. In any case, it is a place from which, for a specific reason, it is necessary to escape from before the end of the countdown. However, the exit door is not so easy to find!



But let us take a step back: how did we come to the conception of this fantastic immersive gaming experience? Although we may consider that escape rooms were created recently, **the concept has a thousand-years history, and finds its roots and inspiration in literature, board games, and more recently, role-playing games, television, and even video games.**

3 The origins of the escape room



The experience of the escape room is based on the model of the maze: the players are imprisoned in a place and they must find a way out of it. We could identify the oldest example of escape room-like experience in the **legendary minotaur maze**: Theseus is trapped in the maze of Minos to free persecuted prisoners from the monstrous Minotaur and must use all his wits to find the exit!

On the other hand, the **concept of treasure hunts**, inspired by pirate adventures, is also a forerunner of this experience.

In more recent times, we find the concept of escape room in **several television programs** whose format revolved around an area containing puzzles, riddles and tests of different kinds to overcome. Examples include "Now Get Out of That" (UK -1981), "The Adventure Game" (UK - 1980), "The Crystal Maze" (UK - 1990) or "Fort Boyard" (France- 1990).



Role-playing games, primarily Dungeons & Dragons (1974), where the task of the participants is to collaborate to overcome the traps, monsters, and above all riddles, also inspired Escape Rooms. The goal is the same for the players: grab a treasure or save a princess! What sets the game apart is the concept that **the only way to win is by teaming up!**



In the 1990s, solving puzzles and passing logic tests also appeared for the first time in **game books** (such as "Lone Wolf"), **textual adventures** ("Colossal Cave Adventure"), and **graphic adventures** ("Maniac Mansion").

With the spread of the internet in the early 2000s, digital Escape Rooms appeared. They copied the model of **'real'** Escape rooms: the player is locked in a room and must get out using the objects and the information that is placed in it.

The evolution of escape room from the virtual world to the real one cannot be attributed to a sole person. **Some identify the Japanese as alleged fathers**, in particular, SCRAP Enterprises Inc. publishing house. The founder and manga designer Takao Kato, in 2007, built for the first time a Live Escape Room with the goal to immerse participants in the game. The player physically plays in a themed room and solves mysteries to escape within the allotted time. Since then, escape rooms have spread, first in the rest of Asia, and then in Europe and America. In China, the "Beijing Takagism" club was founded in 2012.

Budapest, Hungary, was the first European city where live escape games were made. In 2011, the company Parapark was created. Its founder, Attila Gyurkovics, opened a Live Escape Game without knowing that they were already well developed in Asia. The idea came when developing new proposals for Team Building activities.



In 2012, the first franchise opened in Hungary: "Hint Hunt", the same year the company SCRAP was moved to the United States under the name "Real Escape Game". Hint Hunt quickly exported the concept to the UK, and then to France in 2013. That year also saw the arrival of Escape Games in Canada.





An increasing number of escape rooms have been launched and opened to the public, to the point of witnessing a worldwide spread of the phenomenon: the website "Escape RoomDirectory2" counted escape rooms in **97 countries in 2018**, for a total of more than **10,000 active escape rooms** according to "The Economist" - Business travel Gulliver - Jan 11th, 2019.

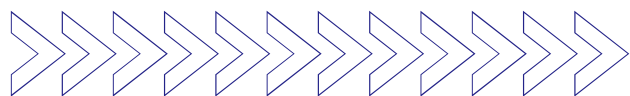
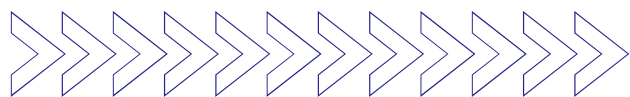
4 How does an Escape Room work?

For whom, by whom?

A recent survey by Prof. Nicholson (2016) reports that escape room players are extremely heterogeneous, both by age (both adults and minors participate) and by gender. It is precisely the fact that we play as a team that makes the experience deeply appreciated by groups of friends, but this format is now also increasingly used for business experiences and educational purposes.

While escape rooms are most often owned by commercial structures and franchises, there is an increasing amount of independent companies, often run by younger people, who are using their creativity and imagination to offer original and out-of-the-box experiences. Access is always on reservation and the average price per player ranges from 15 to 30 euros.





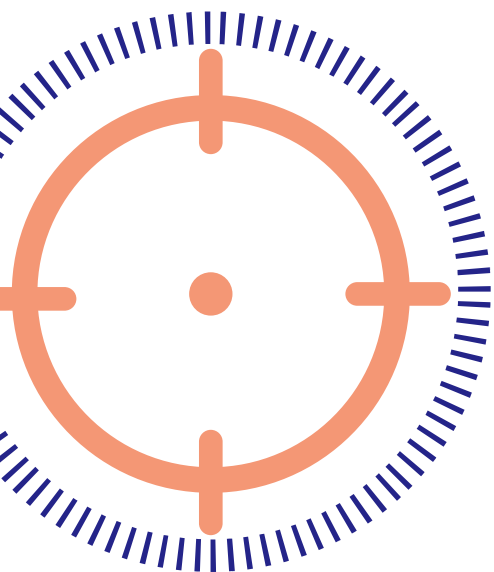
How does it work?

In the most popular escape room model, a professional takes on the role of the facilitator: before entering, he instructs the team, typically at least two and up to eight people, about the plot and rules of the game. After locking the smartphones in a safe, as no help must come from the outside except from the facilitator himself, the door closes behind the facilitator, and the players are locked inside the room.



There is an item that is almost always present: a monitor or other mechanism to show players the time available, which usually ranges from 40 to 60 minutes, and to allow the facilitator to transmit useful messages and some help if need be.

The team then begins the search for locks, puzzles, and other clues, such as keys that open drawers containing additional clues or instructions for example, which can allow them to advance until they reach the goal. The team wins if they finish the game and resolve the puzzle within the allotted time.





What is the secret behind the success of Escape Rooms?

According to Matt DuPlessie, president of 5Wits6, a company that offers 18 rooms in 6 different U.S. cities, the three main elements that make the escape room experience attractive to a growing number of users are:

- 1) **feeling part of a show**
- 2) **the possibility of feeling heroic**
- 3) **the opportunity to face a challenging test**

According to DuPlessie, it is precisely the combination of these three elements that allows players to feel immersed in an adventure and therefore to live through the escape room a memorable and exciting experience.

We add as a fourth element of strong involvement and success, the opportunity to work as a team and be a part of it, with a mission that can only be accomplished with the collaboration of everyone.

An interview with managers of Escape Rooms in Italy was conducted to know what are the recurrent concepts that they wish to convey to anyone who decides to live this adventure:

- This is not a game of strength but of logic.
- The route is pre-established and designed so that each clue always leads to the next one.
- Collaboration is the best ally to success.
- The key to the success of an escape room consists is mainly related to three elements:

1) the reception: it is essential that the players feel involved even before entering the room and in this, the reception staff plays a decisive role.

2) the setting: attention to detail and the study of context will make immersion in the adventure more direct and immediate.

3) Plot or story: it is critical that the mission is clear, coherent and motivates the team to put it all together!



5 What are the elements that characterize an Escape Room?

Let us go into details now: what are the key elements of an Escape Room?

5.1 The story or context

The main element to consider is the **setting**. Recreated within the room through an appropriate **layout, furniture, and objects**, the setting can be of a different nature, precisely because there are no limits to the imagination. For example, it may be:

- a contemporary and realistic context, such as a hotel room, a plane, the studio of a photographer,
- a fairytale, fantasy, horror, or mystery context, such as the world of "Alice in Wonderland" or the "Doctor Black's House", or like in the "Cluedo" game,
- a context inspired by famous or legendary films and/or literary characters, such as Dracula's home in Transylvania, the Indiana Jones studio or the world of Jumanji,
- a historical context, such as ancient Egypt, a medieval house, an old-World War II aircraft, etc.



Since in an escape room everything becomes possible, it is up to the skill and imagination of those who design them to surprise players with a fascinating story and with unexpected special effects that make the context as believable as possible, while being unpredictable at the same time.



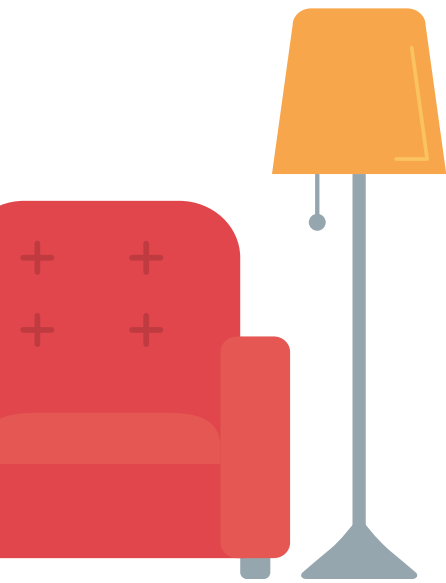


Rooms from Escape Room – Terni (IT)



5.2 The atmosphere

The **lighting** and **sound aspect** also play a key role: it is obvious that those who designed the experience thought to set it by day or night, to convey an atmosphere of mystery or magic, so lights and music are crucial to recreate the right ambiance.



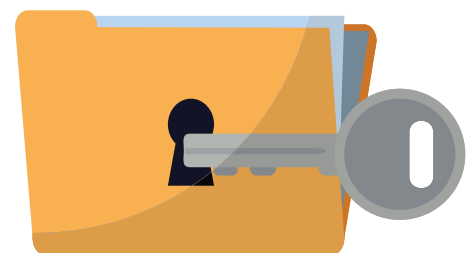
The ambiance and context can change as time goes by (for example, as time flows you could move from day to night) or with the transition from one room to another (for example, starting the experience in a room then "to take a leap in time and be in the same room as it was 500 years before, just by unlocking a door!").

The game environment and everything that it contains (furniture, objects, decorative solutions) are what makes the immersion of the player possible. By "immersion" we mean here **the experience of being psychologically transported to a simulated, realistic, or fantastical place** (Murray, 1997).

5.3 The Clues, Codes and Locks

In addition to everything that is purely scenic, the room will then have to be filled with functional objects to the game path: following a logical line, **there will be a string of connected clues that aim to bring the players to their goal** (for example, the key that opens the last door, a cure, the treasure scope, etc.)

Clues are often conveyed through **messages or objects** but are not directly recognizable and identifiable, as they are protected **by puzzles, padlocks, logic games, codes, etc.**





Inside the room there will be:

- objects to open (secret doors, drawers, chests, locks, padlocks)
- items to open things with (keys, codes, tools)
- objects that convey games of skill and logic (in some cases the solution of which cannot be obtained independently but requires the intervention of one or more teammates)
- distractors, false clues, disturbing elements



Naturally, everything has to be as consistent as possible with the setting and the story that drives the adventure.

Challenges and puzzles are varied and consist of mathematical calculations, manipulation of objects, encrypted messages, etc. For this reason, teamwork is valuable, as it allows you to combine different skills and abilities.



There are **several types of padlocks**:



Each code/key corresponds to an enigma.

5.4 The Actors

In some types of rooms, you can also find **actors** who convey one or more puzzles. This of course makes the experience even more compelling. The actor or actors represent a character from the story and embody an element of **strong interactivity**.



Enigmas, objects and actor from Escape Room Terni (IT)



6 What are the different formats related to the Escape Rooms model?

The escape room model has **numerous variations** that have different characteristics, although all revolve around the concept of solving puzzles to succeed, whereas it is individually or in teams. In addition to the classic 'leaving the room' set-up, we can find other formats such as the following:

6.1 Escape Box

These are real board games, which can be **purchased and used any time**. The playing board and various items in the box create a path to unlock the mystery.



Here, the time factor is almost always present in the form of a timer. More or less modern, it displays the countdown and adds a time pressure that creates an atmosphere of urgency. Engagement in the story can be achieved by introducing the context, either orally, or by reading the introduction provided in writing, or even in digital or audio-recorded form. Sometimes the role of the facilitator is replaced by a decoder that tells the story, illustrates the mission, and can provide useful suggestions.

Again, it is often a team game: whether you win or lose, it is as a team, every player has to do their part. Teamwork is therefore essential to solving the puzzles on time.

6.2 Escape Book



Escape books are a series of puzzles, and logic games that act as the protagonists of an adventure that test the ingenuity and perseverance of the reader, built with a completely original narrative formula. Instead of reading a polar/thriller or an adventure as a mere spectator, **the reader becomes the protagonist and must solve puzzles, brainteasers, optical illusions, and anagrams** to resolve the mystery.

Sources - Escape Box : Enquête + Escape Book - Le Piège de Moriarty, 404 Editions, France, 2018 - Stéphane Anquetil, Marie Capriata



The resolution of each puzzle allows you to continue reading the book, not from the next page as in the traditional books, but from the one whose number coincides with the code found solving the previous puzzle. There is also the possibility of receiving help at any time the final pages of the book, which usually contains a section where you can find clues that help you solve the riddles you came across.

6.3 Cards



Source : <https://www.gamesreviews.com>

Similar to escape boxes, they simulate the experience of a real escape room to bring it to the table using a single deck of about a hundred cards. Players (usually 1 to 6) are faced with a plot and a common goal to achieve in a given amount of time, a series of puzzles to be solved, locks to open, and codes to decrypt to complete the mission.

Again, these are almost always collaborative games, where the group's ability to solve conundrums determines the team's final score. Turning one card at a time, the group discovers the enigmas and cooperates to find the solution. Once the solution is found, the players accumulate points or penalties if there is a wrong answer.

They are characterized by being 'one-shot': the adventure can only be solved once. To redo it would be a duplication of the game as the conundrums' sequence stays the same.

6.4 Virtual Escape Room

A lot of websites offer a virtual escape room format where the person explores different **rooms in the form of screens**. The experience is a little limited immersion-wise but is interesting because these types of escape rooms may be available anytime, anywhere, if you have a computer and an internet connection. They can be solved both in groups and alone. The idea here is to solve a mystery by resolving enigmas and exploring the decor of the different screens to find clues within an allotted time.



Source : <https://www.puzzlebreakli.com/>



Some teachers use a combination of virtual escape rooms and physical clues by hiding clues in the slides of their lessons and the pupils having to find them and resolve the mystery. They can also enter the solutions into a Google form that is password-coded to get to the next riddle. Platforms such as Genially offer relevant support to create these kinds of virtual Escape Rooms.

6.5 Virtual Reality Escape Room



Source : <https://brussels.virtual-room.com/>

A VR escape room consists of a **three-dimensional gaming environment** that allows you to immerse yourself and perceive things in that environment. The experience is **made possible due to HMD (Head Mounted Display) devices**, which can be of various types (helmet, glasses, etc).

Once worn, they allow you to immerse yourself completely (visually and acoustically) in a virtual sensory experience. The vision through an HMD is stereoscopic, which means that it provides a different image for each eye, and, through motion sensors, it is possible to change the view through simple head movements, just like in physical reality. The ability to equip players with controllers similar to a joystick to use their hands and manipulate objects inside the virtual environment makes the experience even more interactive. Unlike the traditional escape room, in this case, the content and the setting are located in the virtual environment. In the case of multiple people participating, it is possible to see the avatar of other players, communicate and interact with them (for example, exchanging virtual objects), and maintain all the dynamics of physical escape room cooperation.



The most obvious advantage of a VR escape room is that the same physical environment can be used for endless game scenarios since the content is digital and can be uploaded and saved as in any video game. It also becomes possible to play with people who are physically in different locations.

6.6 Breakout box

A breakout box functions in a similar way to an escape room, the only difference being that the group needs to **break into a box instead of trying to get out of the room**. The scenario could be for example, people needing to break into a safe to find a cure to a fatal disease for humankind before the disease spreads too wide. They usually come in the form of a box that is locked with multiple locks and multiple layers of security. Some breakout boxes come in the form of a locked box inside another locked box, etc. The main advantage of a breakout box is its versatility and easy use. They may be brought anywhere easily and do not take a lot of space or a lot of time to install.



As we see, there are many different sorts of Escape Rooms and endless possibilities of uses, themes, and configurations. In this manual, we will concentrate on pedagogical Escape Rooms. This type of Escape Rooms is usually usable in a classroom where it is easy to install materials and clues. While they can take any format given the right amount of time, expertise and means, pedagogical ER are usually Escape Boxes or Breakout Boxes which are highly practical. Lastly, virtual ER on computers and EB are also an option. Now that we know what kind of tools and formats are available, let us explore why Escape Rooms are useful for STEAM education specifically.





PART 1: WHY ESCAPE ROOMS ARE USEFUL FOR STEAM EDUCATION

Escape Rooms' (ER) popularity boomed in the last 10 years. They are now widely spread and can be found in every European country, especially in capital cities. We have intensively described Escape Rooms' characteristics and format in the previous section to give a broad panorama of possibilities. It is time now to analyse why ER's could be a useful tool in education with a focus on STEAM. Our initial focal point will be on Game-Based Learning, its importance, and how it links with ERs, before moving on to STEAM education and how they can both be integrated into said ER.

1.1. Concept: Game-Based Learning

Three key expressions emerged in the last decades to try and term the new tendency to integrate games into education and the learning process: **Game-Based Learning, Gamification, and Serious Games**. As they are all linked to the same field, people describing the subject tend to use them interchangeably. However, these expressions do not relate to the same phenomenon.

As Meihua Qian and Karen R. Clark (2016) define it, **Game-Based Learning (GBL)** 'describes an environment where game content and gameplay enhance knowledge and skills acquisition'.^[1] GBL turns the focus of the educational curriculum into a game.

[1] Qian M., Clark K. R. (2016), Game-based Learning and 21st century skills: A review of recent research, Computers in Human Behavior, 63, p.51





Serious Games are similar. They are created for the sole purpose of learning. As Juliette Denny explains, the difference between the two comes from the focus of the creator.[2] Serious Games can be used in GBL, but GBL does not only use Serious Games. A game that helps you learn was not necessarily designed to do it initially. Here is an example of a Serious Game: “La machine à remonter le temps 14/18” conceived by the Franco-German TV Channel Arte.[3] The idea is to allow players to immerse themselves in the period of the First World War by embodying one of the 28 suggested characters. The game was awarded the German prize “Comedius EduMedia” in 2014. On this topic, the French online platform serious-game.fr is a goldmine. It acts as a database for Serious Games in French.

Gamification, on the other hand, is different. The company ‘Growth Engineering’ describes it on their website as ‘the application of gaming mechanics to non-gaming environments in order to make it more engaging’.[4] Hence, there is no game creation within gamification. Games mechanics are analysed, extracted, and applied to an environment where they do not usually exist. In daily life, the most visible and widespread example of gamification is probably the concept of loyalty cards, found in many shops around the globe, as they trigger a sense of reward once completed. Within companies, several methods exist, and some are more criticised than others. It is possible to set up leader boards, progress bars, and challenges, completed with rewards, e.g. badges. In education, the well-known language learning website DuoLingo is a good example, as it makes extensive use of gamification techniques. Each completed lesson awards points that help progress onto the leader board that is reset every week. Aside, there are a collection of badges won by completing different challenges. Additionally, a system of forum discussions also exists to foster mutual assistance and a sense of belonging. All of this makes language learning more engaging, even though DuoLingo is not a game. In this guide, we will focus on Game-Based Learning as the concept is more adapted to Escape Rooms.

[2] Growth Engineering (2019, August 21), *Gamification vs Game based Learning: What's the Difference?* [Video File]

[3] Direct link to the game: <http://was-waere-wenn.14-tagebuecher.de/index>

[4] Growth Engineering (2018, November 23), *What is the Definition of Gamification?*



1.1.1 The Impact of Game-Based Learning

It has become increasingly difficult to get young people involved in learning in a general and 'regular' education system. The rise of the internet, its growing influence on younger generations, and the popularization of video games can be linked to this growing disinterest.

Game-Based Learning is an attempt to tackle this problem. Many studies were published in the 2000s regarding its effects and advantages on the learning process, with the primary argument being that games create a favourable environment to engage participants in learning. The following **impacts** have been found[5]:

- **Soft-skill development.** We will come back to this point more extensively later in the guide.
- **Motivation and higher engagement.** In 2011, the American Game Designer Jane McGonigal wrote the following excerpt in her book *Reality is Broken*:
'in a good computer or video game you're always playing on the very edge of your skill level, always on the brink of falling off. When you do fall off, you feel the urge to climb back on. That's because there is virtually nothing as engaging as this state of working at the very limits of your ability'[6].

GBL helps reach this state, which is otherwise complicated to attain in formal education processes. Nevertheless, as Sauvé L., Renaud L. & Gauvin M. noted, the learner's motivation depends on his/her interests, on the importance given to the final goal, and on the perception he/she has about the task's scope. Creators of Serious Games should therefore try to trigger the above-mentioned state while keeping in mind that a task that is too hard or too simple will tend to bore the learner.

[5] Sauvé, L., Renaud, L. & Gauvin, M. (2007). Une analyse des écrits sur les impacts du jeu sur l'apprentissage. *Revue des sciences de l'éducation*, 33 (1), p.95

[6] McGonigal J. (2011), *Reality is Broken*, New York, NY: Penguin, p.24





- **Knowledge structure and integration.** Games can help to put knowledge into actions, by giving a concrete practical scheme in which learners can repeat the task without fear of failure.
- **Influence on behaviour and attitudes.** Games, especially multi-player ones, can foster collaboration and communication between learners. Also, they can help children focus and concentrate on subjects which might have seemed boring to them in the formal education context.

Richard Bartle, the inventor of the first multi-player virtual world **MUD1**, describes four categories of gamers, linked to individual personalities: Socializers, Achievers, Killers, and Explorers.[7] Each category has different interests and reacts to games differently. Since then, other attempts at categorizing have been made. One is the **Hexad player type**, created by Andrzej Marczewski, splitting players into twelve different groups.[8] Whichever categorization we choose to follow, the conclusion is the same: games must take the player type into consideration, either by focusing on one or by trying to accommodate everyone. It is even more important with Game-Based Learning. Undeniably, motivation is the core purpose of GBL; That is the reason why this technique is working better than others on children. For example, we could make sure that the game has enough challenges to satisfy Achievers and discussion space for Socializers.[9]

Unfortunately, more research and analysis is needed on this subject. For example, Meihua Qian and Karen R. Clark were highlighting in 2016 the lack of knowledge on the degree of complexity necessary in a game to produce 'meaningful learning'.[10]

[7] Arnold, B. (2014). *Gamification in Education*. Paper presented at the 2014 annual American Society of Business and Behavioral Sciences (ASBBS) conference. Las Vegas, NV, p.36

[8] Marczewski, A. (2015). User Types. In *Even Ninja Monkeys Like to Play: Gamification, Game Thinking and Motivational Design* (1st ed., pp. 65-80). CreateSpace Independent Publishing Platform.

[9] Cloke H. (2017, September 26), *4 Types of Gamers and Learner Engagement*



The importance of GBL practices is well illustrated by their integration into cultural heritage. It is not unusual to see children reluctant to visit museums, castles or different cultural and historical buildings. However, as families account for most of their customers, it is highly understandable that museums developed techniques to attract children. Most rely on games and other playful and pedagogical resources to engage children, making their visit meaningful and memorable.

In Italy, the Cooperative Sistema Museo launched an escape room in a hypogeum site. The MUSE of Trento has launched an escape room linked to a theatrical show and the figure of the physicist Majorana. In Holland, the Villa Mondriaan Museum, dedicated to the painter after whom it is named, has equipped itself with a permanent scavenger hunt.[11] These GBL practices are not solely steered towards children and young people. In France, in 2019, the famous **Palais Garnier**, also known as the French National Opera, regularly operated a life-size immersive adventure, where participants had to solve the curse of the *Phantom of the Opera*. [12] The targeted public was not children, but playful adults who might not have visited the site otherwise. The set-up of Escape Rooms – or similar games – is a good way to involve both children and adults, as the level of difficulty can vary.

Escape Rooms are a prime example of what a complex and complete Game-Based Learning project could look like, as it is linked with all the impacts previously mentioned.

[10] Qian M., Clark K. R. (2016), Game-based Learning and 21st century skills: A review of recent research, *Computers in Human Behavior*, 63, p.51

[11] More information can be found on the museum website: <https://villamondriaan.nl/en/activities/scavenger-hunt>

[12] Direct link to the Opera's adventure website: <https://www.inside-infos.fr/opera/en/index.php>





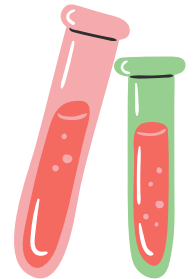
1.1.2 The four freedoms

The Four Freedoms of Play is a concept created by the MIT professor Scot Osterweil. Similar to the players' types, they are important to integrate as they can explain why children do not seem to engage well in a game.



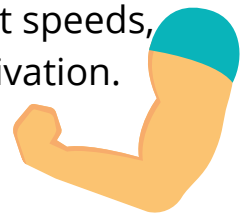
The first one is the **freedom to fail**, which is essentially at the core of every game: the possibility to fail and restart from the beginning. This process integrates a well-known and proved learning mechanism, which dates back to the end of the 19th century and has been extensively studied since the 1980s. Repetitive failure allows the learners to recognize, remember, and overcome the mistake made.

The second one is the **freedom to explore or to experiment**. As games allow you to start again, they also allow you to try to accomplish your goal differently, by using a variety of strategies, and identify which one works best.



The third one is the **freedom to try on identities**. Games give you the possibility to be whomever you want to be. They might help you discover a part of you that you did not know, such as a leaning for leadership roles for example, by playing multi-player games.

The fourth is **freedom of effort**. Games allow to play at different speeds, to engage in them differently according to the player's daily motivation.
[13]



These should also be considered as the four freedoms of learning. However, they often do not appear in schools.[14]

[13] *The four freedoms of games and gamification* (2017, October 20)

[14] Osterweil S. (2014), *Freedoms of Play* [Video File], MIT Open Course Ware



1.1.3 Development of specific soft skills: Critical Thinking - Problem solving / Reasoning and deductions

A relatively new trend in research focuses the sets of competence and skills required to succeed in the 21st century societies. Here is a synthetic list given by Meihua Qian and Karen R. Clark (2016):

- **Critical thinking:** scientific reasoning, systems thinking, computational thinking, decision making and problem solving
 - **Creativity:** divergent thinking, innovative thinking, originality, inventiveness, and the ability to view failure as an opportunity to improve
 - **Collaboration:** effective teamwork, flexibility, compromise, assume shared responsibility
 - **Communication:** articulate thoughts, use media and technologies.
- [15]

We mentioned previously that GBL helped learners develop soft skills. They might vary according to the game played and its features: is it multiplayer? Can it be solved alone? Is it a serious game? Is it an online game? Is the first aim strategy or social interaction?

As there is an important number of possibilities, we will try to cover here the most important – and visible – soft skills that GBL can trigger, regardless of the game features.

[15] Qian M., Clark K. R. (2016), Game-based Learning and 21st century skills: A review of recent research, *Computers in Human Behavior*, 63, p.51



The first ones are the basic 4 Cs, namely:

- **Collaboration.** If the game requires several people to be solved, the players will be forced to collaborate and find their place in the team.
- **Communication**
- **Critical thinking**
- **Creativity**

GBL also triggers problem-solving and reasoning skills.[16]

As skills acquisition differs from game to game, the teacher using GBL should give special attention to the type of game and focus on the one which will be the most useful to the students. Therefore, an analysis of the students' needs might also be necessary before designing the game and implementing it in the classroom.

Escape Rooms differ from other games because of one intrinsic feature: their multifunctionality. Many different skills are required to solve them. For example, **Problems-solving skills** are put to the test as several puzzles and items are hidden in the room. **Time and pressure management** are highly requested, as players are given a limited time to solve the problems. **Organizational management** comes in handy to compile all the data and solutions found through the problem-solving process.

Furthermore, **communication and collaboration** are evidently necessary, as it is not possible to solve the game alone. Even if a player had all the skills necessary to solve every puzzle, the time limit would still be there to stop them from succeeding.

To sum up, we notice here that both GBL and more importantly Escape Rooms, trigger 21st century skills.

Now that the methodology and the pedagogical interest of the medium have been covered, let us take a look at the next concept of this project: **STEAM.**

[16] Abdul Talib C. et al. (2019), Enhancing Students' Reasoning Skills in Engineering and Technology through Game-based learning. *International Journal of Emerging Technologies in Learning (ijET)*, 14 (24), p.72



1.2. STEAM:

STEAM derives from STEM, but what is STEM? The acronym stands for **Science, Technology, Engineering, Mathematics**. The acronym “STEAM” designates an approach to learning which blends the four subjects of STEM, plus **Art**, together, to create interdisciplinary teaching with strong real-world applications. It has been created to foster children’s interest and understanding of subjects regarded as somewhat difficult and dull. STEM education offers a ground in real life, a way to learn by doing, a possibility to understand the applications of the content acquired.

Why is STEM important? As we explained in the introduction of this guide, the latest PISA test scores speak for themselves.[17] European Countries are far from being the top runners. These low scores call for action, as scientific knowledge is essential in our modern societies, to tackle the challenges ahead of us. The struggle to integrate STEM into education has been long and it is not over. However, governments are starting to realize its importance and to implement it within their education scheme. Such is the case of Australia, which launched in 2015 several funded initiatives in their schools.[18] At the European level, the European Commission released in 2015 the report ‘Science education for responsible citizenship’, with a focus on STEM.[19]

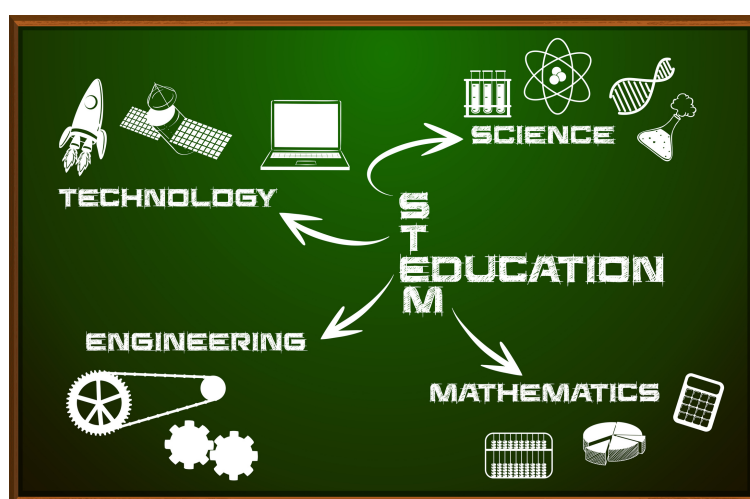


Image : '<https://www.freepik.com/vectors/background>'>Background vector created by brgfx

[17] OECD (2019), PISA 2018: *Insights and Interpretations*, Paris: OECD Publishing

[18] Australian Government, Department for Education, skills and employment (n.d.), *Support for Science, Technology, Engineering and Mathematics (STEM)*

[19] European Commission (2015), *Science Education for Responsible Citizenship*, Luxembourg: Publications Office of the European Union



STEM education's main aims are to develop students' critical thinking, problem-solving skills, and ability to link science concepts with real-life situations.[20]

STEM education and Game-Based Learning share some specific positive outcomes: they both enhance children's motivation to learn, facilitate the process, and help them acquire skills that they would not have gained in a regular lecture class. However, they are not mutually exclusive but can work better together.

STEAM is the new variable in the world of STEM. It adds 'Arts' to the acronym. We will discover soon why this additional letter matters and why it brings more to the discipline. Furthermore, we will see how Escape Rooms fit in the STEAM context. They mostly act as a tool, a conveyor. Many scenarios and guides already exist for each STEM subject: we will highlight several successful examples in the following sections.

1.2.1. Science

Science has been defined by the US' National Research Council as:

'the study of the natural world, including the laws of nature associated with physics, chemistry, and biology and the treatment or applications of facts, principles, concepts, or conventions associated with these disciplines'[21]

Here is an example of a science-based Escape Room: **La Disparition**, created by Aurelie le Hir for a class of French 2nd Graders (15-16 years old)[22]. Following a break-in at the high-school science-lab, groups of 3 to 5 students become police investigators and must solve the perpetrated crime.

[20] European Schoolnet (2018). Science, Technology, Engineering and Mathematics Education Policies in Europe. Scientix Observatory report – October 2018. Brussels: European Schoolnet, p.6

[21] Bahrum S., Ibrahim N., Wahid N. (2017), Integration of STEM Education in Malaysia and Why to STEAM, *International Journal of Academic Research in Business and Social Sciences*, 7(6), p.646

[22] Le Hir A. (n.d.), *Escape Game – La Disparition*



The objectives are: to find the victim's and culprit's identities, to find out how the culprit kidnapped the victims, and to get out of the room following the same path as the culprit. The scenario and puzzles build on two notions taught in this grade's biology class: blood sampling and pollen analysis.

1.2.2. Technology

Technology has been defined by the US' National Research Council as:

'the entire system of people and organization, knowledge, processes and devices that go into creating and operating technological artifacts, as well as the artifacts themselves.'[23]

Here is an example of a Technology-based Escape Game: **Retrouvez les bases de l'informatique** (Roughly translated: 'Find the fundamentals of IT'), created by Aurore Dupuy, Enora Gabory and Celia Kessassi, for a group of 6 students of French 3rd and 2nd graders (14-16 years old).[24] In a hypothetic future, a group of people – called **Antitheks**, afraid of the scope taken by IT, decided to create a virus that would destroy the Internet and all connected devices. People with IT knowledge have been eliminated. Feeling the attack coming, one IT scientist created a secret room to help novices rediscover the lost knowledge. However, he scrambled it into codes and enigmas. In this ER, students play the group of novices and must within an hour – time remaining before the Antitheks arrive in the secret room – solve the puzzles. Curriculum notions tackled by this ER are computer components, binary conversion, picture coding, database, algorithms, etc. According to teachers who implemented this ER scenario, it can be easily adapted to different age groups, by adding or removing hints.[25]

[23] Bahrum S., Ibrahim N., Wahid N. (2017), Integration of STEM Education in Malaysia and Why to STEAM, *International Journal of Academic Research in Business and Social Sciences*, 7(6), p.646

[24] Dupuy A., Gabory E., Kessassi C. (n.d.), *Retrouvez les bases de l'informatique*

[25] Dupuy A., Gabory E., Kessassi C. (n.d.), *Retrouvez les bases de l'informatique*





1.2.3. Engineering

Engineering has been defined by the US' National Research Council as:

'[A] body of knowledge about the design and creation of products and a process for solving problems. Engineering utilizes concept in sciences and mathematics and technological tools.'[26]

Engineering is a subject that seems to have fewer examples of implemented ER. However, one scenario idea can be found on the website **Instructable**, a page that gathers different tutorials on how to build a variety of projects. The ER was created by a teacher (under the pseudonym **TeacherMike**) for high school students, but the precise target age or grade is not given. The puzzles tackle notions such as Design Process, Unit Conversion, and CAD Modelling. The scenario in itself is quite simple, but the number of subjects covered by the ER is numerous.[27]

1.2.4. Mathematics

Mathematics has been defined by the US' National Research Council as:

'A study of patterns and relationships among quantities, numbers, and shapes. Mathematics includes theoretical mathematics and apply mathematics'[28]

Here is an example of a Mathematics-based Escape Game: **Enigmaths**, from Jennifer Garrido, created for a class of French 1st Graders (16-17 years old).[29] The aim is to find a code to open a safe, where the treasure of the criminal Enigmaths lies. Policemen requested the help of the students to find the code. Split into four teams, the students must solve a succession of five puzzles linked to notions taught in their class

[26] Bahrum S., Ibrahim N., Wahid N. (2017), Integration of STEM Education in Malaysia and Why to STEAM, *International Journal of Academic Research in Business and Social Sciences*, 7(6), p.646

[27] *Escape Room Engineering Review Game* (n.d.)

[28] Bahrum S., Ibrahim N., Wahid N. (2017), Integration of STEM Education in Malaysia and Why to STEAM, *International Journal of Academic Research in Business and Social Sciences*, 7(6), p.646

[29] Garrido J. (2019, May 4), *Retrouvez Enigmaths*





level (trigonometry, statistics, quadratic equation, etc.). The answer to each puzzle allows the students to find the code, then appears as a final enigma. Students can choose to collaborate to solve each puzzle or split the puzzles between them. In any case, they need to cooperate, listen to, and help each other out.

Most of the scenarios based on math follow this example: letting the pupils know that they are locked in the room and must solve enigmas to crack a code, which will allow them to get out. 'Viens jouer... aux mathématiques', created by teachers of the Bordeaux Academy in France, followed the same storyline.[30] It was made for children between 11 and 16 years old. The enigmas, their number, and the notions on which they are based vary and can be rendered more or less complex, so as to adapt to different age groups.

1.2.5. Integrating the Art in STEM

As mentioned earlier, the integration of arts in STEM is a new trend, but it derives from an alarming observation: the lack of students' creativity and the standardization of traditional education hindering it. However, creativity is crucial in training full-bodied scientists able to innovate and cope with the 21st century world-problems.[31] According to Joseph Lathan, Master of Education program's director at the University of San Diego, the Arts integrate practices that can be retranslated into science: 'modelling, developing explanations, and engaging in critique, and evaluation (argumentation)'.[32] A very practical example is the use of sketching in Engineering. Moreover, the Cultural Learning Alliance (CLA) suggests that STEAM education has a higher impact on fostering innovation than STEM does. Thirdly, CLA argues that the Arts can enhance high-performance teamwork, change management, intercultural communication, as well as improve observational skills and adaptability.[33]

[30] « Viens jouer aux maths » – exposition et escape game clefs en main pour la semaine des maths (2019, March 5)

[31] Colucci-Gray L., Burnard P., Cooke C., Davies R., Gray D., Trowsdale J. (2017), *Reviewing the potential and challenges of developing STEAM education through creative pedagogies for 21st learning: how can school curricula be broadened towards a more responsive, dynamic, and inclusive form of education?* BERA, p.28

[32] Lathan J. (n.d.), *STEAM Education: A 21st Century Approach to Learning*

[33] Colucci-Gray L., Burnard P., Cooke C., Davies R., Gray D., Trowsdale J. (2017), *Reviewing the potential and challenges of developing STEAM education through creative pedagogies for 21st learning: how can school curricula be broadened towards a more responsive, dynamic, and inclusive form of education?* BERA, p.28





Free tutorials of Escape Rooms implementation in the broad STEM context are rare but they exist: several can be found – mixing two or three subjects – on the two French websites **scape.enepe.fr** and **cquesne-escapegames.com**.



However, when it comes to STEAM, resources are scarce. Only one can be found on S'CAPE website:

Polymorphos, mixing art, mathematics and science, created and implemented by several secondary school teacher from Nice region in France. The aim of the **Polymorphos** ER is to elucidate the death of a local photographer, Charles Negre, famous for the invention of the rotogravure process. In order to achieve the goal, players must find chemicals formulas used into the rotogravure process, while discovering photography notions and history.[34]



Another project has been reported by **Scientix**: an escape room specifically designed for STEAM classes, made by pupils and teachers from different schools across Europe, for pupils, under the project 'Learn to escape'.

Unfortunately, the website **Scientix** does not give access to the tutorials, to implement this project in other schools. Contrary to previous Escape Rooms described, the project in itself was not to solve the ER but to create it from scratch with the students.[35]

Here are the conclusions we can draw from this section: Escape rooms are a great tool for both game-based learning and STEAM education as they foster fundamental skills. Within the triggered soft skills, we can particularly outline problem-solving, critical thinking, communication, and collaboration. Hard skills and knowledge depend on the subject and the puzzles deployed. Furthermore, ER apply to all types of gamers and respect the four freedoms of play. As teachers report needing more pedagogical models on how to teach STEM attractively, Escape Rooms might be the solution.[36] In the end, as **Scientix** publication shows it, ER's creation and design can even become a STEAM exercise.

Image 1 : <https://scape.enepe.fr/> - Image 2: <http://www.scientix.eu>

[34] Nadam P. (2019, October 15), *Polymorphos*

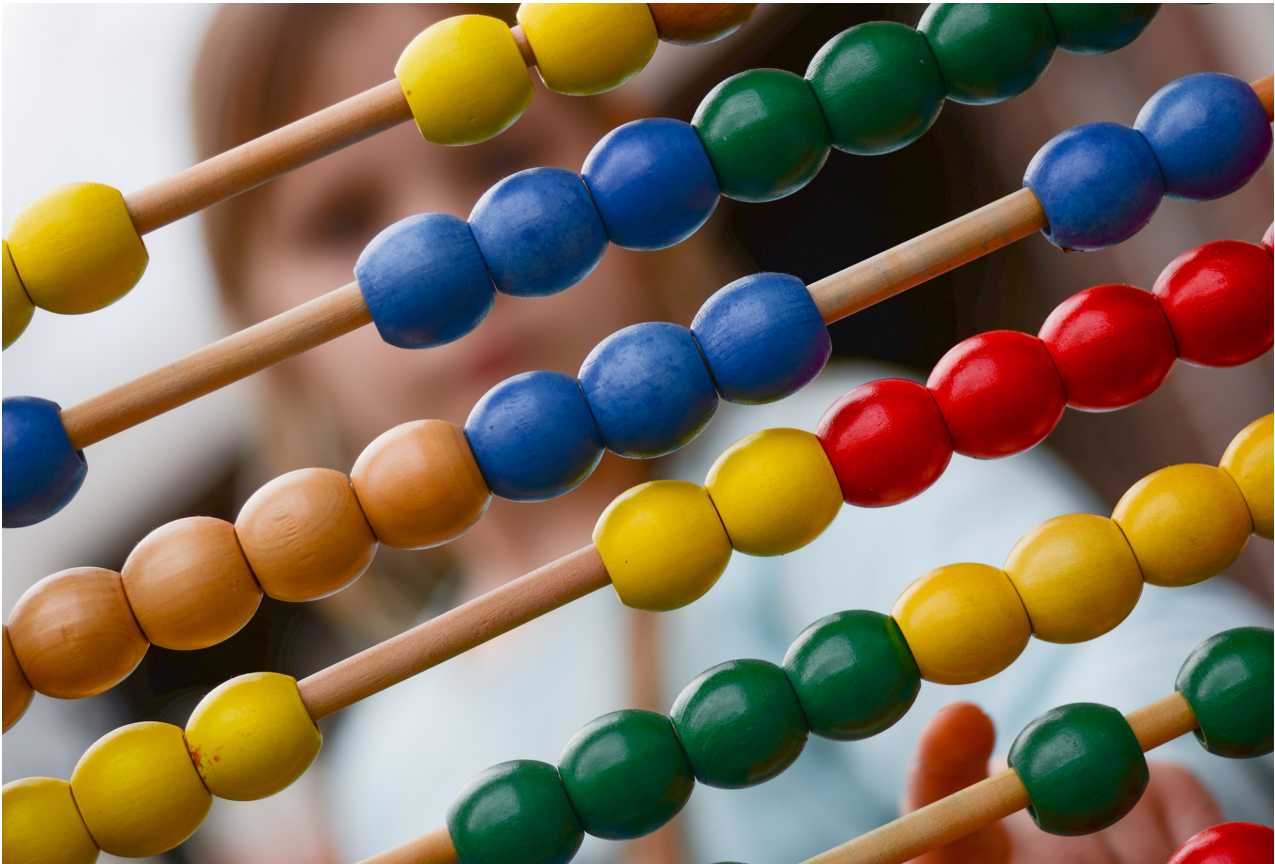
[35] Farassopoulos N. (2019, August 23), *STEAM escape room: How to integrate STEM activities in an escape room made by students for students*



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Now that we have an overview of all the concepts of this project, we can delve deeper into the actual implementation process of a pedagogical Escape Room into the school curricula. The first step that needs to be addressed, is how to integrate an Escape Room into the school curricula?



[36] Billon N., Gras-Velazquez A., Mihai G., Nistor A. (2018). *Science, Technology, Engineering and Mathematics Education Practices in Europe. Scientix Observatory report – December 2018*, Brussels: European Schoolnet, p.43



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PART 2: HOW TO INTEGRATE **ER** INTO THE SCHOOL CURRICULA

2.1. Defining the objectives of the Escape Room starting from the school curricula

One of STEAM education's priority is to provoke students' interest and to provide an authentic learning experience. According to Reeves et al. (2004), students should have **authentic tasks that have a real-world context**, ill-defined problems, complex or multi-step questions, multiple ways to approach a problem, integrate across the disciplines, and have failures and iterations built into the assignment itself (Armory, 2014). Many teachers praise the **benefits of STEAM education**, recognizing that the "design and creativity of the arts are crucial underpinnings of the successful mathematician, scientist and engineer" (Hogan & Down, 2016, p. 50).

According to Bertrand (2019), a few questions arise:

- 1) **What curriculum and instruction models of STEAM education are implemented in schools?**
- 2) **What do students learn through different models of STEAM education?**
- 3) **What sorts of assessment of student learning is occurring in STEAM education?**
- 4) **How do classroom teachers view such models of STEAM education in meeting their curriculum and instruction goals?**

The new changes in society are critical for understanding the emerging trends in education. With the proliferation of data and communication technologies, we face multiple challenges when it involves educators, therefore we must be ready to try new and effective modern teaching experiences and to make the necessary changes to stay up-to-date.





To cope with this new emerging reality, new trends in education are to be experienced and evaluated. Nowadays, we are faced with more interactive and collaborative technological environments (Amberg, Reinhardt, Haushahn & Hofmann 2009).

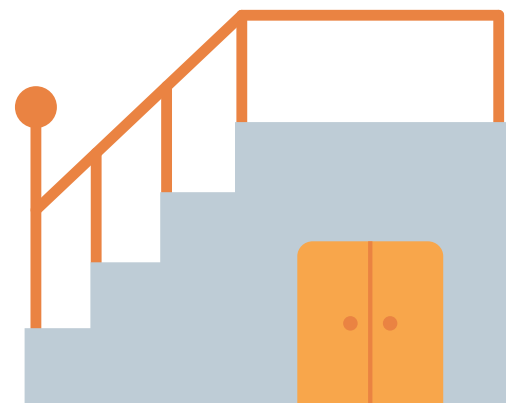
Escape rooms have already been used in education. An escape room in STEAM tries to gather tasks that involve knowledge from several subjects. It is important to have a clear briefing, from the very beginning, that states the age group of the students, the number of students, and the place where the game will be played. When working with an educational escape room, it is important to define the educational content the group will face as early as possible.

To do that, teachers should first meet and reach a consensus about several things:

- the age group and educational needs of the students
- the length of experience
- the difficulty of puzzles for different levels of players
- the mode of the escape room: Cooperation based vs Competitive based
- number of participants the game/room is to be designed for

The next step is to **develop the objectives** of the educational escape room experience.

According to Arnab & Clarke, developing the objectives for the game experience early in the design process will ensure that the experience is designed purposefully and that the game theme and puzzles are developed to reinforce the objectives instead of attempting to embed objectives into an already designed game.





The objectives are presented by:

- **Learning Objectives:** Learning objectives are required to create a meaningful educational game. These objectives are often worked into the theme, its puzzles, and its chosen mode to assist in structuring the training plan/outcomes. Creating tangible objectives allows to develop the evaluation strategy to assess players learning experience, learning achievements, change metrics, and can be iteratively redesigned to focus on the desired outcomes of the experience.

The educational escape room can be used:

- To provide alternative and exciting ways for learning new knowledge, skills or aptitudes.
- To test existing knowledge/skills/understanding/growth level.
- To link knowledge to multisensory, effective, active and/or practical memories.

The educational escape room is built to learn with various but specific learning objectives:

- To learn something concrete (subject, topic, empathy, social skills, and knowledge).
- To increase self-esteem and awareness, social interaction.
- To understand what role best fits in the team.
- To open the mind and look at things and situations from different perspectives.
- To use what is already known for a different purpose.
- To apply existing knowledge or skills, sometimes for a different purpose.
- To create awareness of the attitude and behaviour of learners and the effect of that on themselves and others in the group.



- **Solo/Multi-Disciplinary:** The escape room can be created to solve problems specific to one subject, or a group of subjects such as STEAM. It can be valuable to bring students together to explore problems from different viewpoints.
- **Soft Skills:** Interactive live-action games are by their very nature, great tools for helping to develop soft skills such as communication and leadership. One method could also be to run the experience across multiple rooms, with the answers split between them.
- **Social Skills:** Escape rooms offer opportunities for groups of students to work together to solve puzzles, gaining the benefits of knowledge and insights from others.
 - Good escape rooms are designed in such a way that they cannot be solved alone (for example they need two people in different spaces to solve a code) so that players have to communicate and collaborate to solve the puzzles.
 - **Lateral thinking.** Many of the problems and puzzles that players face in escape rooms require them to think differently from their usual mindset and combine objects and ideas in novel ways. This type of thinking is an important underpinning of creativity and innovation.
 - **Time management** is also at stake in a time-based challenge. Together with collaboration, this can promote overall personal resource management.



- **Problem Solving:** Develop problem-solving challenges to make the game experience interesting to players. A range of challenges will be attractive to different learner types. Challenges might be physical (think checking out an item), intellectual (i.e. algebra or maths puzzles), or many other variations.
 - Escape rooms present a variety of different types of puzzles from codes and cyphers and traditional puzzles, to finding or manipulating objects and complex digital puzzles. Players are presented with a variety of problems that they have to solve, gaining skills in thinking through problems, and developing approaches to solve them.
 - Players also develop resilience as they make multiple attempts to solve puzzles in different ways, and creativity as they come up with different novel solutions.

Following this step should provide a foundation in which it is clear what the objectives are that the intended game is trying to achieve with the participants. This will also provide a basis for developing the evaluation strategy later on in the design process and will help the debriefing stage.





2.2. Defining the content/materials introduced

The basic objective of an educational escape room/game is to **assimilate content** in a modern and different way so that knowledge is better comprehended. The escape room will lead students through the knowledge already acquired in lessons or will help gain new knowledge, skills, and competences innovatively. That will follow one of the principles of the scaffolding strategies, that is, tapping into prior content area and connect it to the future (Alber 2014). Therefore, such an escape room can be used as a way to revise for a possible exam or for introducing a new unit/chapter using already studied content.

Teachers meet to reach a **consensus about the scope** and the **different activities** that students will have to carry out in order to escape from the class.

On the one hand, teachers will have to decide the **type and number of assignments** depending on the length of their escape room. On the other hand, they have to bear in mind **materials and places for these tasks**.

Some of the ideas for the elaboration of this escape room include puzzle, locks (directional, alpha, digit, etc.), decrypt messages, hidden objects, searching for items in odd places, searching for objects in images, lights, pattern identification, blacklight pens, riddles, ciphers without a key, secret codes, sounds, mirrors, abstract logic, lockable containers or zippered pouches, research using information sources, mazes, physical agility, UV flashlights, shape manipulation, magnets, piece together parts, smell or taste, etc. Some of these ideas have been extracted from Nicholson (2015).


Ideally, of course, the solving of these puzzles and riddles should be based on STEAM school materials seen in the classroom, or for which the solution is available in some form inside the room. A geometry formula, the missing name of a biology system, Mathematics calculations, etc. It is important that educators know the level of their students in every subject. Accordingly, **the tasks should be challenging but achievable**. If assignments are too difficult, it could be counterproductive as students could be disappointed.



In this step, a first teacher meeting will be held to **establish the main topic** of the educational experience through brainstorming ideas. A further meeting will **set the content** that is going to be studied/revised **and activities** with a more detailed description.

After identifying the educational goals and available resources, comes a crucial step: **creating a STORY** for the room. As explained in the introduction, you have to create a **narrative** about what is going on in this room and what the learners need to do.

In this step, **players' motivations, game story, and content** are considered to bring about an amazing game experience for the students. Popular themes such as; detective mysteries, prison breaks, escape the kidnapper, spy/espionage games, etc. are used to build believability of the game experience using a range of decorations and props, lighting, music, puzzles and riddles and clues that follow the theme of the room. This step has been informed by the work conducted by Nicholson. The theme step is split into four areas for developers to consider in their design process.



ESCAPE MODE
Escape a locked room in a set time.

MYSTERY MODE
Solve a mystery in a set time.

NARRATIVE DESIGN
Develop a compelling narrative for the game to keep players' interest.

STAND-ALONE/NESTED
Determine whether the game is a one-off experience or part of a larger, nested experience in which several games can be designed and played.



Within the four steps, the developers are asked to consider the composition and narrative structure of the game so that players can identify with the game experience and build personal motivations to complete the game.

The escape room aims to utilize learners' potential by addressing different skills and competences and at the same time be relevant to the content/ theme of the game. Tasks should respond to different learning styles, qualities, and personalities.

Elements that contribute to learning, understanding, remembering, creating awareness, and personal growth are:

- **Use of pictures;**
- **Use of pieces of text and information in order to understand it and come up with the answer;**
- **Use of quotations/ facts and need to structure them and put in order;**
- **Logical thinking tasks;**
- **Creative thinking tasks;**
- **Chemical, biological, physical related tasks;**
- **Lateral thinking tasks that force the participant to understand and escape from their own box;**
- **Possible tasks that are not mandatory for solving the room and exit, but those tasks are exciting and useful for learning objectives**



2.3. Creating a coherent context

It is relatively easy for teachers to define good teaching goals and to find a narrative scenario. Designing a game-flow instead is less common: in an escape room, it is a matter of designing the puzzle sequence that players would have to solve to get out of the room. Escape rooms could have a predefined sequence (sequential game) or a more flexible one (open sequence), or even hybrid solutions with more paths (Nicholson, 2016). Teachers also need to consider whether there is something for everyone to be doing during gameplay. This will depend on the degree to which the puzzles are open or sequential.

An entirely open game may lack narrative flow, while a sequential one may leave some players on the sidelines. A balanced combination of different parallel paths provides a solution but needs careful testing to ensure that all paths are with the same degree of difficulty.

After creating the story for the room, the teachers should use their creative thinking abilities to figure out the TASKS (games, puzzles, riddles...), each kind of challenge inside the room that learners will have to solve to advance in the escape room and get closer and closer to the final goal.

Each task should reveal some information, provide a guideline, or key that learners will use afterward. Those tasks are also the opportunity **to link the room with the educational goals.**

The tasks should be **designed** according **to different competences and abilities of learners**; not all of them should require only logical, digital, or mathematical challenges. The tasks should be solved using **different perspectives**, ensuring that **all learners are included** as each one can bring to the common goal something different but equally needed.



All exercises and assignments must be prepared and placed in advance. It is important to have **a system to check the game-flow** of the room, the puzzles and their order, and the key objects that the players need to interact with. A simple way to do this is by creating **a room map** - this details each puzzle and provides a memory aid to where it is located in the room, and visibly shows the flow of the room in terms of the order in which the puzzles must be completed.

A **room map** is useful for **checking for consistency** in the room design, sharing the design with others in the design team, and acting as a key to re-setting the room once it has been played.

It also provides an overview of the room and enables you to consider the **game balance**:

- Have you included a range of different types of puzzles?
- Have you included a range of different puzzles difficulties?
- Have you used a variety of different types of lock, such as physical (padlocks, keys), mechanical (Magnets, weights, gears), and electronic (computer passwords)?
- Are there many different things for people to do (e.g. searching for objects, solving puzzles, opening Boxes)?

It is also important to consider how to **integrate the narrative into the game** – it will be the key to solving the puzzles or simply add to the atmosphere of the game. Teachers need to think creatively about how to bring the narrative into the game from initial briefing through to the end game. Teachers also need to think about the finish of the game - what is the objective from the students' perspectives and how they can make it as satisfying as possible if they achieve it. It might be to escape a room, but it could involve defusing a bomb, or solving a mystery.



Again, tying this together in a **coherent narrative** can significantly add to the players' enjoyment of the game.

As with all aspects of the game, it is important to test each puzzle individually with as many people as possible. Consider:

- **Is it clear? Do the players understand what they have to do? Are there other possible interpretations of the instructions?**
- **Does the puzzle assume some prior knowledge? Can you make this available in some form?**
- **Is there only one solution, and is it obvious when the correct solution has been found? This is a very important point: nothing is more frustrating than finding out a puzzle has been solved first try without even realizing it!**

Once there is a **plan** and the basic **individual puzzles** that form the game, the teachers can **bring them all together**. Testing at this stage will enable teachers to discover whether they have the **right balance of playability and learning**, and allow them to refine existing puzzles or add new ones. At that time, supplementary elements (secrets and surprises that add an extra level to the game) can be put in.

The next thing to think about is the necessary equipment to make the puzzles work and to set the scene. Consider:

- **Staging and props.** What can be added to the room so that it fits in with the theme?
- **Lighting and sound.** If there is control over the light, how will it be set? Will there be music playing?
- **Backstory.** Are there additional elements that fit in with the narrative and provide colour through a backstory?

Testing the escape room **at all stages** is crucial in order to develop a game that is both **educational and fun to play**. A self-evaluation checklist tool can be used to guide testing.



2.4. Tools to integrate content; Visuals, Apps, ...

Developing the puzzles and activities that the players will interact with during the game experience is a very important stage in the overall design of the escape room. This step has been informed by the work conducted by Nicholson.

Puzzle Design Puzzles and riddles should be diverse, challenging and adapted to fit learning objectives.	Reflect Learning Objectives Refer to proposed learning objectives and themes to ensure that puzzles reflect the overall goals of the learning experience.
Instructions/Manuals Clear instructions and explanations are of major importance to help guide players	Clues/Hints Escape Rooms are notoriously hard. Insure clues are available and the method of delivering these clues to players in-game does not break player immersion.

Ensuring that the puzzles accurately reflect the objectives set previously in the design process will allow for easier validation and assessment of whether the objectives have been achieved at the end of the game experience. It is also useful and an essential part of escape rooms as noted by Nicholson, that the developers provide players with clear instructions and have a plan for providing clues when/if players get stuck whilst playing through the game.

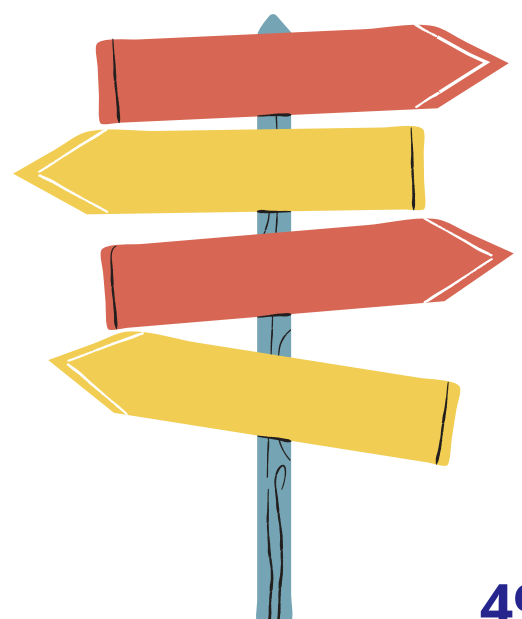
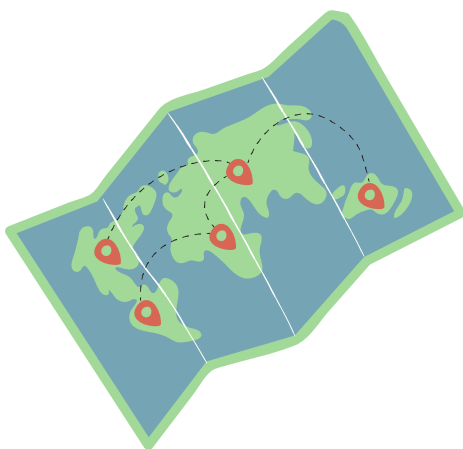
Most Escape Rooms have levels of difficulty ranging from beginner to intermediate and finally landing on expert. Depending on the group, you will want to challenge the group but not stump them so the puzzles and riddles are nearly impossible to solve.



Create the easiest puzzle first and increasingly make the tasks more difficult. You will also want to create a wide range of puzzles, clues, and strategies to adhere to the different skills each player will possess. It will get boring if the same person who is great at finding patterns for codes is used over and over again.

A possible example for designing the assignments for the escape room:

- Choose 6-9 puzzles for an hour-long experience. Puzzles might be things like substitution ciphers, visual images, word puzzles, word searches, or logic puzzles.
- Divide students into teams of 4-8 people.
- Use Google Forms as the basic "progress meter": this is where each puzzle is presented, the answer is typed in, and the next puzzle is revealed with the instructions to make the next handout actionable. Every subsequent puzzle will need a correctly spelled answer in the Google Form to advance to the next screen, which provides the needed clues to solve the next puzzle, and so on until the end.
- Each team gets an envelope with all the puzzles as the game begins. While the handouts are all present at the start of the game, none of them makes sense at the outset until the first puzzle is solved. Each subsequent puzzle only makes sense as the last one is solved, because it provides a necessary clue in the introduction of the next puzzle.





Another important step in designing the escape room is the location/equipment that should be used to support the game experience, informed by Nicholson's work. If the design of the game is to be supported with technology, this step can be useful to consider and plan for how the players are going to interact with that technology and what to do if the technology fails. For example, should you want to create digital puzzles and clues, free software such as Genially are very sufficient for pedagogical ER.

DESIGN OF THE game

Location/Space Design

Ensure enough space for the game experience and that it is comfortable to move around. The environment should reflect the theme as realistic as possible within means.

Physical Props

Puzzle props, red herrings + general environment items, these are needed to make a compelling and workable experience.

Technical Props

Use technology to enhance the game experience.

Actors

Real-life actors can help concrete the experience further as believable. Actors can also indicate the time or can give out hints if they see the players have difficulties.



This step is used to bring animation to the game experience in terms of providing a life-like or believable setting for the players to interact with.





2.5. Debriefing to link to the school curricula's requirements

It seems appropriate to mention that the ability to make judgments has recently become a major issue. It refers to the ability to analyze and evaluate information and make a reasoned decision, which will empower students' critical thinking. By groups, students will have to assess two dissimilar aspects. On the one hand, students will have to value the escape room itself. They have to learn to make constructive comments that could help teachers to improve the work. On the other, they will have to evaluate themselves as a group. Students must be aware that what a person in a group does might affect the rest of the partners.

The power of the escape room experience often lies in **the debrief**. The teachers should set aside at least 10-15 minutes to allow students to talk about the experience. It is recommended to have students explain each of the puzzles, and after discussing what the teachers observed. Pointing times when teachers saw communication fall apart, or when they thought students were on the same page, is a great way of having students understand where their strengths and gaps lie.

What about learning? Every task should be linked with the story and provide some learning, either from a specific topic or transversal topic thanks to the game itself (while working in a team, discovering own competences and needs, dealing with time pressure, etc.). Depending on the educational purpose of the room, the crucial learning may happen after learners have exited the room. This is the 'debriefing room'.

The **debriefing room** could be a neighbouring room/space or can even be in the same room. It is the content and the role of educators that matters more than the space. In the debriefing room, the educator can talk with the team about their experience in many ways: what they have learned or understood, what changes this experience made to them, what their role was on the team, what surprised them, what specific subject material they learned, what would they change, etc.



The debrief acts as **feedback on the game** from the teacher/game master as well as an explanation of how to solve the puzzles. The key part of the debrief process is to facilitate the players into providing feedback on the experience. The debrief process can provide valuable insight into things such as team-dynamics, communication, and different ways players approach problems. The teacher/game-master directs the discussions and asks the students how this can help them moving forward with their studies.

In the end, the teachers will have a meeting to assess the strengths and limitations of the educational experience. They will use the rubrics completed by students to have their point of view.

As a result of our studies of pedagogical scientific literature, we can draw the following conclusions:

1. Game-based learning techniques and escape room projects are one of the most current and preferred methods of teaching STEAM subjects;
2. "Escape room" are very suitable and are directly dependent on the requirements of modern students for diversifying the process of mastering complex STEM disciplines;
3. "Escape rooms" are also part of the constructivist classroom, Problem-Based Learning, Inquiry-Based Learning, Project-Based Learning and develop the following important skills in students:

- awareness (active listening);
- development of strategies (planning);
- stress management;
- change management;
- criticality and creativity;
- productive collaboration in a group (team);
- self-assessment skills;
- learning skills (laws, theories, concepts);
- time management;
- leadership skills;
- the ability to put yourself in the place of the other (empathy);
- making a decision;
- problem-solving



Escape rooms, on the other hand, can help develop problem-solving competencies such as:

- ability to understand the nature of the problem;
- ability to understand the causes, consequences, and wider impact of the problem;
- ability to see the problem systematically;
- ability to deal with the problem systematically;
- the ability to use intuition;
- ability to structure the problem;
- the ability to avoid oversimplification and maintain focus;
- the ability to ask questions that would bring us to the heart of the problem;
- ability to adequately evaluate

The organization of the Escape room is an Inquiry-Based Learning, which is at the heart of all curricula in Europe.

So now that we know how to integrate Escape Rooms into the school curricula, we need to take a look at how we can use the students' previous knowledge best into the escape room and how to augment the impact of the skills and knowledge developed during the Escape Room itself. In other words; how do we maximize the pedagogical benefits of the Escape Room?





PART 3: HOW TO CAPITALIZE ON PREVIOUS KNOWLEDGE OF THE STUDENTS AND HOW TO VALORISE THE SKILLS AND KNOWLEDGE DEVELOPED DURING THE ESCAPE ROOM

Different steps can be taken to ensure maximum pedagogical benefits of the Escape Room. Good preparation and design of the Escape Room, on both a practical and pedagogical level, are necessary for the efficiency of the ER. First, we will mention the steps needed before the implementation of the ER, such as Preparatory Lessons and the appropriate design of the ER. Then, before diving into the ER itself, we will address the aftermath of the ER with regards to the importance of debriefing, collecting feedback from the students and the follow up. Finally, we will explore ways to improve the process to maximise the pedagogy, efficiency, engagement and fun for the students. First, let us begin in order with preparation.

3.1 Preparatory lessons

Game-based learning gives the advantage of gaming technologies and uses game strategies in the context of educational development and processing. However, non-digital game-based learning applications compared to their digital counterparts are more human-centred and focused on cooperation and collaboration. As a result, the popularity of escape rooms in educational settings is rising and includes elements from “point-and-click adventure games, live-action role-playing, interactive theatre, treasure hunts, movies” (Panagiotis, Mastoraz 2019), etc. Educational escape rooms can immerse students as active participants in the learning environment and simulates real-life conditions.





Thus, considering the preparatory lessons and planning of an educational escape room in the context of STEAM education, cross-disciplinary collaboration among pedagogues and its principles should be addressed. The preparatory lessons must elaborate on students' knowledge in all STEAM subjects, so the escape room session capitalizes on the knowledge obtained during the preparatory lessons by integrating all fields genuinely and intuitively. According to Oganisjana, aspects of cross-disciplinary learning process foster the development of a habit to interpret and analyze phenomena around the students in its whole complexity. Moreover, real-life problems cannot be solved within one specific field but require knowledge from different fields and the farther the fields are, the higher the level of creativity is (Oganisjana 2015, 42).

Based on the combination of this theory the following three aspects should be kept in mind while collaborating to develop a STEAM-based escape room:

1. there should be a real-life problem that students have to solve during the escape room session to develop a new skills or understanding about the world or issue in the context of STEAM;
2. the problem is considered in a cross-disciplinary way and the tasks, along with the preparatory lessons, should be designed around knowledge that leads to a discovery of new perspectives, innovative ideas and crosses traditional subject borders;
3. the cooperation among STEAM educators should not be based on the assumption that each of them is an expert in their field, rather on the willingness to cooperate because it is only together that it is possible to solve the problem and boost students to create new values or understandings;



Considering the three aspects of the cross-disciplinary learning process, an example can be provided to illustrate the concept of cross-disciplinary pedagogical escape room in opposition with an academically single-field focused escape scenario. The problem or the issue to start planning a STEAM-based escape room can be facilitated by educators as well (and which is even more recommended) by students, as that would drive the learning process closer to their understanding of the world. In order to search for a research question, Oganisjana suggests to try out a simple technique:

- 1) Write 5 things or phenomena that caught your attention today.
- 2) How could you use these things or phenomena in your specific subject?
- 3) Try to connect the idea developed in Point 2 with at least two other subjects (in this context it would be STEAM fields) (by Oganisjana 2015)

Escape games lend themselves to learning a range of transferable cross-curricular skills - such as collaboration and team-building, problem-solving, lateral thinking, and creativity - because of their intrinsic design that involves working together to solve puzzles.





EDUCATORS WILL WANT TO DESIGN ESCAPE ROOMS THAT ADDRESS THE CURRICULUM ACROSS A WIDE RANGE OF DISCIPLINES.



● SUBJECT KNOWLEDGE:

Puzzles can be designed to test knowledge of a subject, for example putting historical events in the correct order or recognising characters of novels.



● SKILLS:

Application of knowledge to tasks that develop or test physical or mental skills, for example using a microscope to identify a certain type of insect, hitting a target with a ball, or a code that involves translating binary into decimal.



● FAMILIARISATION:

Where the puzzles are not necessarily directly related to an area of skill or subject knowledge but allow the learner to familiarise themselves with an artefact related to the discipline, for example, codes using the periodic table.



● PRACTICE:

Where learners have to practice a core repetitive skill, such as a mathematical formula, to consolidate learning, for example students could solve problems to find the circumference of circles of different sizes.



● RESEARCH:

Learners can enhance their research skills in the room, applying both their skills and subject knowledge to solve a puzzle, for example using a bilingual dictionary to translate a secret message, or looking up information to solve a puzzle.





ESCAPE ROOMS CAN BE USED IN SEVERAL DIFFERENT WAYS AS PART OF A LEARNING EXPERIENCE.



They can be used diagnostically to test where students are before starting a new topic or area of study so that the teacher can gauge their level, identify any gaps and misconceptions that need to be addressed.

They can be used to introduce new information, concepts, or ideas to students or as an eye-catcher to engage students' curiosity.

They can be used for consolidating knowledge and applying skills already learned in a previous step.

They can also be used formatively - both for the teacher and students - to assess progress and areas that need additional attention.



Finally, they can be used as a summative assessment at the end of a block of study to check that the intended learning outcomes have been achieved.





In many countries, it is difficult to fit activities such as escape rooms into an existing classroom setting because the curriculum is prescribed and already full. This is much more the case at high school or secondary education than primary schools where there may still be some flexibility. This makes it harder for 'fun' or innovative teaching approaches to be embedded or accepted in schools. Though the classroom environment and inflexible schedules may also make it difficult, there is a range of ways in which escape games can be embedded in the classroom:

ESCAPE GAMES WITHIN THE CLASSROOM:

class

Within **core subject curricula** - if there is a close mapping between the curriculum and the content of the game then it may be possible to fit into the standard teaching class.

teachers

In some countries, during **induction** - this is a common time to use escape rooms before the prescribed curriculum starts; it is also typically a dull topic that students engage with poorly, therefore escape rooms are a good alternative.

friends

After-school clubs - There are fewer restrictions on optional activities which can offer a good alternative to get learners engaged in activities such as escape rooms. However, as the activity is optional, students will choose to attend or not and there is a possibility that not all students will benefit from it.

School

Enrichment - many schools in the UK offer 'enrichment' times, often one or two weeks before the start of the summer holidays or after exams that are specifically designed for different types of non-academic activities such as sports or work experience. Escape rooms may fit in well here.



3.2 Pre-Escape Room briefing

It is useful to have a standard briefing for players before they enter the Escape Room, both to introduce them to the escape room format and lay ground rules but also to orient them to the narrative of the specific game being played. This should cover:

- health and safety issues (e.g. don't climb on the bookcase), make it clear what is - and what isn't - part of the game (e.g. anything above head height or with a sticker on it is not part of the game)
- set expectations about what is acceptable behaviour in the room (e.g. don't use brute force), introduce difficult or unusual locks
- explain what happens in the case of a genuine emergency.

Introduction of the narrative can be verbal, but can also take the form of short videos, making it more engaging for students to delve into the theme.

3.3 The importance of debriefing

Debriefing after the Escape Room is key to supporting the transfer of skills and knowledge through the ER. It also initiates reflection on the tasks of the ER. Whichever way an escape room is embedded into the classroom, time needs to be built into the design of the learning experience to allow for reflection which will consolidate learning. Learning happens within the game, but it only becomes conscious and stable after it is brought to light through discussion. The debriefing session at the end of an educational escape room is as important as the game itself as it offers players the opportunity to talk about what happened (including their feelings and emotions), reflect on what went well, what did not, and why. Furthermore, discussing the team's performance, exploring common mistakes and problems, and linking the game puzzles to the curriculum, are occurrences where the teacher can check that the students have met the intended learning outcomes for the game and explain any issues that occurred or misconceptions that learners may have left the game with.



3.4 Feedback of Students

The feedback phase of the escape room is for developers to consider how they are going to evaluate the game experience of each participant in the context of STEAM education. Also, it is useful to gather feedback from the students that made the ER to identify problems, weaknesses, and to improve the experience for the next participants.

Several aspects should be taken into account:

Objectives of the escape room i.e. the pedagogues should consider the methods that they are going to employ to assess whether the game has met the intended objectives and outcomes. Moreover, in the context of STEAM education and the cross-disciplinary methodology by Oganisjane 2015, the evaluation is considered to be one of the main components of developing educational escape rooms applications.

The evaluation of learning objectives is essential, and a formal evaluation of the learning objectives that were set for the game experience should be created to be used after the educational escape room experience. This can be done according to preferred methods.

In order to make adjustments and improvements, the player feedback can be used to provide informed decisions.

The feedback after the game can be used to gather data and to assess the overall efficiency and impact of the STEAM-based educational escape room experience and the transfer of knowledge. Additionally, it is useful to employ the data gathered from the evaluation to apply any further needed development of the game experience.



3.5 Follow up

Learning in the 21st century consists of two essential parts and can even be named 'hybrid learning'. Similar to real-life situations, the learning experiences and processes can be scaffolded within digital and physical contexts and virtual spaces. According to Clark & Co., exploiting the engaging characteristics of gameplay into the classroom, escape rooms provide a hybrid environment within which physical spaces play a key role in creating a creative context to the learning activities, personified by puzzle-solving, use of digital means, connecting clues, teamwork, and communication (Clark & Co 2017). This approach enables the application of hard skills along with soft skills and opens up opportunities for the STEAM learning process to be more active and hands-on.

Furthermore, STEAM experts cooperating and taking a cross-disciplinary approach to the creation of pedagogical escape rooms allows for having an enriched viewpoint on the different ways to consolidate escape rooms and valorise the different skills, competences, and knowledge acquired. The following questions can be used to gather data for further projects and to evaluate and improve each aspect:

1. Do you think an escape room has educational value?
2. What have you learned that you didn't know before?
3. Which of the ideas are useful to you?
4. What new values or understanding have you developed?
5. Write three main ideas describing today's escape room?
6. What obstacles did you have to overcome?
7. What helps or hinders you to work and cooperate in a group?
8. What different STEAM subjects have you used in the escape room?





3.6 How to Improve the Process

The follow-up questions and the data gathered during the feedback session can be used to improve the educational escape room creation process, as analyzing the gathered data can help visualize information hidden in the process of participating and getting involved. Another important part is a reflection from the teacher on what went well, what had the students struggling, and why? It is important to take observational notes during the experience to improve the creation process. Communication with other teachers and pedagogical escape rooms experimenters can be beneficial as well.

We are now aware of all the steps that can be taken before and after the Escape Room to maximize its benefits in terms of pedagogy. Let us now concentrate on what happens in the escape room itself and how to build it game-wise.





PART 4. HOW TO ANIMATE AN ESCAPE ROOM

In an escape game, the game master has a major role in the animation. Even if he does not participate in the creation, he must know every cog of the game. Throughout the session, he will have to be attentive, dynamic, and rigorous. Keeping all these recommendations in mind, he will ensure that the game runs smoothly.

4.1 Guidelines and briefing

The main mission of the game master is a completed game. To do this, the facilitator must use his observation and listening skills. When the students play, the teacher must assist them in their quest to solve the mission. Interventions must be adjusted: only essential information should be given.

Beware, a controlling posture could slow down the game dynamics and hinder the players in their game. It is necessary to find the right balance by accepting that sometimes students find different strategies to solve enigmas. Some puzzles can sometimes be too complex for the players.

At the end of the game, the facilitator should take the time to debrief with his or her students for a minimum of fifteen minutes. It is important to go through the game again and bring to light the skills and concepts involved, but also to highlight their successes and discuss the obstacles they faced. Finally, the facilitator should listen to their feedback to improve the next animation or perfect the creation of the next game.

Each game part is different and evolves according to the personality of the animator. Experiencing an escape game as a player can help to identify the expectations and emotions you may have when you play it.





4.2 Supervision and Security

In a traditional escape room, the game master is outside the room where the game takes place. Here, he will be in the room with the players. The facilitator can sit in a corner of the room to observe without disturbing. It is also possible to communicate with the students using a screen (walkie-talkie; microphone; computer screen, etc.). Unless it is to help depending on the time, the progress of the teams) or to settle any conflicts that may arise in the groups, the Game Master does not intervene.

During the introduction of the game, the presentation of the mission must be done carefully: to strengthen the quest, the number of instructions will be reduced to a minimum. It is also possible, depending on the degree of complexity of the game and the autonomy of the players, to not set any rules.

The students are under the responsibility of the facilitator. After having explained the rules of the game, he must remind them of the safety requirements to abide by during the game: "do not use physical force, do not sneak anywhere, do not climb on furniture and do not attempt to dismantle objects or furniture...". The facilitator should not hesitate to ask another adult to assist him or her to supervise the game. He or she can also anticipate this step by giving each student a road map with safety and operating rules beforehand.

Once the pupils have been immersed in the plot and made aware of the operating and safety rules, the game master must inform the pupils of the time allotted to solve the puzzles and complete the mission.





4.3 Different types of help for different objectives

Players must mobilize various skills related to teamwork such as collaboration, exchange, mutual aid, and listening. They must also use research skills such as deduction or deciphering. Students are actors in their learning. Thus, the game master must observe the actions and modes of operation of the players and take note of how the students benefit from solving the escape room.

From the start, the game master must remember that the escape game has been set up to take advantage of what has been learned in class. They are able to solve the puzzles using their knowledge. By creating sub-groups to divide the riddles, they will be able to progress faster. The facilitator must insist on the fact that each player and sub-group must try to solve every unsolved puzzle. A different reading of the information will allow them to adjust their thinking and thus get to the end of the puzzle.

It is necessary to anticipate possible blocks. Depending on the progress of the teams and the time elapsed, the teacher can give clues to speed up the thinking process or add time if the pupils have not finished. Be careful, it is not a question of giving the solution, but of giving clues of varying degrees. In facilitator can offer a card to understand a tool; the possibility of "buying" hints with a starting sum (this restricts the amount of requests for help and encourages group autonomy); if the riddle is solved in a given time, students can benefit from bonus points allowing them to have a joker for emergencies.



4.4 Clues and guidance

Unlike a traditional escape room where players are locked in a room, students must find hidden or coded clues to complete their quest. Before the game begins, the Game Master must take the time to brief them on the experience they will be having.

A minimum of instructions and a diversity of puzzles in both content and form are therefore important to encourage teamwork. The facilitator should also think about going deeper into the scenario, avoiding a linear synopsis. If each puzzle is solved one after the other and so on, the game experience will be weaker. The game master can imagine his students discovering clues for a puzzle they will face later, whether they are codes, keys, or even objects to use.

Puzzles must be enigmatic, or the game loses its interest. Care must be taken to alternate levels of difficulty, keeping in mind that they must be neither too easy (at the risk of losing the students' commitment) nor too difficult. To reach the end of the quest, all the puzzles must be solved and understood. Students should work in small groups according to their connections and affinities. They should collaborate by discussing, hypothesizing, experimenting, and sometimes making mistakes.

Players should not be helped too much. But neither should the facilitator not help them at all. This would slow them down and could lead to a final non-resolution of the quest and cause a loss of confidence. The game master must observe them, guide them, accompany them, and evaluate if he needs to readjust the game.





4.5 Time management

While a traditional course may seem long to some students, the escape game format can offer the opportunity to review or address concepts at a different pace in an entertaining way. To reach their goal, players must be able to solve the puzzles and, additionally, complete their quest.

While a traditional escape game usually lasts an hour, the game master can set the time allocated to the game according to the time slot available or the attention span of his students. In any case, he must inform the students at the beginning of each game of the time allotted to them.

As the game is timed, the facilitator must be attentive and reactive. He must not hesitate to play on timing to control the energy and excitement of the players. If students get stuck on certain puzzles, the facilitator should give them a helping hand by luring them to clues or suggesting leads. Be aware that each push must be given at the right time. Creating a flow chart, which shows the game scenario and the relationships between each puzzle will allow the facilitator to visualize the progress of the players. It is up to the facilitator to judge if, and when, to intervene, taking into account the time, the dynamics of the game, and the exchanges between players.

The facilitator can use objects to symbolize the “pushes” or “hints”, and thus keep count of them. The use of cards with a thumb, hidden in the escape room or offered on request by the game master, will help to de-dramatize the concept of error and go beyond the blocks. Be careful however never to give the answer! This is counter-productive and will increase the disappointment of the participants.

Finally, the game master has to accept that he is not always in control of everything. If he has to deal with the unexpected, rhythm, and time, he must also leave room for chance. It is important to remember that this is a game and that it is important to let go of method and technique.



4.6 Position of the Teacher

Learning through play is an issue that has been discussed for several years in school pedagogy. In addition to games on media, the growth of digital tools available in schools requires investment in what are known as "serious games", which include escape games. Games have always been linked to learning, and by using them, pupils change their behaviour in order to learn. In this way, they contribute more to the development of their knowledge.

Playing an escape game means letting go of your role as a teacher. The teacher takes the role of master of the game, he monitors the progress of the game, reminds the students of the time that is running out, and accompanies by giving a helping hand when an enigma blocks the group. The uncertainty of the game, which evolves according to the difficulties of the puzzles and the time that elapses, among other things, requires the teacher to let go. The teacher must accept that he is not in control, trust his students, and his own ability to overcome difficulties.

However, the facilitator must not forget the objective of this activity: learning. It is difficult for the teacher to perceive the contributions of each player (reasoning, knowledge, and skills) because it is a collaborative and cooperative game. He or she should remind participants from the outset that even if an escape game is indeed a game, real learning objectives are hidden behind the puzzles.





As with any fun activity organised in class, a debriefing phase should be organised at the end of the game. Whether it is during the design of the escape game or the game phase, the teacher must keep in mind the pedagogical exploitation of the aftergame. This phase allows for the teacher to analyse each puzzle again and thus demonstrate the solving strategies, skills and knowledge retained. Therefore, even those who were not involved in solving the puzzles directly during the escape game can understand. It may also provide the teacher with ideas for improving his or her game. It is recommended that a paper trail accompany this phase, if none was available during the activity, to allow students to retain the new concepts they have learned.

Finally, the teacher must not forget to collect the students' feedback and make sure that none disliked the experience. Collaboration and communication within the group should be discussed: ask participants which steps they preferred and why, even if they did not. Also, ask what they learned best and why.

4.7 Preparation and classroom organisation

The Game Master must have a thorough knowledge of the scenario, even if he didn't design it himself. He is the only one who knows all the elements of the puzzle: the location of the puzzles, the solutions, and the shortcomings. By knowing exactly how the scenario unfolds, he ensures that everything runs smoothly. He should not hesitate to keep in hand the game's flow chart, this will allow him to react quickly in case of difficulty.

Before the start of the mission, he has to check that the equipment is ready, that nothing is missing, and that the digital tools, if any, are well configured. The room in which the escape game will take place must be available at least fifteen minutes before the start of the game. He must not forget to remove any unnecessary equipment that would interfere with the game.



The class must be prepared: the students must know what an escape game is. He has to let them know that beyond the game and behind the puzzles, they are there to deepen the knowledge they have learned in class.

The first step is to script the moment the pupils enter the game. The facilitator must present the plot of the story in such a way that the players are transported. Where are they? Why are they there? What is the goal? All this, while maintaining the atmosphere of the game. It's up to them to determine how they will go about completing the quest. For the experience to have a stronger chance of immersion, the presentation or the introductory speech could be done in such a way that the students have not a teacher, but a character involved in the adventure in front of them!

During the game, the game master can direct participants by encouraging them, alerting them to their forgetfulness, or giving them a helping hand if they get stuck. However, he must not forget to give the participants the freedom to own the space, discover the material, collect clues, and question themselves to initiate cooperation. Finally, he must pay attention to existing and developing relationships. He must adapt to the personalities of the students: encourage the most hesitant to participate. Likewise, the facilitator should not hesitate to temper players too invested in the game. Everyone should be able to participate as they wish, and it is necessary to accept that some people are resistant to the game.





4.8 Tips for teachers to overcome potential challenges

For an escape game to run smoothly, a maximum of ten students should participate in the experiment. The space dedicated to the game and the number of puzzles must be accessible to all. Players must be able to move freely in the space and participate in one or more puzzles. The teacher can imagine, with another teacher, the animation of two escapades games in parallel, which will increase the dynamics of the game. The players will be faced with a double challenge: to solve the puzzles in a given time and faster than the other team.

Throughout the game, one must preserve the team's dynamism and sustain the rhythm. To do this, the minutes that elapse must be reminded aloud to motivate the troops if necessary. The facilitator allows for cooperation and collaboration between players. Teams should be asked to split up and create sub-teams to solve the puzzles separately. As well, they should be reminded of the need to communicate with each other and guided as needed to re-establish connections.

The scripting of the game is important: the more linear the game is (the solution of the first puzzle gives access to the next one, etc.), the less the group will split up the puzzles. All players will follow the puzzles at the same time. In addition to muddling around the same question, the game loses interest. To avoid this, the teacher should plan the game with several activity areas from the start.



A typical school activity comes with instructions. Here, it is advisable to add as few instructions as possible. If the teacher finds it difficult to detach himself from the classic activities, he can imagine instructions that will be given to the students only if they have difficulty solving the puzzles.

Finally, it may be difficult, depending on some of the school subjects and their programs, to imagine puzzles. To deal with this, the teacher can create a cross-curricular escape game or use it as a tool to review several parts of the school-based program.

There is one aspect that we haven't covered yet in this chapter that involves the preparation and explanation of the animation of an escape room and that is: how to prepare for and how to integrate different types of student profiles? This next chapter addresses these questions.





PART 5: HOW TO INTEGRATE DIFFERENT PROFILES OF STUDENTS

The inclusion of all types of learners, especially children who have Specific Learning Disorders (SLDs)[37] is essential for this innovative way of promoting STEAM education through Escape Rooms to work efficiently. In this part of the guide, we will have an overview of the different types of SLDs, the challenges they may encounter in an Escape Room, and potential ways to adapt the Escape Room to make it inclusive.

5.1 Determination of the target groups

To make an escape room inclusive, the first step is to determine the target group of the escape room. It is necessary to identify the peculiarities of the students to tailor the learning experience in a way that all pupils will be able to benefit from it. As we are developing educational Escape Rooms, we will focus on Specific Learning Disorders, but the adaptations advised for SLDs are usually useful for all pupils.

First, it is advised to determine if some participants have specific needs, and if so, which ones? Are there any particularly difficult tasks for them? What type of group is it: is it composed of people that have similar needs or is it a mixed group? How many are they? What is the age range? Once the information is compiled, you need to establish a list of the specific needs that need to be addressed for the escape room and how to reasonably adapt the materials or the experience.

[37] SLD: "Specific Learning Disorder", also referred to as a "Dys"-pupil, as in Dyspraxia, Dyslexia, etc.





5.1.1 Inclusion in Escape Rooms

The design itself of an Escape Room is often the source of challenges with inclusion. To understand these challenges, we will make a quick introduction to the different Specific Learning Disorders on which we will concentrate here so that it will be easier to identify the target group and the necessary adaptations.

It is important to understand that Specific Learning Disorders, or SLDs, are not stemming from a physical impairment, a motor disability, or mental retardation. They are also not due to an emotional disturbance, nor a disadvantage of economic, environmental, or cultural nature.

Specific Learning Disorders have a neurobiological cause that affects the way the brain **processes information** and can disturb the **cognitive development** of a learning ability such as reading, writing, speaking, doing mathematics, or planning and coordinating motor tasks. To be more precise, the brain of a person having a Specific Learning Disorder functions differently when it comes to receiving, integrating, retaining, and expressing information, which can result in difficulties to process certain information or stimuli.

There are different types of SLDs and although all of them, as their name suggests, are specific, they can also overlap in some cases.



5.1.2 What are SLDs?

Dyslexia is the first and most common Specific Learning Disorder. It is a cognitive disorder that translates into difficulties in reading and language-based processing skills. Concretely, the brain takes longer than usual to identify and connect letters and words with other kinds of knowledge. This disorder can affect reading fluency, decoding, reading comprehension, memorization, writing, spelling, and sometimes speech. It is not rare to have it overlap with another Specific Learning Disorder, which is a phenomenon called co-occurrence.

Dysgraphia usually affects a person's handwriting ability and fine motor skills. It can also come in the form of difficulties with spelling, spatial planning on paper, breaking the sentences down into words, composing writing, or thinking and writing at the same time, but can also show in overlapping letters, overlapping words, and inconsistent spacing.



Source :<https://www.scientificworldinfo.com/2019/01/psychological-implication-of-specific-learning-disabilities.html>



Dyscalculia translates into difficulties to understand numbers and learn math facts. Memorizing and organizing numbers can be an obstacle and calculus or abstract mathematical operations a challenge. Telling and estimating time can also be difficult.

Dysphasia affects a person's ability to speak and understand spoken words. This can translate into difficulties in "sequencing" sentences down into words. Sequencing sentences means to mentally divide the sentences they hear into a logical series of separate words. Indeed, for pupils with Dysphasia, spoken speech can sometimes sound like a foreign language in which they are unable to tell when one word ends and the next begins, even though they speak the language.

Dyspraxia is characterized by difficulties with fine motor skills such as hand-eye coordination for reading from one line to another or for writing for example. It translates into difficulties with movement and coordination, and consequently with language and speech. However, this last disorder is generally classified as a Developmental Coordination Disorder and not as a Specific Learning Disorder, but we will address it nevertheless, as it impacts the learning process and education as well.

The phenomenon of co-occurrence

Co-occurrence of several disorders in the same pupil often creates an added difficulty. According to the 2014 publication of the French National Institute of Health and Medical Research (Inserm), 40% of children with one "Dys", a Specific Learning Disorder, also have at least one additional accompanying Dys.

According to the European Dyslexia Association:

- 50 % of persons with dyslexia are dyspraxic as well.
- 40 % of persons with dyspraxia are either dyslexic or have attention disorders.
- 85 % of persons with dysphasia are dyslexic as well.
- 20 % of persons with dyslexia are having differences in attention with or without hyperactivity
- 50 % of hyperactive children are dyslexic etc.



All these disorders have specific areas in which some tasks can be challenging. An Escape Room is a challenge already by nature, but it can reveal itself to be even harder for people with a Specific Learning Disorder. There are several elements that can be put in place for pupils with a Dys, and even people in general, to have a better experience. In this next part, we will explore some things to avoid, and some things to emphasize to create a stimulating, inclusive experience for all pupils.

5.2 What to avoid / what to emphasize on

5.2.1. About Group Management

Let us set the scene

It is advisable to make a very clear and structured **briefing** and to explain how an Escape Room works beforehand.

Having all the **general and safety rules** written in bullet points somewhere visible or even have them written somewhere inside the room itself will be of great help. (in an original way, consistent with the theme of course.)

It is also good to take the time to **explain the purpose** of an Escape Room, to remind pupils that different tasks will be necessary and that **teamwork** and good **communication** are essential if they want to escape the Room.



It is always better to avoid using red herrings with Dys-pupils. However, if you are using red herrings, it might be interesting to **warn people** that there might be some.



Keep it small

Keeping the groups small in the escape room improves inclusiveness as this reduces the number of people circulating. It will allow for easier movements in the room itself, but also engage all pupils to participate fully. Especially for dyslexic and dyspraxic children, it will be easier to navigate and to situate themselves in the space. Also, the stress levels that a crowded place can induce will be reduced, allowing for easier communication and better focus.



5.2.2 About Space Management

Keep it airy

It is recommended to have a space that is easy to navigate and uncluttered in the centre as much as possible. That way, players will be able to go from one corner to the other without bumping into props or other players causing a source of stress and/or injury.

Additionally, to prevent pupils from looking into places they have no business looking into, typically, the ceiling, inside walls, etc. it is advised to clearly mark “off-limits” places with stickers, or by arranging the room so that pupils only have access to a portion of it, using the benches to make a room inside the room for example.



Source :<https://www.edtechteam.com/blog/2017/08/break-out-of-classroom/s/>





Be consistent



Consistency will not only help pupils with SLD but is also essential to an escape room in general. It is important to use types of clues that are **coherent with the theme** and to have clear, logical transitions between the different challenges. This will help students avoid confusion and stay on track within the logic of the room. Some places will like to use red herrings, unnecessary information, or plain distractions; it is highly recommended to avoid all of these as much as possible when it comes to SLDs.

5.2.3 About the types of exercises

For pupils with SLD, one of the best strategies to adopt is to **diversify** the type of elements (codes, clues, riddles, enigmas, etc.) and their type of support (written, sound, light, drawings, maths, physical puzzles, etc.) as much as possible. Multisensory stimuli are key in this kind of exercise. However, **multisensory stimulation does not equal overstimulation**. It is important to avoid having an overload of different information going on at the same time. Diversification will also help with limiting the amount of written text and/or writing that needs to be done.



Source : Image courtesy of TFH USA -

<https://www.ucsf.edu/news/2014/06/115256/sanctuary-aims-soothe-or-stimulate-young-patients%E2%80%99-senses/>



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5.3 Adaptation of codes

Codes can reveal themselves to be particularly challenging in some cases for pupils with SLD. The first thing to take into account is: what kind of code to use?

5.3.1 Letter-based ciphers and codes.

The most famous ciphers and codes are letter-based and thus require writing and reading in a way that is even more complicated than usual. If used correctly, these ciphers and codes may be useful, but keep in mind that reading and writing are some of the main challenges for pupils with SLD and so are to be avoided as much as possible.

In the spectrum of letter-based codes, it is advised to use short codes, with the supporting material to decipher it. There is the code consisting of a page of a book, and a piece of paper with holes in it. Once on top of the book page, some letters are visible in the holes. This way of using a letter-based code is easier for people with SLDs as no real transcription or reading is going on.

You can also have a substitution cipher such as a **cipher disk** that gives you the corresponding letters or another interesting cipher would be the **grid ciphers**.

For example,[38]



A	B	C	J	K	L
D	E	F	M	N	O
G	H	I	P	Q	R
<div><div>S</div><div>T</div><div>U</div><div>V</div></div>			<div><div>W</div><div>X</div><div>Y</div><div>Z</div></div>		

> X MARKS THE SPOT

[38] https://en.wikipedia.org/wiki/Pigpen_cipher



Another original way to encrypt a code is to use a scytale.

It is a pretty straightforward tool to find the code to a word-lock and should not be too difficult. To make a scytale, you need a tube of some sort, around which you will wrap a long strip of material with letters written on it. Once wrapped entirely, a word will appear on one side. [39]



5.3.2 Symbol-based ciphers and codes.

A ●—	J ●— — —	S ●●●
B —●●●	K —●—	T —
C —●—●	L ●—●●	U ●●—
D —●●	M —	V ●●●—
E ●	N —●	W ●— —
F ●●—●	O — — —	X —●●—
G — — ●	P ●— — ●	Y —●— —
H ●●●●	Q — — ● —	Z — — ●●
I ●●	R ●—●	

Source:

<https://medium.com/@damongself/decode-the-morse-code-aeee5ada0c1f>

Not all codes use letters, there are a lot of codes using symbols, colours, or signals (light, sound). The most famous of those would probably be the **morse code**, which is interesting as it can be used with sounds or with light as well. The use of different mediums to code rather than writing is particularly interesting with pupils with SLD.

There are also others, such as classical **symbols encrypted texts** in which each letter is replaced by a symbol. Again, as with letter-based codes, this can be a challenge.

If you are using a **code** of some sort, it would be best to avoid spreading the pieces of the code everywhere and in different fonts or sizes if possible. Having to assemble two parts or three parts is alright as long as the parts can be assembled in a way that allows it to be read in one go.

If you use **writing** in any way inside the escape room, make sure to use a Dys-friendly font such as **Arial** or **Century Gothic**, and be careful about the text's legibility and contrast. A font size **between 12 and 14** is favoured whenever possible, with a **line spacing of 1.5** in between the lines. Also, it is good to support the text with pictures, drawings, or paintings. Objects can also add to the experience. Typing on a keyboard instead of handwriting can help.

[39] <https://fr.wikipedia.org/wiki/Scytale>





5.4 Adaptation of locks

The locks are one of the biggest obstacles for people with SLDs. Fine motor skills are often a challenge, which means that, depending on the lock, this may cause difficulties. However, thankfully, there is a wide variety of locks that can be found on the market that are easier to manipulate for pupils with SLDs.



Simple key locks, provided that they are not miniature locks, are generally fine. The general rule is to avoid locks that require fine motor skills as much as possible, either by finding the same lock but bigger or by finding a lock that is easy to use practically, even if finding the right combination is difficult.

Words locks can be a challenge. Both because they involve spelling a word and they require fine motor skills to use unless you find a lock that is big enough to easily manipulate and with few letters that are written in a Dys-friendly font.



Cryptexes, for example, may pose this problem, unless they are very big in size and the key to open it is a simple word. It is better to avoid small complex cryptexes such as the one in the picture.[40]

There are tutorials on YouTube[41] to create a cardboard cryptex, as big and simple as needed. It is very practical as it is possible to use anything from letters to numbers, to symbols, etc.

Numerical locks, again, need to be big enough to not require fine motor skills and not too complicated. Pupils with dyscalculia may find those more challenging though. Another lock that may pose a challenge is the **directional lock**, especially for dyslexic pupils. As they have difficulties sorting their right from their left, a directional lock may prove difficult. Especially as it is tricky to reset and we never know how many steps it has. Directional locks are not advised in this case.

[40] <https://www.amazon.es/Cryptex-interesante-regalo-rom%C3%A1ntico-creativo/dp/B07DS2RPQQ>

[41] <https://www.youtube.com/watch?v=CFVFvj5c8IE>





A **mechanical process**, if it is not too minute may be pertinent, as well as a **logical puzzle**.

In conclusion, as a rule, it is better to try to avoid micro manipulations and complicated or confusing patterns and words. It is better to use mechanical puzzles of general patterns.

Logical clues and puzzles are also good tools to use with SLDs.

5.5 Adaptation of technological components

5.5.1 In General

One of the main challenges for students with SLD is the overflow of sensory stimuli. While it is very good for them to vary the type of stimulation and sensory information, everything at once will most probably be overwhelming and confusing.

For example, some will want to install an atmosphere of urgency with alarms, repeated instructions, stroboscopic red lights, maybe additional button light signals, etc. All of that at once and the added time pressure will most probably be too much for pupils with SLD. They will have more difficulties to discern the important information from the ambient noise and superfluous signals.



5.5.2 Other tech components

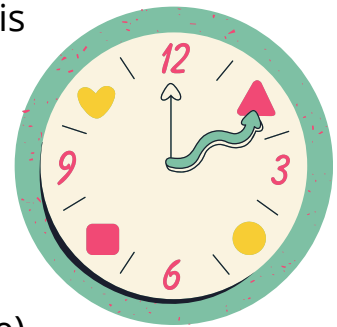


Some modern technology can be useful when introducing an escape room. To complement written and oral guidelines when introducing the theme or main character of the escape room, it is nice to have an **introductory video**. Other technological components such as **timers or clocks** can be used.

Time estimation is usually a challenge for pupils with SLD, especially for dyslexic and dyscalculic pupils. In that case, the traditional clock face of a watch can be difficult to read, and it would be better to use a clearer and more visual time indicator. It can range from a digital clock if the escape room is set in modern times, or an hourglass for older periods' themes. The physical amount of sand helps to visualise if there is a lot of time left or not.

Instead of using a traditional clock, it can also be the level of something. For example: for more modern themes, the level of air left in the room for which there can be a digital indicator (fake of course).

If the room is about finding the cure to a disease, for example, you may have a number of infected people after which there is no way back and an "infected people counter" as the time limit. Various websites are available online to create countdowns for free.





5.6 Interchangeable clues depending on the needs of the escapees

There are two types of clues that we can speak of. The first one consists of clues that the players will find all over the space in the escape room itself. The second type is the clues given by the Game Master whenever the players are stuck.

5.6.1 Clues for the game

The first thing to pay attention to is coherence. Clues need to fit seamlessly into the theme of the escape room to avoid disrupting the experience. Next, it is good to vary the kind of clues used. Everything in an escape room can be a clue, including something misplaced.

The number of chairs can be relevant, a missing book in a bookshelf, the pictures on the wall, the music that you may hear, etc. These types of clues may be more useful in the case of SLDs instead of using complicated written codes for example. Pupils with SLD tend to see the big picture more easily, so this type of clues is to be favoured as they will be able to hone in on them without trouble.

5.6.2 Clues from the game Master

In an Escape Room, one of the main features that allow an Escape Room or Game to go smoothly and be a great experience is the supervision of the escape room. Usually, it is done by a Game master, here, it will be handled by the teacher of course. If pupils with Dys are going to participate in the room, it is good to let the Game Master know in advance so that they may adapt to this information during the supervision. The whole challenge is to say enough so that they figure out the next step by themselves, without giving the answer. The help from the Game Master needs to be minimal, the point is to nudge the pupils in the right direction when they are really stuck. This balance can be hard to find but is essential to a good experience.



So, **how to make the game master's help inclusive?** It depends on how the Escape Room is rigged and which theme it is. There can be a screen giving written instructions through a chat for example, in which case, the instructions for any written materials apply. If clues are necessarily written, the Game Master can advise the players before the game to pay attention to have someone signal the arrival of the message and ideally, to have a good reader read them out loud, so that people with troubles reading or slow readers can participate as well and as efficiently. The clues can also be given orally, through a radio, a microphone, etc. In that case, it is advised to avoid parasite noises or white noise at the same time.

5.7 The importance of complementarity

As we mentioned, the greatest strength of a group of players inside an escape room is probably their complementarity. Whenever players are inside the room, they should rely on the skills of all the people.

There should be good communication within the group and tasks should be distributed equally. Everyone is involved and it is ok when someone doesn't find the solution to something, but it is important to share the information with the group. A lot of escape rooms rely on teamwork or cooperative locks and clues. That is key in the solving of an escape room and needs to be emphasised before entering the room.

People with SLD will maybe have some difficulties with some tasks, but they will have their own strengths as well and can then still participate fully without feeling left aside because they are unable to perform a specific task. As they would have their tasks to perform, everyone does their parts, and no one feels left out. Insisting on complementarity beforehand can also help pupils realise that to not excel in everything does not mean being bad and that teamwork prevails over individuality.



It is also interesting to explain to the pupils that **roles can be attributed** beforehand. You can have searchers, solvers, communicators, coordinators, etc. There can be a **rotation** of roles within the room as well. Usually, this occurs naturally, people do what is most comfortable for them. However, in the case of a group where everyone searches for clues but no one tries to solve them, and there is no communication between participants, the room will most likely not be escaped, even with all the clues discovered.

This complementary is the aspect that needs to be emphasised the most in an escape room with pupils with SLD. As we saw throughout this chapter, a lot of codes, locks, and clues will probably lead to additional challenges for pupils with SLD. By having a group that works as a team, those “weak points” can be compensated, and each member will bring their strengths to the group.



CONCLUSION

Escape Rooms are developing fast around the world and trending as an innovative, immersing experience. They attract a vast public of all ages and all horizons. Their versatile concept inspired us to explore their pedagogical potential and to use them in an educative context to boost STEAM education.

Indeed, Escape rooms are an incredible tool that has a lot of potential for education through game-based-learning. They offer a wide range of gamified possibilities for education, in all topics imaginable but particularly for STEAM education, and they stimulate a lot of 21st century's essential soft skills that are targeted at school and needed in the professional world, such as teamwork, communication, time management, critical thinking, problem-solving, out-of-the-box thinking, organisation skills, inquiry-based learning, active learning, etc.

They also stimulate different profiles of students and engage them more in the STEAM subjects by respecting the four freedom of play while still bringing educative content to them. Thanks to their multiple game-modes, they are also an ideal tool for inclusion in education.

As we have seen, there are many different kinds of Escape Rooms and endless possibilities of uses, themes, and configurations. In this manual, we concentrated on pedagogical Escape Rooms, which are usually coming in the form of Escape boxes, breakout boxes, or escape books as these are the most practical to install and easy-to-use in a pedagogical context.

CONCLUSION

While escape rooms need a lot of time to be prepared, they can boost the interest of the pupils in STEAM subjects, which will have a positive long-term impact on the STEAM results and be reused later on, which makes them a wonderful educational investment.

This guide covers the structure, preparation, design, exploitation, and inclusion in escape rooms. In the following outputs, you will be able to apply all the advice given in this guide directly by making your own escape room. Thanks to their natural versatility, they will be able to support any kind of school material for a wide age range.

The escape room creation guide and the e-learning module will help you step-by-step in the creation of your escape room, while the STEAMER generator will help with the scenario and characters that your escape room might need. Scenario and lesson packages, as well as an implementation practice guide, will also be available so that you have all the tools necessary to build an immersive, game-based educative experience for your pupils.



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Note: This Bibliography is provisional until after the testing period. It will be uniformised and finalised once all additional references have been added post-testing.



Escape rooms adapted for school education on STEAM

STEAMER

The project aims to create a methodology, tools and practical examples of Escape Rooms adapted to teaching of STEAM at school.

Project Outputs:

- Pedagogical guide
- Scenarios and lessons packages
- ER creation guide
- Steamer generator
- E-learning module
- Implementation practice guide

The partners working on this project are :



LES APPRIMEURS



Escape rooms adapted
for school education on STEAM



Steamer is funded by Erasmus+ program

