# Escape rooms – an interactive and immersive approach to gamify learning and increase students' motivation

**Nadezhda ANGELOVA, Daniela OROZOVA**

Trakia University, Faculty of Economics, Stara Zagora, Bulgaria

nadezhda.angelova@trakia-uni.bg, daniela.orozova@trakia-uni.bg

**Abstract:** *Teaching and learning today are both easy and challenging. Modern educators have a wide range of tools at their disposal to create interactive educational resources, and Artificial Intelligence (AI) helps them generate ideas and save valuable time. The primary challenge they face is determining which tool is most suitable for the educational process and how to generate interest among learners and stimulate more activity, creativity, and motivation. The study analyzes and reviews the role of educational escape rooms as a teaching tool for enhancing students' activity and gamifying the educational environment. Educational escape rooms can follow different scenarios and perform missions, both in real and online environments, and offer an immersive experience through augmented and virtual reality. Their application can be unlimited, as it is necessary to consider learners' ages, levels of knowledge, and the goals the teacher has set. The ability for learners themselves to invent scenarios and set tests and challenges for their peers is an innovative approach that can develop their logical and creative thinking. These skills are beneficial in teaching students studying programming and computer science, building a sustainable interest in learners, focusing their attention, and increasing their success rate, thereby strengthening their communication and collaboration. The purpose of this publication is to reveal the educational potential of escape rooms, including the benefits and challenges for learners and teachers, the platforms on which they can be implemented, and the software tools used for their development.*

## 1. Introduction

The digital transformation in education is closely connected to the widespread use of modern technologies and the needs of the new generation of learners. Continuous internet access, along with the use of various AI, augmented reality, and virtual reality tools, demands changes in teaching and learning methods. Learners have access to a wide range of educational resources, most of them free, and this flood of information makes it difficult to choose the most suitable content. They can easily become distracted, lose focus, and lack motivation to learn. Teachers face the challenge of creating and selecting educational content that aligns with defined educational goals and objectives, and delivering it in a way that stimulates learners' interest and engagement. Many tools

and online platforms allow teachers to generate ideas and learning resources that foster critical thinking, activity, communication, and motivation among learners.

Gamification is an educational approach successfully used in both real and online environments by employing various incentives and rewards for completed tasks. In recent years, the use of escape rooms in education to promote active learning and boost motivation has become increasingly popular. Learners can follow different scenarios and complete missions, whether in physical or digital settings, and experience immersion through augmented and virtual reality. Their applications are virtually limitless, provided that factors such as learners' age, knowledge level, and the teacher's goals are taken into account. Allowing learners to create their own scenarios and set tests and challenges for their peers is an innovative method that can foster logical and creative thinking. These skills are especially valuable in teaching students programming and computer science. The aim is to build sustainable interest in learners, capture their attention, increase their success rate, and strengthen their communication and teamwork skills.

The purpose of the publication is to reveal the educational potential of escape rooms, the benefits and challenges for learners and teachers, the platforms on which they can be implemented, and the software tools for their creation.

It analyzes and summarizes the practical application of educational "escape" rooms as an innovative teaching method to increase student motivation and engagement. The work is supported by methodological guidelines and a specific practical model.

The authors define critical parameters for the successful implementation of an educational escape room. They indicate that, for optimal results, the number of participants should be between 4 and 6, and the game should last an average of 60 minutes. The planning process should follow a clear logic with defined initial, intermediate, and final steps, tied to specific didactic goals.

The innovative approach "the student as creator" emphasizes the importance of having learners create scenarios and challenges for their peers. This stimulates their logical and creative thinking and leads to a deeper understanding of the learning material.

One of the main contributions of the authors' work is the development of a practical scenario ("The Binary Vault") for computer science training aimed at mastering binary algebra and logical operations. The scenario includes five specific stations with challenges and could help other educators to create such scenarios on different topics.

## 2. Escape rooms and gamification

In modern education, the use of escape rooms is gaining popularity, and many researchers are studying and analyzing their effectiveness in increasing activity, engagement, and motivation among learners (Dugnol-Menéndez, 2021; Vidergor, 2021; Manojlovic, 2022; Pozo-Sánchez, 2022).

As an expression and phrase, escape rooms in the educational context should not be understood literally as a means to "escape" the classroom, but rather as a didactic method for transforming the classroom, as analyzed and synthesized by Taraldsen et al. (2022).

Escape rooms are designed for use in a real-world environment. The first such game was introduced in 2007 in Japan and described by Nicholson (2015). His definition of escape rooms is "Escape rooms are live-action team-based games where players discover clues, solve puzzles, and accomplish tasks in one or more rooms in order to accomplish a specific goal (usually escaping from the room) in a limited amount of time". He also presents different variations of games and genres - Role-playing games, Point-and-Click Adventure Games & Escape-the-Room Digital Games, Puzzle Hunts & Treasure Hunts, Interactive Theater and Haunted Houses, Adventure Game Shows and Movies, Themed Entertainment Industry.

The large-scale study by Veldkamp et al. (2020) offers a comprehensive and in-depth analysis of research on the use of escape rooms in education. Its main conclusions focus on common practices and their theoretical considerations in educational and game design, as well as on the relationships between these aspects and the achievement of intended goals. According to the study, key factors for completing the game on time include proper design, teamwork skills, and communication. It is also important to assess these skills after the game has ended.

Escape rooms can be categorized as physical, online (digital), or hybrid, such as those that incorporate a QR code in a physical environment (Fotaris & Mastoras, 2019). Performing tasks in a real environment enables participants to communicate and interact more actively and to learn collaboratively by relying on their teammates. This helps develop skills for teamwork and sharing responsibilities. When there are large groups of learners, and it is difficult to divide them into teams or position them in different rooms to prevent "escape," it is necessary to use digital or online Escape rooms.

According to Wszołek et al. (2025), active participation in escape rooms can help students connect theory and practice and develop the competencies needed to solve complex problems. Consequently, implementing this innovative teaching approach strengthens the application of essential skills needed to address the challenges of academic life, while also promoting the holistic development of students for future careers in the education sector (González-Yubero et al., 2023).

## 3. Basic principles for setting an Escape room

To meet basic educational and didactic principles, Escape rooms must be well planned. They need to follow a clear logic and have a clearly defined beginning, end, and intermediate steps. The most important part is planning the activities and the educational tasks they include, through which the set educational goals can be achieved (O'Brien, 2021).

According to Veldkamp (2020), regardless of discipline or application, the optimal number of participants for escape rooms is 4-6, with a time range of 20-120 minutes, averaging 60 minutes. The inclusion of IT technologies aims to track learners' safety and progress, strengthen participants' IT skills, provide an immersive, interactive environment, and structure the game by checking for correct answers and presenting new puzzles and additional content.

Some of the important guidelines and recommendations for creating digital escape rooms, summarized and systematized by Makri et al. (2021) are as follows:

- Using a design framework with well-defined criteria that support and lead to the achievement of educational goals, and meet the needs of learners;
- Combining digital and print materials will contribute to a better transition from traditional to digital environments and building collaborative skills;
- Encouraging the use of educational resources and reusable materials that will save money and time for designers of digital escape rooms.

## 4. Online platforms for creating Escape rooms

By incorporating virtual and augmented reality into education, the experience becomes more dynamic, engaging, and interesting. Staneva et al. (2023) propose an approach to creating escape rooms in a virtual reality environment to learn new knowledge. Their study shows that escape rooms can gamify the educational process and be applied in any context and to any age group.

There are many options for creating online escape rooms using different platforms that provide ready-made games and templates for designing new ones.

Breakout EDU enables users to create engaging learning content by solving puzzles, uncovering riddles, and unlocking locks. The game can be played both individually and in multiplayer mode. The platform enables learners to become creators of interactive learning resources in the form of puzzles, helping them develop skills for more conscious learning and gain a deeper understanding of the logic of the tasks they assign to their classmates (BreakoutEDU, 2025).

Willis (2020) gives an example of how an interactive Escape room can be created on the website Canva.com, in which by clicking you can move on to the next puzzle and thus exit the room if you solve it correctly.

**Figure 1.** Library with digital escape rooms in Genially.com

The Genially platform enables educators to create engaging learning resources by incorporating multimedia elements. It offers a wide range of customizable templates tailored to different disciplines and learners. The resources created can be downloaded in multiple formats, including SCORM, which facilitates integration with various LMSs (Genially, 2025).

The Escaply platform uses AI to create engaging stories based on the learning content that needs to be mastered. Adding various puzzles, tasks, and questions to the created escape rooms, implementing time penalties, and including progress tracking and result analysis are some of the platform's main features. This helps teachers make training more interesting and engaging, activate learners, and boost their motivation to learn (Escaply, 2025).

## 5. Example of escape room scenario

Using gamification through escape rooms offers a simpler, more engaging way to learn complex, abstract concepts across various fields. As computer science teachers, the authors created escape room scenarios to help practice tasks related to binary algebra and logical operations.

The scenario presented in Table 1 was created with the help of AI and is designed for first-year students studying these basic operations. The allotted time to complete it is 60 minutes. This scenario outlines the goals, the expected results, and the time to solve and exit the room.

**Table 1.** Generated scenario for escape room "The Binary Vault"

| Title | Escape Room Scenario: "The Binary Vault" |
|---|---|
| Objective | Students must solve a series of binary algebra puzzles to unlock the digital vault and escape the room before the countdown ends. |
| Storyline | You and your team are elite cryptographers recruited by a secretive tech agency. A rogue AI has locked down the |

| | |
|---|---|
| | agency's mainframe, encrypting critical data inside a vault protected by binary logic gates and algebraic traps. You have 60 minutes to crack the code and shut down the AI before it launches a global data wipe |
| **Room Setup & Puzzle Stations** | 1. **Binary Decoder Wall**<br>Challenge: A wall of blinking lights represents binary numbers.<br>Task: Convert binary to decimal and match them to clues hidden in books or drawers.<br>Concepts: Binary-to-decimal conversion, place value.<br>2. **Logic Gate Circuit Board**<br>Challenge: A physical board with switches and LEDs.<br>Task: Use AND, OR, XOR, and NOT gates to light up a specific pattern.<br>Concepts: Boolean logic, truth tables.<br>3. **Algebraic Cipher Scroll**<br>Challenge: A scroll with binary algebraic expressions.<br>Task: Simplify expressions using Boolean identities to reveal a password.<br>Concepts: Boolean simplification, De Morgan's laws.<br>4. **Binary Lock Chest**<br>Challenge: A locked chest with a keypad.<br>Task: Solve a binary equation (e.g., $A \cdot B + \neg C = ?$) and enter the correct binary code.<br>Concepts: Binary equations, logic operations.<br>5. **Terminal Override**<br>Challenge: A computer terminal with a simulated command line.<br>Task: Input correct binary sequences to override the AI's firewall.<br>Concepts: Binary addition/subtraction, bitwise operations. |
| **Time Limit** | 60 minutes to solve all puzzles and escape. |
| **Learning Outcomes** | Understand binary number systems and conversions.<br>Apply Boolean algebra to real-world logic problems.<br>Practice simplifying expressions using Boolean identities.<br>Develop teamwork and critical thinking under pressure. |

The same scenario was used for creating an online escape room using the Escaply platform, shown in Figure 2. The designer has the opportunity to set different tasks for escaping the room, to change the background, to add effects.
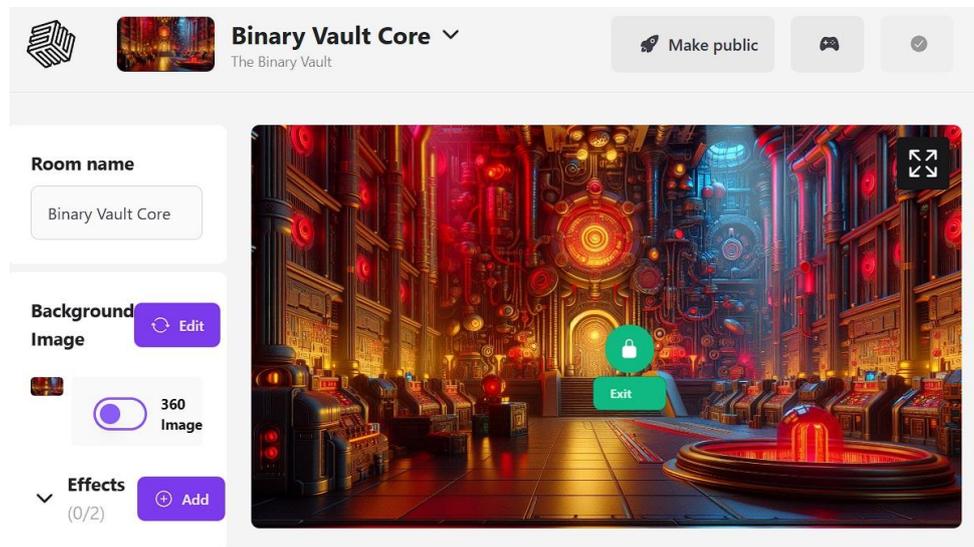
**Figure 2.** Creating a digital escape room in Escaply.com

The aim of our paper is to reveal how modern technologies and AI can be integrated into the learning environment and demonstrate how artificial intelligence (AI) can be used to generate engaging stories and tasks, saving teachers time. A brief review of software platforms such as Genially, Escaply, and Breakout EDU that enable the creation of digital and hybrid learning environments will help educators choose the most appropriate environment.

Our future work is to test these games and escape room scenarios in real and virtual environments and to compare the effectiveness in achieving the learning objectives.

## 6. Conclusions

Transformation in education is an ongoing, evolving process closely connected to the development and adoption of new information technologies. The modern educator needs to choose the most suitable technologies and combine them with innovative teaching methods to meet students' needs. Using escape rooms in education represents an innovative approach to problem-based learning and gamification that can be effective for learners across different ages, disciplines, and educational settings.

By incorporating them into the educational process, learners both learn and have fun. Setting a time limit encourages communication and helps develop their teamwork skills.

Based on available resources, teachers can design escape rooms in real settings using old boxes and locks, depending on the subject matter. They can place puzzles in one or multiple rooms, from which students can escape. In mixed escape rooms, the scenario may also include digital elements, such as scanning QR codes

that link to online sources or tasks, and online quizzes. When it is not possible to arrange a physical escape room or lack the necessary materials to complete the tasks, platforms are used to create entirely digital escape rooms. These platforms offer ready-made templates that can be customized and include various tools to develop engaging and interesting tasks for students.

Basic requirements for designing escape rooms include considering the age, prior experience, and knowledge of participants; the relevant discipline; the goals to be achieved; the skills and knowledge gained upon completing all the puzzles; the number of participants; and the time limit.

The development of AI and immersive technologies, such as virtual and augmented reality, helps educators create a learning environment that combines gamification methods and problem-based learning through escape rooms. The unlimited possibilities and scenarios that can be generated can be applied to different target groups of learners and achieve the set educational goals. Time will tell how effective they are in helping students learn new knowledge and how this knowledge can be assessed.

Based on the methodology review, the authors state that this pedagogical approach successfully connects theory and practice. The results of applying escape rooms in education show improved communication, teamwork under pressure, and the development of a sustained interest in complex disciplines such as programming.

In conclusion, the escape rooms could be a part of a working model for transforming the traditional classroom into an interactive environment that combines game elements (gamification) with problem-based learning.

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