

Locked In on Learning: An Escape Room Approach to Project Management Pedagogy

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Abstract

This paper presents the design of an assessment Escape Room, crafted as a gamified simulation to assess players' knowledge and skills in the field of project management. Utilizing the Design-Play-Experience (DPE) and the Octalysis frameworks, the activity comprises four sequential challenges addressing the triple constraint of project management that consists of Scope, Time and Cost Management as well as the Stakeholders and Risk Management knowledge areas. The various stages of the game are designed to assess technical and problem-solving skills, while simultaneously promoting communication and collaboration among the players. The storyline aims to enhance the players' immersion in the game and simulate the pressure experienced by professionals in high-pressure management scenarios. This project contributes to the growing field of gamified educational and evaluation methods, effectively bridging the gap between theoretical knowledge and practical application in project management.

Keywords

Project Management, Serious Games, Education, Escape room and Teaching & Learning

1. Introduction

Project management which stands on the intersection of applied engineering and business management, is taught globally, and requires a strong theoretical framework in combination with non-discipline-specific skills such as critical thinking, teamworking and the ability to make decisions under pressure (Kearney et al., 2024). While university courses and seminars excel at imparting and assessing theoretical knowledge with traditional methods like multiple-choice questions or written exams, such approaches primarily examine theoretical understanding rather than the ability to apply knowledge in practice within team-based environments (Villarroel et al., 2020). Furthermore, high-stakes

testing methods, like written exams, are inherently stressful, often causing anxiety which can distort one's true capabilities in a "normal" context (Jerrim, 2023). Rather than replacing foundational exams, there is a growing need to complement them with educational frameworks geared towards relieving individual pressure and encouraging collaborative competency (Sibley & Parmalee, 2008). To address this need, educators are increasingly turning to gamification and serious games as an innovative and dynamic way of learning (Barbosa & de Ávila Rodrigues, 2020). Within the scope of gamified learning, educational escape rooms stand out as a compatible framework for project management, placing teams in a 'safe-to-fail' environment and compelling the application of technical knowledge and principles in a simulated setting, while innately encouraging collaboration and communication (Rawlinson & Whitton, 2024). Specifically, the core mechanics of escape rooms mimic the challenges field professionals face. The linear structure of the game, which prevents some puzzles from being solved until previous ones have been completed successfully, mirrors workflows and task dependencies and demonstrates how delays in one area can influence the progression of a real-life project (Gordillo Méndez et al., 2025). The different kinds of puzzles and knowledge areas require players to assign roles based on their individual strengths and expertise, much like in project resource management, where the team must optimize their workforce to avoid inefficiencies. Encountering an exceptionally demanding puzzle or making an incorrect assumption mimics a realized risk that delays progress, which forces the team to reevaluate and change their strategy to overcome the challenge or salvage a project (Jääskä et al., 2022).

1.1 Objectives

The primary objective of this research is to propose the design of an original educational Escape Room for the assessment of competencies in the field of project management, integrating two different gamification frameworks, the Design-Play-Experience model and the Octalysis framework. Operating as a complementary tool to traditional assessment methods, this study aims to foster active learning, by allowing students to apply project management concepts under realistic operational constraints. Specifically, this paper focuses strictly on architectural design, detailing the game flow, puzzles and targeted competencies thereby establishing the necessary foundation for empirical deployment of the game. To the authors' best knowledge, this is the first ever project management related Escape Room worldwide.

This study may hold significant relevance for several key stakeholder groups: (i) academic researchers and educators interested in broadening the landscape of practices for engineering education by integrating experiential learning frameworks, (ii) professionals in the field of project management in search of modern tools for workforce evaluation, team-building and corporate training and (iii) professional bodies like the Project Management Institute (PMI) and the International Project Management Association (IPMA) which emphasize the importance of assessing both technical and non-technical skills.

2. Literature Review

2.1 Experiential Learning Paradigms in STEM Education

The importance of the role of experience as a process of acquiring knowledge is not a recent idea, rather, it has philosophical roots dating back to Aristotle, who in *Metaphysics* and *Nicomachean Ethics* argues that experience constitutes the basis of practical knowledge (W. D. Ross, 1908)(D. Ross et al., 1998). The view of experience as a fundamental source of learning was later articulated by John Dewey who developed his educational philosophy around the central role of experience. Dewey (1938) argues that "*all genuine education comes about through experience*", suggesting that learning is not simply achieved by absorbing information but emerges through meaningful interactions with experiences. However, for Dewey, the development of deeper understanding demands a reflection on these interactions as they, alone, do not necessarily lead to learning. Reflective thinking emerges when individuals come against uncertainty or difficulties leading them to a process of inquiry to overcome these challenges. Through this process, learning occurs when individuals actively explore, question, and reorganize their existing knowledge, rather than accepting knowledge at face value (Dewey, 1933).

Building on Dewey's ideas, Kolb (2015, pp.37) later formulated a more structured theory of experiential learning, defining learning "*as a process whereby concepts are derived from and continuously modified by experience*". His experiential learning cycle includes four stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb, 2015).

The conceptual foundations established by Dewey and Kolb along with others, have led to decades of empirical investigations evaluating the impact of experiential learning.

A meta-analysis conducted by Burch et al. (2019) which synthesized 89 studies published over a 43-year period, found that experiential learning pedagogies were associated with significantly higher student learning outcomes. Similarly, Freeman et al. (2014) meta-analysis of 225 studies comparing active learning to traditional lecturing in undergraduate Science, Technology, Engineering, and Mathematics (STEM) courses found that students in active learning classes outperformed those in traditional lectures by roughly half a standard deviation on examinations, while failure rates dropped from 33.8% under lecturing to 21.8% under active learning. Desai et al. (2018) further demonstrated that experiential learning and Problem-based learning (PBL) outperform lecture-based approaches by enhancing engineering students' problem-solving skills, teamwork, and professional competencies while strengthening the connection between theoretical knowledge and professional practice.

According to Marar et al. (2022) work-integrated learning is a form of experiential learning that enables students to gain authentic workplace experience while they are still studying. A systematic review of work-integrated learning in undergraduate engineering education by Hwang et al. (2026) showed that it benefits engineering students by developing their employability, professional identity, and self-confidence while also bridging the gap between classroom learning and practical application.

2.2 Serious Games as an Emerging Trend in Project Management Education

Effective project management training requires not only an understanding of fundamental theoretical principles but also the development of skills that can be applied in real-world professional environments (Farooq et al., 2022). Consequently, exclusive reliance on theoretical education is widely regarded as inadequate, highlighting the need for complementary pedagogical strategies that promote the acquisition of practical competencies alongside essential transferable competencies (Hellström et al., 2023). In this context, a fundamental objective of university education is linking classroom instruction to workplace demands in authentic contexts (Turner, 2016). Game-based learning (GBL) integrates subject-specific content with authentic problem-solving scenarios, enabling learners to acquire, apply, and reinforce knowledge through meaningful and contextualized learning experiences (Law, 2019). Within project management education, serious games constitute a specific application of GBL and are increasingly being incorporated into higher education programmes to support course instruction (Tews et al., 2020). These games primarily aim to enhance practical competencies and interpersonal skills that are not easily cultivated through traditional lecture-based instruction, providing a risk-free setting in which students can experiment, make decisions, and learn from failure (Hellström et al., 2023). A growing body of research suggests that game-based learning (GBL) and gamification can make learning in higher education more motivating and engaging while also supporting the development of important soft skills. However, these positive outcomes are not automatic and largely depend on how these approaches are designed and integrated into the learning experience. For example, Jääskä et al. (2022) showed that using a digital GBL approach across six European universities increased students' motivation and helped them become more confident in dealing with uncertain, realistic situations. Likewise, Farooq et al. (2022) systematic review found that gamification is widely adopted to encourage student engagement, maintain motivation, and promote the development of interpersonal competencies, with blended learning environments. Reflecting their growing recognition within the field, the literature shows that the number of PM serious games has increased exponentially during the past two decades (Rumeser & Emsley, 2018).

Two notable case studies of serious games designed for project management education include DELIVER! (Von Wangenheim et al., 2012) and SCRUMIA (Von Wangenheim et al., 2013). DELIVER! is a board game developed for undergraduate computer science students to apply the concepts of Earned Value Management (EVM). The game is a simulation of software project execution where players take on managing budgets, allocating resources and calculating performance indicators, such as Cost Variance (CV), Schedule Variance (SV) and Estimate At Completion (EAC), at defined project milestones. Empirical evaluations of this game showed that students' motivation, understanding and application levels were enhanced. Similarly, SCRUMIA is a paper-and-pencil simulation game designed to teach the agile SCRUM framework to university students. During the game, the players assume specific roles, such as Scrum Master, Product Owner and Developers, estimate user story points, perform sprint planning, physically produce paper artifacts, like hats and boats, and hold meetings to track progress. Feedback on SCRUMIA demonstrated an increase in the players' perceived knowledge of agile processes, active engagement, fun and peer collaboration (Von Wangenheim et al., 2013).

2.3 Escape rooms as an educational tool

Since games naturally capture human interest and engagement, educational approaches involving gamification and game-based learning have gained increasing attention, with educators incorporating game elements and developing

games specifically designed to support learning (R. Ross & Bennett, 2022) . This movement has led to the growing adoption of escape rooms and breakout games in academic settings (Fotaris & Mastoras, 2019) . According to Gordillo Méndez et al. (2025) “*educational escape rooms can be defined as games designed with educational purposes in which the participants, usually organized in teams, must solve a series of puzzles within a specified time frame by discovering clues, accomplishing tasks, and applying field-specific knowledge and skills*”.

Their implementation has been shown to present both benefits and challenges which have been documented in literature. Veldkamp et al. (2020) supports that the vast majority of participants in this type of activity responded enthusiastically to it, showing a great amount of active engagement during the game. Additionally, the study showed that educational escape rooms proved to be effective in cultivating problem-solving and teamworking skills as well as providing an effective way to simulate realistic situations within the confines of the classroom. On the other hand, it is argued that this type of game is less effective for the introduction to new concepts. Furthermore, the study found that students feel disappointment in the case that they fail to escape within the specified timeframe. Rawlinson & Whitton (2024) maintains that educational escape rooms help students navigate failure and mistakes productively, by creating a safe space where they can experiment and take risks without the anguish of traditional academic evaluation methods, while simultaneously developing trust in their team members. Conversely, this study points out that game-based learning does not attract every student, as the idea of games in academic context or the exposure to possible failure might seem unappealing. The studies by Gordillo & Lopez-Fernandez (2024) and López-Pernas et al. (2019) showed that students who previously participated in educational escape rooms achieved statistically higher academic results than the ones who did not, by examining their knowledge gain using a randomized controlled trial and analyzing their final exam score and comparing success percentages. Nonetheless, according to R. Ross & Bennett (2022), the full potential of escape rooms as educational tools in science, technology, engineering and math (STEM) and other disciplines remain largely untapped.

3. Methods

For the creation of the Escape Room, this study integrates two different models: Winn (2009) Design-Play-Experience (DPE) and Chou (2014) Octalysis. This decision stems from a design duality: system architecture VS human motivation. These two frameworks operate in a complementary way, in that the first establishes the structure, rules and learning goals of the game, answering what should be incorporated in the Escape Room and how, and the second reveals motivation triggers to keep players engaged, answering the why.

The Escape Room developed, incorporates core project management concepts drawn from the PMBOK performance domains (PMBOK Guide, 2025). Specifically, participants engage in challenges related to Scope, Cost (Finance), Scheduling, Risk and Stakeholders, requiring them to make decisions, collaborate effectively, and solve project-related problems under time constraints. These domains are embedded within the game mechanics to provide an immersive and experiential learning environment.

3.1 Design-Play-Experience (DPE) Framework

The Design-Play-Experience framework is an extension and enhancement of the Mechanics-Dynamics-Aesthetics Framework (MDA) by Hunicke et al. (2004), to address specific challenges in the development of serious games and constitutes a useful tool for developing games mainly for entertainment purposes. The DPE model integrates educational objectives and learning outcomes into the player's experience and outlines the different perspectives of the designer and the player (Winn, 2009).

To demonstrate how Winn (2009) model works in practice when applied to this study, **Table 1** maps out specific game design components from this Escape Room, how they translate during the playing of the game and are experienced by the player.

Table 1: Mapping DPE Game Design Components to Escape Room elements

	Design	Play	Experience
Learning	Domain-specific project management puzzles	Collaborative problem-solving, application of project management knowledge	Experiential knowledge consolidation
Storytelling	Narrative with corporate theme	Role assumption, perceived urgency	Heightened sense of accountability
Gameplay	Physical locks and hidden objects	Room exploration, information searching	Curiosity, anticipation, reward of discovery
User Experience	Interactive hint delivering mechanisms (e.g. office telephone)	Adaptation to new instructions, validation of players' hypotheses	Minimized cognitive frustration

3.2 Octalysis Framework

The Octalysis framework, developed by Japanese gamification expert Chou (2014), is a human behavior-oriented gamification design system, aiming to engage as well as extrinsically and intrinsically motivate players. According to this visual tool, there are eight core drives that bring out different behaviors from the players and drive decisions and progress in a gamification setting. The eight core drives proposed are (Chou, 2014) :

- *“Epic Meaning & Calling*
- *Development & Accomplishment*
- *Empowerment of Creativity & Feedback*
- *Ownership & Possession*
- *Social Influence & Relatedness*
- *Scarcity & Impatience*
- *Unpredictability & Curiosity*
- *Loss & Avoidance.*”

According to Chou (2014) , these elements can be categorized from two different perspectives:

- Left Brain Drives, which focus on social interactions, creativity and self-expression vs Right Brain Drives, geared more towards logical or analytical thinking and possession
- White Hat Gamification, motivating players through positive emotions such as success through mastery or a higher sense of meaning vs Black Hat Gamification, driving players through negative emotions such as uncertainty for what will follow, fear of losing or struggle.

Chou (2014) framework also suggests that the lack of all these elements results in no behavior and progress whatsoever. Table 2 maps out the elements of the Escape Room that trigger each of the core drives within the Octalysis framework.

Table 2: Mapping of core drives onto Escape Room elements

Core Drive	Escape Room elements (triggers)
Epic Meaning & Calling	The players believe they are directly responsible for salvaging the project and making sure the meeting with the clients is successful.
Development & Accomplishment	The puzzles in the game drive the players to showcase their skills and overcome challenges.
Empowerment of Creativity & Feedback	The players must think creatively in order to understand clues and solve puzzles. The hint system and the Game Master's feedback help them adjust if and when they need to.
Ownership & Possession	The narrative frames the endangered project as the players' own creation and responsibility.
Social Influence & Relatedness	The activity fosters teamwork and creates an environment where praise and shared breakthroughs serve as powerful drives.
Scarcity & Impatience	Informing players that all the clues are either physically locked away or waiting to be used at the right time, drives them to actively pursue them.
Unpredictability & Curiosity	Locking away essential clues and keeping the specific goals of each phase hidden adds an element of surprise to the experience.
Loss & Avoidance	The impending arrival of the strict Executive Director introduces a psychological threat of failure and a sense of urgency.

4. Escape Room Design

The architecture of the Escape Room is designed to directly evaluate competencies related to the project management Performance Domains, specifically Stakeholders, Risk and the concepts of the “Iron Triangle” Scope, Time and Cost. Although the Governance and Resources Performance Domains lack dedicated phases in the game, related concepts are inherently and contextually woven into the content of the puzzles. To the authors’ best knowledge, this is the first assessment Escape Room related to this discipline.

4.1 Game Narrative

The narrative immerses participants in a high-stakes corporate environment, confined within a conference room, where they assume the role of project team members, preparing for an important meeting with their company’s clients, to kick-off an ambitious new project. The company they work for operates within the sustainable construction sector, tasking the team with a commercial green upgrade for a building owned by a premium real estate client. A sudden cybersecurity breach wipes all the digital files containing the project’s data and locks away the presentation they were supposed to set out to the client. The demanding Executive Director is on his way to lead the meeting entirely unaware of the situation. Fortunately, the director has kept physical backup copies of the lost files. These files are scattered, encrypted and locked within the conference room, requiring the team to locate and decrypt them, to “escape”. They must reconstruct the project baseline and complete the schedule, budget and risk assessment to unlock the presentation prior to the Director’s arrival.

4.2 Hint System

A dual-layer hint system is embedded into the design of the Escape Room to optimize player engagement and prevent frustration and cognitive overload without compromising academic rigor. The first tier consists of enigmatic rhymed prompts for each phase of the escape room, delivered through a screen, if the team exceeds a predetermined time limit. The guidance these prompts offer is implicit, forcing the players to decode them in order to progress, therefore preserving the challenge and flow of the game. The second tier utilizes office telephone located inside the room. This setup allows the game master, who plays the role of the Executive Director’s Secretary to deliver case-specific guidance to each team tailored to the exact situation they are facing. This method of providing assistance reinforces the corporate setting of the Escape Room and does not compromise the players’ immersion, aligning with the design principles proposed by Clarke et al. (2017).

5. Game flow

5.1 Game Building Blocks

The Escape Room comprises four sequential challenges, each addressing one or more Performance Domains and consisting of three types of game building blocks: objects, puzzles, and hints.

The first phase introduces the players to Scope and Stakeholder Management, using request cards, a Power/Interest matrix and a lockbox. To progress, the team must evaluate the project's scope and prioritize stakeholders. If they face roadblocks, the hint system provides assistance for the card search and the stakeholder analysis.

The second phase transitions to Scheduling and Time Management, where the available objects include a Gantt Chart, a Network Diagram and a chessboard. During this challenge, the players must isolate the Critical Path and plan the project. Guidance in this phase includes clues for utilizing the chessboard and points to the Critical Path Method.

The third phase of the Escape Room addresses Budget and Cost Management, using a cost inventory, a risk register and corporate policy sheets. The puzzle requires the team to calculate the budget required for the project and the necessary contingency reserves based on constraints posed by the company's policies. Hints for this section of the game include guidance for the budget calculation.

The fourth and final phase concludes the game with Risk Management concepts, where the players encounter risk cards, a whiteboard matrix and a UV flashlight. The objective here is to plot the matrix accurately in order to decipher a hidden message that appears in the dark and categorize corrective actions into their respective risk treatment strategies. To streamline this complex task, if necessary, the team is offered advice on matrix organization and clarifications regarding the categorization of the risks.

To streamline gameplay and reduce cognitive load, a color-coding technique is used: all the documents concerning a specific phase utilize a uniform color and font or a combination of colors, signaling to the players that they are somehow interconnected and belong to the same puzzle (Figure 1).

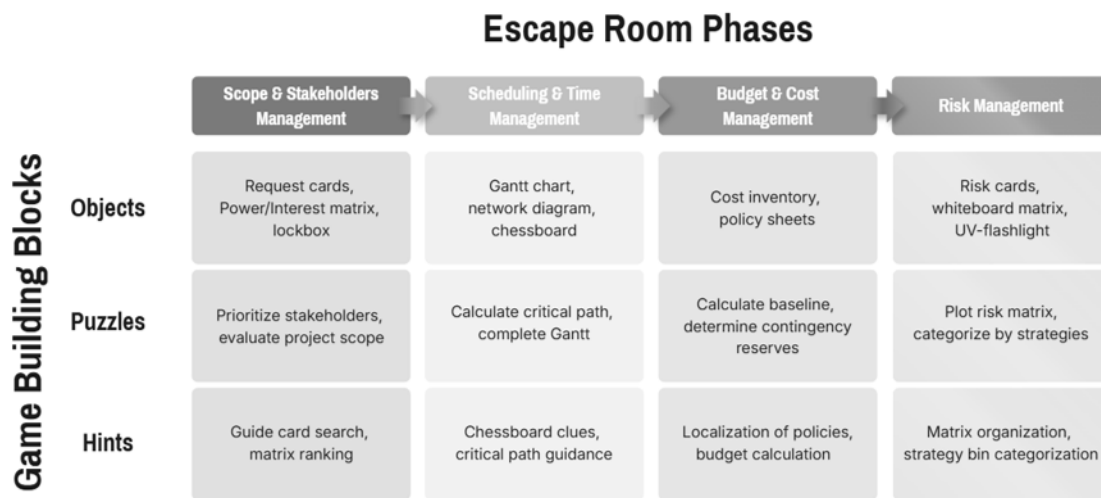


Figure 1: Game building blocks by game phase

5.2 Competencies Targeted by Game Phase

The structure of these consecutive phases serves as a mechanism for evaluating specific competencies and knowledge of the players. As detailed in the figure below, every phase targets distinct technical and non-technical skills required to complete each challenge (Figure 2 and 3).

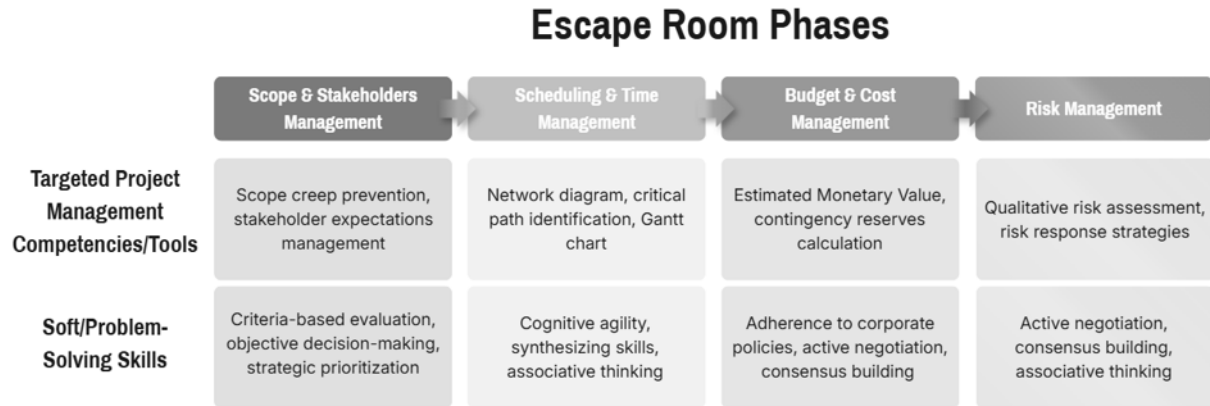


Figure 2: Competencies targeted by game phase



Figure 3: Physical setup of the Escape Room

5.3 Illustrative puzzle

To provide a clearer understanding of the Escape Room's structure and mechanics, the second phase concerning scheduling and time management is analyzed below as an illustrative example of the gameplay experience.

5.3.1 Artifacts & Materials

The set of clues for this phase are inside a drawer, which has been unlocked as a result of progress of the participants at the end of the first phase. The clues include a Gantt Chart template, a document which compartmentalizes the project's scope into work-packages and details their attributes such as logical dependencies and durations, though some of them are intentionally omitted, and Activity Cards, corresponding to each work-package. On the workspace the players are presented with an empty Network Diagram template, a chessboard with some chess pieces displaced and a file box marked 'CONFIDENTIAL' that is locked with a directional padlock.

5.3.2 Puzzle Logic

The players must use the Activity Cards to construct the project's Network Diagram and therefore lay the foundation to identify the Critical Path. However, the team must recognize that the information being deliberately withheld is

essential to achieve this. After an environmental search for other data sources, they must deduce the required values from the coordinates of the displaced pieces on the chessboard. If needed the Game Master intervenes with the following hint:

*As proper project managers, it's true,
Time is a slight obsession for you,
So to make sure your breaks are properly spent,
With timed chess you study each event.
If you observe the pieces on the board,
The secret durations will be explored.*

Once the missing information has been discovered and the Critical Path isolated on the diagram, the sequence of the arrows linking the critical nodes dictates a spatial pattern, which must be utilized to unlock the directional padlock, granting access to the next set of clues.

This is a typical example of the puzzles developed specifically for the presented Escape Room.

6. Conclusion and further research

This study presents the development of an Escape Room for the assessment of project management knowledge and tools. The combination of the Design-Play-Experience and the Octalysis model establishes a clear connection between pedagogical objectives and the players' engagement, allowing them to apply knowledge in a simulated professional environment. The architecture of the game integrates theoretical principles and technical tools into interactive, physical puzzles within a structured narrative intended to encourage collaboration and promote joint decision-making. The outcome of this study has the potential to provide value to three principal stakeholder groups. First, they offer insights for scholars and educators seeking to enrich engineering education through the adoption of experiential and practice-oriented learning approaches, thereby expanding existing pedagogical methodologies. Second, they may support project management practitioners by introducing innovative approaches for assessing personnel capabilities, strengthening team formation processes, and enhancing the effectiveness of organizational training and professional development initiatives. Third, the study may be of interest to professional associations, including the Project Management Institute (PMI) and the International Project Management Association (IPMA), whose competency frameworks highlight the need to evaluate not only technical expertise but also the interpersonal and behavioral competencies that are essential for successful project delivery.

The research team is currently employing a mixed-methods approach to analyze data from pilot trials of the Escape Room and extract insights into team dynamics and performance as well as observations to improve the experience and the game itself.

Future studies could investigate the digitization of the escape room, transitioning it from a physical to a virtual environment, to enhance scalability and user accessibility as well as automate the collection of performance data. Alternatively, one could investigate the transferability of the dual framework model, Design-Play-Experience and Octalysis, to create different serious games for the education or assessment of project management knowledge.

Ultimately, this work highlights how experiential learning and in particular educational escape rooms can bridge the gap between classroom theory and execution in a collegial environment. Further research opportunities could investigate the digital transition of the Escape Room or its enhancement to include more challenges to address different project management methodologies or to delve into a specific kind of project such as construction, software, event organizing etc.

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References

- Barbosa, M. W., and C. de Ávila Rodrigues. "Project portfolio management teaching: Contributions of a gamified approach," *International Journal of Management Education*, Vol. 18, No. 2, 2020. <https://doi.org/10.1016/j.ijme.2020.100388>
- Burch, G. F., R. Giambatista, J. H. Batchelor, J. J. Burch, J. D. Hoover, and N. A. Heller. "A meta-analysis of the relationship between experiential learning and learning outcomes," *Decision Sciences Journal of Innovative Education*, Vol. 17, No. 3, pp. 239–273, 2019. <https://doi.org/10.1111/dsji.12188>
- Chou, Y.-K. *Actionable Gamification: Beyond Points, Badges, and Leaderboards*, CreateSpace Independent Publishing Platform, 2014. <https://twitter.com/search?q=#OctalysisBook>
- Clarke, S. J., D. J. Peel, S. Arnab, L. Morini, H. Keegan, and O. Wood. "EscapED: A framework for creating educational escape rooms and interactive games for higher/further education," *International Journal of Serious Games*, Vol. 4, No. 3, pp. 73–86, 2017. <https://doi.org/10.17083/ijsg.v4i3.180>
- Desai, P., A. Bhandiwad, and A. S. Shettar. "Impact of experiential learning on students' success in undergraduate engineering," *Proceedings of the IEEE 18th International Conference on Advanced Learning Technologies (ICALT 2018)*, pp. 46–50, 2018. <https://doi.org/10.1109/ICALT.2018.00018>
- Dewey, J. *How We Think*, Henry Regnery Company, 1933.
- Dewey, J. *Experience and Education*, Macmillan Publishing Co., 1938.
- Farooq, M. S., A. Hamid, A. Alvi, and U. Omer. "Blended learning models, curricula, and gamification in project management education," *IEEE Access*, Vol. 10, pp. 60341–60361, 2022. <https://doi.org/10.1109/ACCESS.2022.3180355>
- Fotaris, P., and T. Mastoras. "Escape rooms for learning: A systematic review," *13th European Conference on Games Based Learning (ECGBL 2019)*, Odense, Denmark, 2019.
- Freeman, S., S. L. Eddy, M. McDonough, M. K. Smith, N. Okoroafor, H. Jordt, and M. P. Wenderoth. "Active learning increases student performance in science, engineering, and mathematics," *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 111, No. 23, pp. 8410–8415, 2014. <https://doi.org/10.1073/pnas.1319030111>
- Gordillo, A., and D. Lopez-Fernandez. "Are educational escape rooms more effective than traditional lectures for teaching software engineering? A randomized controlled trial," *IEEE Transactions on Education*, Vol. 67, No. 5, pp. 660–668, 2024. <https://doi.org/10.1109/TE.2024.3403913>
- Gordillo Méndez, A., A. Santamaría Urbieto, S. López Pernas, S. Gutiérrez Gómez-Calcerrada, M. Milošević, M. Čosić, E. Barra Arias, and R. Elmoazen. *Best Practices for Creating and Conducting Educational Escape Rooms: A Comprehensive Guide for Teachers*, Universidad Politécnica de Madrid, 2025. <https://doi.org/10.20868/upm.book.88943>
- Hellström, M. M., D. Jaccard, and K. E. Bonnier. "A systematic review on the use of serious games in project management education," *International Journal of Serious Games*, Vol. 10, No. 2, pp. 3–24, 2023. <https://doi.org/10.17083/ijsg.v10i2.630>
- Hunicke, R., M. LeBlanc, and R. Zubek. "MDA: A formal approach to game design and game research," *Game Developers Conference (GDC)*, 2004.
- Hwang, W., P. Aguinalde, K. J. Crippen, J. Shin, and B. F. Carroll. "Systematic review of work-integrated learning in undergraduate engineering education," *Journal of Engineering Education*, Vol. 115, No. 1, 2026. <https://doi.org/10.1002/jee.70050>
- Jääskä, E., J. Lehtinen, J. Kujala, and O. Kauppila. "Game-based learning and students' motivation in project management education," *Project Leadership and Society*, Vol. 3, 2022. <https://doi.org/10.1016/j.plas.2022.100055>
- Jerrim, J. "Test anxiety: Is it associated with performance in high-stakes examinations?" *Oxford Review of Education*, Vol. 49, No. 3, pp. 321–341, 2023. <https://doi.org/10.1080/03054985.2022.2079616>
- Kearney, J., T. Bond-Barnard, and R. Chugh. "Soft skills and learning methods for 21st-century project management: A review," *International Journal of Information Systems and Project Management*, Vol. 12, No. 4, pp. 5–20, 2024. <https://doi.org/10.12821/ijispm120401>
- Kolb, D. A. *Experience as the Source of Learning and Development*, 2nd ed., Pearson Education, Inc., 2015.
- Law, K. M. Y. "Teaching project management using project-action learning (PAL) games: A case involving engineering management students in Hong Kong," *International Journal of Engineering Business Management*, Vol. 11, 2019. <https://doi.org/10.1177/1847979019828570>
- López-Pernas, S., A. Gordillo, E. Barra, and J. Quemada. "Examining the use of an educational escape room for teaching programming in a higher education setting," *IEEE Access*, Vol. 7, pp. 31723–31737, 2019. <https://doi.org/10.1109/ACCESS.2019.2902976>

- Marar, H. W., F. R. Shahroury, and M. Fares. "Work-integrated and cooperative learning effects on micro-electronics design classes," *Journal of Higher Education Theory and Practice*, Vol. 22, No. 13, 2022.
- Project Management Institute. *PMBOK Guide*, 8th ed., Project Management Institute, 2025.
- Rawlinson, R. E., and N. Whitton. "Escape rooms as tools for learning through failure," *Electronic Journal of E-Learning*, Vol. 22, No. 4, pp. 19–29, 2024. <https://doi.org/10.34190/ejel.21.7.3182>
- Ross, D., J. L. Ackrill, and J. O. Urmson. *Aristotle – The Nicomachean Ethics*, 3rd ed., Oxford University Press, 1998.
- Ross, R., and A. Bennett. "Increasing engagement with engineering escape rooms," *IEEE Transactions on Games*, Vol. 14, No. 2, pp. 161–169, 2022. <https://doi.org/10.1109/TG.2020.3025003>
- Ross, W. D. *Metaphysics*, 1908.
- Rumeser, D., and M. Emsley. "Project management serious games: Identifying gaps, trends, and directions for future research," *Journal of Modern Project Management*, Vol. 6, No. 1, pp. 48–59, 2018. <https://doi.org/10.19255/JMPM01605>
- Sibley, J., and D. X. Parmalee. "Knowledge is no longer enough: Enhancing professional education with team-based learning," *New Directions for Teaching and Learning*, No. 116, pp. 41–53, 2008. <https://doi.org/10.1002/tl.332>
- Tews, T., G. Skulmoski, C. Langston, and A. Patching. "Innovation in project management education—Let's get serious!" *Construction Economics and Building*, Vol. 20, No. 3, pp. 124–141, 2020. <https://doi.org/10.5130/AJCEB.v20i3.7040>
- Turner, M. "Beyond the iron triangle: Reflections of an early career academic," *International Journal of Managing Projects in Business*, Vol. 9, No. 4, pp. 892–902, 2016. <https://doi.org/10.1108/IJMPB-01-2016-0005>
- Veldkamp, A., L. van de Grint, M. C. P. J. Knippels, and W. R. van Joolingen. "Escape education: A systematic review on escape rooms in education," *Educational Research Review*, Vol. 31, 2020. <https://doi.org/10.1016/j.edurev.2020.100364>
- Villarroel, V., D. Boud, S. Bloxham, D. Bruna, and C. Bruna. "Using principles of authentic assessment to redesign written examinations and tests," *Innovations in Education and Teaching International*, Vol. 57, No. 1, pp. 38–49, 2020. <https://doi.org/10.1080/14703297.2018.1564882>
- Von Wangenheim, C. G., R. Savi, and A. F. Borgatto. "DELIVER! – An educational game for teaching earned value management in computing courses," *Information and Software Technology*, Vol. 54, No. 3, pp. 286–298, 2012. <https://doi.org/10.1016/j.infsof.2011.10.005>
- Von Wangenheim, C. G., R. Savi, and A. F. Borgatto. "SCRUMIA – An educational game for teaching SCRUM in computing courses," *Journal of Systems and Software*, Vol. 86, No. 10, pp. 2675–2687, 2013. <https://doi.org/10.1016/j.jss.2013.05.030>
- Winn, B. M. "The design, play, and experience framework," in *Handbook of Research on Effective Electronic Gaming in Education*, Vol. 3, Information Science Reference, 2009.

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