Level-Up Tutor-Qualification: A Digital Escape Room for Game-Based Learning in Higher Education

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Abstract: This paper presents the development and formative evaluation of an early-stage prototype of a digital escape room designed for student tutor training at TUD Dresden University of Technology. The study focuses on usability and motivation rather than learning gains. The escape room simulates typical challenges encountered in the everyday life of student tutors, such as dealing with technical issues, structuring seminars, and responding to disruptions. The scenario places players in the role of a tutor who must prepare a seminar room within a limited timeframe while overcoming realistic obstacles. Each task must be solved logically and sequentially, guided by minimal interface elements and visual feedback. The challenge lies in identifying problems, making decisions under time pressure, and learning through trial and error, elements that mirror real tutoring situations. The design is anchored in the principles of flow theory (Csikszentmihalyi, 1990) and deindividuation theory (Zimbardo, 1969; Joinson, 2001) to enable engaging and supportive learning. The prototype was evaluated in a two-stage process: qualitatively using the thinking-aloud method, and quantitatively via an online survey on self-efficacy and usability. Initial feedback shows high acceptance of the format and a strong motivational effect, particularly due to the immersive setting, clear progress indicators, and gamified elements. Nevertheless, findings also revealed areas for improvement, most notably in onboarding, clarity of task instructions, and technical stability. Planned improvements directly address these points through redesigned task prompts, enhanced navigation aids, and an introductory onboarding module. The project demonstrates how such game-based formats can serve as scalable, accessible tools for tutor training in higher education.

Keywords: Digital escape room, Gamification, Problem-Based learning, Tutor training, Higher education didactics

1. Introduction

As an important interface between teachers and students, tutors are responsible for knowledge transfer, moderation and organisational support. However, they often lack formal didactic training or teaching qualifications. As preparation for tutorials often focuses solely on subject content or organisational aspects, many tutors feel overwhelmed when they start teaching and are unable to respond effectively to everyday situations. This uncertainty can negatively impact the quality of teaching. Furthermore, due to the dual demands of their own studies and teaching activities, they often lack the time for traditional, theory-focused training formats that are inflexible and often impractical. In light of these circumstances, the TUD developed a digital escape room to encourage tutors to learn in a motivating, playful and action-oriented environment. It prepares tutors for the typical challenges involved in preparing for and conducting tutorials through experience-based learning. In a virtual room, users engage with situations that also arise in everyday university life, such as faulty technology, unclear room organisation, time pressure and lack of accessibility. The aim is to promote confidence and problem-solving skills through exploratory learning and direct feedback when solving tasks.

Drawing on elements from game-based learning research, the project combines these with the didactic principles of university teaching and the technical capabilities of Unity[1], Blender[2] and Spatial.io[3]. The escape room is web-based, accessible and multilingual, and can be used on any device.

This article outlines the didactic concept and technical implementation of the prototype. It also describes the two-stage evaluation process, which incorporates qualitative and quantitative usability data. The aim is to evaluate the potential of a digital escape room for tutor training and to present initial empirical findings on its use, acceptance and effectiveness. The next section provides a more detailed description of the background and the current state of research. The theoretical frame of reference is then explained in more detail to establish a

[1] Unity (https://unity.com) is a powerful development environment for creating 2D, 3D and virtual reality applications, which is particularly frequently used in game development and interactive learning.

[2] Blender (https://www.blender.org/) is a free, open-source 3D graphics suite for modelling, animation, simulation, texturing and rendering 3D objects and scenes.

[3] Spatial.io (https://www.spatial.io) is a platform for creating and exploring interactive 3D spaces directly in the browser. It allows users to design immersive virtual environments and integrate interactive scripts.

didactic framework and clarify the psychological basis. This is followed by a presentation of the prototype's design and technical implementation (Chapter 4). Chapter 5 describes the qualitative and quantitative evaluation methods in more detail, before Chapter 6 presents the results of the two-stage evaluation method. The following chapter discusses the results in the context of current research, theoretical considerations and concepts. Chapter 7 concludes with a summary and an outlook on future developments and further applications in the field of education.

2. Background and State of Research

The qualification of student tutors is a central task of university didactics. As a link between teachers and students, they make a significant contribution to promoting learning, social integration in study contexts and ensuring teaching quality (Zitzelsberger, 2019). A survey conducted at TUD in June 2024 (Ludwig, Pippig, Thamm, 2025) revealed that 86% of the tutors surveyed expressed a need for further training, with 68% highlighting key competencies such as classroom moderation, coping with challenging situations, course organisation, didactic structuring and the development of soft skills. In view of these identified challenges, the implementation of practice-oriented training methods is necessary to prepare tutors for their work as teachers. Inspired by the room of horror from medical training (Zimmermann, Schwappach, 2019), a digital escape game format was developed at TUD to test typical challenges in teaching, such as structuring seminars or dealing with disruptions and technical problems.

Game-based learning and gamification are often used to promote motivation and collaborative problem solving. Educational escape rooms take advantage of these characteristics by appealing to the cognitive and emotional engagement of learners. Research shows that escape rooms can contribute to deeper and more sustainable learning outcomes, especially due to the realism of the tasks set under time pressure (Pais et al., 2023). In higher education, escape rooms have so far been used primarily to liven up existing courses or in specialised subject contexts such as medicine or STEM subjects. The focus there is usually on teaching subject-specific content or training individual skills such as teamwork or time management. However, initial studies demonstrate the potential of digital escape rooms to promote skills relevant to university teaching (Zimmermann, Schwappach, 2019). Until now, however, escape rooms have hardly been used in the context of tutor training. The web-based escape game developed here closes this gap by making typical practical situations tangible. Tutors can thus be prepared for their diverse and often demanding role, with a focus not only on subject-specific content, but also on soft skills, self-organisation and stress resilience. Tutors can go through the escape room flexibly, regardless of location and time, which is an essential requirement given their often tight schedules. Thanks to its integration into a digital 3D environment based on Unity and Spatial.io, the format is not only easy to use, but also technically compatible with multiplayer options and extensions. This project extends prior work by applying the escape room concept specifically to tutor training, a domain where it has rarely been tested.

3. Theoretical Framework

The design of the escape room is based on three central theoretical approaches: Csikszentmihalyi's flow theory (1990); the problem-based learning approach; and Zimbardo's deindividuation theory (1969), as interpreted by Joinson (2001).

Flow theory describes a state of complete immersion and concentration, whereby learners actively engage with a task without being distracted by external factors. Flow occurs when the demands of a task are balanced with the learner's abilities. The learning environment must offer clear goals, immediate feedback, and an appropriate level of difficulty. When designing the escape room, time pressure and problem-centred tasks were employed to create a challenging yet feasible experience. This is made possible by a clear task structure and embedded clues. However, care must be taken to ensure that the time limit is appropriate and that the controls are understandable, in order to avoid overwhelming players. This playful learning principle makes use of situational learning, whereby knowledge is acquired in the context of everyday situations typically encountered by tutors, such as disorganised rooms, malfunctioning equipment, and time-related stress factors. This principle is complemented by problem-based learning approaches, in which learners actively and independently solve challenges instead of passively receiving information. Another effective principle comes from research on visual anonymity in the digital space. Drawing on Zimbardo's (1969) deindividuation theory and Joinson's (2001) subsequent empirical research, it has been demonstrated that anonymised digital spaces can increase the willingness to explore and make mistakes. For new tutors who have not yet established their role, a gaming environment without social observation can encourage experimentation. It can also help tutors who feel uncertain in face-to-face training and frequently compare themselves with others to get started. For this reason,

there are no plans to personalise the avatars or clearly identify them by player names in the game. Finally, the escape room can be viewed as an example of a 'cognitive apprenticeship' as defined by Collins, Brown and Newman (1989). Players implicitly observe what 'good preparation' means, try it out, receive situational feedback, and can revise their strategies. Through this process of experiencing and repeating problems, specialist and practical knowledge is built up. Learning is therefore most likely to occur when it is challenging but not overwhelming, and when learners have a personal connection to the learning content.

4. Didactic Concept and Technical Implementation of the Prototype

The project aimed to develop a digital, interactive learning format to prepare tutors for the typical challenges they face when planning and conducting courses, in a realistic yet playful environment. Players take on the role of a tutor whose seminar is due to start in 20 minutes. However, they find that the assigned seminar room is chaotic, with technical defects, misaligned chairs and missing materials, and there is no time for extensive preparation (see Figure 1). Players must get the room ready for class in time.

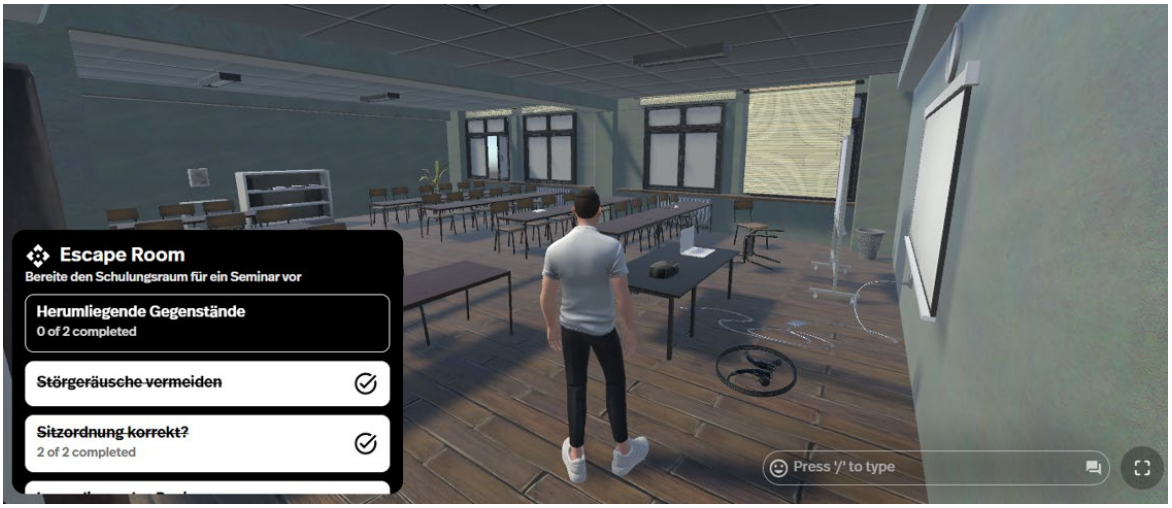

Figure 1: Game environment of the digital escape room (own illustration)

The tasks were selected based on didactic principles to address key areas of competence frequently required of tutors: organisation, technical proficiency, problem-solving, time management, and communication sensitivity. Situations that regularly occur in real teaching contexts, but which are often not systematically addressed in training courses, were deliberately chosen. The aim is to encourage learners to analyse and respond to authentic problem situations. The tasks are divided into so-called 'pitfalls' that must be worked through one after the other and assigned to typical problem areas. These include technical issues such as an unconnected laptop or a non-functioning projector, organisational issues such as a whiteboard with no pens or paper, and communication issues such as an open window with street noise or a muted microphone for online participants. These types of tasks represent common but often unforeseen hurdles in tutorials that require quick, goal-oriented action. To enable accessibility for all, the environment has been designed so that all tasks can be completed in a linear fashion and without prior knowledge. A progress bar shows the status of the remaining tasks, thus supporting self-directed learning. The linearity of the tasks was chosen deliberately to enable structured evaluation of usability, particularly during the initial testing phase. However, non-linear variants are also being considered for the future, to allow for situation-specific prioritisation. After successfully completing a task, players receive immediate feedback, such as visual confirmation, a progress bar or confetti, to promote intrinsic motivation and support orientation within the game.

The escape room was technically implemented using the Unity game engine and the Spatial.io Creator Toolkit, supplemented with our own 3D models from Blender. The seminar room was modelled to scale and imported into Unity in glTF format. Interactive objects were given triggers and specific action options using Unity's visual scripting system. A custom progress system comprising individual 'quests' was programmed to control the game flow and save progress. The minimalist user interface focuses attention on what is happening in the room and is derived from Cognitive Load Theory (Sweller et al., 2011). The environment can be used directly in the browser via Spatial.io, which is an important feature for enabling tutors to access it regardless of their location or the time. All interactions are performed via keyboard or mouse click. As soon as interactive objects enter the radius

of action, they are marked with the relevant action options. Playing time is limited to 20 minutes to simulate a realistic seminar situation.

5. Evaluation Methods

To further improve the first prototype and evaluate the motivational quality of the digital escape room, a combination of qualitative and quantitative methods was employed. Qualitative usability tests involved analysing individual game runs and conducting follow-up interviews, while quantitative data was collected during two workshops. The aim was to gain insight into the user experience and collect feedback on usability and implementation. This initial feedback is not intended primarily to measure effectiveness, but rather to inform the further development of the game from technical and didactic perspectives.

Combining both methods allowed us to gain individual insights into the perceptions and user experience of the test subjects, as well as collecting standardised feedback on the design, comprehensibility, and motivational effect of the format. The qualitative method, particularly the thinking-aloud technique, enables targeted collection of information about thought processes, interaction problems and intuitive reactions, especially at the beginning of development (Rubin, Chisnell, 2011). This enables usability issues and signs of frustration during task processing to be identified as early as possible.

In addition, quantitative surveys, such as standardised questionnaires (e.g. the System Usability Scale), provide comparable user assessments and enable an initial classification of the user-friendliness and motivation involved in the overall experience. Combining these two approaches is particularly meaningful as it allows qualitative impressions to be combined with quantitative evaluations. This enables the development process to be viewed from both the users' perspective and a broader analytical perspective. This approach has proven particularly useful in the prototypical development of digital learning formats.

5.1 Qualitative Results: Think-Aloud Method and Interviews

In the first phase, four usability tests were conducted using the think-aloud method. Four test subjects were asked to complete the first prototype of the escape room in a quiet environment, saying aloud what they saw, thought and did as they did so. These sessions were documented using a screen recording that included mouse pointer tracking and audio recording.

This method aims to identify problems in user guidance and gaps in understanding tasks. The method is intended to demonstrate the intuitiveness of the game and identify where usability problems occur. This enables initial conclusions to be drawn about user behaviour, particularly in the early stages of development, and allows technical weaknesses to be identified at an early stage. Four test subjects were selected for the sample, as four to five tests are sufficient to identify most error sources and usage problems, as suggested by Nielsen et al., 1993. As the prototype is at an early stage of development, the initial focus of the test was on a qualitative in-depth analysis of usability rather than on achieving the highest possible number of cases. After playing the game, the test subjects were asked about their overall impression, motivation, any disruptions, and the relevance of the content in a semi-structured interview. The qualitative data were transcribed, systematically coded, and evaluated using a category system comprising seven inductively formed categories. These categories are: graphic design and atmosphere; task comprehension; orientation and control; motivation and enjoyment of the game; technical problems; realism of the tasks; and suggestions for improvement. During the initial test games, it became clear that all test subjects found the start of the game too abrupt, as an explanation of the game principle and general gameplay was missing. In many cases, the test administrators also had to explain how to use the controls. Due to the lack of an introduction, participants often failed to recognise the tasks displayed at the beginning or overlooked them. The graphic design received positive ratings across the board, and the atmosphere was described as appropriate, albeit somewhat oppressive. This was acknowledged as being stylistically appropriate. Overall, the tasks were well understood, but some confusion arose from the choice of terms ('correct seating arrangement') or tasks that had not yet been fully implemented. The linear structure of the task sequence was also discussed. On the other hand, the realism and perceived relevance of the tasks were consistently rated positively. The high level of motivation and enjoyment triggered by the game was emphasised in particular. Elements such as the high level of interactivity and gamification were also perceived positively. Several participants expressed a desire to continue playing the game or working on further tasks: *'I wanted to continue.'* (Quote from Test Subject 2). While the majority described the controls in the room as successful, individual problems with the camera work were mentioned. The keyboard controls were considered intuitive, even by those with limited gaming experience. There were minor technical limitations, such as incomplete tasks or slight control issues. However, these were considered to be expected weaknesses of an early prototype and

did not affect the overall usability. Future improvements should focus on providing a more targeted introduction to the game, as well as adding additional tasks and gamification elements, such as Easter eggs, time limits and playful rewards.

Qualitative testing procedures carried out in the early development stage revealed comprehension difficulties and technical errors, while confirming the motivational potential of a digital escape room.

5.2 Quantitative Results: Standardised Questionnaires

In the second phase, a larger group (n = 24) tested the escape room as part of two workshop concepts. Afterwards, participants completed a standardised online questionnaire consisting of the System Usability Scale (SUS), a Likert scale on game motivation, sense of flow and perceived learning gains, and three open-ended questions. The quantitative data were analysed descriptively (mean, median and variance). Participants rated ten statements using a five-point Likert scale (*1 = strongly disagree, 5 = strongly agree*). The results are shown in Figure 2.

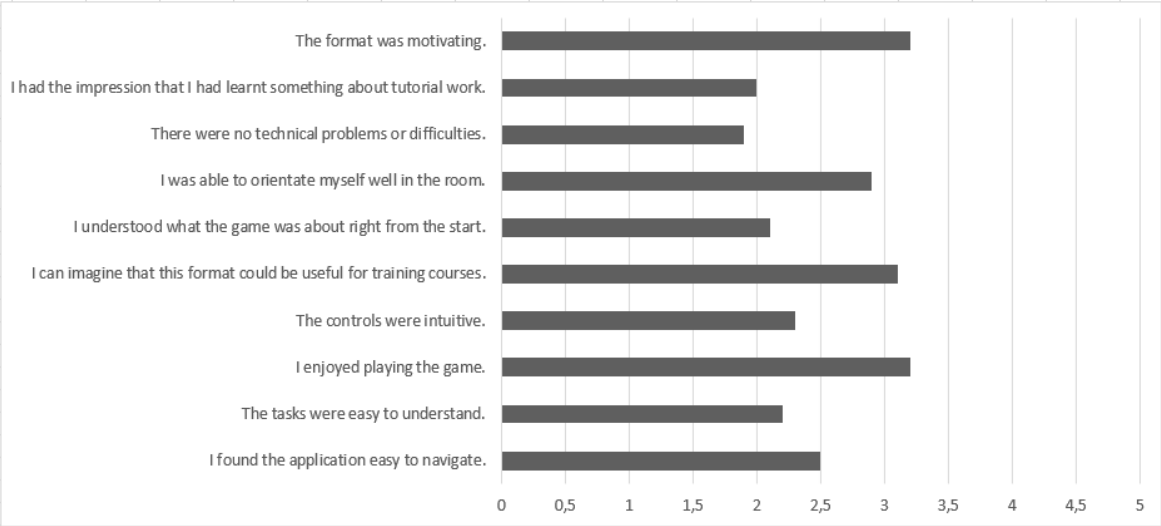

Figure 2: Quantitative Likert scale (from 1 = strongly disagree to 5 = strongly agree) for evaluating the prototype

In usability research, values above 3.0 indicate predominantly positive agreement, whereas values below 2.5 suggest room for improvement (Bangor et al., 2009). Participants particularly enjoyed the game (mean = 3.3), felt motivated (mean = 3.2) and found it easy to orient themselves in the room (mean = 3.2). The game's general suitability for training was also rated positively (mean = 3.0).

However, lower ratings were given for aspects of usability and clarity: 'The controls were intuitive' (mean = 2.5), 'The tasks were clearly understandable' (mean = 2.3), and 'I understood what the game was about right from the start' (mean = 2.3). The statement 'There were no technical problems' received a mean score of 2.2. Open-ended feedback was mixed. While terms such as *'great idea'* and *'modern'* reflected positive impressions, critical feedback included *'not self-explanatory'*, *'unclear controls'*, and *'technical errors'*. When asked what they would improve, respondents mostly said they wanted more structure and clarity.

The demographic analysis of the evaluation shows a higher proportion of female participants (Figure 3).

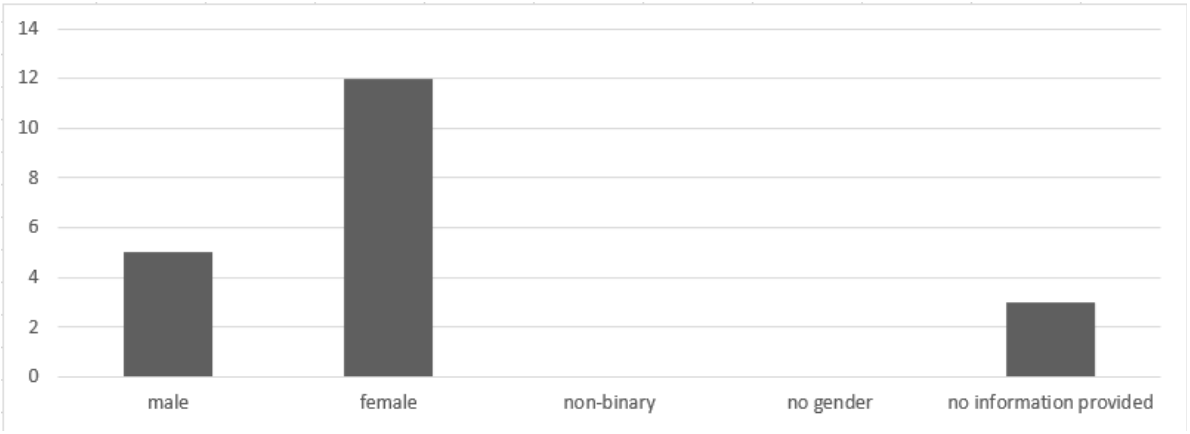

Figure 3: Distribution by gender

This distribution reflects the common tendency for more individuals who identify as female to be active in university teaching. The age distribution also shows a pronounced spread, focusing on young adults and individuals of working age (see Figure 4).

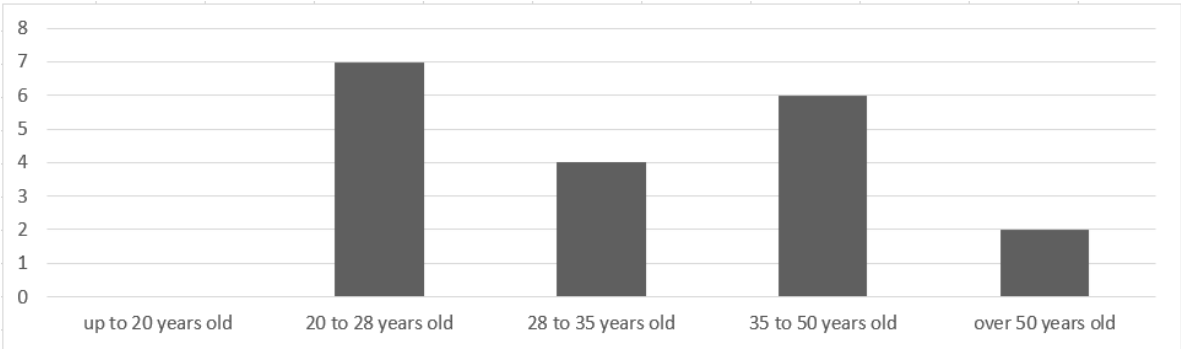

Figure 4: Distribution by age

Feedback came from a variety of disciplines. Although the concept of the game was perceived as innovative and motivating, the results clearly indicate that its implementation was considered insufficiently structured, technically unstable, and difficult to understand. Criticism was particularly levelled at the lack of instructions relating to the controls, the task logic and the game objective. Many of the aforementioned problems could be resolved through technical adjustments, particularly by providing a guided introduction to the game and simplifying the structure of the tasks.

It should be noted when analysing the results that only an initial prototype has been tested so far, and that no final conclusions can yet be drawn about the technical design and learning effectiveness. Nevertheless, the initial findings suggest that the escape room is motivating, but there is scope for improvement, particularly with regard to user guidance, task clarification and technical introduction.

6. Discussion

The evaluation results indicate that the digital escape room is perceived as a promising tool for preparing tutors for practical teaching challenges. The format's high level of acceptance as a learning medium is particularly positive. Both the quantitative evaluations ('I enjoyed the game,' 'The format motivated me') and the open feedback *('cool idea*', *'great concept'*) indicate that a game-based setting is considered a valuable part of tutor training.

The positive SUS ratings and feedback on the fun factor may indicate that the escape room can promote conditions that are consistent with Csikszentmihalyi's (1990) flow concept, particularly through the balance between challenge and ability. However, this needs to be verified through further evaluations. In particular, the balance between challenge and ability was perceived as motivating. The opportunity to make mistakes and learn from them was described as an educational added value. This could help to reduce uncertainties when dealing with technology or organisational requirements, for example. However, the evaluation also revealed significant potential for improvement, particularly with regard to user guidance and task comprehension. Participants often

expressed uncertainty about the game's objective, difficulty in navigating the environment, and confusion regarding the order and structure of the tasks. Statements such as *'I found the application easy to use', 'The tasks were clearly understandable'*, and *'I understood what the game was about from the start'* received the lowest ratings. Due to these low ratings and the qualitative feedback regarding the comprehensibility of the tasks, the task instructions are currently being revised to be more concise and better embedded in the game context. Frequent disorientation during the game has also led to the development of a structured introductory tutorial that explains the game's purpose, controls, and basic mechanisms. A progress bar will be added to structure the sequence of tasks and provide support in the form of hints during longer breaks. Further suggestions from open feedback, such as introducing additional gamification elements (e.g. bonus points, Easter eggs or simulated disruptions), will also be incorporated to increase motivation to play. Future versions will feature a more flexible task structure, with multiple task strands unlocked simultaneously to strengthen learners' autonomy and sense of control. A final reflection component will help players to consider their learning process and the decisions they made during the game. It is important to emphasise that the present results are formative in nature and reflect an early stage of development. The study takes a design-based research approach, focusing explicitly on usability and motivation rather than on measurable learning outcomes or long-term effectiveness. The results are therefore intended to inform the further development of the prototype and will be incorporated into future design iterations. A summative evaluation focusing on learning outcomes will be conducted in later phases of the project. The results also highlight the importance of adaptive and inclusive design. Not all users have the same technical, cognitive, or physical prerequisites from the outset. Therefore, aspects of accessibility, such as keyboard control, contrast mode and intuitive icon design, will be prioritised in future development phases. Beyond the qualifications of the tutors, the evaluation also demonstrates the broader potential of digital escape rooms as a learning format in higher education and vocational training. They could support new teachers in lesson preparation, mentors in practical school internships, and induction processes in educational institutions. They could also be used in training scenarios for crisis management, inclusion, or hybrid teaching. Realistic scenarios could also be designed as digital learning spaces in vocational schools or social settings, for example to prepare for internships, train workshop leaders, or teach crisis intervention strategies.

The evaluation provides a detailed and differentiated picture of user-friendliness and acceptance, offering clear, actionable guidelines for further developing the escape room.

7. Conclusion and Outlook

The digital escape room developed offers a practical addition to existing training formats and addresses typical challenges in tutor training in a playful way. The evaluation showed that participants found the concept very appealing, especially the motivating design, the realistic scenarios and the potential for use in higher education. At the same time, the results highlighted areas for improvement, such as onboarding, control and task logic. Many of the challenges identified are common problems in the early stages of developing digital environments and provide important pointers for targeted further development. The results reinforce the assumption that digital escape rooms can function as a learning medium if tailored to the needs of their target group and appropriately designed. In the long term, this format could also be adapted for other groups, such as new teachers, mentors, and student teams. Topics such as 'communication in hybrid settings', 'barrier-free teaching' and 'crisis management in tutorials' could be covered. The escape room can serve as both an introductory and a qualification tool.

The next development steps will focus on content, technical, and pedagogical refinement. Initially, an introductory tutorial will be integrated to provide players with clear guidance before they immerse themselves in the actual game situation. This tutorial will explain the controls and clarify the goal of the escape room and the basic game mechanics. This should lower the barriers to entry and improve the gaming experience. Furthermore, situation-specific task hints are planned. These will offer players targeted assistance based on their interactions without revealing the solution. The aim is to make the task structure more intuitive and reduce uncertainty when dealing with the game environment. Visual feedback can also indicate when a task has been completed successfully and suggest the next steps. Additionally, a final reflection after the game ends can encourage players to consider their decisions and insights, for example in the form of short self-reflection questions or optional group discussions. Future evaluation phases will combine qualitative usability tests (e.g., think-aloud method) with quantitative surveys to systematically assess improvements in task comprehensibility, navigation, and motivational impact. By triangulating individual user experiences with broader measurement, the project ensures an evidence-based, iterative development process. In this way, the escape room has the potential to become a scalable and transferable model for competence development in higher education and beyond.

Ethics Declaration: No ethical approval was required for the research presented in this paper, as all data were collected anonymously, voluntarily, and without any intervention posing risk to participants. Participants provided informed consent prior to taking part in the usability tests and survey.

AI Declaration: AI-assisted tools (e.g. ChatGPT and DeepL Write) were used to help structure and word individual sections, especially for linguistic optimisation, summarising qualitative results and translation. The author critically reviewed, edited and supplemented all generated content to ensure scientific accuracy, coherence and originality. The author takes final responsibility for the content.

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