

Educational Escape Room in Physics

Principle and Idea

Escape rooms (ER) are rooms in which various puzzles must be solved one after the other or sometimes in parallel in order to find the key to leave the room. These rooms and their board game and digital variants have been growing in popularity for several years. Logical thinking, a love of experimentation, curiosity and team spirit are important skills for successfully mastering an ER. As part of a project, in addition to the regular physics lecture, a real escape room was developed for students of veterinary medicine in the teaching building with the topic of physics, in which they can apply and test the knowledge they have learned in lectures in a problem-oriented way. For this purpose, part of the subject matter is packed into small puzzles covering important topics from the fields of mechanics, electromagnetism, thermodynamics, vibrations and waves as well as optics. With each puzzle solved, students receive new information and tools with which they can solve further puzzles. An escape room scenario - "Save Schrödinger's Cat" - puts the individual puzzles into a thematic context and immerses the students in the game. The ER is intended to playfully reduce the gaps in understanding in the basic physics lecture, which is compulsory in the introductory phase of veterinary studies, and to promote collaborative learning in a problem-oriented manner. The ER is offered to students as an elective course and is thus sustainably integrated into the

teaching catalogue of the University of Veterinary Medicine Hannover (TiHo).



Structure and Room Concept

The Escape Room Physics is a so-called inverted escape room. The aim is not to leave the room, but to enter a second room. This concept takes particular account of teaching and fire safety requirements at a university, for example. The first room (the starting room) is a room with mirror constructions (plane and curved mirrors) which is furnished in a modern and sterile way. Mirrors have a special connection to optics as a branch of classical physics. Mirror cubes and blue beanbags break up the academic rigidity of a university and invite visitors to linger. The second room is a rustically furnished room with many wooden elements, which

bears the name “Schrödinger's study” and represents a strong contrast to the first room. This is modelled on the style of the last century.

Physics Puzzle

The physics puzzles in the Escape Room cover a wide range of physics topics. The puzzles are supplemented by knowledge transfer documents that summarize the physical knowledge of the relevant physics disciplines. Puzzle cards also provide specific clues for solving the puzzles and obtaining a three- to four-digit numerical code for opening locks and safe boxes. The physics puzzles are up to date:

- Nobel Prize winner puzzle as a warm-up
- Model train puzzle (kinematics)
- Apple puzzle (mechanics and forces)
- Conductivity bone puzzle (direct electric current)
- X-ray picture puzzle (absorption of X-rays)
- 50 Hz hum test (alternating electric current)
- 3D-dog construction with magnetic building blocks (magnetism, solid state physics)
- Refraction and reflection (classical optics)
- Stirling engine (thermodynamics)
- Fluorescence puzzle (atomic physics/molecular physics)

The order of the puzzles is not given by the above order and must be found out while in the escape room.

Eurogame Puzzles

The educational Escape Room has a tactical secondary puzzle concept based on European board games (Eurogames). In Eurogames, players earn victory points and compare their performance with that of other players. The game groups in the escape room collectively receive points for solving the tactical secondary puzzles (Eurogame puzzles). The secondary puzzles do not necessarily have anything to do with physics, but serve to motivate and entertain. For example, there are special wooden puzzle cubes or games of skill that need to be solved. The Eurogame puzzles are optional, while the physics puzzles have priority and support the playful experience (gamification). At the end, the groups come up with a virtual group name (e.g. Schrödinger's kitten), which is then published in a scoring list. There is no evaluation based on victory points.



Student Impressions and Comments

"Something completely new."

"I was completely surprised by the second room, it looks completely different from the first."

"A lot of effort has been made here, you can tell."

"I've completed and visited escape rooms before and they really work just like this!"

"I liked the thermodynamics experiment with the Stirling engine best, I hadn't seen anything like it before."

The project was funded as part of the "InnovationPlus" program for the development of innovative teaching and learning concepts by the Lower Saxony Ministry of Science and Culture with approximately €50,000.

Special

The Escape Room at the TiHo is one of the first Escape Rooms in the German-speaking world that really covers a wide range of different physics topics, is actively used in teaching and has been fully incorporated into the university's teaching catalogue as part of the minor subject training. There is already one Escape Room each for upper secondary level (RPTU Kaiserslautern-Landau, Germany) and for quantum physics (TU Berlin, Germany) in German-speaking countries, which have been developed using university didactics. However, there is a large deficit worldwide with regard to escape rooms in physics, although they are very well suited for secondary education. The results of the PISA study 2023 have further focused interest in ER as a new tool in university didactics in the field of physics.

Links

For details, see:

<https://arxiv.org/abs/2406.15454>

https://doi.org/10.15487/tiho.11_2024.4

https://doi.org/10.15487/tiho.8_2024.1

https://doi.org/10.15487/tiho.6_2023.1

https://doi.org/10.15487/tiho.7_2023.2

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