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Escape Games in Particle Physics Education & Outreach

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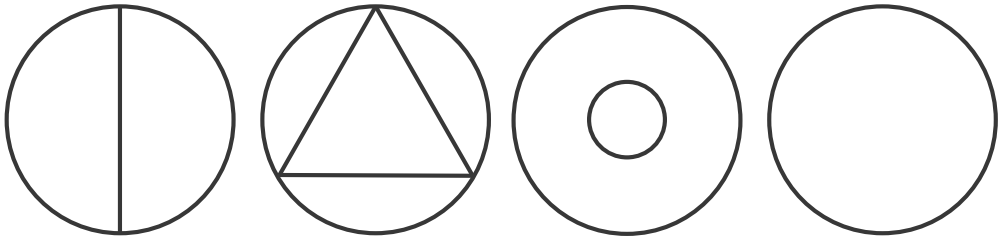
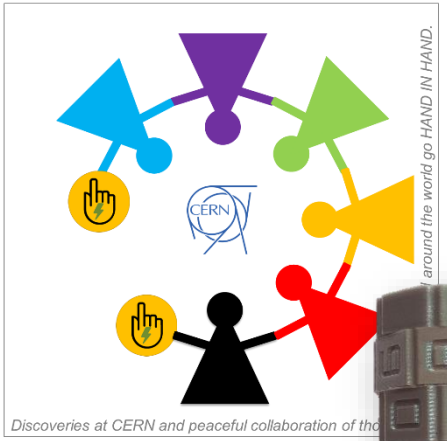
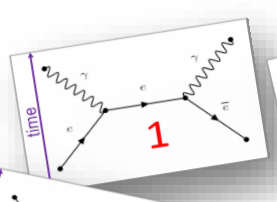
Penguins stole an antimatter trap from CERN's antimatter factory. After playing with it for a while, they got distracted by the dry ice in S'Cool LAB and forgot the antimatter somewhere. Unfortunately, they forgot to switch on the time-super-warp-shift-nano-laser stabilizer. That means that the antimatter trap will destabilize and the antimatter will annihilate with normal matter soon …

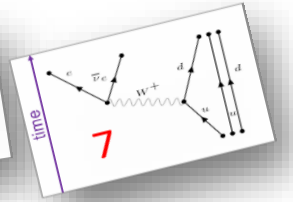


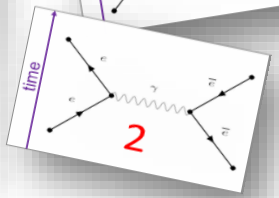
CERN | S'Cool LAB

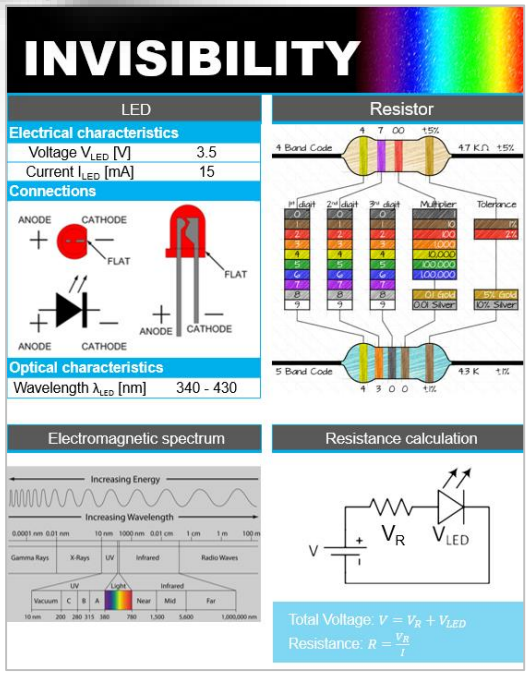
Puzzles & Equipment >> scool.lab@cern.ch

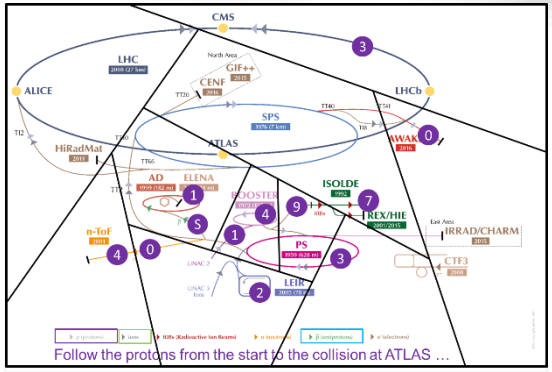












Participants: students aged 16-19

Objectives

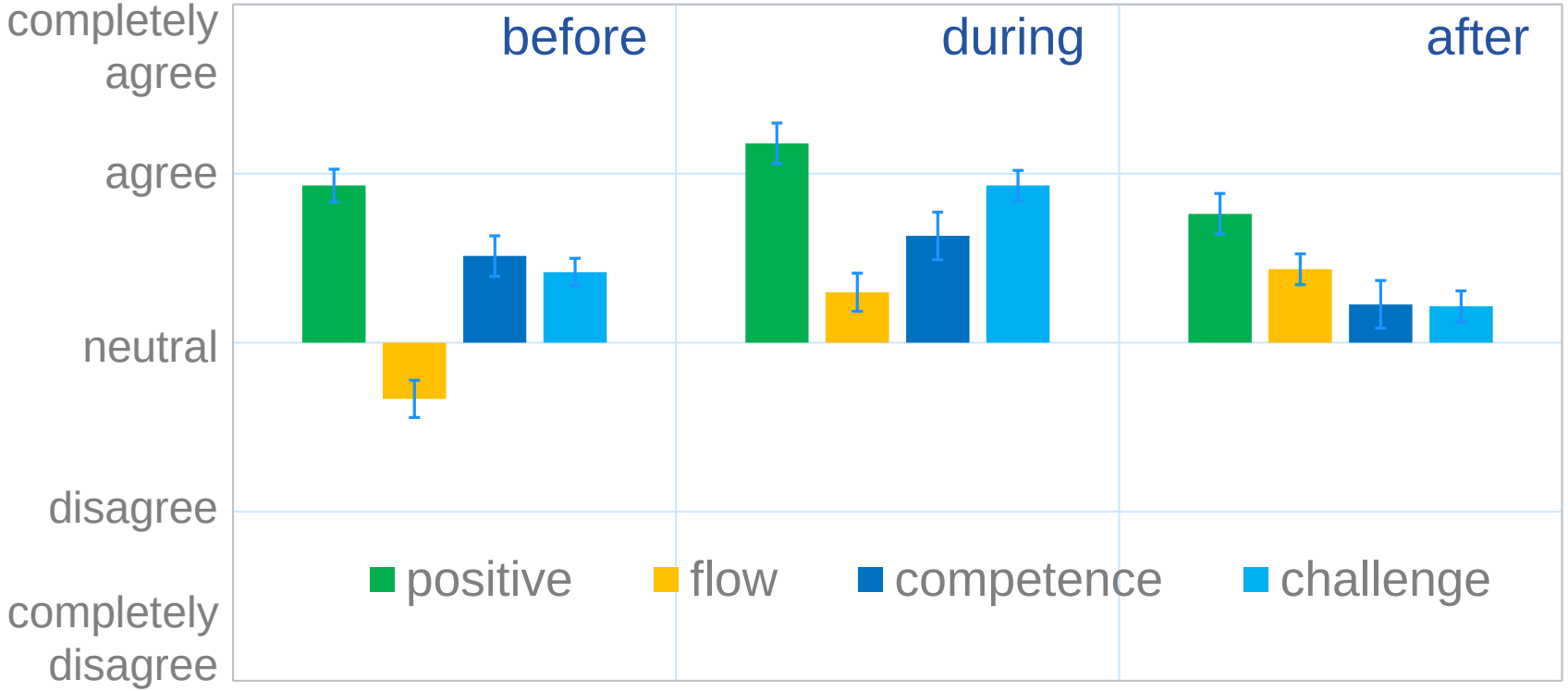
- Provide positive & enjoyable physics learning experience
- Mental state of flow (Csikszentmihalyi & Csikszentmihalyi, 1992)
- Game-based learning (Whitton & Moseley, 2012)
- Apply physics knowledge from school in a particle physics context
- Curiosity about particle physics/CERN
- Foster team work & communication

Development guided by EscapED framework for educational escape rooms and Interactive Games (Clarke, et al., 2017)

Evaluation

- Does this educational escape game foster a mental state of flow?
- How do students describe their (learning) experience?

Quantitative Evaluation



Mean & SE | Game Experience Questionnaire
(Poels, De Kort, & Ijsselsteijn, 2007)

Qualitative Evaluation

- 4 focus group interviews (4-5 students each, ~30 min)
- Discussion guide about game experience

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- Discussion guide about game experience
- “What do you think, how much time did you need to solve the escape game?”

S1: *It seemed like 10 min (all: yes) because you just got stressed all the time but (..) "stress"*
S2: *Because you are always doing something and you are not just sitting there bored*
S3: *and because it’s fun*

Qualitative Evaluation

- 4 focus group interviews (4-5 students each, ~30 min)
- Discussion guide about game experience
- „How would you describe your escape game experience in S'Cool LAB to your friends?"

S1: *„Everyone knows escape games. They have a goal and to reach their goal you have to solve riddles. To solve the riddles in this escape game one needs some physics knowledge. That means, one doesn't only have to move number from A to B or sort colours like it is in other Escape games, but you need physics."*

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Theme: Antimatter & Penguins

- Fascinating for students
- Avoiding stereotypes such as evil old scientists
- Avoiding negative emotions associated with bombs, terrorist, crime

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Theme: Antimatter & Penguins

Thank you for your attention!

contact us: scool.lab@cern.ch

Literature

S. Clarke, D. J. Peel, S. Arnab, L. Morini, H. Keegan & O. Wood, EscapED: a framework for creating educational escape rooms and Interactive Games For Higher/Further Education, International Journal of Serious Games 4 (2017) 73-86.
M. Csikszentmihalyi & I. S. Csikszentmihalyi (Eds.), Optimal experience: Psychological studies of flow in consciousness, Cambridge university press, 1992.
N. Whitton, & A. Moseley (Eds.), Using games to enhance learning and teaching: a beginner's guide, Routledge, 2012.
K. Poels, Y. De Kort, & W. IJsselsteijn. Game Experience Questionnaire: development of a self-report measure to assess the psychological impact of digital games, 2007

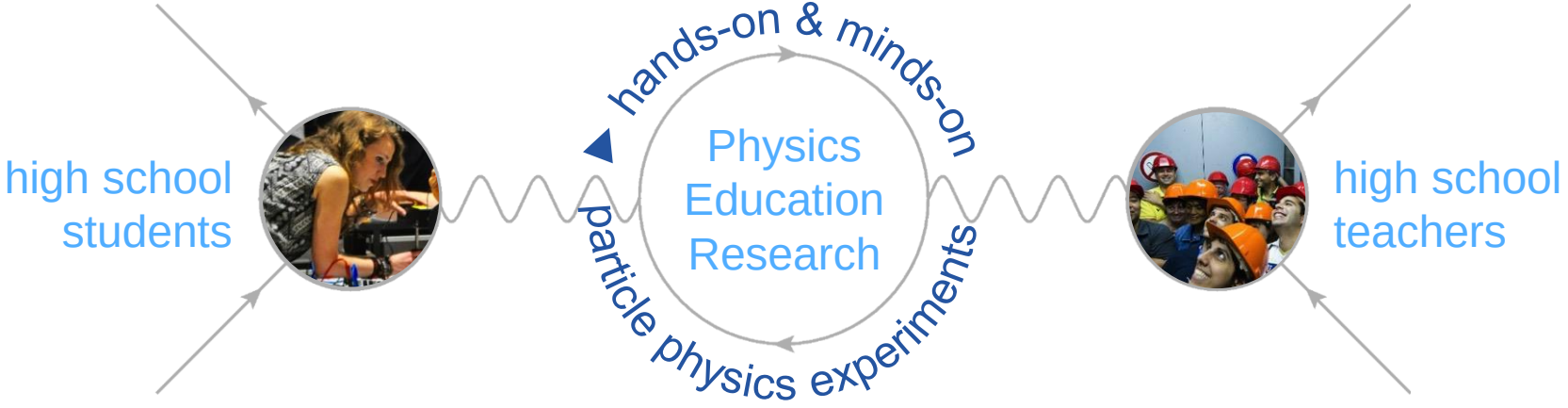
Creating educational escape games

Participants	Objectives	Theme	Puzzles	Equipment	Evaluation
• User type • Time • Difficulty • Mode • Scale	• Learning objectives • Solo/multi-disciplinary • Soft skills • Problem solving	• Escape mode • Mystery mode • Narrative design • Stand alone/ nested	• Puzzles design • Reflect objectives • Instruction/ manual • Clues/hints	• Location/ space design • Physical props • Technical props • Actors	• Testing • Reflection • Evaluate learning objectives • Adjust • Re-set

(Clarke, et al., 2017)

CERN S‘Cool LAB

a hands-on particle physics learning laboratory



Focus group Interviews

Do you think that you can learn physics while playing?

S1: In general, yes. In this case, in particular at A-level, it's more difficult but at lower grades – sure, especially if it's about magnetism.
S2: Well, understanding the Compton effect while playing for 4 hours is difficult (all laughing). But as he said, at that level – definitely.
S3: The topics get more theoretical and therefore, I think, it's more difficult to learn while playing.
S4: For complex topics, you have to read first, which then takes a while. And then playing games …
S3: It's maybe more an introduction.

How would you describe your experience in 3 words? positive stress – fun – creative