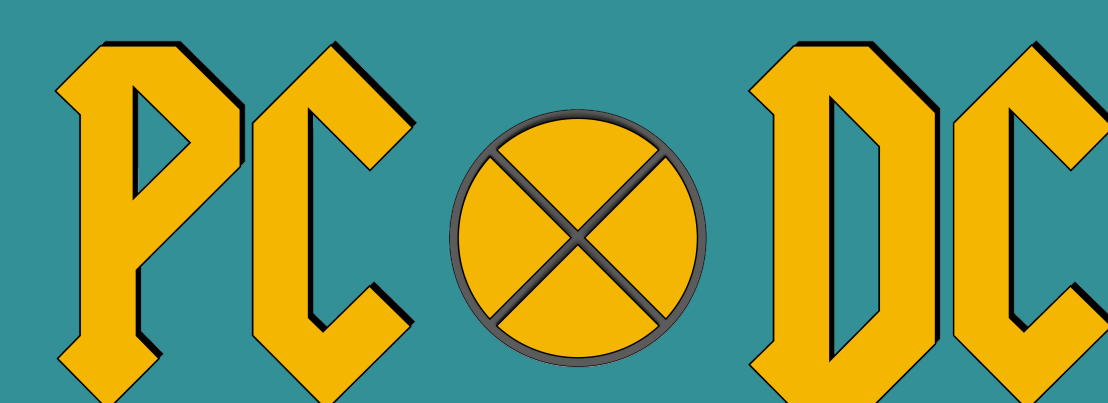


Gamification meets Research-based learning - the NanoBioLab an extracurricular learning location as a teaching and learning workshop

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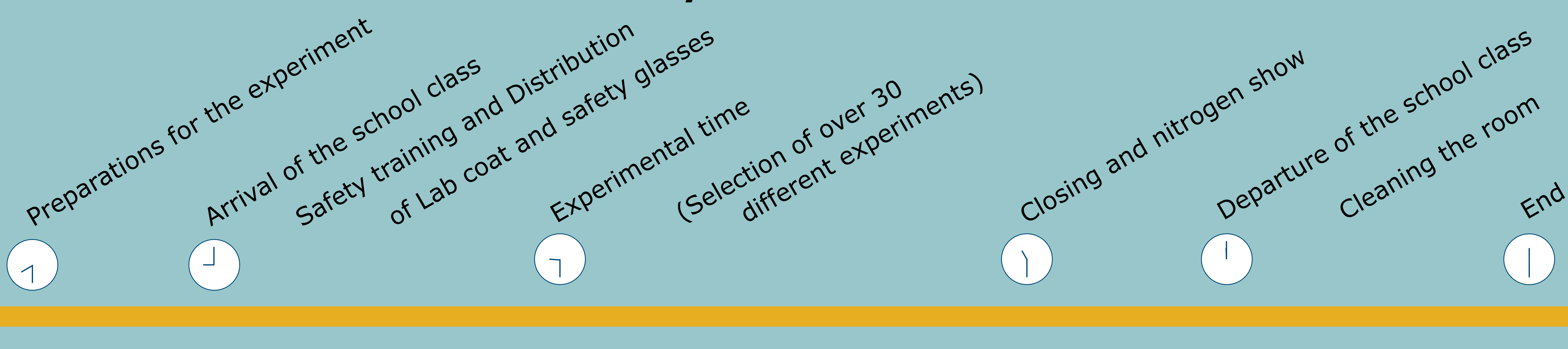
Motivational approaches are well-established psychological tools for helping school students to get excited about science. Gamification is a suitable method for promoting motivation in this area, as it helps children to learn or consolidate subject content in a playful way. In Germany, the education system offers the opportunity to visit so-called "school labs" with school children and classes. These are extracurricular learning locations and can promote the spirit of research and enthusiasm for science through research-

based learning. In our school laboratory, the NanoBioLab, pupils of all grades can carry out experiments on a wide range of science and chemistry topics. Some are also enriched with gamification and digital tools. One of these learning environments is the "EscapeLab". The mission starts with a video, which explains the situation. While using their knowledge in chemistry, they solve mysteries to open a safe with the prescription for an antidote.^[1]

Pupils can use digitally implemented tips in the scenario or ask an assistant to support their approach. Thus, they solve the problems at their individual speed and are therefore motivated while saving the world as a part of the game.

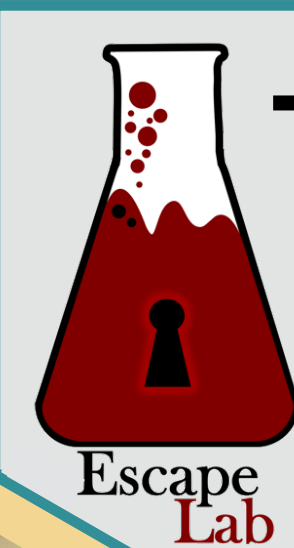
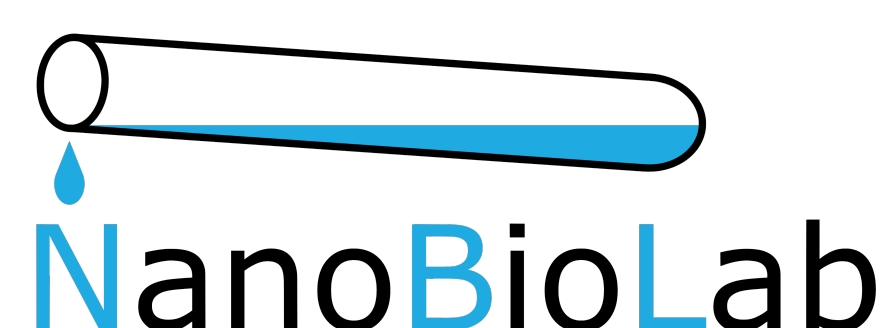
Keywords: Gamification; Research-based learning; extracurricular learning; school lab; Motivation

A day at the NanoBioLab



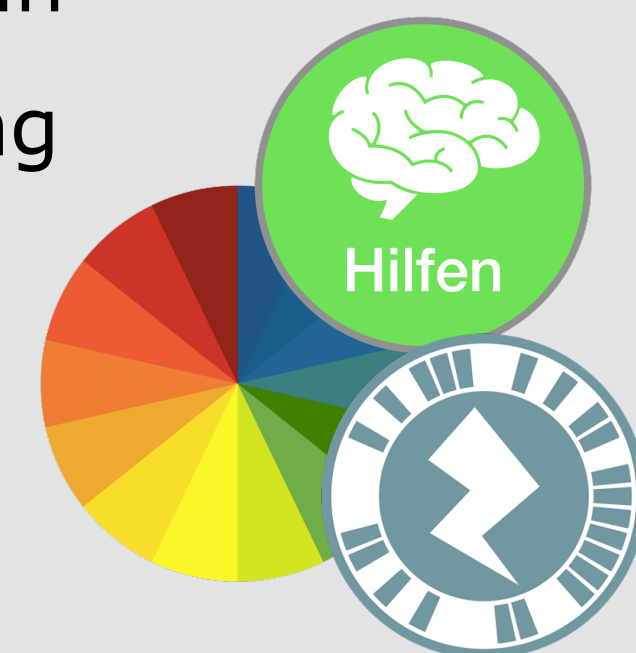
Teaching and Learning workshop - A definition^[2]

- Extracurricular laboratory (e.g. for STEM)
- Bookable time slots per week
- Aim of increasing interest in science
- Experimenting in groups of 3-4 pupils
- Part of the teacher training programme



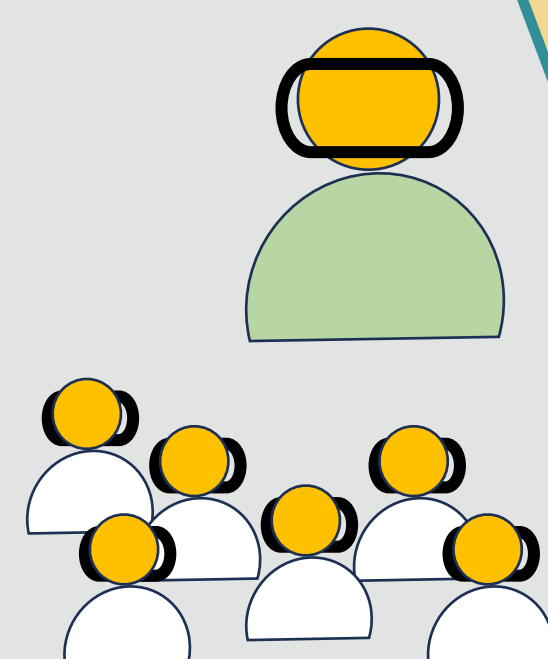
The Escape Lab - An user case of Gamification

- Arouse interest through a mystery in a chemical context
- Use of staggered digital assistance in the sense of research-based learning to solve the mystery^[3]



Students' motivation

- First experiences in teaching
- Deeper understanding of pupils' practical skills (e.g. difficulties in understanding)
- Learning new skills for helping pupils and safety in practical work



Digitalisation in Teaching

- General usage of digital media in STEM (PP, sensors, etc.)^[4]
- Better possibility of differentiation via Augmentation and staggered help^{[3][5]}



Literature:

[1] Seibert, J., Lang, V., Dörrenbächer-Ulrich, L., Marquardt, M., Perels, F., Kay, C. W. M. (2019): EscapeLab: Gamification als Lernwerkzeug zur Individualisierung im Chemieunterricht. Computer & Unterricht. Heft 113. [2] Haupt, O. J., Domjahn, J., Martin, U., Skiebe-Corrette, P., Vorst, S., Zehren, W., & Hempelmann, R. (o.J.). Schülerlabor – Begriffsschärfung und Kategorisierung. MNU Journal, 66(6), 324, 330. [3] Seibert J., Marquardt, M., Gebhard, M., Kay, C.W.M., Huwer, J. (2020). Augmented Reality zur Visualisierung der Teilchenebene am Beispiel des Li-Ion Akkus. Naturwissenschaften im Unterricht. Heft 119/120. [4] Seibert, J., Ollinger, F., Huwer, J., Perels, F., Kay, C.W.M. (2020). Promotion of self-regulation with the help of a Multitouch Experiment Instruction for water analysis in the context of ESD. International Journal of Physics and Chemistry Education. [5] Seibert, J., Heuser, K., Huwer, J., Perels, F. & Kay, C.W.M. (2020). Multitouch Experiment Instructions to promote self-regulation in inquiry based learning Schülerlabors. Journal of Chemical Education.

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