

An augmented reality game makes chemistry less intimidating for kids, a study finds

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from the Interactive Technologies Institute

Periodic fable: hydrogen. Credit: Interactive Technologies Institute

Researchers developed an educational game that uses augmented reality and tangible interaction to teach young students STEM. They recently published their research on the use and effectiveness of play to promote chemistry learning and improve children's perception of the subject.

The study aimed to address the problem that children perceive chemistry as a challenging and complex subject, which can lead to poorer academic performance and reduced interest in a career in STEM subjects. The Periodic Fable Discovery game presents children with scientific content supported by an exploration activity using manipulable physical cubes and augmented reality.

The game is designed to entertain children and engage them with engaging stories about the basics of chemistry and the periodic table. "Children use smartphones to get information about a specific chemical element by pointing the smartphone camera at the surface of the cubes. Each face shows text, audio or animations about certain properties of chemical elements," explains Sandra Câmara Olim, lead researcher.

These results were presented at the ACM International Conference on Tangible, Embedded and Embodied Interaction in Warsaw in February. Sandra Câmara Olim, researcher at the Interactive Technologies Institute, leads the project, led by Valentina Nisi, professor at the Instituto Superior Técnico. The quantitative and qualitative results of the study showed clearly positive results in terms of learning outcomes and participant engagement.

“Children retained more information about chemistry and the periodic table, leading to better performance on knowledge tests. In addition, the students changed their perception of chemistry from a difficult and boring subject to an interesting and useful one,” says the researcher.

The study encourages researchers to continue evaluating this design system as a tool to advance STEM education. The research provides insights into the design and development of game-based AR experiences using an interdisciplinary approach between learning content, human factors and technology to stimulate children’s interest in chemistry.

“By combining our technological know-how with the pedagogical skills of the teachers, we were able to create a fun interactive game that uses storytelling to create an emotional connection with children, thereby increasing their interest in the subject,” says Sandra.

Periodic Fable’s game mechanics were designed to engage children in learning about chemistry through storytelling, physical interaction with manipulable cubes, and augmented reality. The game consists of an interactive, fun and engaging learning experience for children that can lead to better retention of knowledge and increased interest in the subject.

Using physical cubes, the game provides a tactile experience that allows children to manipulate and explore the elements of the periodic table in a hands-on way. Augmented Reality further enhances the experience by adding a digital layer that overlays information and animations onto the physical cubes, making the learning experience more engaging and immersive. The researchers plan to further evaluate the game’s design and effectiveness by conducting further studies with more participants and examining the potential long-term effects of AR-based games on students’ endurance in science classes and the development of their spatial skills.

The Periodic Fable project is part of Sandra Câmara Olim’s PhD work. The set of AR-based educational games is aimed at children aged nine to 13, with different pedagogical approaches to facilitate the acquisition of academic concepts in a fun and playful way.

Researchers believe this study will have a long-term impact on society by providing insights into the design and development of AR-based games to advance STEM education. The paper is published as part of the *Proceedings of the Seventeenth International Conference on Tangible, Embedded, and Embodied Interaction*.

More information:

Sandra Monica Camara Olim et al, "Periodic Fable Discovery" Using Tangible Interactions and Augmented Reality to Promote STEM subjects, *Proceedings of the Seventeenth International Conference on Tangible, Embedded, and Embodied Interaction* (2023). DOI: 10.1145/3569009.3572804

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