

Game-Based Approaches for Education and Outreach in Quantum Science and Technology

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Abstract: Game-based approaches are effective in education and outreach, particularly for complex topics like quantum mechanics. We present different case studies, highlighting the importance of a proper analysis of their impact.

Game-based approaches have proven highly effective in education and outreach, particularly when communicating complex topics like quantum science and technology. By leveraging the power of play, these methods make abstract concepts accessible and engaging for diverse audiences. We present and discuss different experiences in public events, such as Lucca Comics & Games, and educational initiatives with schools. These case studies highlight the potential of gamification to foster curiosity, enhance understanding, and inspire interest in the field of quantum science. Additionally, we emphasize the importance of evaluating the impact of these game-based methods, considering not only their educational outcomes but also their broader cognitive and psychological implications.

Example References

- [1] Sciarretta, W., Bondani, M., Galano, S., Malgieri, M., Onorato, P., & Testa, I. (2024). Analysis of pseudoscientific beliefs in quantum mechanics of high school students and teachers. *Physical Review Physics Education Research*, 20(2), 020145.
- [2] Zuccarini, G., Suttrini, C., Bondani, M., Macchiavello, C., & Malgieri, M. (2024). Teaching quantum information science to secondary school students with photon polarization and which-path encoding. *EPJ Quantum Technology*, 11(1), 74.
- [3] Bondani, M., Galano, S., Malgieri, M., Onorato, P., Sciarretta, W., & Testa, I. (2024). Development and use of an instrument to measure pseudoscientific beliefs in quantum mechanics: the PSEUDO-QM scale. *Research in Science & Technological Education*, 1-22.
- [4] Zuccarini, G., Suttrini, C., Bondani, M., Macchiavello, C., & Malgieri, M. (2024). Design and structure of an integrated secondary school course of quantum information science with photon polarization and which-path encoding.
- [5] Bondani, M., Caprara, S., Chiarello, F., Dabbicco, M., Hamma, A., Malgieri, M., ... & Paladino, E. (2024, June). QTris: a quantum game. In *Quantum Technologies 2024* (Vol. 12993, pp. 143-147). SPIE.