













Integrating cutting-edge technologies such as chatGPT played a pivotal role in enhancing interactivity and engagement within the learning environment. Using AI-driven language models allowed for personalized and adaptive learning experiences catering to individual student needs and preferences. It further contributed to the overall effectiveness of the metaverse-based learning environment in fostering a more profound understanding and retention of subject matter.

As the educational landscape evolves, adopting metaverse-based learning environments across various disciplines and subject areas presents a promising opportunity for revolutionizing how students learn and interact with educational content. This shift in educational methodologies can lead to more engaging, immersive, and compelling learning experiences that cater to the diverse needs of learners in the 21st century.

Furthermore, incorporating advanced technologies such as virtual reality, augmented reality, and artificial intelligence can further elevate the metaverse learning environment, offering even more personalized and adaptive learning experiences. This integration can help students to understand complex concepts better, develop critical skills, and promote a growth mindset, ultimately preparing them for success in an ever-changing global society.

The potential for collaboration and networking opportunities within metaverse-based learning environments also presents a significant advantage. It fosters a sense of community, encourages the exchange of ideas, and facilitates collaborative problem-solving among students and educators from different institutions and locations. It can enhance the educational experience, fostering global connections and promoting cultural understanding.

Lastly, the metaverse learning environment can be a valuable resource for professional development and lifelong learning, providing engaging and interactive experiences for professionals seeking to stay up to date with the latest industry trends and developments. It ensures they remain competitive in their respective fields, contributing to personal and professional growth.

In summary, the metaverse-based learning environment for electrical machines has demonstrated immense potential in transforming the educational landscape. By integrating advanced technologies, adapting the platform to the specific needs of various disciplines, and fostering collaboration and networking opportunities, metaverse-based learning environments can revolutionize education, leading to more engaging, compelling, and immersive learning experiences for students and professionals alike. The Roblox game file is downloadable from <https://tinyurl.com/ykpvuz5w>, and the game site is available at <https://tinyurl.com/3sywyjz>.

## REFERENCES

- [1] H. Lin et al., "Metaverse in education: Vision, opportunities, and challenges", arXiv preprint arXiv:2211.14951, 2022.
- [2] J. Singh, M. Malhotra, and N. Sharma, "Metaverse in education: An overview", *Applying Metalytics to Measure Customer Experience in the Metaverse*, pp. 135-142, 2022.
- [3] B. Kye et al., "Educational applications of metaverse: possibilities and limitations", *Journal of educational evaluation for health professions*, vol. 18, 2021.
- [4] G. S. Contreras et al., "The importance of the application of the metaverse in education", *Modern Applied Science*, vol. 16, no. 3, pp. 1-34, 2022.
- [5] A. Tlili et al., "Is Metaverse in education a blessing or a curse: a combined content and bibliometric analysis", *Smart Learning Environments*, vol. 9, no. 1, Jan. 2022.
- [6] H. Lee and Y. Hwang, "Technology-enhanced education through VR-making and metaverse-linking to foster teacher readiness and sustainable learning", *Sustainability*, vol. 14, no. 8, pp. 4786, 2022.
- [7] R. Hare and Y. Tang, "Hierarchical deep reinforcement learning with experience sharing for metaverse in education", *IEEE Transactions on Systems, Man, and Cybernetics: Systems*, 2022.
- [8] Z. Chen, "Exploring the application scenarios and issues facing Metaverse technology in education", *Interactive Learning Environments*, Jan. 2022.
- [9] R. U. Long, "Roblox and effect on education", Springfield (MO): Drury University, 2019.
- [10] J. Han, G. Liu, and Y. Gao, "Learners in the Metaverse: A Systematic Review on the Use of Roblox in Learning", *Education Sciences*, vol. 13, no. 3, pp. 296, 2023.
- [11] P. Rospigliosi, "Metaverse or Simulacra? Roblox, Minecraft, Meta and the turn to virtual reality for education, socialisation and work", *Interactive Learning Environments*, vol. 30, no. 1, Jan. 2022.
- [12] N. H. Mustafa et al., "English Language Problem-based Learning via user-generated 3D world Roblox Module: Need Analysis", 2020.
- [13] D. Kang, H. Choi, and S. Nam, "Learning Cultural Spaces: A Collaborative Creation of a Virtual Art Museum Using Roblox.", *International Journal of Emerging Technologies in Learning*, vol. 17, no. 22, 2022.
- [14] C. Conlan, "The blender python API: Precision 3D modeling and add-on development", 2017.
- [15] B. R. Kent, "3D scientific visualization with Blender®", Morgan & Claypool Publishers, 2015.
- [16] M. Z. Patoli et al., "An open-source grid-based render farm for blender 3d", 2009 IEEE/PES Power Systems Conference and Exposition, Jan. 2009.
- [17] M. M. Rose et al., "Development of 3D Multimedia as a Practical Suggestion Based on Virtual Reality", 5th FIRST T1 T2 2021 International Conference (FIRST-T1-T2 2021), pp. 306-309, 2022.
- [18] M. Ouza, M. Ulrich, and B. Yang, "A simple radar simulation tool for 3D objects based on blender", 2017 18th International Radar Symposium (IRS), Jan. 2017.
- [19] M. Zoppè et al., "Using Blender for molecular animation and scientific representation", Blender conference. amsterdam, 2008.
- [20] S. S. Jawhar et al., "Collaborative Problem Solving and Literacy Practices: A Conversation-Analytic Case Study of Children's Pre-Roblox Gaming Interaction", Available at SSRN 4279993.
- [21] A. Krnjajic and S. R. Wesslén, "Ready Company One: How game developers facilitate value creation in the Roblox metaverse", 2022.
- [22] C. S. Meier et al., "Using the Roblox video game engine for creating virtual tours and learning about the sculptural heritage", *International Journal of Emerging Technologies in Learning (iJET)*, vol. 15, no. 20, pp. 268-280, 2020.
- [23] S. Davidson and L. Candy, "Teaching EBP using game-based learning: Improving the student experience", *Worldviews on Evidence-Based Nursing*, vol. 13, pp. 285-293, 2016.
- [24] K. S. Jossan, A. Gauthier, and J. Jenkinson, "Cultural implications in the acceptability of game-based learning", *Computers & Education*, vol. 174, 104305, 2021.
- [25] T. Coleman and A. G. Money, "Student-centred digital game-based learning: a conceptual framework and survey of the state of the art", *Higher Education*, vol. 79, pp. 415-457, 2020.
- [26] D. Sobania et al., "An analysis of the automatic bug fixing performance of chatGPT", arXiv preprint arXiv:2301.08653, 2023.
- [27] A. Kashefi and T. Mukerji, "ChatGPT for Programming Numerical Methods", arXiv preprint arXiv:2303.12093, 2023.
- [28] V. Taecharunroj, "'What Can chatGPT Do?'" Analyzing Early Reactions to the Innovative AI Chatbot on Twitter", *Big Data and Cognitive Computing*, vol. 7, no. 1, pp. 35, 2023.
- [29] F. Wang et al., "What does chatGPT say: the DAO from algorithmic intelligence to linguistic intelligence", *IEEE/CAA Journal of Automatica Sinica*, vol. 10, no. 3, pp. 575-579, 2023.
- [30] S. Jalil et al., "ChatGPT and software testing education: Promises & perils", arXiv preprint arXiv:2302.03287, 2023.