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The use of computer-based experiments in physics education

The integration of computer-based experiments (CBEs) in physics education has transformed traditional teaching methodologies by providing interactive, data-driven, and real-time analysis capabilities. This paper examines the role of CBEs in enhancing conceptual understanding, fostering inquiry-based learning, and improving student engagement. By utilizing digital simulations, virtual laboratories, and sensor-based data collection tools, CBEs offer a flexible and cost-effective alternative to conventional experiments, addressing resource limitations in many educational settings. The study explores the pedagogical advantages of CBEs, particularly their impact on students' problem-solving skills, scientific reasoning, and ability to visualize abstract physics concepts. Additionally, challenges associated with the adoption of CBEs, including accessibility constraints and technological infrastructure requirements, are critically analyzed. The findings emphasize the necessity of robust instructional strategies to optimize the benefits of CBEs in physics education. The paper concludes with recommendations for effectively integrating CBEs into curriculum design, bridging the gap between theoretical knowledge and practical application to enhance learning outcomes in physics education.

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