

References

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INTERDISCIPLINARY CONNECTIONS IN EDUCATION: HOW TO INTEGRATE PHYSICS AND COMPUTER SCIENCE

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The modern education system requires innovative pedagogical approaches aimed at fostering comprehensive and systematic knowledge among students. One of the most relevant strategies in this context is the implementation of interdisciplinary integration within the learning process.

Physics and computer science are naturally interconnected through shared methods and tools such as modeling, measurement, numerical data processing, and visualization. Integrating these subjects supports the development of students' critical and systems thinking, while enabling them to connect theoretical concepts with real-life experiences.

Despite often being taught separately within school curricula, the potential for synergy between physics and computer science remains underutilized. The increasing digitalization of education and the growing emphasis on digital literacy further underscore the importance of interdisciplinary teaching [1].

Programming languages—particularly Python—offer effective opportunities for modeling physical processes such as motion dynamics or heat transfer, solving problems using numerical methods, and visualizing results graphically. This approach enhances not only subject-specific knowledge but also promotes algorithmic thinking and analytical skills.

Virtual laboratories allow students to safely conduct experiments without the need for costly equipment. This is particularly valuable for schools with limited resources. One prominent example is the PhET Interactive Simulations platform, which enables students to explore various physical phenomena—such as Newton's laws, electrical circuits, and wave motion—through interactive animations.

Simulations help learners better grasp theoretical content by presenting it through clear, visual models. Moreover, by integrating this platform into computer science lessons, students can be tasked with designing their own simulations to model specific phenomena [2]. This fosters creativity and deepens their understanding of inter-subject relationships.

Through such interdisciplinary activities, students can develop applications that model the motion of objects or thermal processes, gaining deeper insights into physical laws. Processing

experimental data via spreadsheets or code supports the development of scientific data analysis skills[3].

Platforms such as Arduino and other microcontrollers provide opportunities to merge physical experiments with programming, enabling the creation of real-world technical projects. Robotics, as an interdisciplinary field involving physics, computer science, and mathematics, contributes to the development of technical thinking. Project-based learning enables the application of knowledge across multiple disciplines, increasing student motivation and engagement. However, challenges remain in the implementation of interdisciplinary integration, including the lack of ready-made methodological frameworks and insufficient collaboration among educators. Teachers often face psychological and professional barriers, and misalignment in class schedules can hinder the organization of joint lessons and projects [4].

Addressing these issues requires the organization of interdisciplinary workshops and teacher training programs, along with the pre-planned development of integrated modules. Institutional support—both technical and motivational—is essential to the successful implementation of interdisciplinary initiatives.

The use of digital platforms such as Moodle and Google Classroom enhances the accessibility, flexibility, and personalization of the learning process. Additionally, free interactive platforms like PhET enrich the educational experience through visual, experimental, and data-driven approaches, encouraging students' inquiry-based learning.

Ultimately, this approach equips learners with the skills needed to thrive in a digital environment. By fostering 21st-century competencies—such as critical thinking, teamwork, digital literacy, and creativity—interdisciplinary education opens pathways toward scientific and professional futures [5].

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NON-STANDARD PROBLEMS IN MATHEMATICS

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