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Improving the Students' Learning of Optics and Atomic and Molecular Physics by Computer-assisted Spectroscopic School Experiments

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In the present work, we investigate the possibility to improve the students' understanding of the spectral properties of different light sources and the transmission/absorption of different media by means of a partially computer-based school experiment in physics. Numerous studies have identified certain difficulties in understanding and applying atomic models [1,2], and more specifically, atomic spectra [3,4]. Savall-Alemany et al. [3], for example, identify the following students' misconceptions: do not take into account the quantization of atomic energy levels; assume that the atom can absorb a photon with arbitrary energy; do not differentiate between the quantities intensity and frequency or assume them to be directly proportional; often assume violation of the energy conservation law with respect to the emission of a photon; do not consider the possibility of an atom to decay into an excited state with lower energy, etc.

The experiment includes data acquisition and analysis of the spectra of different light sources, as well as the transmission spectra of different media. The numerical data are then used to calculate and visualize the absorption spectra of the media, with an analysis of the energy level structure of the absorber. A detailed description of the experiments will be provided, together with results from a survey performed among 10-grade students before and after the experimental work. Our hypothesis is that the proposed combined practical work on physics and information technology will improve the students' understanding of optics and atomic and molecular physics, as well as their data analysis skills.

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