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A review of upgrades to First-Year Physics Experiments to integrate digital control and utilization of more modern technology.

Hands-on laboratory work is essential in first-year physics education, yet traditional setups can lack precision and adaptability. In this study, we present upgrades to key first-year experiments (air-track, the simple pendulum, and optics-based experiments), to enhance accuracy, interactivity, longevity and student engagement.

For the air-track and pendulum experiments, we developed a custom Windows-based C# software interfaced with Arduino microcontrollers to automate control and data acquisition. This upgrade improves measurement capabilities and allows for greater experimental flexibility as well as longevity and compatibility. In optics, we replaced filament-based light sources with LEDs, providing more stable and energy-efficient illumination. The spectral characteristics of the different light sources and their implications for experimental results will be presented.

These enhancements offer a more modernized learning experience, fostering deeper conceptual understanding through improved experimental interaction. We will discuss the advantages and challenges of these upgrades, including reliability, ease of use, and student feedback. By integrating modern technology into classical experiments, we aim to bridge the gap between traditional physics education and contemporary scientific methodologies.

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Primary author: Dr VAN HEERDEN, Hendrik Jacobus (University of the Free State)

Co-authors: Prof. TERBLANS, Koos (University of the Free State); Prof. HARRIS, Richard (University of the Free State); Dr CRONJE, Shaun (University of the Free State)

Presenter: Dr VAN HEERDEN, Hendrik Jacobus (University of the Free State)

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