Building Measurement Devices with Students – From Hands-on to Minds-on

Author: Gilit Porat and Shulamit Kapon

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Abstract

Although the teaching of mechanics at advanced K12 levels often starts with a brief introduction to physical quantities and units, the nature and function of measurements in physics and their inherent uncertainty are hardly ever discussed. The laboratory is mainly used to illustrate the theoretical principles taught in class. This paper presents a project-based learning approach that aims to provide high school students with a sense of the nature and role of measurements in physics (units, uncertainty, etc.) as well as help them develop laboratory, data analysis, and scientific communication skills in a fun and engaging way. Each project involves the design, building, and calibration of a measurement device for a basic physical quantity (time, length, and mass). Each measurement device is made up of recycled materials (e.g., plastic bottles) and simple pieces of equipment available in any high school physics laboratory (e.g., springs). The students build the device, calibrate it, and write a detailed documentation that explains how it works, its specifications, and instructions for use. The students also present their work to peers and visitors. We describe five basic measurement devices, the scaffolding we used to help the students make the transition from the “arts and crafts” aspect of the work to its deeper scientific meaning, and different orchestrations for various classroom settings.

Keywords: project-based learning, physics

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