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A modern approach to Thermodynamics practicals

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In the age of information and automation systems, students need to develop a skills set used in modern laboratories and industry. Innovative practicals can add another dimension to the education process by the application of the learnt theory in a real-life situation. In this paper, the utilization of skills sets commonly used at a postgraduate level are introduced to second year students to illustrate real world applications. Concentrating on the thermodynamics module content, students were introduced to the concepts of; 1) 3D design and modeling, where accurate relative measurements and calculations with regards to thermal expansion were conducted to build functional prototypes. 2) the use of custom-written LabVIEW programs for instrument control, data acquisition, digitization and visualization. This was done by controlling the boiling of water, plotting measured values and calculating thermodynamic properties such as rate of heating, thermal capacity, etc. 3) IR thermography by using a LabVIEW program, FLIR one thermal camera coupled to a smartphone was used to visualize heat flow across an aluminum cylinder. Combining the images with the measure elapsed time and temperature data as a function of distance, the heat flow rate was calculated. In addition, thermal imaging was illustrated for fault detection within circuitry and photovoltaic devices. Other standard thermodynamics practicals associated with concepts such as heat engines and Cp/Cv were also conducted using computerized data acquisition and analysed using Pasco's Capstone^{TM} software.
From these and other modernized practicals, the students showed an increased interest in continuing with Physics and also considering postgraduate Physics studies.

Apply to be
 considered for a student
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Yes

Level for award
 (Hons, MSc,
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MSc

Main supervisor (name and email)
and his / her institution

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Yes

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