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Do the students understand the thermodynamics concepts?

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In the last years, researchers have made efforts to evaluate how thermodynamical concepts and laws are being learned by students. In a previous study, we based our research on the answers to a test presented to a restrict number of university students. We have identified a number of specific difficulties such as the understanding of heat, temperature, work and internal energy concepts and applications of the first and second laws of thermodynamics to simple physical processes.
In this work, we extend our study to students of other different university courses to realize how thermodynamics concepts and laws are being learned and understood. We are particularly interested how the university students are able to apply the first and second laws to irreversible processes.
The methodology consists on the analysis of the results obtained with a questionnaire of multiple choice forms with only one correct answer. The investigation was carried in the University of Trás-os-Montes e Alto Douro, in Portugal, with students of several courses such as Forest, Environmental and Animal Science Engineering, Physics/Chemistry teaching among others. We found that many students had difficulties with the application of first and second laws to irreversible processes. Many others are misunderstanding the energy transfer signal convention.