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Students' pre-knowledge as a guideline in the teaching of introductory thermal physics at university.

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Summary: This study concentrates on analysing university students' pre-knowledge of thermal physics. The students' understanding of the basic concepts and of the adiabatic compression of an ideal gas was studied at the start of an introductory level course. A total of 48 students participated in a paper-and-pencil test, and analysis of the responses revealed that they had several kinds of problems. They did not differentiate between concepts, confusing in particular the concepts of temperature, internal energy and heat. The students also seemed to have serious problems in applying the first law of thermodynamics: they were frequently more likely to use the ideal gas law rather than the first law, e.g., in the case of adiabatic compression, even though it cannot provide a proper explanation of the phenomenon. More detailed analysis revealed that the underlying reasons for many of the problems detected were based on an inadequate understanding of micro-level models of substance. At the upper secondary level, students have acquired an impression of how particles move, vibrate and interact, but they have not learnt how to apply the ideas and concepts of the micro-models in a scientific manner. All of this means that university teachers need to exercise great care in designing their teaching. Explicit recommendations for teachers to take into account both the findings of this research project and also students' pre-knowledge are presented in the discussion section at the end of this paper.

Classification: M55 D45 D75

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