

# Teaching Thermodynamics with MOOC: Motivations and Results

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## Abstract

As much as learning thermodynamics is a challenge to students, teaching thermodynamics is a great challenge to teachers. This paper seeks to forward information to universities and industry and share ideas for best practice in thermodynamics education. MINES ParisTech is a French leading engineer school which proposes to its student a strong theory background associated with a practical learning experience. In the frame of the development of Thermoptim, R. Gicquel has already exposed the advantages of teaching Thermodynamics to students with new pedagogical tools [1]. How to educate students so that they might deal with complex problems with less scientific skills in a reduced time dedicated to the teaching? Information and Communication Technology (ICT) in Education can help in displacing the teaching content from writing and solving the equations of a fluid submitted to evolutions, to the architecture of innovating thermodynamic cycles.

MINES ParisTech has already conceived and managed several Massive Open Online Courses (MOOC) in the field of energetic (Problèmes Energétiques Globaux [2]) as well as thermodynamics in collaboration with Institut Mines Telecom (Conversion Thermodynamique de la Chaleur [3]) on the France Université Numérique Platform. This paper proposes in a first part some returns of experience from these MOOC, such as attendance, examination attendance, successful student percentages...

Then it describes a new Massive Open Online Course "Introduction to Experimental Thermodynamics" devoted to the teaching of experimental thermodynamics for attendants ranging from students attending Masters classes or having a PhD in the field, to personal or customer individuals of process design and maker companies or new fluid or product producer companies. This Massive Open Online Course "Introduction to Experimental Thermodynamics" will contain six parts, each taking two hours to complete and a test for self-assessment: (1) Fundamental and basis of thermodynamics; (2) Technics to generate phase diagrams or other thermodynamics data; (3) Options and decisions making among various experimental methods; (4) Settings, scaling, measure quality and measurement accuracy; (5) Two practical filmed demonstrations of measurements; (6) Data treatment including modeling and writing of report or. It may be followed by a practical work covering experimental set up, calibration, measurement and error analysis, to learn experimental procedure, calibration, sampling, analytical techniques with a view to determining phase diagrams.

The MOOC "Introduction to Experimental Thermodynamics" will be proposed in self paced mode for students of French Universities and Engineer Schools as well as in English in the frame of a European Consortium built by IFP Energies Nouvelles aiming at training to Early Stage Researchers.

## References

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