

# Education of students and citizens for process development

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**Teaching does not create necessarily concerned learners  
or does not imply agreeing by learners (e.g. climate change)**

## **1. Teaching may be a mean to avoid effective acting:**

**Teaching used to pretend acting**

**Teaching used to procrastinate**

**Teaching used to pass the burden to future generation**

**Teaching used to denounce the wrong man**

## **2. Pedagogy as a method for non-participative or thumb management**

**Managers and decision makers may argue a misunderstanding due  
to a lack of skills or pedagogy instead of recognize a disagreement**

## Climate change: Teaching people or decision makers ?

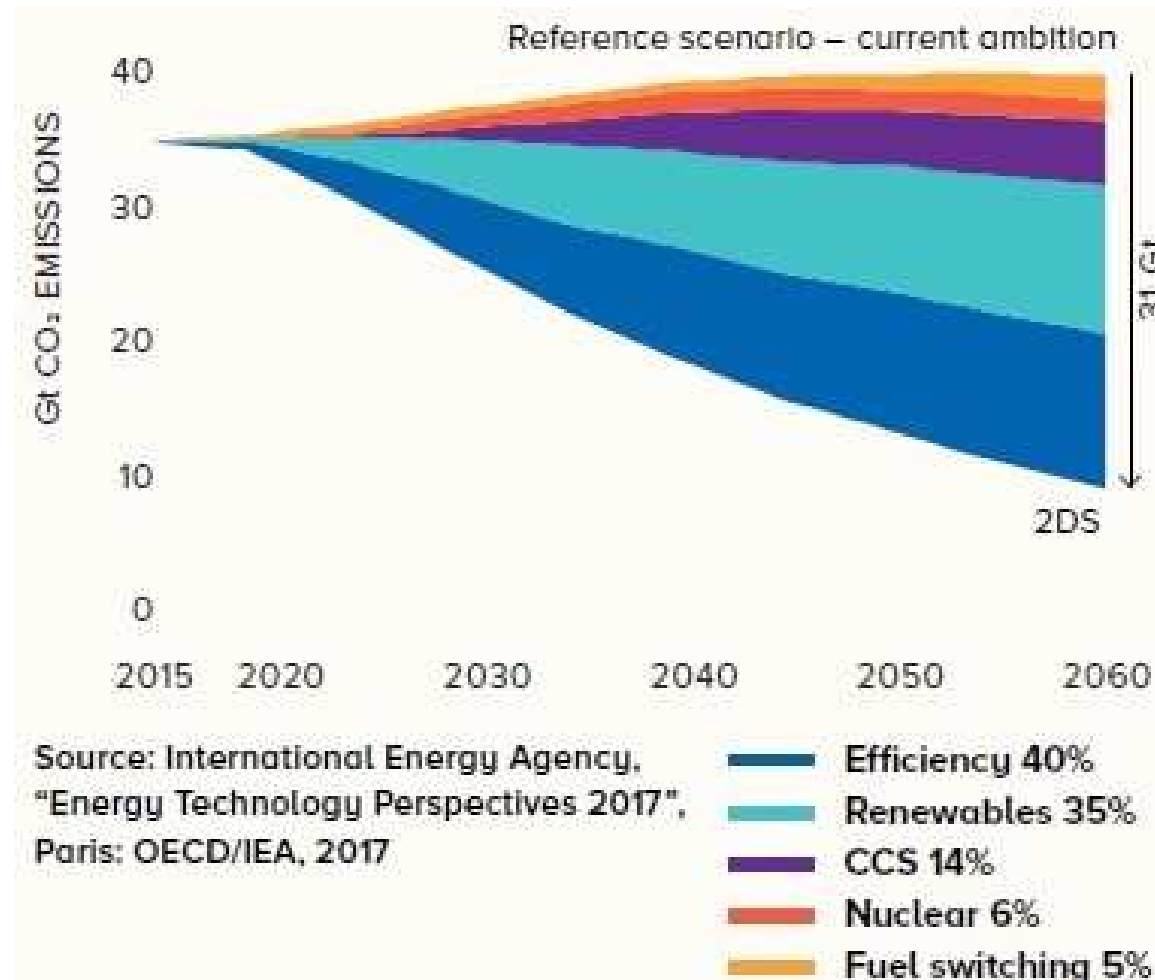
- Education of deputies or ministers: Some accept an express training
- Education at school and at university: Difference between age classes
- Education of older people: Refreshing of giving new knowledge ?

Source: Pool Ipsos-Sopra-Steria Fractures Françaises # 10 16-22 September 2022					
12 044 ind. > or = 18 y. old					
Question: Concerning climate change, would you say that ?					
	It is mainly due to human activities	It is mainly a natural phenomena	One cannot know	We do not experience any climate change	Without opinion
Together	61	16	8	8	7
Executive	74	11	5	6	4
Middle-level profession	70	11	7	6	6
Employee	66	13	7	8	6
Worker	55	18	8	11	8
Retired	49	23	11	8	9
Less than 35 y. old	66	13	6	10	5
35-59 y. old	66	13	7	7	7
More than 60 y. old	51	21	10	9	9

## Climate change: What can we do ?

- **Technical Innovation? Change of lifestyles? Change of production modes? As said by Armin Grunwald in Plenary: To change people to change technologies and their uses**
- Opinion 1: It is mainly technical progress and scientific innovations which will enable us to find solutions against climate change : 14%
- Opinion 2: This is mainly the important modification of our lifestyles which will limit climate change (save water and electricity, more local consumption, fewer plane and car journeys, etc.) : 30 %
- Opinion 3: It is mainly the changes in the production modes of companies that will limit climate change (less polluting industrial processes, less intensive agriculture, less transport of products over very long distances, etc.) : 38 %
- Opinion 4: There is nothing to do, we will no longer be able to limit climate change : 10 %
- Opinion 5: Do not know : 8 %

## Teaching to give the knowledge to stakeholders to become able of changing processes (e.g. climate change)



### 1. MOOC “Problèmes Energétiques Globaux”

- In French (= “World Energy Issues”)
- Acquiring the big picture of world energy issues for all attendance or large audience
- Duration: 6 weeks
- 5 sessions played on France University Numérique (FUN): 2016 to 2019

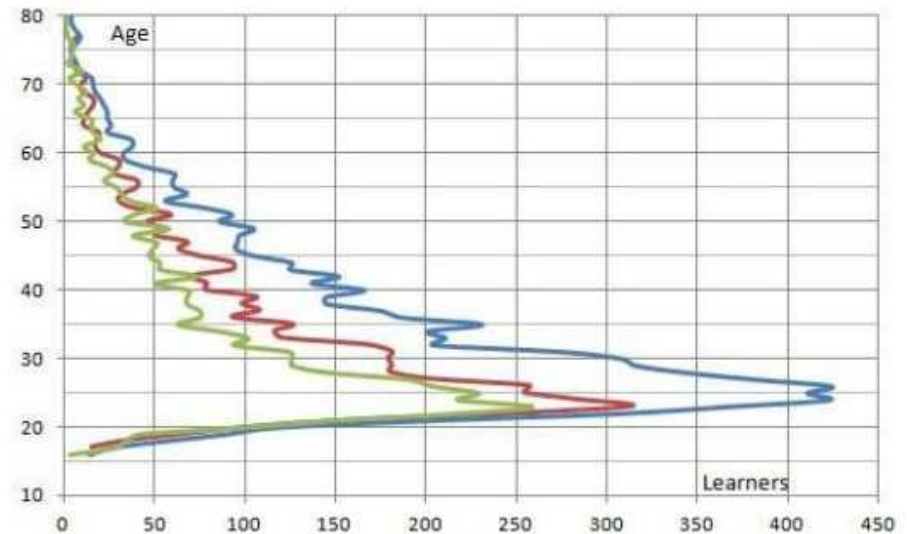
### 2. MOOC “Thermodynamique Expérimentale”

- In French (= “Experimental Thermodynamics”)
- Acquiring experimental thermodynamics for students (Master/PhD) or personal and customer of fluid or product producer companies
- Duration: 4 weeks
- 3 sessions played on FUN from 2020 to 2022

## MOOC “Problèmes Energétiques Globaux” of Mines Paris

### Attendance of the 3 first sessions played on FUN (France Université Numérique)

- Session 1: end 14th March 2016 ; 8 947 learners; 36% F – 64% M; Master 53%; PhD 6%; Final exam: 1080; Successful exam: 848 (9.8% of registered learners); blue
- Session 2: end 24th October 2016 ; 5 531 learners; 40% F – 60% M; Master 64%; PhD 5%; Final exam: 675; Successful exam: 606 (11.1%); red
- Session 3: end 3rd November 2017 ; 5 189 learners; 40% F – 60% M; Master 61%; PhD 5%; Final exam: 502; Successful exam: 470 (9.1%); green



After SAM12, 2018, in Metz, France

## MOOC “Problèmes Energétiques Globaux” of Mines Paris

### Evolution #1: Change of team in charge of the MOOC and some content evolution

Session 4: End 10<sup>th</sup> December 2018 ; 4 703 learners - 301 Successful

Session 5: End 25<sup>th</sup> November 2019 ; 6 622 learners - 305 Successful

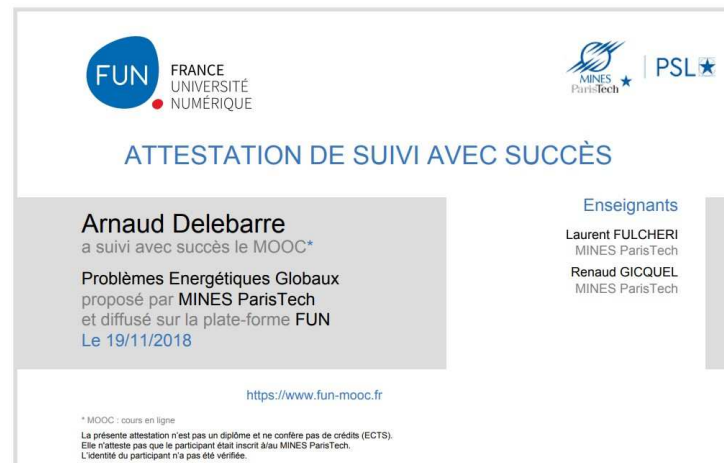
### Evolution #2: Used as a Small Private Online Course (SPOC) with the initial Videos and Transcripts and an automatic choice of questions among 250 for the evaluations

For 5 years, played as a self paced as a SPOC at Engineer School SPEIT (20-25 students) and at Mastère IGE (30 students) by Mines Paris



## MOOC “Problèmes Energétiques Globaux” of Mines Paris

As a MOOC: 31 000 Registered learners ;  
2 500 Attestations “Suivi avec Succès (= Successful)”



As a SPOC: 250 Learners as Master or Mastère students  
250 Successful evaluations as part of diploma

Other “unknown” users of MOOC’s materials

## MOOC “Thermodynamique Expérimentale” of Mines Paris

### 1. Three sessions played in French on FUN Platform

**Session 1: end on 8<sup>th</sup> June 2020 ; 2942 registered learners ;  
attestation attempted: 11.8 % of learners ; success among them: 65 %**

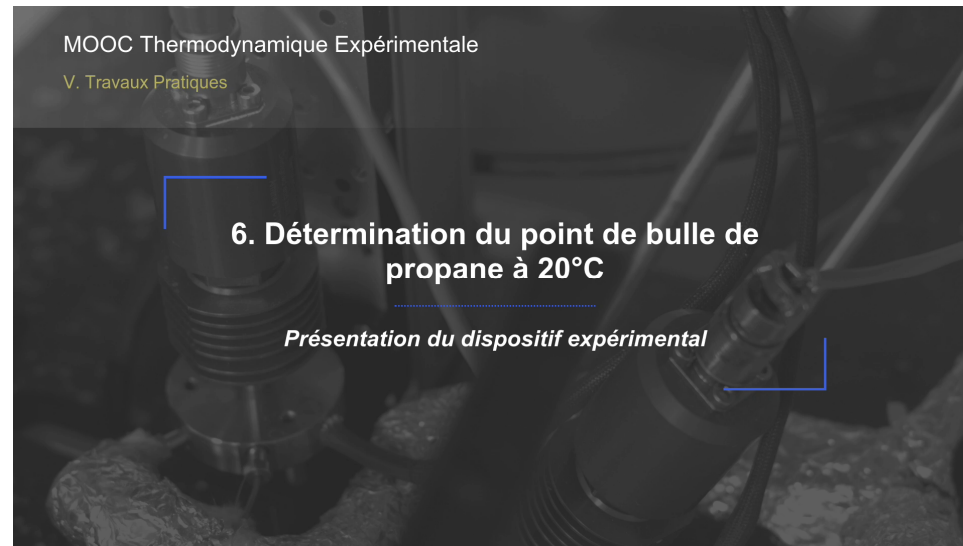
**Session 2: end on 19<sup>th</sup> July 2021 ; 1435 registered learners ;  
attestation attempted: 7.8 % of learners ; success among them: 58 %**

**Session 3: end on 11<sup>th</sup> July 2022 ; 1081 registered learners ;  
attestation attempted : 4.5 % of learners ; success among them: 59 %**

### 2. A specific tutorial with simulation of experiment by learner

## MOOC “Thermodynamique Expérimentale” of Mines Paris

### 1. Tutorial shown



### 2. Practical work to be done by learners

EXPÉRIENCE VIRTUELLE

Bienvenue de retour dans notre laboratoire 2.0!

Le dispositif expérimental présenté ci-dessous, vous est désormais familier. Si ce n'est pas le cas, nous vous invitons à revenir un peu sur vos pas, au chapitre 1, pour faire le tracé du diagramme de Clapeyron du CO<sub>2</sub>. En votre absence, nous avons chargé 0,02 mol de Propane dans la cellule.

L'exercice que nous vous proposons est de mesurer avec précision le point de bulle de Propane à 20 °C en utilisant la technique présentée dans la vidéo précédente.

L'idée étant, après avoir grossièrement repéré la position du piston lorsque le CO<sub>2</sub> est au point de bulle, d'effectuer plusieurs mesures de pression/volume molaire de part et d'autre de ce point de cassure à partir duquel la pression augmente rapidement, comme présenté sur la figure suivante :

À partir des données expérimentales, il est possible, par régression linéaire, de calculer les équations des deux droites, en amont et en aval du point de cassure, et d'en déterminer le point d'intersection. Ce point d'intersection correspond en effet au point de bulle.

Position du piston

Agitation

Corps pur : C<sub>3</sub>H<sub>8</sub>, n = 0,02 mol, V = 5,0671x10<sup>-6</sup> m<sup>3</sup>, V = 0,253354x10<sup>-3</sup> m<sup>3</sup> mol<sup>-1</sup>

**Renaud Gicquel**, professor formerly in Mines Paris, author of the MOOC “Problèmes Energétiques Globaux”

**Christophe Coquelet** (IMT Mines Albi) co-author of the MOOC “Thermodynamique Expérimentale” and **Nicolas Vion** filmmaker of the MOOC, **Alain Valtz** and **Snaide Ahamada** who contributed to the tutorial elaboration of the MOOC

Authors and designers thank the **UNIT foundation** for its founding of the MOOC “Thermodynamique Expérimentale” and **PSL** for its founding of FUN diffusion