

Flipped classroom in Linear Algebra

As Saitta et al. report in [1], the flipped classroom model builds on several well-known teaching approaches. In particular, using in-class time for more active learning activities has been constantly shown by research to improve learning [2]. In this presentation, we report about a pilot class in Linear Algebra for Engineers at EPFL that has implemented the flipped classroom model during two years.

To allow for an analysis of the performances of the students, the course has implemented three features. First, the course has been offered in parallel to seven other regular service courses taught to roughly 1'500 students, with a common content and a common exam. In addition, students attending the course have been selected among volunteers using stratified random sampling, thus allowing for a comparison between the experimental group (selected volunteers) and a control group (non-selected volunteers). Finally, the course has implemented an A-B-A design with the flipped format being implemented only over a few weeks of the semester.

In 2017-2018, the class has been given to 100 students (out of 500 volunteers) and has been flipped during 5 weeks. The results at the final exam showed that the performance of the experimental group was statistically equivalent to that of the control students (the 400 non-selected volunteers) although the A-B-A design indicated differences that require further exploration. The students highly appreciated the flipped format and asked that the course remained flipped in the last part of the semester. Following the positive feedback, it has been decided to hold a second pilot class with the objective to scale it up. The class is currently running with around 200 students and 10 weeks of the flipped format.

[1] Waldrop J. B., Bowdon M. A. (eds.) (2015). *Best practices for flipping the college classroom*. New York, NY ; Abingdon, Oxon: Routledge, is an imprint of the Taylor & Francis Group, an Informa business.

[2] Freeman S. et al. (2014). "Active learning increases student performance in science, engineering, and mathematics", *Proc. Natl. Acad. Sci.* vol. 111, no. 23 (Jun. 2014): 8410–8415.