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## **What is the value of mathematics?: Encouraging meaningful participation in mathematics for engineering courses**

Day 2 – Parallel IV (11.15-11.45)

We report on a case study of an engineering mathematics course where previous attempts to engage the students had failed. In spite of introducing a mathematical modelling approach to teaching with the intention of showing students the use-value of mathematics, attendance rates remained poor and most students continued to be indifferent and highly strategic about assessment. Students saw mathematics mainly for its exchange-value.

In order to address this problem, we re-designed the module by introducing employability skills. The intention of this re-design was to convince students of the value of engaging in mathematically meaningful activities. By participating in activities such as discussing ideas, working in group, presenting oral and written work, et cetera, students could see a practical and tangible outcome: they were developing relevant and transferable expertise that could make them more employable in a very competitive world. In this context, the use-value of mathematics lays in its potential to produce informed graduates that are able to critique, understand and express complex ideas using mathematics and at the same appealing to students' aspirations and to the exchange-value of mathematics as an important subject that might enhance someone's CV.

We evaluated the results of this practice by collecting data from student feedback questionnaires, teaching observations (the second author would observe while the first author taught the module) and the module's assessment (coursework and final exam). Results were very encouraging: attendance rates remained high (75% on average) throughout the course but more importantly, we gathered evidence of substantial participation of most of the students in the different activities designed to enhance their learning. For instance, throughout the module students were asked to work in groups outside of lectures to solve some modelling problems and to hand in an individual report of their solution. Most of them handed in well-structured reports even though these did not carry any marks towards the module's assessment. When asked to comment on the report of another peer, most students wrote thoughtful and supportive feedback. When asked to produce a (non-assessed) group presentation of the results of a substantial problem, 7 out of 10 groups produced and presented well-thought, well structured presentations. In most of the lectures, student input was common and many of them engaged in "healthy debates" during group discussions. Students' willing engagement in these mathematically meaningful activities showed that most of them believed that these tasks could be useful to their future and that developing these skills was worth investing time and effort.

Certainly, the exam-driven mentality was still very much present in these students but the data show that it can co-exist with a genuine sense that mathematics can somehow be useful.

In the conference presentation, we will discuss the challenges that we faced in introducing this form of teaching, and how these efforts could be sustained and extended to other courses, as well as more general implications for teaching and learning mathematics in Higher Education.