**The ESA Concurrent Engineering Challenge in Aerospace Engineering Education: educational impact and perspectives at the Technical University of Madrid**

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1. **Introduction**

We describe here the main educational impact and future perspectives at the Technical University of Madrid (UPM) after participating in the 2018 ESA Concurrent Engineering Challenge, which aimed to combine Challenge-Based Learning (CBL) as an active learning methodology, and Concurrent Engineering (CE) as a design methodology in the scope of tertiary learning.

A group of 20 students enrolled in the Master’s Degree in Aeronautical Engineering, supervised by professors in close contact with the industry, took part in the experience. It consisted on the preliminary design of a space mission following the CE philosophy in an integrated environment, where students complemented their knowledge, familiarised themselves with the CE approach and its benefits, and learnt how ESA assesses the technical and financial feasibility of real space missions.

We revise here the main educational impact of the experience [1], which was analysed via different surveys and instruments presented to both students and professors. It is discussed around the following main points: students’ motivation, professor-student relationship, teaching-learning process and difficulties.

1. **Educational impact**

*Students’ motivation.* Results have shown that CBL had an enhancing effect on the motivation of students. Improvements were particularly noticeable in aspects related with extrinsic motivators, like the perception about the professors’ performance. Intrinsic aspects, like the self-accomplishment, got better too.

*Professor-student relationship.* The professor-student relationship was closer and more productive; it was notably improved. Results strongly suggested that students valued their professors substantially better after working side by side with them during the challenge.

*The teaching-learning process.* The teaching-learning process benefited from CBL from two perspectives. The two aforementioned points affected directly on the improvement of the learning process. Indirectly, CBL influenced academic aspects related with the achievement of objectives, knowledge acquisition and improvement of technical and soft skills.

*Difficulties of performing CBL.* Certain difficulties were identified. From the professors’ point of view, there was a shared concern that CBL required more resources at the instrumental and organisational levels. From the students’ perspective, it was found a certain resistance to shift to a more active and collaborative mind-set.

1. **Perspectives**

During the first semester of the present academic year (2019-2020), UPM professors involved in the 2018 ESA Concurrent Engineering Challenge have organised satisfactorily a similar experience in collaboration with other participating Universities. Besides the analysis of the experience from a purely educational perspective, we aimed to explore the impact on the students’ conception about design and the engineering design process. The interesting results obtained have further motivated a comparative analysis between students from different fields and enrolled in different stages of their tertiary training (from new entry students to Master students). This work is currently in progress.

1. **References**

[1] López-Fernandez, D., Salgado Sánchez, P., Fernández, J., Tinao, I. and Lapuerta, V.: Challenge-Based Learning in Aerospace Engineering Education: The ESA Concurrent Engineering Challenge at the Technical University of Madrid. Acta Astronautica, Vol. 171, pp. 369-377, 2020.