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Compartmental Learning versus Joint Learning in Engineering Education

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Abstract: Sophomore students from the Chemical Engineering undergraduate Degree at the University of Salamanca are involved in a Mathematics course during the third semester and in an Engineering Thermodynamics course during the fourth one. When they participate in the latter they are already familiar with mathematical software and mathematical concepts about numerical methods, including non-linear equations, interpolation or differential equations. We have focused this study on the way engineering students learn Mathematics and Engineering Thermodynamics. As students use to learn each matter separately and do not associate Mathematics and Physics, they separate each matter into different and independent compartments. We have proposed an experience to increase the interrelationship between different subjects, to promote transversal skills, and to make the subjects closer to real work. The satisfactory results of the experience are exposed in this work. Moreover, we have analyzed the results obtained in both courses during the academic year 2018–2019. We found that there is a relation between both courses and student's final marks do not depend on the course.

Keywords: competency-based learning; mathematics skills; computer-based problem solving; engineering degrees

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1. Introduction

Chemical Engineers are professionals capable of developing their work through innovation and continuous improvement of processes and products. This is associated with analytical, creative, and critical thinking, entrepreneurial spirit, and the ability to lead highly productive teams. In their professional performance they will have to plan, analyze and interpret, design, implement, evaluate, investigate, and put into practice possible solutions to needs that arise in society [1]. All these skills are also essential for other engineering degrees and majors [2]. This work is focused on Chemical Engineering undergraduate Degree but the objectives, procedures, and methodology could be easily applied to other engineering specialties.

Traditionally, in engineering area, there has been a mismatch between the way in which universities have evaluated the results of their educational processes in Mathematics and other subjects and the way in which society, in general, and companies, in particular, do so. We could say that until a few years ago, university teachers wanted to determine a student's level of understanding, but nowadays this has changed and now we focus on what skills and competencies they acquire during their university studies. Competencies-based assessment seeks to change the educational process towards this direction [3].