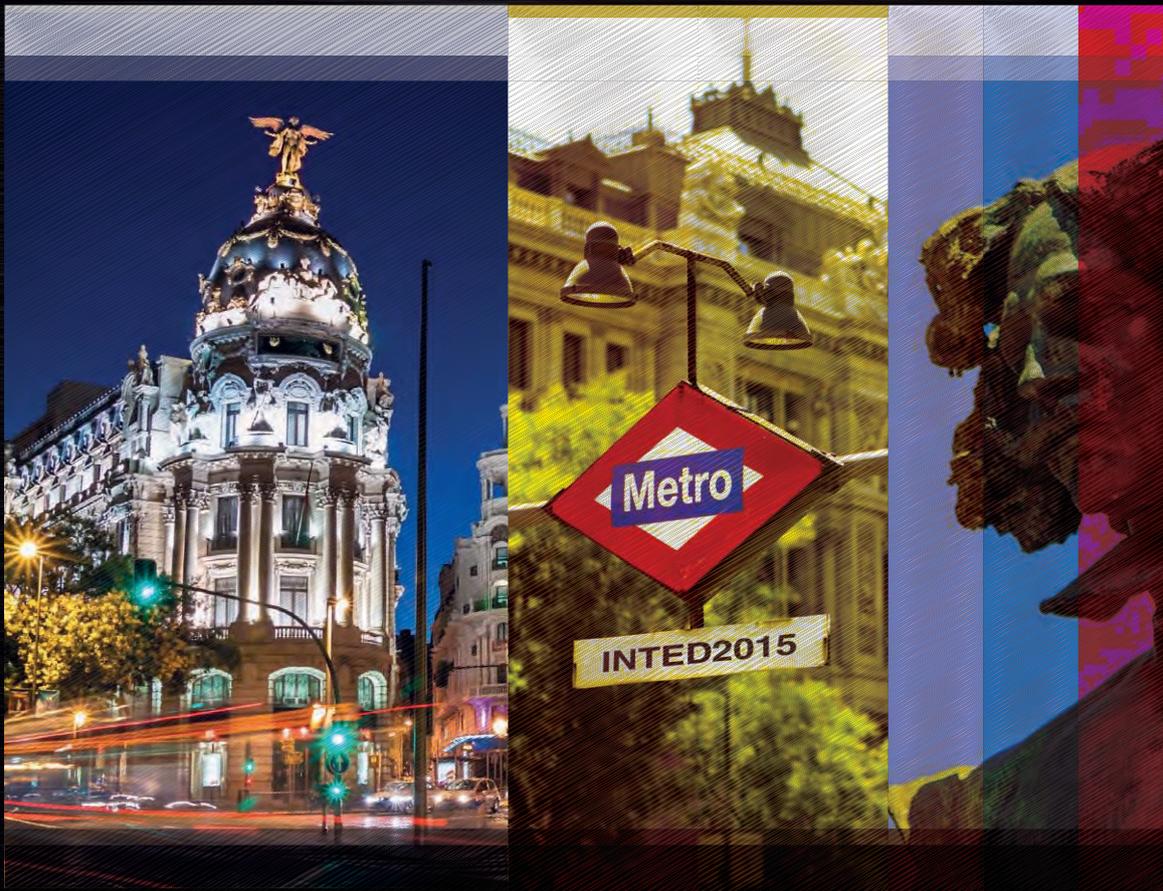


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ASSESSING STUDENTS' CREATIVITY COMPETENCIES FOR INNOVATIVE INDUSTRIAL ENGINEERING DESIGNS

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Abstract

In the new degrees of the Bologna framework, creativity competencies have been included among the skills needed by graduate students in engineering. Indeed, creativity is an important feature that allows engineers to provide new innovative designs. Therefore, engineers with creativity capabilities are able to produce more competitive products, open new opportunities and make our industries more profitable. However, the problem that engineering faculties have to face now is how to teach a student to be more creative. Teaching creativity has been studied from the pedagogical point of view since the middle of the twentieth century. Nevertheless, the implementation throughout the different courses of engineering degrees is not clear. The engineering student's perception is that, in the best cases, creativity is relegated to the final degree project. They think that their assessment is focused on their technical knowledge and their skills in using well-known engineering techniques, but new creative ideas to solve open-ended problems are not considered in their curricula. In this paper, a case study is presented encouraging and assessing creativity in engineering students with application to industrial design. A survey of the students' perception of the process was also performed.

Keywords: Creativity, industrial engineering, teaching, assessing competencies.

1 INTRODUCTION

Before the bologna framework was introduced, education based on contents established engineering degrees as academic disciplines requiring multidisciplinary knowledge of mathematics, science and technology. The sum of these disciplines provided engineers with a profound theoretical knowledge about their professional field. However, when they had to make their way into the employment market they had to learn to be engineers in many aspects. In other words, they had to practice and needed training for a long period before they had enough professional experience to become a valuable employee for their company. Normally, this training process was taken on by the companies when they could afford it. Obviously, this training period undermines the competitiveness of the companies because they have to invest time and money in the formation of their employees. Therefore, a reduction in this process could make engineers valuable for business in a shorter period of time. One of the main goals of education based on competencies is to provide engineers with professional capabilities to be able to compete in the job market [1,2]. Their competences allow employers to know the skills they have and when the training process can be reduced. The consequence is a reduction in cost and the enhancement of competitiveness [3].

Creativity in engineering design is a competence that makes engineers more valuable for their companies [4,5]. Creativity in engineering can be defined as a preference for thinking in a novel way, from different and unusual points of view and the capability and skill to provide novel and useful solutions [6]. The importance of creativity as a competence in engineering education is also clear because it has a great repercussion in making engineers good professionals in the design of new and innovative products [7].

The engineering design process begins with the identification of a need which is not satisfied by the market and ends with the development of a new product or system satisfying this need. To solve the design problem demands original thinking and here is where creativity plays an important role [8]. In fact, engineering design can be considered as the systematic and creative application of scientific and mathematical principles to create something new in order to satisfy human needs (see Fig. 1). However, engineering faculties dedicate a lot of time to teaching mathematical and scientific principles and often forget the creativity term of the definition [9]. Indeed, creativity is neglected in the resolution of academic problems [10] and the marks obtained by our students are often based on how much the result approaches the expected solution. When we expect only one solution for one engineering problem we are limiting the capability of creativity and innovation in students. We have to realise that

creativity so that ideas can flow freely. The paper provides an objective method to evaluate creativity capabilities, which is detailed in the case study. Creativity is seen as a process where the skills of the students are improved with advice from the instructors. It is not necessary that the solution provided by the students is an original idea but the important thing is that the creativity skills of the students are improved during the process.

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