

INTED **2019**

13th International
Technology, Education and
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11-13 March, 2019
Valencia (Spain)

CONFERENCE PROCEEDINGS



Exploring New Frontiers in Education

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Challenges of a Multicultural Society (1)
Teaching and Learning Mathematics

Serious Games & Game-Based Learning (1)
Collaborative Educational Environments
Adult and Lifelong Learning
Creativity and Design Thinking in Education
Experiences in Special Education (1)
Educating on Interactive Technology, Entrepreneur-ship and Participation
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e-Learning
Education and Globalization
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Educational Software and Serious Games
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Impact of Education on Development
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COMBINATION OF PUZZLE METHOD AND SCALED MODELS TO IMPROVE COOPERATIVE AND AUTONOMOUS LEARNING IN STRENGTH OF MATERIALS SUBJECT

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Abstract

The Strength of Materials is a fundamental subject for the development of competences in the rest of the mechanical engineering. In recent years, there have been difficulties in understanding key concepts by students, such as the behavior of tensions and deformations of simple structures, reflected both in a limited success rate and in the surveys made to students. The teaching team has proposed to improve the understanding of the fundamental concepts of the subject by implementing a methodology that combines the puzzle method, which improves cooperative learning, with an innovative technique, which consists of the use of scaled structural models. This last methodology is based on the representation of simple structures on a reduced scale in which the basic concepts of tension, deformation, stability and stiffness are reflected. These models are used in lectures, by the teacher, as in the seminars, where students interact with the models, improving their autonomous and cooperative learning. The results of the employed methodologies have been valued, among others, by means of some surveys completed by the students. In them, the students have valued the methodologies very positively and it has been reflected that they have the feeling that they achieve a better understanding. Likewise, students have shown great interest in the use of scaled structural models as a learning tool.

Keywords: Puzzle, scaled models, cooperative autonomous learning, strength of materials.

1 INTRODUCTION

The methodology presented in the following article has been implemented in strength of materials subject (9 ECTS, European Credits Transfer System). This subject is taught in the first semester of the third year of the Mechanical Engineering Degree. It deals with the behavior of real solid bodies subjected to various types of load, providing the student with fundamental knowledge for the analysis and design of mechanical and structural systems such as stress states and deformations in the resistant mechanical elements. That is why, this subject is of great importance within the degree because, the key concepts explained in it are used in the vast majority of subjects such as structural theory or machine design.

In this subject, key concepts such as tension, deformation and buckling are explained to the student for the first time to understand the behavior of a beam or structure. These concepts are new for the students and of great importance for the rest of the subjects to be studied by them in the degree. This is because in this subject the behavior of a structure due to different external loads is studied.

The traditional way of explaining these fundamental concepts is through equations and graphical representations of the phenomena linked to the behavior of an element or structure [1]. This is also done in this subject through a non-active methodology focused on mathematical theory and without experimentation.

In recent years it has been reflected in the poor academic results obtained in this subject and in the subjects related to it, that the student finds these concepts difficult to understand. Largely because the student has difficulty visualizing these concepts through graphic representations and assimilating them, making it difficult to remember fundamental concepts shortly after having acquired them, as has been observed in previous studies [2]. In addition, previous studies have addressed the problems associated with learning difficulties that students have the degree in which this subject is found [3].

That is why, the teachers of this subject consider a change in the traditional methodology used so far in the subject, in order to improve the results and strengthen the fundamental concepts. A more active

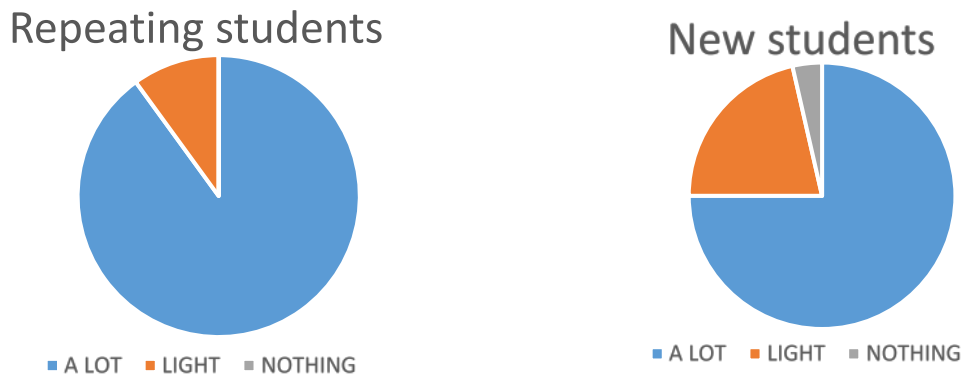


Figure 5. Assessment of combination method.

4 CONCLUSIONS

The difficulty on the part of the students to understand key concepts of the subject has carried to the implementation of cooperative and autonomous learning methodologies. In addition, the high rate of repetitive students and the poor results obtained during the previous years in the signature, almost half of the students are repeaters, has carried to measures taken by the teaching team. The proposed measures consist of a methodology that combines the Puzzle method with reduced-scale models.

Puzzle method has helped to improve the cooperative learning and the reduced models have done the same with the autonomous teaching. In addition, this last method has been a great help for teachers since it has been able to use it as a support to explain in class the key concepts, which are sometimes difficult to visualize by the students.

The combination proposed has given very good results, as it has been reflected in the surveys made to students. The reception has been very good and a large part of the students have thought that the methodology should be repeated in more classes of the subject and in subjects of the Mechanical Degree.

As a result, it can be concluded that by implementing the methodology in the course 2018\19 in the subject strength of materials, has improved the spatial vision of students and has managed to improve in autonomous and cooperative learning. That is why it is proposed by the faculty to continue using this methodology in more seminars and in future courses. In addition, it has been seen the need to inform the other teachers of the Mechanical Engineering Degree about the good results obtained so that this method can be used in other subjects.

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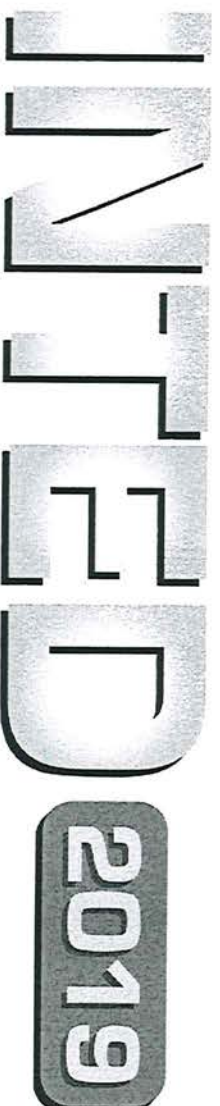
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