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**Full paper**

## PROMOTE LEARNING IN MECHANICAL TECHNOLOGY MANUFACTURING WORK EQUIPMENT

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### Abstract

The study plan of the bachelor in Mechanical Engineering of the School of Technology and Management of the Polytechnic Institute of Bragança (Portugal) includes the course unit Mechanical Technology II, whose contents are related to different manufacturing processes, namely the machining and welding processes. In terms of organization, there is a theoretical component (theoretical classes) and a practical component (laboratory classes) and, traditionally, it is followed a teaching methodology with expositive characteristics. Although there is a more active participation of the students in the laboratory, it is still incipient because these classes are even very teacher-centered and are only used for demonstrative purposes.

In order to change this paradigm, in the academic years 2015/2016 and 2016/2017, the teacher of the course unit decided that, although he maintained the format of the theoretical classes, for the advantage of addressing a great quantity of interest topics in the scope of the course, laboratory classes would focus on works with practical application, at least for a selected group of students. Thus, two practical works (one in each year) corresponding to the design and manufacture of two didactic machines were proposed: a hydraulic press and a manual rolling machine. In real works, at least for a selected group of students. The main objective was to get students to apply theoretical knowledge in solving real problems and to learn how to use the laboratory's machine tools.

The design of the hydraulic press was implemented in the academic year 2015/2016 and the manual rolling machine in 2016/2017. The methodology was the same for both practical works where each one was elaborated by student groups with four elements and was performed during a semester.

The practical work was divided into four stages:

- a) design (design and dimensioning),
- b) manufacturing and assembly,

c) machine testing and

d) writing a technical report. SolidWorks® software was used to design and dimensioning the machines.

After completing the project, the students manufactured the non-standard components in the laboratory, using industrial machines (milling machine, lathe, welding, among others). These components were assembled to reach a complete machine that was tested in a real-world scenario. Finally, the students wrote a technical report and presented the work to other colleagues.

The students who participated in the experience were motivated and committed throughout the process, although they had some difficulties, for example, in the use of software and in working with industrial machines. Those difficulties were overcome by consulting the existing bibliography (internet, books / manuals) and the support of the teacher and laboratory technicians.

The work done, in addition to allowing students to better understand the theoretical concepts, because they had to apply them in practice, also made them more responsible and made them develop their communication skills and collaboration with peers.

**Keywords:** Mechanical technology, laboratory classes, didactic machines, hydraulic press, plate rolling machine.