

## Project-Based Learning in vibrations and environmental care

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### Abstract

*During the last years, we attend an increasing interest for the environment care. People are preoccupied with all kinds of contamination including „undesired vibrations“ or noise. By the other hand, problem based learning approach has been used in some science fields. Project realization is a learning method in which the students' work acquires high relevance and students are awarded about their capacities of self-learning, working in a team and take decisions. In this work we present the use of this method in an elective university course on Acoustics. Students are invited to study a real life case, originated from environmental acoustics problems (noise mapping, acoustical conditioning). These activities allow the students to acquire both technical and non-technical skills: in addition of problem-solving and reasoning skills, other such as communication abilities and group work that are highly important nowadays.*

### Introduction

Project-based learning can be a good alternative or a good complement to conventional educational approaches. In this learning method, students carry out projects about course contents, as an extension of the subject or as a practical application. The projects are based in real problems that students have to resolve applying their knowledge about the subject, searching information, analyzing their findings and proposing solutions. Normally, the work is developed by a team, that works in a collaborative form.

Nowadays, some areas related to engineering, such as sustainable development and ecology have a great social interest. Between all the subjects contained in these areas, we can include the noise and vibrations. Noisy surroundings are more and more frequent in our society and the public's demand for quiet is increasing. Besides the noise reduction, there is a greater interest in adequate indoor acoustics that provides pleasant environments.

In this work we present the use of project-based learning in an elective course of Acoustics in the Engineering Technical High School of the University of Basque Country (UPV/EHU). Students are in their third or fourth degree's year, and all of them have a basic knowledge of physical phenomena.

### 1 Students' work

Students choose a subject based on research questions proposed by the staff. During ten weeks they work together in teams, formulating their hypothesis, experimenting, measuring and searching solutions for the studied problem. At the end they write a technical report of their results that they present at a mini conference.

After the mini conference, they improve their work with suggestions and comments of all their colleagues, and present a final report.

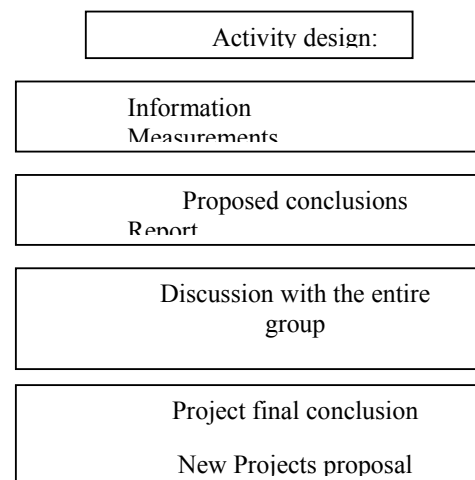


Figure 1. Activity development

### 2 Two examples of students' work

Students are invited to develop some work related with environmental acoustics, may be outdoor or indoor acoustics.

Outdoor acoustics selected topic was noise mapping while indoor acoustics one was room acoustics conditioning.

Two topics have been developed using a sound level meter as measurement tool.

**2.1 Noise mapping**

The objective of this work was the elaboration of a noise map for the surrounding area of the Engineering Technical High School (see Table 1).

**Table 1. Noise mapping description**

<b>ELABORATION OF A NOISE MAP FOR THE SURROUNDING AREA OF THE SCHOOL</b>	
Objective study	Noise level measurement in a suitable number of positions around the studied area. Analysis of obtained data.
Subjective study	Design of a inquiry about noise perception. Inquiry fulfill by the school students. Analysis of obtained data.
Conclusions	Noise sources identification. Strategies for noise level reduction.

**2.2 Acoustical conditioning**

**Table 2. Acoustical conditioning description**

<b>IMPROVEMENT OF ACOUSTICAL CHARACTERISTICS OF A ROOM</b>	
Room study	Measurement of the reverberation time in a suitable number of positions of the studied room. Calculation of the optimal reverberation time. Analysis of obtained data.
Planning	Calculation of the optimal absorption coefficients. Material choice. Economical report.
Conclusions	Identification of the bad acoustics causes. Strategies for acoustical conditioning.

The objective of this work was the improvement of the acoustical characteristics of a room. The elected room was a garage that would be converted in a meeting room (see Table 2).

**Conclusions**

Project-based learning approach to environmental acoustics problems permits to introduce engineering students in two key subjects: the understanding of what engineers actually do, and the importance of the care of the environment in which they work and interact with the community.

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