IT'S YOUR DAY! TAKE ACTION AND CLICK ON THE VIDEO ZONE: UNDERSTANDING, IMAGINING, DOING AND REVIEWING.

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ABSTRACT

This paper summarizes the results obtained in a project concived to improve remote and face-to-face teaching of Calculus in the fields of industrial and biomedical engineering. The project consists of developing teaching videos on key topics of Calculus through some engineering problems at a first semester university course. We focus on achieving the goal of learning by setting it in the approach and solution of a subject, making it more experiential. This type of practice should be the central focus of activities inside and outside the classroom. In this way we will be able to consolidate the students' mathematical skills, but at the same time acquire other skills that will be vital for their professional and personal development.

The evaluation process must be formative, as the assessment should provide teacher-student feedback in order to adjust teaching or learning based on the information received. We propose two main types of activities: Production of audiovisual material for the improvement of teaching and completion of Wiris questionnaires for self-assessment. The didactic video is very useful in class and has a motivating intention because rather than transmitting exhaustive and

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systematized information on the subject, it aims to open questions, raise problems, arouse the interest of students, disturb and generate a participatory dynamic. With the elaboration of these videos we promote that students be able to understand through specific problems and with the help of graphic material, a specific problem and then move on to the abstraction of more general situations.

1 INTRODUCTION

The health events of recent years, together with the growth of social networks and video platforms, have represented a revolution in the educational system. The world has evolved from the traditional education system to the online classroom system. Video conference rooms and platforms that offer live streaming for education have acquired the relevant role that the market was requiring. A clear example can be found in the Spanish platform Edpuzzle, which has revolutionized the world of education through video. Educational videos currently represent a very important part of higher education, providing an important tool to capture the attention of students. The effective use of video as an educational tool is enhanced when teachers consider different elements as how to maximize student engagement with video and how to promote active learning from video, see [1] and the references therein for an in-depth discussion of the topic.

In this paper we present the material developed under a project that has been carried out in the Barcelona East School of Engineering by a group of professors teaching in the initial level courses. When the pandemic interrupted our lives, teachers had to make a 180º turn in their way of teaching. Most of the members of the group offered virtual classes through GoogleMeet using iPad for transmission, others recorded their classes on videos and we created a YouTube channel to communicate with the students (Canal Càlcul). The generated material is open access in the ZonaVideo UPC. A subsequent analysis made us see that one hour class through a screen or videos of more than 20 minutes may not be as effective as initially thought, which is consistent with the results presented in [2]. Our interest in capturing the attention of students and creating materials that can be used in any situation led us to consider creating videos of no more than 5' that introduce a topic through a problem of interest to them. This material has been complemented with brief scripts, videos of problems in Cristal Board and online tests to monitor if the objectives have been achieved. The produced materials will be available in open format at UPC Video Zone.

2 METHODOLOGY

The objective we want to achieve is attrack the attention of students and arouse their interest in studying and expanding their knowledge in each of the topics that make up the Calculus course. It is a standard first year course in any of the engineering careers. The topics to be developed are function representation, continuity, derivability, Taylor polynomials and Riemann integration. Our approach has been to think of an object or concept that could be present in each of the videos and that

would serve as a common conductive thread for the presentation of the problem. Once the concept was chosen, we scripted the video and, with the collaboration of the Caminstech center, we produced the material. On the other hand, we use the support provided by CristalBoard to solve problems associated with each of the videos, as well as a small pdf document of about 4 pages each that expands on the topic and includes some historical notes. Finally, self-assessment tests have been developed using the WIRIS software on the ATENEA platform of the UPC. The developed materials have been produced in Catalan and English, since part of our students take the subject in that language. To give agility to the presentation of the videos we think of animations with music and not in videos in which some teacher gives the explanation, our goal is to give lightness to the presentation and get closer to the way of doing the students.

The object chosen as the initial thread was the Heaviside function. This function is an unknown element for the student body that comes from high school or higher vocational training, so it can arouse the curiosity of the student body. In addition, the Heaviside feature is largely present in the themes that we wanted to develop and that could be introduced as a real problem.

3 RESULTS

The results of the developed Project are classified into 3 typologies.

3.1 Videos

We have designed, scripted and produced 5 videos of no more than 5 minutes in which one of the topics of the Calculus subject is introduced through a problem of technological interest as explained in the Methodology section. In the following table we summarize the characteristics of the videos.

Table 1. Video futures

Video Name	**Theme**	**Problem**	**Media**
Turn on and off with matehmatics!	Continuity	Turn on a light	Heaviside function
Displacement, intensity and velocity with mathematics!	Signal representation and changes	Signals changes	Translation and dilation of funcitons
Turn on and off immediately with mathematics!	Derivability	Instantaneous changes	Delta function
Approximating signals with mathematics!	Taylor Polinomials	How a calculator works	Polynomials
Discharge of a	Riemann integration	Discharge of a	Antiderivatives

capacitor with mathematics!		capacitor	

3.2 Complementary short text

To complement the information of the videos we have developed an explanatory text associated with each of the videos consists on a file with no more than 4 pages in which the information contained in the videos is expanded and a small historical note of a character related to the topic is added.

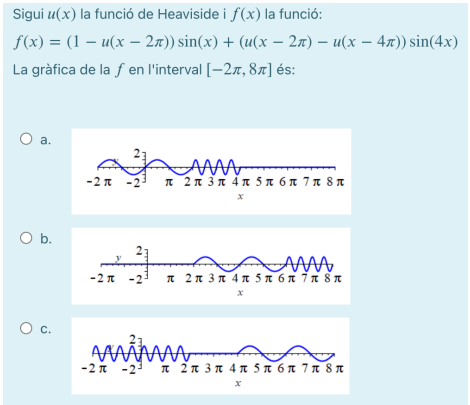
Table 2. Complementary material futures

Title	**Historic note**
Heaviside function	Oliver Heaviside
Functions tranformations	Generic on functions
Dirac Delta function	Paul Adrien Maurice Dirac
Taylor Polinomials	Brook Taylor
Riemann integration	Georg Friedrich Bernhard Riemann

3.3 Test evaluation

The evaluation process must be transparent and formative. Transparency refers to the fact that the evaluation criteria must be public and known to the students from the first day of the course. And they must also be formative, since the assessment must provide teacher-student feedback, to be able to adjust teaching or learning based on the information received.

Figure 1. Example of a question



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