

## TEACHING CALCULUS USING E-LEARNING IN A MOODLE PLATFORM

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### Resumo

Este trabalho descreve o uso de uma nova tecnologia de informação e comunicação no ensino de Análise Matemática I em engenharia no Instituto Superior de Engenharia de Coimbra, usando um ambiente de trabalho conveniente como o Moodle.

Nesta plataforma, apresentamos actividades, exercícios de treino e testes, de modo a motivar os alunos para diferentes áreas da Análise Matemática I.

Palavras-chave: Ferramentas de ensino à distância, Educação matemática, Cálculo, Educação em engenharia, Ensino à distância, Moodle.

### Abstract

This work describes the use of new technological information and communication in teaching Calculus I for Engineering, at Coimbra Institute of Engineering, using a virtual teaching environment such as Moodle.

In this platform, we present activities, training exercises and tests, in order to motivate the students for some different subjects taught in Calculus I.

Keywords: Virtual learning tools, Mathematics education, Calculus, Engineering education, e-learning, Moodle.

### 1. INTRODUCTION

Being known that students have become more and more unmotivated in studying Calculus I, there was a need to introduce new extra tools to help to assist the “traditional” classroom environment.

In recent years, several researches revealed that the use of e-learning tools may improve the learning interaction between students and teachers (Attwell, 2007; Gorghiu G., Bîzoi M., Gorghiu L. M. & Suduc A.M., 2009; Qiang L. & SHiyan W., 2009). In fact, many universities promoted the use of the internet potential to create an online version of some of their subjects/courses. The purpose is to help students beyond the classroom, therefore increasing their participation in the learning/teaching experience (Estela-Carbonell M.R., Saà-Seoane, J. & Villalonga Pons, J., 2011; Gorghiu G. et al., 2009; Marinho-Araújo, C.M., 2009; Vinuesa T.S. & Fornos R. M., 2007).

Students of the 1st year of any Engineering Course at Coimbra Institute of Engineering (ISEC) have several mathematics subjects. In general, students have big difficulties in those subjects, mainly because of the lack of background from secondary school. In order to overcome some of those difficulties, we are building an online support tool for these students, so that they can participate and get involved during the learning & teaching process. Students can access those tools during classes or at home, anytime, so that they can train lectures subjects.

Using the MOODLE platform, several modules have been developed. Students can access the main topics of Calculus I through an e-learning book. This book contains a summary of the main concepts and subjects like, for example, anti-derivatives, definite integrals, indefinite integrals, and applications. In this book are included activities and training exercises organised by increasing order of difficulty. The solution of every exercise is available, and final mock tests for all the modules are proposed.

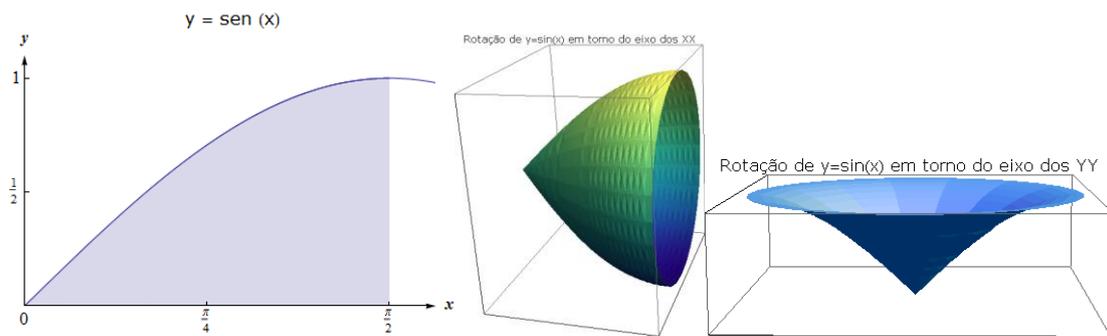
## **2. METHODOLOGY**

In this experience we present a brief summary of the theoretical results, followed by what we feel a Calculus I student most need to know in order to achieve success in a particular chapter of Calculus I:

- a) We begin by showing some examples to illustrate the theoretical results.
- b) Then, we proceed by suggesting some exercises, so that the students can practice and observe the specific techniques for each different subject. We also provide a possible resolution of those exercises, should the students feel some difficulties. These solutions can allow students to verify their results and to analyse the correct resolution.
- c) Later on, in order to check if the student understood the subjects, we propose a list of exercises, and corresponding solutions.
- d) Finally, a multiple choice mock exam is available, to evaluate the skills learned for each subject.

Using this tool, we were able to create a virtual course for Calculus I. This course contains a set of 2D and 3D images to illustrate some of the exercises. In Figure 1 we can see one of those images.

Figure 1. Some plots.



In this example, the 3D illustration helps the student to understand how the solid is generated by revolution of a 2D plot. We also present some solved exercises to help the student find the correct answer for the exercises.

Additionally, a set of multiple choice exercises is available so that the students can train their skills.

In Figure 2 we present some examples of this approach.

Figure 2. Examples and exercises - environment.

### 3. CONCLUSIONS

We believe (and hope) that this approach will help to overcome some of the difficulties that students often present while studying for an introduction Calculus course.

Moreover, the virtual environment provides not only spatial but also temporal flexibility, thus allowing students to interact with the different subjects.

In a near future, we want to evaluate the efficiency of this work by checking the success of the students in this course, as well as their interest and motivation, number of questions answered by the students, and, finally, their general opinion about this approach.

It is our belief that these activities may help students to be more confident in their mathematics learning skills and to improve their apprenticeship.

### REFERENCES

- Attwell G. (2007). Personal Learning Environments- the future of eLearning? *eLearning Papers*. [www.elearningpapers.edu](http://www.elearningpapers.edu), Vol. 2, No. 1, pp. 1-8.
- Estela-Carbonell M.R., Saà-Seoane, J. & Villalonga Pons, J. (2011). Innovative self assessment and learning contents for Calculus within the RIMA project (ICE-UPC). *Proceedings of WEE2011*. Lisbon, Portugal, pp. 122-129.
- Gorghiu G., Bîzoi M., Gorghiu L. M. & Suduc A.M. (2009). Aspects Related to the Usefulness of a Distance Training Course Having Moodle as Course Management System Support. *Proceedings of the 9<sup>th</sup> WSEAS International Conference on Distance Learning and Web Engineering*. Wisconsin, USA, pp. 54-59.
- Marinho-Araújo, C.M. (2009). Desenvolvimento de Competências nos Estudantes no Ensino Superior: Estudos no Brasil e em Portugal. *Actas do X Congresso Internacional Galego-Português de Psicopedagogia*. Braga, Portugal, pp. 5069-5083.

Qiang L. & SHiyan W. (2009). A Competency Model for Civil Engineering Students. *Proceedings of the 1<sup>st</sup> IEEE International Conference on Information Science and Engeneering (ICISE2009)*. Washington, DC, USA, pp. 3172-3174.

Vinuesa T.S. & Fornos R. M. (2007). A virtual mathematics learning environment for engineering students. *Interactive Education Multimedia*. No. 14, pp. 1-18.