The use of mathematical software as a complement to learning

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***Abstract* - In order to facilitate an active approach to learning the use of computational technology can provide a more effective and quick way to solve problems.**
LEMA - Laboratory of Mathematical Engineering, is a research group in the areas of Industrial Mathematics and Mathematical Engineering at ISEP, developing activities in several areas of research and providing training activities for researchers (from various fields), teachers and students. A series of seminars dedicated to "Engineering Mathematics Software" were organized by LEMA, allowed students, of ISEP to become involved in discovery, learning concepts, solve problems and consolidate their own knowledge. This paper presents the software applications, the interactivity and relation with subjects learned at math disciplines in ISEP.

Keywords - Computer, Mathematics, Software, Skills.

INTRODUCTION

To solve different problems that students face in their daily basis, (Jonassen, 2003) suggested using technology for interactive learning.
The use of computational technology can provide a more effective and quick way to solve problems, integrate disciplines, increase individual responsibility and teamwork. (Singh ,1997).

On engineering schools, mathematics, as a fundamental and applied science, is transversal to the various engineering courses. This discipline has benefited from a notable increase in available software that can be used as a complement learning tool for students. The relationship between computer technology and student achievement in mathematics, was reported as a positive correlation between computer proficiency skills and academic achievement (Wenglinsky,1998).

In this work we present some mathematical software applications, the interactivity and relation with subjects learned at math disciplines in ISEP.

METHODOLOGY

In order to facilitate an active approach to learning, LEMA organized a cycle of 3 seminars dedicated to "Engineering Mathematics Software" whose subjects were:

- **PGF / TikZ Mini-course: tool to support the construction of latex graphics**

The purpose of mini-course was to provide an introduction to the features of the TikZ package, drawing figures such as lines, curves, graphics of curves described by mathematical equations, electric circuits. The drawings are fully incorporated in the document as vector images, allowing to take advantage of all the potential of LaTeX.

- **Python as Numerical and Symbolic Calculation Tool**

In this seminar we showed the bases of the phyton language and the potentialities of some libraries considered essential for the realization of scientific calculation - numpy, scipy, matplotlib and pylab and the algebraic or symbolic calculation library, Sympy, commonly known as the CAS tool.

- **A non-random sample of R language considerations**

In this presentation a brief description of the R language was made. Concepts were introduced about operations, flow control, functions, data manipulation and graphics production. It was also presented a functionality that allows the elaboration of reports and dashboards with the R.

The choice of themes was based on the curricula of the mathematics disciplines taught at Isep**,** allowing students to become involved in research and to consolidate their own knowledge.

Examples of Linear Algebra, Calculus, Statistics and Electrical Circuits were some of the topics covered.
A student-centered approach was used, allowing the student learning through formal and informal forms of assessment. The students, undergraduate and in the first years of their

academic courses, attending the seminars can be fairly considered a random and homogenous sample of the ISEP population. Despite their similar background in terms of fundamental disciplines they sample different engineering courses. They were invited to participate actively, to ask questions, to find answers and solutions through exploration.
In this project we had 75 participants.

FINDINGS

The students were asked about the importance of these seminars on their academic course and how it could impact positively in their learning process. All the participants expressed their opinions in a brief and succinct way.
Generally speaking, the satisfaction levels were high. All of the students recognized the importance of the use of mathematics software in the academic environment. It was widely mentioned that a more practical approach, instead of a more theorical one was one of the reasons for the success of the seminars. It was also recognized that it contributed largely to improve their working and studying methods and allowing them to deepen their knowledge as well.

Moreover, unanimously the participants suggested a second edition of these tricycles in mathematical software.

CONCLUSIONS

In this work it was emphasized the importance of the use of mathematical software. Even if a more quantitative assessment, e.g. statistical, is clearly necessary it is still possible to draw some conclusions.

There was a wide recognition that the use of this type of software largely benefits learning in mathematics and engineering.

This "out of classroom" and hands-on approach has intensely motivated the students to look for a consistent and independent learning in matters traditionally difficult.

Finally, the seminars provided the students new software skills together with new insightful research abilities useful for their daily academic duties.

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