

ABSTRACTS, PRESENTATION

#SUSALT17
SALT
Conference

The use of remote labs to contextualize learning and teaching in engineering mathematics

PRESENTATION

Author(s) Marcelo Zannin, Natércia Lima, Arcelina Marques, Ricardo Costa, Gustavo Alves, Karin Ennser, Juarez B. da Silva, Ingvar Gustavsson.

Abstract

Interdisciplinary education is an important aspect of critical thinking development in engineering students, as they prepare for their careers. This study reports the didactic experiences of the integration of remote experiment, simulations and calculations for learning and teaching higher education mathematics. These are the first experiences of the use of the remote electronics laboratory VISIR (Virtual Instrument Systems in Reality) in a didactic implementation in the engineering subjects of Calculus and Statistics. The strategy used in Calculus is to study a real electric circuit modeled by differential

equations, covering 20% of the topics in the syllabus. In statistics, real experiments are used to collect, organise and interpret data, covering around 40% of the syllabus. The results show that students who benefited from this implementation not only feel more engaged and interested in engineering mathematics, but are also likely to develop new skills and achieve higher in mathematics subjects.

Outline

This presentation begins with a description and a demonstration of the use of the remote laboratory VISIR (Virtual Instrument Systems in Reality), developed by Blekinge Institute of Technology (BTH), in Sweden. It is a remote access real electronics laboratory, which is an alternative to hands on laboratory, often unavailable to students due to financial and spatial constraints. Results on the implementation of this technology show there is no significant difference in learning outcomes achievement in hands on versus virtual labs. One of the main advantages of this technology is the great potential in distant learning, as it is a dynamic robust system which has performed well in tests with several simultaneous users. Furthermore, the presentation focus is on its main objective, which is to share the didactic experience of the use of remote lab as a resource to support higher education mathematics learning and teaching. Students benefit from the visualization of mathematics theory in a real experiment. Although VISIR has already been shown to be effective in several engineering courses, these are the first experiences of its use in higher education mathematics. The applications presented here are related to the subjects of calculus and statistics. The behaviour of an electric circuit is investigated with the simultaneous use of remote lab, simulations and calculations. The theory of differential equations allows the students to predict and understand the behaviour of the real circuit assembled in the remote lab, while identifying differences among calculations, simulations and real experiments. Several differential equations solutions methods are explored in circuits applications. With respect to statistics, real experiments are carried out by the students. Descriptive statistics concepts are applied in order to organise and

interpret data collected from the real circuits implemented at the virtual lab. Probability theory and statistical inference concepts are also put to use in order to make predictions about the behaviour of similar experiment. Both applications also provide students with practical experience in electronic circuits, preparing them for further subjects with more specific applications. The presentation is concluded with categorical and quantitative analyses of the results of the the learning and teaching strategy. Results point to benefits of multi resource learning and teaching, and the impact on development of new skills, higher achievement and interest on the topics. Implementation and use of VISIR is encouraged through partnerships with some of the institutions that host remote labs, such as Polytechnic of Porto, in Portugal and Federal University of Santa Catarina, in Brazil. The VISIR Project is starting a partnership with Swansea University and this is a great opportunity to start sharing knowledge, tools and spread the ideas.

Key Words

remote lab, mathematics, VISIR, education

Key Messages

The remote lab VISIR first uses for the contextualization in differential equations, as well as statistics, will be shared. There will also be a discussion on the potential of such practices in distant learning. One of the main goals of this presentation is to develop new partnerships and make this ready-to-use technology available to more students.