4^{th} International CDIO Conference

ACTIVE ENGINEERING EDUCATION

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University College Ghent
Ghent, Belgium.

Title
The use of a software application as a complement to experimental problem solving

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Type of Presentation: (check one)
__X__ active paper (15-30 min)
_____ poster session (60 min)
_____ advanced workshop (45 min)
_____ round-table session (60 min)
_____ advanced workshop (90 min)

Short Description The aim is to show how a software application can be used as a complement to experimental problem solving. After the presentation the participants will able to describe a typical experimental problem solving process and will be able to discuss the potential benefits with a software approach.

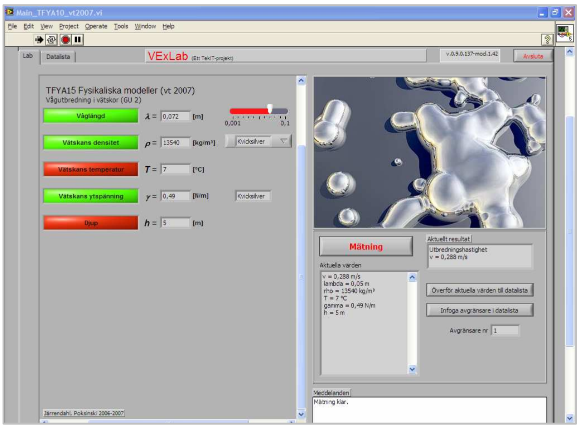
Relevance to the Conference Theme, Strands, and/or CDIO Initiative
Please indicate (tick) the strand that the presentation most closely relates to.

	Application of CDIO to a wide range of disc.		Curriculum and programme design
	The involvement of industry	X	Technology-enhanced learning
X	Development of professional competences		Assessment of professional competences
	Design-implement experiences		Facilitating change in engineering education
	Supporting sciences and CDIO		Evaluating the impact of CDIO Programs
X	Student involvement	X	Active and experiential learning

Abstract (maximum one A4 sheet)

For more than 25 years *experimental problem solving* has been an integrated part in many of the science and engineering programs at Linköping University.
Our main implementation of the experimental problem solving is done via a type of laboratory work where the students have access to an experimental setup with the task to obtain an equation that describes the experiment. It could, for instance, be the task to describe the period time for some type of pendulum or the sinking time for an object in a water tank.
The procedure to obtain the descriptive equation include; hypothesis (what variables should be included in the equation and how should they be included? Is the equation a product or a sum etc.?), dimensional analysis (to obtain exponents), measurements, measurement data handling (logarithmic plotting etc.) and error analysis. In this way the students will practise skills which are important to master as a future researcher or engineer. This type of laboratory work has been included in the introductory courses in several of our engineering programs (e.g. electrical, computer, mechanical and chemical engineering programs). In Linköping, the concept has also been used as *cases* in *problem based learning* (PBL) courses.

Recently, we have developed a LabView™-based software application (VExLab) for "experimental" problem solving. The main difference is that the measurements are now done virtually in a software "simulating" an experiment. We are careful to stress the importance of real experimental work in engineering programs. However, as a complement VExLab is interesting for several reasons. For instance, the software approach makes it possible to;



A screenshot from the VExLab software

• distribute the problem solving over a larger time-span. The students are not limited to given scheduled occasions but can solve the problem at any time at the university computer facilities or on their own computers at home.
• construct problems that are too expensive and/or difficult to do experimentally in a teaching laboratory.
• make individual problems for each student group, e.g. in terms of introduced errors.
• construct problems focusing on some special part of the problem solving process. For instance, the dimensional analysis or error estimation.
• construct new problems on a much shorter time scale.
• construct problems connected to a broader number of research fields.
• construct a number of mini-problems connected to a specific course.
The use of LabView™ also makes it possible to include signals from real detectors in the simulation.

The experimental problem solving will be demonstrated in collaboration with the audience. Both the experimental and software concepts will then be presented and compared. We will also describe how the two approaches is typically implemented and combined in our courses including the examination through written reports.

Active presentation techniques
Describe one or two ways in which you intend to engage the audience (for example, paired discussion, personal response using clickers or flash cards …). This section is a decisive factor in the acceptance of your proposal and the amount of time you will be allocated.

Active presentation technique(s) to be used:
In the first half of the presentation a demonstration of the experimental problem concept will be done by solving a simple but typical problem in collaboration with the participating students (and other).
In the other half the main focus will be on the developed software and how it can be used and examined in a typical course for engineering undergraduates. The participant can then be asked to give a spontaneous response via the clickers.
A problem unit in for the VExLab software will be available for students prior to the conference as a demonstration on how VExLab allows the experimental problem solving to be distributed over larger time spans and in this case also to students distributed geographically.
Students will be encouraged to send in their suggested answers so they can be briefly discussed at the end of the presentation.

The time needed will be 30 minutes.

Facilities/equipment required (tick all those appropriate)
X Computer projector (provided in all locations)
Overhead projector
X Flip charts and pens
X Clickers (personal response system)
Coloured flash cards
Post-it notes
Other (please describe)

Send all proposals via e-mail as MS Word or pdf files to **jgaywood@liv.ac.uk on or before December 7th 2007**