4th International CDIO Conference
ACTIVE ENGINEERING EDUCATION
June 16-19, 2008
Hogeschool Gent
Gent, Belgium.

Proposal Template

Title: From fortune-telling to engineering: how to implement physical concepts.

Authors and Affiliations

Annick Van Deynse (Annick.VanDeynse@hogent.be)
University College Ghent, Faculty of Applied Engineering Sciences
Schoonmeersstraat 52, B-9000 Ghent, Belgium

Type of Presentation: (check one)

_____ active paper (15-30 min)
_____ poster session (60 min)
_____ advanced workshop (45 min)
__X__ round-table session (60 min)
_____ advanced workshop (90 min)

Short Description

In the work session physics more active learning techniques and e-learning are involved besides the traditional performing of experiments. The method used to enhance the understanding in physical concepts, using concept questions, an electronic learning platform, presentations and peer assessment, will be discussed.

Relevance to Conference Theme, Strands, and/or CDIO Initiative

Indicate by a tick which strand the presentation most closely relates to.

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

Abstract
The rapidly changing technology and the new developments in engineering call for changes in the settings, contexts and methods of engineering education. Besides disciplinary knowledge, training different skills and competences is more and more a point of interest. But due to the rapid changes, it is although also important to pay attention to the disciplinary knowledge, especially to the more general courses as physics and mathematics, as the “new” engineers must be able to solve complex problems adequately. In the work sessions physics we find therefore both knowledge and skill development important. By performing physical experiments the students train, among others, to collect data using an appropriate measuring method, to interpret the results using error analysis and to present their findings clearly in a written report or an oral presentation. Besides that they learn to plan their work, develop a critical attitude but are also responsibility for the assessment as also emphasised in the CDIO standards.
Although the work session physics has already evolved to a more diversified approach using different active learning techniques to address more skills, we still notice that the clear understanding of the background of the experiments is rather poor. In the first bachelor year, for the course Physics I, the assessment of the work session consists of two parts. Half of the score assesses the developed skills, the other half comes from a test. First it was a practical test of the performed experiments. It evolved to an open book written test, testing the background of the experiments. Looking at the results of the test, we noticed that the implementation of the necessary physical concepts is rather poor. As physics is the basic for most of the engineering sciences, we developed a method hoping to enhance the insight in these concepts.
To detect the possible misconceptions we developed a multiple choice test, based on the known “Force Concept Inventory”, and perform it at the beginning of the semester. During the semester, the students prepare the experiments profoundly and test their initial knowledge about the subject by answering some concept questions using Dokeos, the electronic learning platform used at the University College Ghent. Adequate feedback is provided at the same moment as the questions are rather for instructing purposes than for testing. At the end of the semester we will check if this results in a better understanding of the physical concepts. This will be tested in two ways. First we will compare the results of the written test with the previous results. Secondly we will redo the initial multiple choice test and check whether the students get better results. This will also be correlated with the results of the concept questions answered during the semester.
This method is now tested in the course Physics I on a population of students following a bachelor after bachelor program. So no major conclusions can be drawn at this moment. From the initial test we can conclude that some misconceptions are still persevering although these students have already obtained a professional bachelor diploma.
In the second bachelor year, for the course Physics II, the upset of the work session is somewhat different. The main difference is that the students have to give an oral presentation about an experiment to their fellow students. To enhance the attention during the presentations and to encourage the student’s more criticism the presentations are evaluated using peer assessment. Afterwards a statistical analysis is performed in order to investigate whether giving a presentation enhances the comprehension of the experiment. We noticed that the students searched for extra information about the experiment, i.e. applets, applications,… in order to make their presentation more interesting and comprehensible for their fellow students. So we wonder if this concludes in a better understanding of the experiment compared to the other experiments.
By diversifying the approach in the work session physics, we address more skills than before. On the other hand we train the disciplinary knowledge by introducing concept questions. So we hope that the “new” engineers have the necessary skills to be both critical and able to solve complicated problems adequately.

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 will play an important part in the acceptance of your proposal and in the time it is allocated.

Active presentation technique(s) to be used:

1. Roundtable discussion: after proposing the research questions the experience of the participants will be asked and new proposals will be discussed.
2. Personal response on the concept questions using flash cards.

Facilities/equipment required (tick all those needed)

Computer projector (provided in all locations)
Overhead projector
Flip charts and pens
Clickers (personal response system)
Coloured flash cards
Post-it notes
Other (please detail)

Send all proposals electronically as MS Word or pdf files to **jgaywood@liv.ac.uk** **on or before December 7, 2007**