REFORMING ENGINEERING EDUCATION

University of Pretoria joins other engineering universities in adopting CDIO.

The University of Pretoria's Department of Mechanical and Aeronautical Engineering has adopted a new framework for education. The main goal with the new framework is to teach engineering students not only the technical fundamentals of their disciplines, but also non-technical skills, such as working in teams, communicating through written or oral presentation, and considering their work within the context of society as well as professional ethics. Instead of emphasising analysis and problem-solving in a theoretical realm, classes will now stress team-based projects in which students go through the cycle of conceiving, designing, implementing and operating (CDIO).

Says departmental head Professor Josua Meyer, "although many of these goals were addressed to a limited extent in previous years, the new programme is in line with the best teaching practices from around the world. The CDIO framework is the result of numerous surveys conducted at American universities and in industry, among government leaders, alumni, and educators. The surveys showed that the success of complex aeronautics projects depends as much on critical thinking and modelling as on an understanding of thermodynamics."

The Massachusetts Institute of Technology (MIT) formally founded the CDIO initiative in the late 90's, and in 2000 it became an international collaboration, with top Swedish and British universities adopting the same framework. The collaborators maintain a dialogue about successes and failures and continue to refine the project. Determining additional members of the collaboration is a selective process managed by the four founding institutions. The University of Pretoria was invited in 2004 to become a collaborator, the only university thus far in the southern hemisphere and the only one in Africa. From 14 to 18 February 2005, an introductory CDIO workshop was held at the University of Pretoria, which was followed by a week-long collaborator's meeting. The workshop was designed for deans, heads of department, academic staff and others concerned with engineering education.

The workshop was presented by project director Professor Ed Crawley (MIT Aero/Astro Engineering) and other CDIO collaborators, including representatives from the Chalmers University of Technology, Linköping University, and the Royal Institute of Technology (all from Sweden), the US Naval Academy, and Queen's University (Northern Ireland). Several engineering academics from South African and African universities also attended this workshop. It is important to realise that the CDIO initiative is relevant to all engineering disciplines, and even to some outside of engineering, such as mathematics, biochemistry and physics.

Professor Meyer of the University's Department of Mechanical and Aeronautical Engineering is enthusiastic about the fact that the new programme has produced more capable students at the universities that adopted the CDIO framework. "Students report an increase in confidence, an increase in motivation, and they become more empowered to become engineers," says Meyer. Although the CDIO initiative is still a fledgling programme, it shows great promise in narrowing the gap between education and industry needs. ◑

CDIO Skills

(In order of expected student proficiency level)
- **Engineering reasoning and problem-solving**
- **Experimentation and knowledge discovery**
- **System thinking**
- **Personal skills and attitudes**
- **Professional skills and attitudes**
- **Teamwork**
- **Communication**
- **External and societal context**
- **Enterprise and business context**
- **Conceiving and engineering systems**
- **Designing**
- **Implementing**

Further information can be obtained from
http://www.me.up.ac/cdio

CDIO Collaborators

Chalmers University of Technology, Sweden
Linköping University, Sweden
Massachusetts Institute of Technology, USA
University of Pretoria, South Africa
Queen's University, Canada
Queen's University, Northern Ireland
Royal Institute of Technology, Sweden
Technical University of Denmark
US Naval Academy, USA