

Innovative approaches to engineering education

**From CDIO reform to innovation of engineering education at DTU:
Leading changes of study programs, the commitment of professors and the mindset of students.**

Prof. Martin E. Vigild
Vice President and Dean of Undergraduate Education and Student Affairs
Technical University of Denmark (DTU)
Anker Engelundsvej 1, Building 101A
2800 Kgs. Lyngby
Direct + 45 45 25 10 09
[*bachelordekan@adm.dtu.dk*](mailto:bachelordekan@adm.dtu.dk)
[*www.dtu.dk*](http://www.dtu.dk)

CAETS 2013 Budapest – June 27, 2013

Summary

This presentation describes the impact of CDIO reform to engineering education and following developments, which builds a better, stronger and certainly more motivating and rewarding way for students and educators to undertake curricular and extra-curricular activities in modern engineering education. Important key elements are engineering authenticity in curricular activities and a large degree of event-oriented projects that offers profiling opportunities for engineering students (and educators).

Abstract

Six years ago university management at the Technical University of Denmark (DTU) decided to use the CDIO principles to reform all bachelor programs in engineering. Conceive Design Implement and Operate (CDIO¹) holds many novel and some well-proved concepts relevant for engineering education reform, and is based on bringing the authenticity of the engineering profession into the teaching and learning of students.

This presentation will introduce the general elements of the CDIO approach and answer many questions: Why did DTU chose to use CDIO for the implementation of the reform? What were the incentives to undertake such reform measures? Which tools could assist the implementation of change, and what were the obstacles and challenges during the process? What are the benefits of going through the change and how does engineering education improve for the benefit of the students, the university and of the society as a whole?

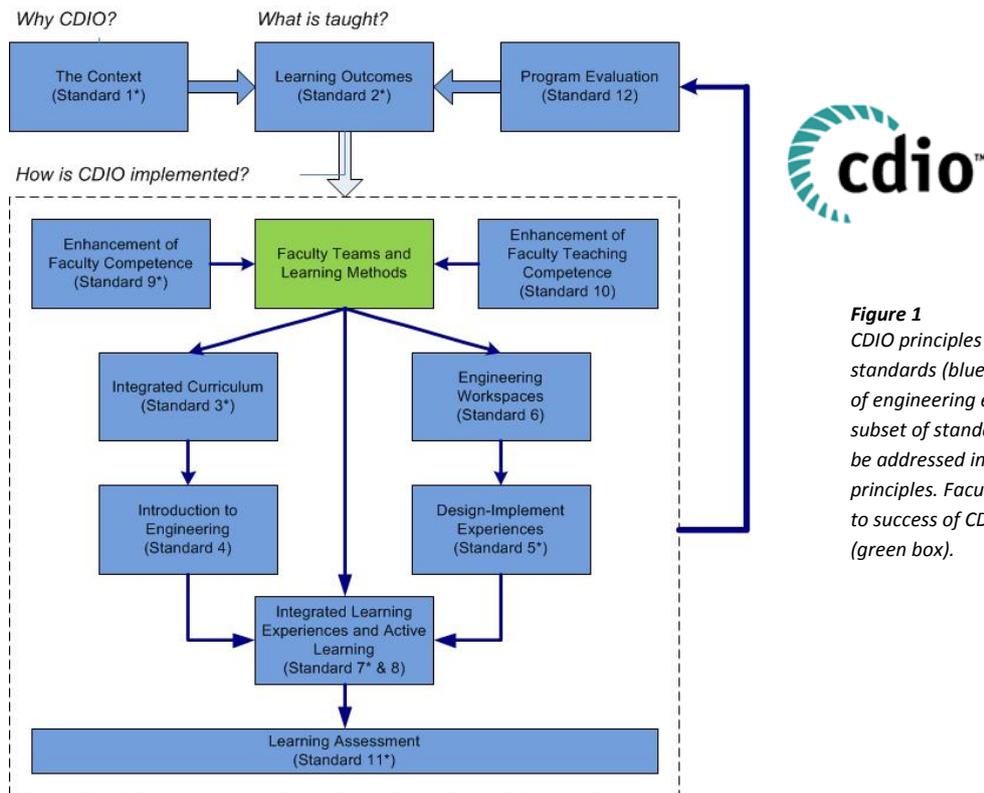


Figure 1
 CDIO principles are described in 12 standards (blue boxes) reflecting all sides of engineering education. A minimum subset of standards (marked by *) must be addressed in order to follow CDIO principles. Faculty engagement is crucial to success of CDIO implementation (green box).

The CDIO initiative was implemented at DTU together with several other innovative improvements within the engineering education. Some examples of these curricular event-oriented activities are:

(a) The student convention **“Grøn Dyst”** (Green Joust) which gives bachelor and master students a chance to submit contributions to a grand seminar focusing on the global challenges of economic, environmental and social sustainability. The total prize pool is 34.000 euro for winners and runners up, and is handed out by a minister from the state cabinet.



Figure 2
 Green Joust (Grøn Dyst) is held every second year as a full campus event to showcase student work focusing on issues of sustainability in all aspects of Engineering. Here the first prize winner is rewarded by a minister from the state cabinet. In 2012 153 projects contributed to the conference with a student participation of 360.

(b) Another initiative is the **DTU Blue Dot Student Projects**. A set of large-scale student-governed project activities present the students with an opportunity to work and live as engineers. The projects sometimes aim at participating in international student competitions (e.g. Solar Decathlon or Shell Eco Marathon), but can also serve their own purpose (e.g. building and launching a satellite).

(c) Finally, DTU and the **Roskilde Music Festival** collaborate on making student projects out of engineering challenges in designing and constructing the festival infrastructure accommodating more than 100.000 guests. The Music Festival submits a long list of projects, which DTU students can respond to and include in curricular or extra-curricular projects.



Figure 3.

The DTU Blue Dot projects are designed to facilitate large scale student operated activities, which demand huge extra-curricular activities. The projects count the Solar Decathlon team (plus-energy house design and construction), the DTU Sattelite team, DTU Brew House, DTU RoboCup (a robot competition). Here the DTU Roadrunner team is at Shell Eco Marathon. In May 2013 the team set a new world record running 612,3 kilometers on one liter of gasoline in the urban car contest. Totally 120 students are involved with Blue Dot Projects.



Figure 4

The Roskilde Music Festival collaborates with DTU on making student projects out of designing and constructing the festival infrastructure accommodating more than 100.000 guests. In 2012 125 engineering students worked on 25 projects ranging from improving sound on the big stage to recycling frying oil into fuel for generators.

References

¹ Edward Crawley, Johan Malmqvist, Sören Östlund, Doris Brodeur: **Rethinking Engineering Education – The CDIO Approach**. 2007 Springer Science+Busines Media, 286 pages