

# Strategies for Lifting an Iceberg - Full Scale Adoption of CDIO

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## ABSTRACT

Picture this, an iceberg as a metaphor for describing the university in the process of adopting a new teaching paradigm. On the top of the iceberg, visible above the surface, we find the innovators and early adopters with a clear overview of the new horizons, pointing out the new directions and having the courage to cling to the top even in times when a cold wind is blowing and it is difficult to hold on. Still the sun is shining on them from time to time as the good examples. Beneath the surface we often find the main part of the teaching community at the university. Down here many educators are striving with their continuing work with teaching, research and many other tasks. Sometimes they might have the experience of being overburdened by work, keeping them down, and they raise their eyes to take a look at the innovators and early adaptors up there in the fresh air and in the sunshine. What could it be like up there? Maybe I should try to go up there after all? See what it is like. Even if those thoughts occur, it often seems difficult for many educators to actually make this move. Why is it so? What reasons are preventing this movement? Is it not better up there in the sun? Are the storms blowing not easier to handle if everyone is helping and moving forward in the same direction? Would it not be easier to create high-quality study programs for the students based on progression and coherence in their educational journey if everyone is navigating after the same principles, sharing the same view over the ocean?

If we really should find the best strategies to lift the whole iceberg above the surface in order to help everyone getting up at the same level, sailing together towards the same destinations, it is important to analyse and act upon the different rationales in the organisation which has an impact on the individual educators and on the organisational development processes. What can we do? As educators who like to adopt new teaching methods? As developers trying to motivate a paradigm shift? As someone responsible for an education program or as someone responsible for a whole university working on adopting new ways and methods in teaching? What strategies can we use individually and as an organisation?

## KEYWORDS

CDIO implementation, teaching development, development strategies, sustaining change in engineering education.

## **INTRODUCTION**

We do not claim to have the answers to the questions raised in the abstract and in fact this paper does not propose solutions or answers to the challenges, at least not yet. Instead the purpose is to outline and problematise the challenges as a part of an ongoing work that will reach an interim maximum in an advanced workshop during the International CDIO conference in Brisbane 2012. The present paper serves as the basis for this workshop and a launch pad for a more thorough paper as well as some joint papers in the wake of the conference.

## **CDIO AS A TEACHING PARADIGM IN ENGINEERING EDUCATION**

The above mentioned challenges are well known to educators and researchers within engineering education. In our perspective engineering education has reached a critical point if we really want a paradigm shift to take place. There are sound alternatives for educational development within engineering education, e.g. the Aalborg PBL model [1] and CDIO [2] to mention but a few. The CDIO initiative is a well thought out approach taking into account important aspects searched for by many scholars including competences such as fearlessness and creativity and properties such as professionalization of the students [3].

Today the issue of providing effective education systems and motivating young people for entering higher education is crucial for our ability to handle a more complex and global interconnected world with new challenges to meet and new problems to solve. Engineers are considered to have a key role in meeting many of these challenges. However, the way education systems are structured and what kind of teaching and learning paradigm is used has a major impact for the competences and knowledge the students are developing [3]. Recent research and reports stress the importance of the development of Engineering Education adopting new teaching methods and revising the curriculum, but the pace of the development seems to be too slow in many cases [4], [5], [2].

At this point, in the CDIO community there are gathered a lot of knowledge and experience on how to facilitate students' learning according to the CDIO-approach and therefore also on development of engineering competences in Engineering Education. However, it still seems to be a continuing challenge to make an overall change in the way students are taught [4]. In many cases it is still the dedicated and engaged educators who continually develop their teaching and try out new methods while educators who would benefit from adopting for example the CDIO-approach do not always grasp the opportunity to do so. Even when a program is structured successfully following a new teaching paradigm such as the CDIO initiative, it seems difficult to change the overall teaching culture.

Having a closer look at the situation and the conditions for many universities there can be good reasons for those difficulties. In higher education research is still the foundation for promotion, rankings and evaluations [6]. What is being valued and given credit for is also what preliminary captures our attention, motivates our efforts and constitutes our main objectives and aims. No doubt, every educator wishes the best for their students and aim to help students to develop knowledge on a high level in courses and educations. One of the questions is if there is enough time in the daily faculty life to emphasize enhancement of their teaching qualifications and to get involved in the development of teaching and learning. In the future this could have an influence on the teaching culture at a university and on the conservation of teaching traditions. Many educators, as well as many universities, are struggling with the question of how to overcome this challenge in order to evolve their students' learning.

### *The DTU example*

At The Technical University of Denmark (DTU) we experience this as well even though it is noticeable that more and more educators and departments increase their efforts to develop teaching and increase their focus on the students' learning.

DTU is running a total of four kinds of education programmes: Bachelor of Engineering, Bachelor of Science and Technology, Master of Science and Technology and PhD programmes. The aim is to provide the students at DTU with educations of highest possible quality. To be successful with this aim DTU continuously and systematically strives to develop both the understanding of teaching and learning among the educators and the teaching practises. In order to do so DTU offers a variety of activities including mandatory teacher training program, training courses, seminars, and development projects.

In 2004 it was decided to adopt CDIO systematically at DTU in the 3½ year Bachelor of Engineering (with 10 different engineering majors) in order to distinguish it as a programme of applied science directing candidates directly towards jobs in industry. Another reason for adopting CDIO was that it serves as a framework for quality improvement and assessment of educational activities giving educators a common language and a goal for higher standards. Adopting CDIO in the Bachelor of Engineering programmes has been a long process spanning over several years, and many experiences have been made from this process. In many ways the adoption has been successful. CDIO now is the overall teaching paradigm in a whole cohort of education programmes, fully implemented, and many educators are engaged in teaching in a CDIO context. CDIO has provided an additional frame work for the general teacher training activities at DTU where the educators can increase their understanding and knowledge about teaching and learning. It thus seems that the adoption of CDIO contributes to the development of a broader knowledge and understanding of (some of) the general principles for efficiently support of student learning in Higher Education.

Many lessons can be learned from the development process at DTU on how to create and sustain an overall change of teaching paradigm in Engineering Education. One issue is how to operate with a top-down approach to the required changes and still motivate and engage the departments and educators in the development, which is crucial to a successful result in the long run. Another issue is how to introduce CDIO to the educators, e.g. how to integrate it in teacher training programmes and other teacher training activities in order to give the educators the necessary competences. Support for educators using new methods has also been a part of the strategies discussed.

Even if the adoption of CDIO has been successful in many ways at DTU there are still challenges to deal with. Those spans from practical issues about how to organise and motivate teams of teachers and how the generic courses, like the basic courses in mathematics and physics, can be included in a CDIO context to more overall organisational questions about how to strengthen the leadership of education programmes, including the power and economy to influence courses. The challenges also address more strategic questions such as how to engage and educate the highest number of educators in order to share the same understanding of teaching and learning and truly work within the CDIO context, how to leave space for the individual educators who want to make an effort to develop teaching and learning, and how to allocate enough time for and to promote acknowledgement of this development in parallel with research.

## Conclusion

Since the outset of this paper was to outline and problematise some of the challenges in engineering education we do not aim to make conclusions. Instead we would like to emphasise the need for deeper discussions with our colleagues in the CDIO community about strategies to be used in the adoption of CDIO and how to motivate educators at universities to change the way they teach, crucial for providing the society with skilled engineers for the future. We hope that the advanced workshop on Strategies for lifting an Iceberg and especially its outcome will help us in our efforts to accomplish an overall change of the teaching paradigm in Engineering Education and to obtain a permanent and sustainable change of the teaching culture. We hope to inspire collaboration and maybe co-authored papers on this subject.

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### **Biographical Information**

Pernille Hammar Andersson is educational consultant at LearningLab DTU at the Technical University of Denmark. She is coordinator and responsible for the compulsory teacher training program at DTU. She works with projects aimed at developing teaching and learning at DTU departments, and at DTU in general. She also works with deeper evaluation of new teaching methods and teaching and learning initiatives at DTU. On national level in Denmark, she is a representative in the steering committee of DACIN, a national network supporting educational development in Danish Engineering Education. Her academic background is in psychology and educational science.

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