WAVES OF REFORM – ANALYSING A HISTORY OF EDUCATIONAL DEVELOPMENT CONCEPTS

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ABSTRACT

Luleå University of Technology (LTU) joined the CDIO Initiative in 2015, and a pilot project involving four engineering programs is now well underway. Studying this case, it strikes us as interesting that this happens now, as LTU could obviously have joined CDIO at least a decade earlier. In order to understand the internal processes leading to this outcome, we studied documents and consulted with key persons. In this paper, the history of reform approaches at LTU is described and analysed. We focus in particular on the Arena concept, which appears to have kept LTU from joining CDIO, and the Pedagogical Idea, which is compatible with CDIO and eventually led to the adoption. Reflecting critically on the lessons learned from the LTU case, and drawing on theory and literature, we consider what can support or hinder the adoption of an educational reform concept in the organisation. Some factors concern the nature of the reform and the strategies of implementation. Further, what other universities do can be an influence.

KEYWORDS

Reform concepts, adoption of innovation, travelling ideas, The Creative University, LTU Pedagogical Idea, CDIO adoption.

AIM OF THE STUDY

Luleå University of Technology (LTU) joined CDIO in February 2015 and is currently implementing CDIO in a pilot project with four programs: the Master of Science in *Civil Engineering*; *Mechanical Engineering*; *Industrial Design Engineering*; and *Engineering Physics and Electrical Engineering*.

Being involved in this implementation project, we became curious about why this happens now, as in retrospect it seems that LTU could have decided to join CDIO anytime during the past decade. To understand why it happened in 2015, and not earlier, we decided to investigate the history of educational reform at LTU during the period 2000-2015. Particular focus is on two internally developed reform concepts, the "Creative University*"* and the "Pedagogical Idea", and on the history of CDIO at LTU.

RESEARCH APPROACH

Several complementary methods for data collection have been used; in particular document studies, a focus group and several interview discussions. Our aim was to be able to triangulate, i.e. to explain more fully the richness and complexity of human behaviour by studying it from more than one standpoint (Cohen, Manion & Morrisson, 2011). Still, our findings tell only one version of the story, collated in retrospect and from a limited number of witnesses, and there may be many other ways to remember and interpret the process.

Focus group

The key participant in the focus group was Roland Larsson, who has witnessed and been instrumental in shaping the events described here. During the time period studied he was a faculty member, then vice Dean; this year he became the Dean. Other participants were authors Gedda and Wikberg Nilsson, and Edström facilitating the discussion. Gedda was the coordinator of one Arena, and Gedda and Wikberg-Nilsson are the creative team behind the Pedagogical Idea. Presently, Gedda leads a newly formed educational development unit, supporting the implementation of the Pedagogical Idea and the on-going CDIO project. Wikberg-Nilsson is Director of Studies in the Industrial Design Engineering program, part of the pilot project. The focus group was explorative in character and semi-structured around largely chronological prompts (Wibeck, 2000). As the facilitator was not part of the history of events at LTU, the level was set by the need for explaining to her, making the discussion more explicit and assumptions more openly scrutinised, than if all participants had been talking from a basis of shared experience. The discussion was allowed to continue until the participants found consensus in their interpretations, in total two hours. In the days following the conversation, the participants gathered complementary materials in the form of old emails and internal materials, for retrospective reflection. The focus group discussion was recorded and transcribed verbatim. The quotes in the following have been translated from Swedish and slightly edited for brevity.

Interviews and discussions

Interview discussions were held in different constellations over several months. First of all, we consulted with two key persons, Ann-Britt Almqvist and Erik Höglund, to solicit their memories and interpretations, and to test the validity of our tentative conclusions. These interviews were documented through written notes. The aim was to compare different memories and impressions, until sufficiently intersubjective interpretation was reached. We also tried to corroborate details with written documentation (e.g. emails, minutes from meetings, presentations, and strategy documents). Other more informal discussions involved the authors, who have been deeply involved in the different educational development projects described here.

Document studies

Data from the focus group, the interviews and the discussions were complemented by documents from 2004 to 2015. We have briefly probed how concepts of educational reform have been described in documents regulating activities at LTU, including meeting protocols, agendas and annual reports. A straightforward application of systematic content analysis (Hall and Wright, 2008) was used, where pre-selected terms related to educational reform were located in the texts.

USEFUL CONCEPTS AND THEORY

Change management

Much literature on organisational change suggests that a majority of initiatives fail to reach their set goals (e.g. Hughes, 2011). It is thus imperative to better understand how to improve success rate. Though numerous studies (see e.g. Durlak and DuPre, 2008), many aspects require further investigation (Harvey et al., 2011; Greenhalgh, 2004).

The three main motives for adopting CDIO are, according to Malmqvist et al. (2015), the ambition to make engineering education more authentic, the need for systematic methodologies for educational design, and the desire to include more design and innovation in curricula. Top success factors were that "CDIO is well aligned with the vision and strategy of our department/university", "University management strongly supported our CDIO implementation" and "The CDIO implementation was associated with higher ambitions for our education".

Hallencreutz and Turner (2011) pinpoint two beliefs about how organisational change occurs, basically a dichotomy of top-down vs. bottom-up: a) organisational change can be planned and managed through an understanding of a structured approach to transitioning built on a set of sequential steps, see e.g. Burnes (2009) and Lewin (1951), and b) organisational change is an emergent and organic learning process which cannot be managed, see for instance Burnes (1996, 2009).

Isomorphism and travelling ideas

DiMaggio and Powell (1983) explain how organisations of the same kind often adopt similar structures, behaviours, and values, calling the phenomenon *isomorphism*. Isomorphic forces may be related to legal environment, norms and values, and the role of professions and education. Of particular interest here is *mimetic isomorphism*, the imitation of other organisations perceived as successful and legitimate. The need to imitate increases with environmental uncertainty, vague relations between means and ends, and ambiguous goals.

Czarniawska and Joerges (1996) describe how ideas travel between organisations like fashions. Following fashions is a competition mechanism, at the same time conformist and creative. Sahlin and Wedlin (2008) describe how ideas and concepts are not just imported, but actively translated and edited into the organisation, evolving differently in different settings. They conclude: "*To imitate is not just to copy, but also to change and innovate.*" Stensaker (2007) points out that by taking up ideas and concepts organisations can innovate and become more effective. At the same time, the organisation must protect its activities from passing fads that will turn out to be useless or inefficient.

Reform as Routine

Brunsson (2009) notes that many organisations are under constant reform, driven by tensions between how the organisation is presented, i.e. how it should work, and the way it actually works. Reforms are basically efforts to apply solutions to problems, both of which are in rich supply. Since organisations are subject to conflicting demands, it may be "*impossible in practical terms to find any balance that could readily be regarded as the right one*". Therefore every solution "*is susceptible to criticism for failing to satisfy one or other – or both*

– of the needs sufficiently" (p.95). A reform furthering one side of such a balance may therefore soon create impetus for new reform in the other direction. It is easy to design reforms that are attractive in comparison to the current reality of the organisation: "*If we set a simple, clear, and good reform idea against our knowledge of the current situation with all its slack, ad hoc solutions; and its uncertainties, inconsistencies, conflicts, compromises, and complicated relationships, then there is a good chance that the new solution will appear better*" (p.97). Common sources of solutions are professional reformers, as well as other organisations (through mimetic isomorphism).

Alvesson and Sveningsson (2008) illustrate risks of repeated reform initiatives: "*Leaders often have unrealistic expectations and start too many projects, of which many are discontinued or failed. The result is often cynicism, a waste of time, institutionalisation of negative expectations and a 'wait-to-see-if-something-happens-thinking'. This makes it harder to implement change next time.*" Alvesson and Sveningsson bluntly conclude that a good condition for making successful reform is to have fewer reform initiatives.

FINDINGS: PREVIOUS REFORM APPROACHES AT LTU

The Creative University concept

After 25 years as a technical college LTU became a university in 1997. Three years later the vision "*The Creative University*" was launched. It used the label "*Knowledge Building*" to denote a shift from teacher-centred to learner-centred education. Instead of traditional programs, education was to be organised in interdisciplinary areas, known as "*Arenas*". Each Arena offered a wide range of subjects that could lead to different degrees. Advised by faculty, individual students were to assemble their own education. The model was later modified, with coexisting Arenas and programs.

Early on, the concepts of Knowledge Building and Arena were contested within the university and, at times, the debate was intense and infected.

> "They went out to preach in the departments, met by people throwing things. It was a classic when someone said: 'If this is so damn good, why hasn't KTH done it before?'"

The Creative University was implemented top-down, i.e. the idea was created and decided in a management context. However, the handover to the teachers who were expected to implement it in a teaching context was weak. As the concept was based on principles of student-centred learning, it made high demands on educational knowledge and teaching skills among the university professionals.

> "The Creative University was a fun idea, but how do you go about it when no one has done it before? We stalled due to a lack of real direction, competence, and professionalism in the implementation. It was all based on enthusiasm. I myself remember giving project courses that were truly inadequate."

The legitimacy of the Creative University gradually lessened. Two surveys (Garvare, 2005; Garvare & Lovén, 2005) showed polarised views on the Arenas, with some representatives strongly in favour; others strongly dissatisfied. The concept and its Arena organisation were gradually phased out.

The Pedagogical Idea concept

A few years later, the faculty board felt a need to support cohesion and success in educational programs.

> "We needed to do something in the education. We asked: how do we create a concept and what is it that really characterizes our education?"

The decision was made to formulate a common pedagogical idea, communicating core values of teaching and learning for the whole university (including e.g. healthcare, art and teacher education). It should build on existing work, most notably a "Pedagogical Signum" developed for the engineering programs (Johnson et al., 2009) emphasising professional engineering practices and projects, and a pedagogical idea for flexible learning (Runardotter et al., 2011). The project leaders (Gedda and Wikberg-Nilsson) were to incorporate these into a unifying concept illustrating "the LTU way of learning".

The Pedagogical Idea formulated an overall objective of LTU's educational programs, to create *autonomous professionals* in their respective fields, emphasising a constructivist approach. During the development, a teacher said:

> "Teachers should motivate and help students in their learning. The teachers' skills are key for this to work well. Teachers are guides, while the students try and test their way themselves. The traditional approach with teachers transferring knowledge does not work."

Through workshops and other activities involving students and teachers, a model of student's learning path was described in the steps of (1) developing the identity of a *professional student*, learning how to approach and what to learn, (2) being *participant contributors*, taking responsibility for their own learning process with help of others, and (3) taking on the identity of *autonomous actors*, furthering the know-how of professional practice. This model can be compared to Alverno's idea of the learner, contributor, and performer (Riordan & Sharkey, 2010).

The Pedagogical Idea emphasizes an integrated student-centred learning role described through the concept of *commitment*, *perseverance* and *autonomy* (Wikberg Nilsson & Gedda, 2013). Each program ought to translate this vision into a strategy as guidance for decisions on purpose and content.

To support implementation, various materials were developed, e.g. guides for constructive alignment of programs (Wikberg Nilsson & Gedda, 2013) and guides for development of courses and teaching activities with a focus on student-centred learning (Gedda & Wikberg Nilsson, 2014). In 2013, it was decided to implement the Pedagogical Idea in all basic education. The experiences of the Creative University had revealed difficulties in introducing top-down pedagogical change (consistent with Gedda 2008, 2014). Therefore, the Pedagogical Idea was not to be implemented through putting pressure on individual teachers, but through creating a capacity for change within the organisation, by addressing micro-, meso- and macrolevel within the organisation.

FINDINGS: THE HISTORY OF CDIO AT LTU

The first official encounter with CDIO at LTU was in 2003, when the Royal Swedish Academy of Engineering Sciences arranged (in collaboration with KTH) a visit to MIT to learn about CDIO. LTU sent Lena Antti and Roland Larsson as delegates, both of whom were to later take on leadership positions. Larsson remembers that timing was poor:

"When we went to MIT in 2003 we had been working on the Creative University for a couple of years. We were in the middle of these creative processes, and perhaps a little full of ourselves. We could still appreciate the systematic approach in CDIO, in particular the idea of progression. But it died out when we came home, and it never occurred to us that we could join the network. Also, back then I was just a normal faculty member without any formal role. I remember bringing up these ideas at the department in 2004, but nothing came of it. I had no mandate, no professionalism, I didn't know what to do really, and no one to turn to."

At this time it was not obvious that an institution could become CDIO collaborator. Ten years later the situation had changed so that a Swedish engineering institution could almost need a reason for not joining. At LTU, the gradual abandonment of the Creative University and the initial implementation of the Pedagogical Idea had brought about a much more favourable situation. Larsson was now the Vice Dean:

"As a Vice Dean I was hungry for networking, for ideas. In April 2014, at the SEFI Dean's Convention, I ran into CDIO implementers again. I thought: Let's do it, let's join CDIO! Now I could propose it, as my responsibility as Vice Dean was education. When I came back, we acted swiftly. A project leader was appointed, pilot programs selected, and by January 2015 we were CDIO Collaborators."

Joining CDIO is a part of a general increase in attention for educational development among the middle level of leaders and teachers at the university.

"We have done many things in the past few years: Pedagogical Idea, the Pedagogical Guide, the Centre for Teaching and Learning. It's all connected and it feels like exponential growth."

CDIO is seen to concern not only didactic and pedagogical aspects but also has the advantage to support the organisation in making priorities, with potential economic consequences:

"Ten years ago our economic situation was bad. We had too few students and too many dropouts in the first year. There was a proliferation of courses, some 1500 different courses. We tried hard to reduce that number by 30 per cent, but the result was an *increase* with "only" a few per cent that year! This is another strength with CDIO. Now we are making it clear that the program is the starting-point, and program leadership is key in making priorities."

CDIO can be seen as a method to support implementation of the Pedagogical Idea, however, they are not fully compatible. For instance, the system for yearly quality assessment of educational programs was based on the Pedagogical Idea. CDIO self-evaluations are partly overlapping, and can thus be seen as an addition to the administrative work. Further, while the Pedagogical Idea was influenced by CDIO and the concepts are considered to be essentially compatible, there are still accommodations to be made:

"In CDIO there is Active Learning, but it is seen in a program perspective. The Pedagogical Idea has a student perspective, the Active Student. We had to merge these views."

Finally, we saw clear signs that the organisation has experienced so many attempts at reform, that there is a certain weariness, and a mistrust that new initiatives are seriously meant. People protect themselves, or the education, against unnecessary disruptions. The result is a dampening filter, affecting future attempts at reform:

"Some of the most engaged people hesitated over the Pedagogical Idea, unsure if the management would really go through with it. It was wait-and-see. They like the idea, they identify themselves as innovators, but they doubt it will be implemented. Some had burnt themselves on the Creative University. Many had invested heavily, both in terms of work and of open commitment. Then when it becomes a bad word, that hurts."

ANALYSIS AND DISCUSSION

Comparing the concepts

In the above, we have investigated the history leading to the eventual adoption of CDIO at LTU. Thus prepared, we will now compare the different reform concepts, the Arena concept, the Pedagogical Idea, and CDIO.

The alignment to the ways of working

The overall vision of CDIO has resonated with engineering faculty at LTU. Further, the CDIO approach is aligned with the present way education is organised at LTU. Hence, instead of implying a disruptive threat to the existence of programs like the Arena concept did, CDIO reinforces the current program structure without fundamentally challenging the disciplines (Edström & Kolmos, 2014). Nevertheless, when aiming to strengthen the programs, CDIO can also become a challenge to existing power bases, e.g. the central administration and its preference for standardisation, and individual faculty or research groups who feel ownership of a course. The Pedagogical Idea can here be seen as a combining or bridging concept, retaining some values of the "Creative university", e.g. the student perspective, while also aligning closely to the program perspective of CDIO, whose integrated curriculum promotes the development of personal, interpersonal and professional competence.

The models of intervention

The Creative University was largely created on the top management level and its implementation focused mainly on individual teachers. It could be argued that implementing the concept was a high-risk venture, as the university went *all in*, switching to a radically different model for organising education. Complexity was high, and so were demands on faculty and administration. This is in contrast to CDIO, starting as a pilot project involving only four programs whose participation was voluntary. Further, each program can select and prioritise what aspects it wants to develop, and everything can be customised, as CDIO is characterised by an open source approach. Both CDIO and the Pedagogical Idea take a more operative perspective, focusing on the programs and courses, and trying to strengthen meso-level structures such as program leadership and the educational development unit at the university.

The framework of the Pedagogical Idea does not stipulate a specific development. Instead, each educational program is asked to initially define its own specific objectives. However, this has created some uncertainty around program objectives and the link between the education and the professional practice. Within LTU's engineering program, this uncertainty of the Pedagogical Idea seems to have given the prescriptive and action-oriented methodology of CDIO considerable appeal.

The change strategies

The Creative University was implemented in what could be considered a top-down approach, conceived mainly on management levels and then communicated to departments and teachers. While there was certainly much enthusiasm, there was also resistance and conflict. In retrospect, it seems that the concept had vague relations between means and ends, and it

raised questions among the teachers. Although many questions were fully legitimate they could sometimes be interpreted as covert resistance, provoking persuasion rather than dialogue. This can be compared to the more emergent, guided and incremental implementations of both the Pedagogical Idea and CDIO.

The environment

LTU went its own way with the Creative University as it was developed in-house. We think this might be an expression of a young university in search for its own identity; LTU wanted to build something new and unique. But with the Arena concept, LTU had no obvious role models among other universities, and no clear proof-of-concept elsewhere. Our findings suggest that this created three obstacles: (1) it was difficult to imagine the vision and (2) even harder to know how to get there, and (3) it also weakened the internal legitimacy. It was also an important factor that the Arenas collided head-on with the deep-rooted tradition of how the educational programs were organised. The Pedagogical Idea was also developed in-house, but in addition to incorporating ideas and strengths emergent from the organisation, it drew on models and successful concepts in the environment. By the time that LTU joined CDIO, it was widely known in the engineering education community, and implementers included high-status organisations.

CONCLUSIONS

We will now venture an answer to our initial question, why it came that LTU joined CDIO in 2015, and not earlier. In 2003 when LTU representatives first encountered CDIO, the full attention of the university was on the Creative University, which challenged fundamentally the programme structure. As CDIO is an approach to strengthen the program, it did not immediately appear as useful. LTU made no serious evaluation of CDIO and there was no proposal to join. The Creative University aimed at the level of individual student learning, while CDIO has a strong program improvement perspective and therefore may have been seen as irrelevant.

Ten years later, there was an advocate in a leadership position, with a mandate to take initiatives in relation to educational reform. Also, CDIO had changed and was now a large community. In the light of the experience with the Creative University, and with the on-going implementation of Pedagogical Idea, some of the characteristics of CDIO appeared as particularly attractive. In this case, LTUs current pedagogical initiative builds on former reforms, but has gained strength and structure from the CDIO approach. As Sahlin and Wedlin (2008) conclude; "to imitate is not just to copy, but also to change and innovate".

The transmission of an initiative and how it is communicated, supported, and performed in another practice is identified as a critical aspect of the diffusion of innovations in higher education. The Creative University emerged from a group of 30 people, with support of the vice chancellor. Despite this fairly wide representation in the idea generation group, the implementation came to be seen as top-down. In contrast, the Pedagogical Idea and the CDIO approach build on faculty initiatives coordinated on the program level, which can be seen as a combination of top-down and bottom-up strategy.

After long periods of mainly internal development, the CDIO national and international community with access to networking with peers were seen as particularly attractive features. Here, mimetic isomorphism (DiMaggio & Powell, 1983) may have been a driving force. Also,

the CDIO vision resonated with the existing culture of LTU education, and the roadmap for implementation felt clear while not overly prescriptive. In Brunsson's (2009) words, CDIO now appeared as a "*simple, clear, and good reform idea*", and as a framework that is compatible with the current Pedagogical Idea.

To conclude, this paper may contribute towards a better understanding of the potential in combining development strategies, if they are aligned and mutually reinforcing, and united by a common vision. The LTU Pedagogical idea is an attempt to build on former concepts and build a university-embracing pedagogical initiative. CDIO served as inspiration, being perceived as a successful and legitimate educational improvement concept. The findings presented here may also have implications for CDIO as, besides engineering, the LTU case indicates a wider applicability of the CDIO approach.

Finally, we want to point out that a university clearly has a limited capacity for reform. The available attention and resources are easily flooded with interrupts such as evaluations, new policy deployment and national reforms. Thus, the remaining capacity for development that the university itself has discretion over should be used very wisely.

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