PATHWAY OF DEVELOPMENT IN CDIO AT KEMI-TORNIO UNIVERSITY OF APPLIED SCIENCES

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ABSTRACT

The goal of the paper is to study the development process of engineering education at a small HEI (higher education institution), Kemi-Tornio University of Applied Sciences (KTUAS), towards the standards of CDIO. The school is situated in the Digipolis Technology Park. The analyses of the operational environment of KTUAS show the significant role a university can take especially in the development on the innovation space and the knowledge space of a region.

Renewing and developing engineering education requires new pedagogical approaches. Based on other research done, it has become more evident that action-based learning and experimental elements should be studied to form the basis for developing the competences needed in working life. It is argued in this paper that the CDIO skills specified as part of the CDIO standards (Syllabus) can be developed through action based learning methods as well.

Action based and experimental engineering education requires well working learning facilities. Engineering school building was renovated during 2010 and 2011. The CDIO standard number 6 was taken into account in the renovation project. This paper presents some of the main changes in the physical learning environment. It also clarifies how the 6^{th} standard is understood at KTUAS. Traditional learning spaces (e.g. classrooms) and engineering workspaces (e.g. laboratories) are discussed.

Ways to promote CDIO and familiarize students, staff and stakeholders with CDIO is one important thing to consider. Education development work is often carried out by people who already work within education itself (e.g. teachers). Therefore, lots of people still do not know much about CDIO. It is self-evident that the educational context should be agreed on and properly understood by all. This paper shows how information on CDIO has been shared and published so far. Several channels can be used and special attention should be paid to social networks and other interactive media.

KEY WORDS

Education development, pedagogy, learning space, information sharing channel

INTRODUCTION

The operational environment of higher education organizations has faced continuous changes and transition phases during the last 20 years in Finland. The first major transition started when the educational system was renewed: the polytechnics were started during an experimental phase in 1992 and established in 1995. Their role was defined to take over the education of higher professional expertise. Thus, the role of the polytechnics was separated from that of the universities which were mainly responsible for scientific education and research. As a result of the new system, there were totally 30 polytechnics (later called universities of applied sciences) along with 20 universities. The second major transition started about 15 years later when the focus of the education policy was re-directed to cut down the number of HEIs. Several reasons such as smaller age groups and lowering birth rate produced the need for re-evaluation. Therefore, new and bigger organizations and consortiums have been, and still are, established. Today there are 25 polytechnics and 16 universities. This macro-level development has forced KTUAS to find new development paths as well.

KTUAS has been an active operator in developing the knowledge space and innovation space of its operational, geographical region to respond to the political expectations of various stakeholders. The importance of the education has been emphasized in the regional strategy 2003 – 2013 of the Ministry of Education in which it is stated that balanced economic growth needs to be supported by ensuring resources for education and research in different regions. In addition, the Ministry of Employment and Economy has defined that its aim is to ensure that the regions can operate efficiently in an open economy by improving the expertise of regions and by developing their own strengths. Engineering education in Finland has had a central role in economic development. After the depression at the beginning of the 1990s, the demand for labour force started to increase. In 1995, for instance, nine out of ten graduated engineers were immediately employed. The input in engineering education started to grow at the end of the 1990s when Finland invested strongly in ITC industry. This influenced the choices of KTUAS as well: new degree programs in information technology were started in 1995 and 2001. [1, 2, 3, 4]

To respond to the challenges of the transition phases and to improve its competitiveness, KTUAS has taken several actions throughout its existence. One of the most recent ones is a significant development project which was started in 2009 to improve the pedagogical operations and abilities of the organization and its staff. The main aim of the project was to renew the curriculum of each degree program to meet the standards of CDIO. In addition, an investment project of 10 million Euros was started to renew and renovate the infrastructure of KTUAS in 2010. Additionally, in 2008 KTUAS formed the Lapland University Consortium together with another northern university of applied sciences operating in Rovaniemi, and the University of Lapland.

This paper contains four aspects describing the pathway of KTUAS towards CDIO. Firstly, it introduces the operational environment of the university together with the expectations of the needs of the region. Secondly, it describes the pedagogical choices which form the background and basis for using action based methods in engineering education at KTUAS. Thirdly, it opens the connection between the changes made in the physical learning environment and fourthly, launches new views on how to promote CDIO and familiarize students and other stakeholders with CDIO.

THE ANALYSES OF THE OPERATIONAL ENVIRONMENT OF KTUAS

KTUAS is situated in Digipolis Technology Park which has its origins in 1986 when the first technology-based companies representing ICT were established. The Technology Park was founded due to the need to widen the local economic structure: process based industry started to need companies which were able to offer ICT services. The location of the park was to be in the neighbourhood of Kemi Institute of Technology – later Kemi-Tornio University of Applied Sciences – to enable links to higher education. [5]

The number of technology-based firms is about 40 today operating in six business sectors: industrial services, electronics, information technology, environmental technology, corporate and training services, and low-temperature and winter technology. The total of 500 employees are operating in the park organizations. 30 % of the firms are independent and locally owned, while 45 % are managed from other locations: 50 % are national, 33 % international, and 17 % regional. The locally owned firms are mainly micro firms. [6]

The establishment of the technology park is based on an agreement between the town of Kemi and Kemin Digipolis Oy, the organization taking care of the activities in the technology park. The agreement regulates the role of Digipolis Technology Park by setting goals for each line of action which are defined as follows: the development of a knowledge environment, the development of existing firms, promoting the setting up of new firms, communication, collaboration networks, internationalisation, and new openings. The technology park is a member of the Norhern Scandinavian network called Multipolis which is an entity comprised of 19 northern centres of expertise involving different areas of advanced technology. The network combines different “polis” centres in research co-operation, for instance.

The interviews conducted in the year 2008 revealed that a firm serving process industries collaborates with ICT firms in two cases. In one case the firms had a joint product development project; while in the other, a service firm purchased tailor-made software for its in-house use. About 85% of the firms have customers in Kemi-Tornio region, 70% elsewhere in the north of Finland, 10% abroad, and 7% in the Technology Park. With regard to research, applied research, and testing services, 33% of the firms co-operated with Kemi-Tornio University of Applied Sciences. 10% of the firms collaborate with other research centres or universities – mainly with the University of Oulu and VTT (Technical Research Centre in Finland) in Oulu. Kemin Digipolis Oy has started several activities and projects as an intermediary between firms, Technology Parks, universities, and research centres locally, regionally, in the north of Finland, and in the north of Sweden. The availability of new, skilled and highly educated personnel is an important part of the innovation system. This emphasizes the importance of the existence of KTUAS in the region. [5]

When analysing the development phases of the operational environment of KTUAS, it possesses features of a spiral innovation system which consists of different organizations representing different fields such as university, industry and government (Triple Helix). Building up the innovation space can proceed through three steps. The first step in a three stage process is the creation of ‘knowledge space’, or the regional innovation environment. The second step is the creation of a ‘consensus space’, a venue that brings together people with different organisational backgrounds and perspectives for the purpose of generating new strategies and ideas. The third step is the creation of an ‘innovation space’, a new organisational mechanism that attempts to realise the goals shaped in the consensus space. The development stages of Digipolis Technology Park have followed the three steps mainly. [7]

The development of the operational environment requires, on one hand, new locally owned firms and new business opportunities. On the other hand, building new firms requires qualified and skilful employees as well. The experiences of Digipolis Technology Park show that to ensure the continuity of development, the companies need to be locally owned. In 2009, the interviewed SME owners in Finland emphasized that the engineering graduates need to have, in addition to the skills in their substance, better skills in engineering, collaboration and communication, and internationalization. The same competences were considered important also locally when studying local technology-based companies and their expectations in the spring of 2009: the interviewed entrepreneurs commented that the graduates need to have good skills in project and team work, for instance. The economic structure in the region is changing. The region produces about 8 % of the GDP in Finland at the moment, new business operations are going to start in mining, metal processing, construction and transportation. Thus the need for new engineering graduates is growing due to the growth in technology-based business. The employment rate is expected to be 67 % in 2015 in the whole of Lapland (about 61 % in 2010). [7, 9, 10]

PEDAGOGICAL APPROACHES TO ACTION-BASED LEARNING

Learning is a joint process of the learner and the teacher. Action-based learning, on one hand, enables but, on the other hand, requires co-operation and collaboration between the participants of the learning process. Additionally, it is natural that action-based learning includes that the learner has an active role in the process. In this paper, action-based learning methods are defined to include all the methods that share the same features such as learning by doing, experiential elements, reflection, collaboration and co-operation between the participants of the learning environment. Therefore, the teaching methods that fit with the mentioned features are problem based learning, project based – or project oriented learning -, enquiry based learning and work-based learning, for instance. Ontologically learning can be seen as the creation of new knowledge and new practices in a social process. The learning event consists of cognitive, metacognitive and affective/motivational factors which all support the learning process and outcomes. Cognitive factors include the process of thinking and interpreting the knowledge and developing new understanding. Metacognition, on the other hand, contains understanding of the learning process in the individual level, learning to learn. Affective/motivational aspects have either positive or negative effect on the learning outcomes as well. Constructivist learning theory forms the basis for the present understanding of the learning process in action-based learning. The teacher's or instructor's role is to support the process and create the context, the learning environment, to enable that process. [17, 18, 19, 20]

The learning process consists of two processes. The external one takes place between the learner and the social, cultural or material environment and the internal psychological one includes cognitive and emotional aspects of the learner. Both these processes, internal and external, are in continuous interaction as well. In the internal process the learner acquires and elaborates information and processes it to form knowledge, skills and understanding or meaning of the content. Emotions and motivation regulate the internal process. In the external process the learning environment creates the framework and context for learning and the learner's sociality (see Illeris 2003). Relevant questions for grasping the learning process in all education are: 1. Who are the subjects of learning, how are they defined and located?, 2. Why do they learn and what makes them make the effort?, 3. What do they learn, what are the contents and outcomes of learning, 4. How do they learn and what are the key actions or processes of learning? [21, 22]

Reflection on action, meaning that we evaluate, think and describe our actions to develop understanding, is a focal element of action-based learning. It can be argued as well that reflection on action supports the development process of the individual and construction of knowledge. The lack of reflection hinders learning. Project based learning, or project oriented learning, is built on a project to find a solution to a problem, realistic or fictional. The output or result is typically a concrete artefact; students are expected to be initiative during the project time span. Problem based learning, on the other hand, is based on defining the learning goal – a problem to be solved. The problem is usually based on a reality phenomenon of the operational environment, society, working environment, and studying environment. The problem is specified by the leader, i.e. a teacher, directing and supervising the learning process. [23, 24, 25, 26]

Enquiry based learning approaches the role of the learner by paying attention more intensively to the learning activity as such – creating a problem is not relevant. The developers of enquiry based learning find that it can promote the learner's ability to use reflection and actively seek the new knowledge during the process. The purpose is to build up the learner's innate curiosity to investigate, understand and create a process of enquiry. Enquiry based learning can be seen as an umbrella utilizing the possibilities of other action and activity based learning methods:

case based learning, problem based learning, field study, and dissertations. The purpose is to courage students' imagination and creativity with varying teaching methods. [27]

Action-based learning methods, problem based learning for instance, can enhance students' intrinsic motivation to study, learn and create a learning environment which supports extrinsic motivation as well. According to some recent research, problem based learning can give students responsibility and control their own learning processes, which can have positive impact on students' motivation. Teachers ability to create and enable a motivating learning environment is relevant for utilizing the benefits of problem based learning. On the other hand, individual characteristics (prior knowledge and experience, for instance) are also relevant to the student's motivation and therefore have impact on the study results. [28]

Traditionally action-based learning methods and their benefits have been justified through Kolb's experiential learning cycle. Kolb's experiential learning cycle consists of four elements: concrete experience, reflective observation, abstract conceptualisation and active experimentation — all the elements form a continuous circle in which each element has an influence on the next one. An optional model for emphasizing the benefits of action-based learning can be found in Engeström's expansive learning model depicted below. [29]

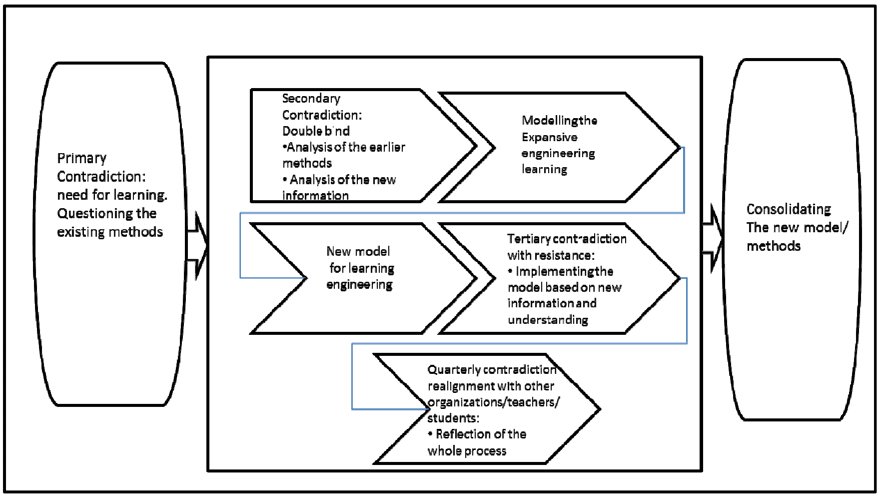

Fig. 1 Expansive engineering learning

In the expansive learning model (Figure 1), the whole process is based on the need to question the existing methods and models and double-binding the evaluation and analysis of the past with future actions. The purpose is to deepen the understanding of the present state by analysing one's history during the secondary contradiction. The process continues when the actor (teacher, student) begins the process of seeking out a new way to teach/learn the subject. Thereafter, the new model is implemented but with resistance as in all change processes. This resistance leads to re-evaluation of the model which will be developed further thereafter. The sixth phase is comprised of comparisons and discussions (realignment) with other actors (organizations, teachers, students) and reflection on the learning process as a whole. The entire learning event should be seen as a multidimensional process in which learning takes place horizontally and sideways and not only vertically, thus involving all the actors. Action-based methods are particularly effective in enabling the expansive learning process when the participating students are allowed to realign their understanding with fellow students in teamwork sessions.

LEARNING SPACE SOLUTIONS & CDIO STANDARD 6

The environment around us at school is definitely one major factor affecting learning itself [11]. Widely speaking, a learning environment can be seen as a context where learning takes place and it includes many distinct elements such as social, physical, psychological and pedagogical ones [12]. All of the elements must be taken care of in order to create an efficient learning space. This chapter concentrates on describing the changes in the physical learning environment at KTUAS 'Kosmos' building during the years 2010 and 2011. The changes especially in traditional learning facilities (e.g. classrooms) and engineering workspaces (e.g. laboratories) are discussed. The school building renovation lasted nearly two years. The whole building was modernized and partly enlarged. The renovated area was ~8500m^2 + ~1000m^2 new space. The main aim was to create learning spaces that students as well as staff want to go to and that are cozy and functional. The learning environment should generally help the learner to engage in self directed and co-operative learning activities, and physical spaces should support this [13].

It was decided at the early stage of the renovation that the CDIO standard number 6 should be understood and considered in the project. According to the standard, especially workspaces and laboratories supporting the learning of product and system building skills as well as social interaction should be carefully planned [14]. Another important solution was to combine some of the laboratories in the fields of electrical and mechanical engineering (e.g. machine automation and electrical automation). The aim was to create workspaces where the borders of engineering programs could gradually fade. It was seen that KTUAS as a small organization could quite easily move towards new directions in engineering education and the physical learning environment would have a key role in this movement. One of the results was that the laboratory of machine automation was placed in the middle of the electrical engineering workspaces. The purchase of laboratory equipment was planned and accomplished together. This was seen as a good way to promote collaboration between the programs. Comments and feedback as well as supplier meetings were carried out together.

Campus area and 'Kosmos'- building

The layout view of the Digipolis campus area is seen in Figure 2. The 'Digipolis' area includes several educational levels and buildings. Most of the education in the area is technical. Kosmos (Fig. 2.) is the main engineering school building while Compus and Louhi have a more supportive role in engineering education (e.g. laboratories and other workspaces). Lumikko is an administrative building and the rest of the buildings are used by the Vocational College Lappia.

Fig 2. Digipolis campus area and Kosmos building

The Kosmos building was renovated during the years 2010-2011. The layout views (old vs. new) of the building are seen in Figures 3 & 4. Fig. 3 shows the first floor and Fig. 4 the second floor respectively. The most remarkable changes such as location of the library (1), the main lobby (2), the entrances (3) and the department offices (4) can easily be seen. The school building used to be labyrinthine and difficult to use. There were lots of narrow corridors, the main lobby was small and the location of the library was isolated. There was a big outdoor garden in the middle of the school and possibilities for social interaction were not very good. When the most important public places (e.g. library, main lobby, restaurants) were combined with each other and moved to the center of the building the general atmosphere changed a lot. The school building became more open, lively and user-friendly. The outdoor garden does not exist any longer but it is not a big loss in a cold and snowy country like Finland. The daylight comes nowadays in through a wide glass roof above the library.

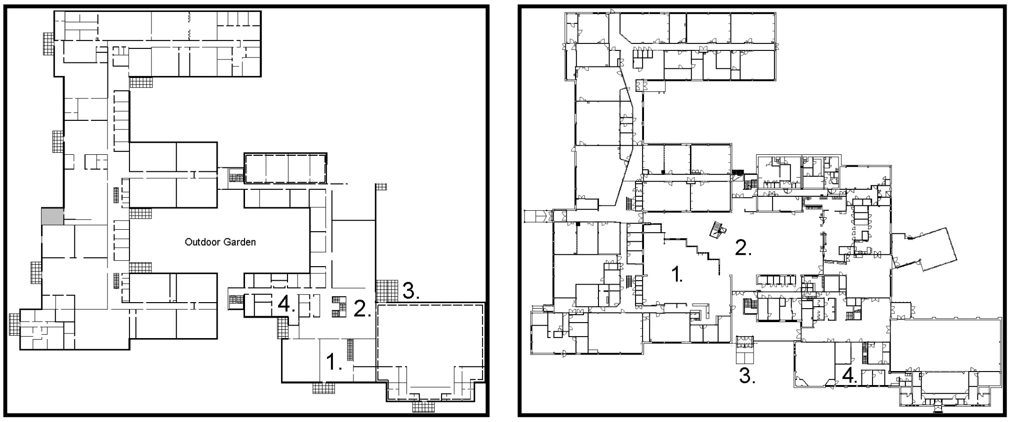

Fig 3. Kosmos building layout – The 1st. floor - Old vs. New

Fig 4. Kosmos building layout – The 2nd. floor - Old vs. New

Fig 5. Photos inside the school building

Learning spaces in renovated building

The traditional learning spaces (e.g. classrooms) are located on the first and second floors around the main lobby (2) in the middle of the building. Two elevators and several staircases connect the floors. Attention has been paid to disabled people (e.g. wheelchairs) moving around the building. The classrooms are easily accessible and distances between them are short. The restrooms are located near the classrooms and their number has increased. The water taps inside the classrooms should improve hand hygiene and speed up the daily classroom routines. The corridor names and classroom numbers are now more visual and easily understood.

Students normally carry a laptop. Therefore the number of AC power outlets was increased. The wireless network covers the whole building. The lighting system is based on motion detectors and the lights switch on or off automatically. Automation, among other things, saves energy. Classroom lighting is easily adjusted by a teacher (e.g. dimming). Most of the classrooms have two video projectors and projection screens. There is one dual screen PC on the teacher's desk but a laptop can also be used. Additionally, there is a document camera in the classroom. Some of the rooms are equipped with 'smart board' or movable whiteboards. Traditional black boards are in use, too. The air conditioning is based on carbon dioxide sensors.

The general opinion on the classrooms is good. The level of technology is now high enough for both students and teachers. The classrooms are student-friendly, flexible and can be used in many ways. Classroom reservation is based on a computer aided system that is managed by the department secretaries. Therefore, it is easy to maintain flexible and transparent week programs. If there are changes in week programs or if the classroom reservation suddenly changes, students get the information from the web or the information screens. Preliminary student feedback has been positive and they seem to be satisfied with the spaces. Figure 6 shows examples of typical classrooms.

Fig 6. Traditional learning spaces e.g. classrooms

Engineering workspaces (e.g. laboratories) are mainly used for teaching practical program specific engineering skills (= teaching laboratories). Research and development laboratories are located in the other part of the school building and are not normally used by the students or teachers. The amount of studies in the laboratories depends on the engineering program, the biggest user being the program of electrical engineering. A typical size of a group operating in the laboratory is between 12 to 20 students. New work spaces were planned so that they would fit for the groups and serve them well. Student work in the laboratories may be fully guided by the teacher or more free-form/independent. Therefore, it is important that the laboratories are easily available and working there is safe and easy to start. The most important laboratories in the building are listed in table 1. All the laboratories are renovated or new and will be equipped in the near future (equipment and furniture to be purchased during the years 2011,2012 & 2013).

Table 1
Main teaching laboratories in 'Kosmos' building
(EE = Electrical Engineering, **ME = Mechanical Engineering)*

LAB. NAME	MAINLY USED BY	SIZE [m^2]	EQUIPPED WITH
Electrical Lab. I	*Program of EE**	*~190 m^2*	*Electric motors and distribution*
Electrical Lab. II	*Program of EE*	*~142 m^2*	*Household electricity and distribution*
Water Lab.	*Program of EE*	*~116 m^2*	*Small scale water processes, cameras and web-based-control systems*
Control Tech. Lab	*Program of EE*	*~102 m^2*	*Control system development tools*
Electronics Lab.	*Program of EE*	*~94 m^2*	*Electronics production and testing equipment*
Product Development Lab.	*Program of EE*	*~94 m^2*	*Computers, CAD, simulation etc.*
Embedded Systems Lab.	*Program of EE*	*~74 m^2*	*Embedded systems development tools*
Machine Automation	*Program of ME***	*~66 m^2*	*Pneumatics, sensors and simulation*
Automation Lab.	*Program of EE*	*~55 m^2*	*Automation, PLCs and controls*
1151, 1152, 1153	*Program of ME & EE*	*~50 m^2*	*Hydraulics, pneumatics and renewable energy*

Table 1 shows that most of the laboratories are used by the electrical engineering program. The students of mechanical engineering mostly use laboratories in other buildings (e.g. material testing, machining, welding, production technologies, etc.). However, using spaces in a cross scientific manner has been widely discussed. The latest curricula also supports the idea. Therefore, laboratory equipment has been chosen so that it is possible to teach both mechanical and electrical engineering subjects by using the same tools. Widely speaking, it is considered more and more important to find and form links between the engineering programs. It has been argued that the world of engineering is becoming more and more cross scientific – Future engineers need good skills in social interaction and shared expertise [16]. It is really important that students can adapt to this new operating environment at the early stage. Figure 7 shows examples of typical laboratories.

Fig 7. Engineering workspaces e.g. laboratories

New spaces vs. CDIO standard 6

The evidence of CDIO standard 6 points out that the engineering workspaces should be equipped with modern engineering tools [14]. At KTUAS this is understood so that software, laboratory equipment and other supportive tools or hardware should be modern and work well. It is also important that the equipment has strong links with the curricula and it is really in use (not just showrooms). Students should be able to use the equipment by themselves, learn by doing and experience technical phenomena in action based manner. It is also important that teachers can use the equipment efficiently and are well aware of their working principles as well as pedagogical possibilities.

According to the standard, workspaces should also be student centered, user-friendly, accessible and interactive [14]. This is understood so that students must be able to use the equipment at least partly independently (without a teacher) and computer software (e.g. simulation, programming, data analysis, network drives) should be accessible to all. It is also important that laboratory spaces are quiet and peaceful in order to make it possible to work intensively on laboratory projects. Student groups working together in the same spaces encourage and stimulate students to learn from each other. It is always positive if younger students have possibilities to see what the older ones work on. Projects combining different fields of engineering (e.g. mechanical, electrical, industrial management) are preferred and hoped for. Social spaces for students are also important. Figure 8 shows some examples of social spaces located next to the laboratories.

The satisfaction with the engineering workspaces has not really been measured yet. It is important to collect feedback at least once a year. Informal feedback is given all the time. However, written feedback is considered more important and at KTUAS it will be collected later next semester. The feedback questionnaire should be drawn up so that it measures how workspaces support and encourage hands-on learning activities, disciplinary knowledge and social learning. The results will be used as part of the CDIO self evaluation process. The evaluation will be carried out together with other Finnish CDIO institutions/HEIs.

Fig 8. Social spaces for the students

COMMUNICATING CDIO PRINCIPLES TO OTHERS

It is important to consider the ways how to promote CDIO and familiarize students, staff and stakeholders with CDIO. Engineering education has mainly been developed by people who already work closely in the field of education or research (e.g. teachers and R&D staff). However, there are still lots of people who do not actually know much about CDIO. As mentioned earlier, CDIO is considered to be the context for engineering education at KTUAS. Therefore, it is important that information sharing channels work well and are accessible to all. The CDIO approach should be agreed on and properly understood by students, staff and stakeholders in order to create a vibrant cultural framework. At KTUAS CDIO related activities have been promoted, shared and published actively. So far, the scope of promotion has been in general information sharing. The following ways have been used to spread the CDIO message through the organization:

- Theme days at the school ('CDIO days')
- Student project presentations and competitions
- Roll-ups and posters
- Photographs and videos made by the students (examples below)
  (http://www.youtube.com/watch?v=yhOFOmkFtDU&context=C3dddea3ADOEgsToPDskI6doD2OHVNi_MCc3IYQH5m)
  (http://www.youtube.com/watch?v=9bkoo-JYBu0)
- Stories in local newspapers (about engineering education, CDIO, future trends, etc.)
- CDIO seminars, workshops & ideation (with and without the other CDIO HEIs)
- Courses and training for employees (pedagogy, collaborative learning, PBL, etc.)
- 'Coffee & discussion'- forums
- Internet/webpage/Facebook- updates and news
- Moodle- environment for document sharing (documents, reports, etc.)
- National benchmarking and visits to other HEIs

As shown above, several channels can and should be used in information sharing. Creating a positive and stimulating atmosphere around CDIO is important. It has been noted that networks and social media have remarkable effect among young people especially. Therefore, a special attention should be paid to interactive media. This paper introduces one example of reaching students especially but also younger people who do not study at the school yet. The selected media is a combination of ordinary webpage and Facebook timeline.

It is commonly known that Facebook is a social media platform connecting people with those who work, study and live around them. People use Facebook in many ways and most of the youngsters in Finland are registered to it. They use it to communicate with friends, share photos, links and videos etc. It is also known that organizations can make public profiles (pages) to Facebook to present themselves and share news and other information [15]. It is possible for page owners to connect with people, post updates, answer questions or receive feedback. People can "like" a page and easily get information from there. At KTUAS is was assumed that students, staff and stakeholders generally use Facebook and therefore it would be one of the most effective information sharing channels. At the beginning of 2012 it was also announced by Facebook that the timeline property could also be used on the pages starting from March 2012 [15]. The timeline was introduced by Facebook in September 2011. In the beginning it was for private users only but later it could be used on the pages as well. The timeline makes it possible to show events and highlights in chronological order. It is also possible to make pages visual and easily understandable for all.

At KTUAS the Facebook timeline was selected one of the information sharing channels. Users are guided to Facebook by using two ordinary web pages. The timeline itself shows the history and present day of CDIO at KTUAS. Figure 9 shows the web pages and links that are in use.

Fig 9. Information sharing on the Internet

As mentioned before, CDIO is considered the context for engineering education at KTUAS. Therefore, being active in the field of information sharing and communication is an important part of developing the skills and attitudes of faculty members as well as students and stakeholders. Releasing news, publishing project reports, success stories and other achievements of the students and staff will make it easier for people to understand what CDIO stands for. New innovations, project initiatives and public interest in what is happening at the school will help the whole organization to orientate in the CDIO state of mind. Good news will spread and build the confidence. Possibilities for participation, open communication and feedback sharing are good in social media and web based environments. As mentioned in the standards also, faculty and students should be able to articulate the CDIO principle – it is one way to prove that everybody understands the context properly [14].

CONCLUSIONS

The operational environment of higher education institutions (HEI) in Finland have faced changes and transition phases during the last 20 years. These changes have often challenged the HEIs to find new ways to operate or even survive. However, universities of applied sciences have had and still have an important role especially in regional development and in the field of education of higher professional expertise. KTUAS, for instance, has tried to respond to the challenges by improving its competitiveness, skills and attitudes. The history of CDIO at KTUAS is still less than 5 years. However, CDIO was recently selected the main context for engineering education. The path towards CDIO has been interesting and refreshing. The ideas behind it seem to fit well to the organization and many positive things have already happened.

The operational environment of KTUAS possesses features of a spiral innovation system. The higher education institution, together with industry and government, has possibilities to create innovations and new businesses. The system will also work as a platform for the CDIO type education producing skilled employees and engineers to the area. Several measures in developing pedagogy, learning methods, assessment etc. have already been taken. The learning facilities (e.g. classrooms, laboratories and social spaces) have been renovated as well. Over 10M€ was recently invested in the school building. Hopefully, these investments will help the organization on its path towards new kind of engineering education.

The new CDIO oriented curricula will be launched later this year. Therefore, it is important to consider the communication of CDIO principles. The new approach should be agreed on and properly understood by students, staff and stakeholders. Several communication channels have been used to spread the message through the organization. It has been noted that networks and the social media should be utilized in order to reach the young people efficiently. That is why the CDIO history and milestones of KTUAS were put onto Facebook Timeline. The timeline makes it possible to show events and highlights in chronological order. The pages are visual and easily understood. Hopefully, the timeline channel reaches students and newcomers and provides them the necessary facts on CDIO at KTUAS.

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