A New Master's Program in Technological Competence Management – Curriculum Design and Experiences on the First Implementation

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Abstract

Autumn 2008 Turku University of Applied Sciences started a new Master's program in Technological Competence Management. The curriculum and implementation model of the program were designed in close co-operation with the industry. The main objective of the program was set to develop especially technologically-oriented business knowledge, management and leadership skills of students that have already gained years of professional engineering experience. Furthermore, one goal is also to create a collaborative professional network between the students. The studies have been organized so that it is possible to complete them while working simultaneously. In this paper, the planning process of the degree program, the structure of the curriculum and the implementation model utilized with the first intake group are described. Moreover, experiences gathered during the first implementation are discussed, and initiatives to further improve the program are suggested.

Introduction

Autumn 2008 Turku University of Applied Sciences (TUAS) started a new Master's program, the Degree Program in Technological Competence Management. The initiative to start the program came from the representatives of the local industry. They indicated a strong need for a program tailored for such professional engineers (B.Eng. graduates) whose career path had led to positions in which they need new knowledge and skills e.g. in themes in Management and Industrial Economics.

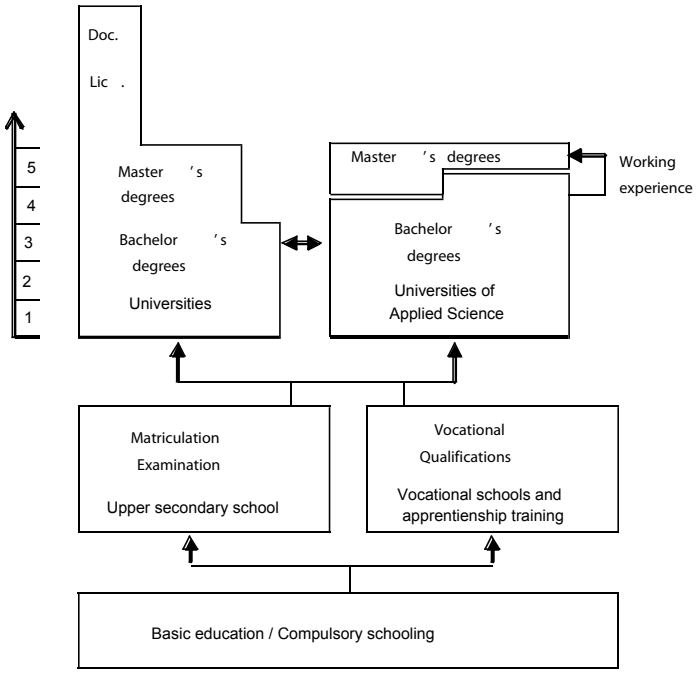
According to the dual model of the Finnish higher education system, the applicants were required to have a four years professionally oriented B.Eng. degree (240 ECTS credits (cr)) and, at least, three years of professional experience after graduation. The curriculum and implementation model of the program were designed in close co-operation with the industry. The main objective of the program was set to develop especially technologically-oriented business knowledge, management and leadership skills of students that have already gained years of professional engineering experience. The courses of the program shall give a broad understanding of the central topics of the field, whereas the thesis project shall provide an opportunity to focus on a special topic according to the student's individual interest.

In addition, the program should be implemented so that it allowed the student to continue working, at least part-time, even during their studies. Most other Master's programs in the local universities require, in practice, full-time studies which make it very difficult for many professionals to successfully complete further degree studies. Thus, the studies of this new program were organized so that it is possible to complete them while working simultaneously within two academic years (60 ECTS credits = one year of full time studies). Furthermore, a significant part of the learning assignments are integrated with the development needs of the students' employers.

The Education System of Finland & Turku University of Applied Sciences

To understand the context of the degree program from a correct perspective, it is necessary to briefly study the Finnish national education system (Figure 1).

Figure 1: The Finnish education system (simplified) [1]



The Finnish higher education system contains two parallel sectors: universities and universities of applied science (also called polytechnics). The universities focus on research and education based on research. They confer Bachelor's, Master's, Licentiate and Doctoral degrees. The universities of applied sciences are usually regional higher education institutions that provide instruction in subjects from several sectors, and which emphasize a connection with working life. The degrees they provide (Bachelor's and Master's degrees) are higher education degrees with a professional emphasis. [1]

A Bachelor's degree in Engineering in a university of applied science requires 4 years of full-time studies (240 ECTS credits (cr)). The requirement for entering an Engineering Master's program (60 cr) in a university of applied science is a B.Eng. degree or equivalent, plus a minimum of three years of work experience in the field concerned.

Turku University of Applied Sciences (former Turku Polytechnic) is a multidisciplinary university offering higher education in the fields of Technology and Transport, Health Care & Social Services, Arts and Media, Business & Administration, Hospitality Management, Natural Sciences, and Natural Resources & Environment. Currently, TUAS has 35 Bachelor's and 9 Master's degree programs. The total amount of students at TUAS is about 7,000 full-time students plus circa 1,500 students in continuing education.

TUAS has organized its operations in six faculties. The Master's degree program in Technological Competence Management is hosted by the Faculty of Telecommunication and e-Business and implemented in close co-operation with the Faculty of Technology, Environment and Business.

The Curriculum of the Degree Program

A graduate of the Degree Program in Technological Competence Management has a broad knowledge in her/his expertise area, and she/he understands the role and importance of her/his own work in the society. She/he is familiar

with the theoretical background of the field and is able to utilize and apply state-of-the-art methods, tools and scientific knowledge in her/his assignments. The graduate can analyze complex real-life problem settings with sound criticism and successfully define alternative solutions to them. She/he can proactively lead and innovate in the development of industrial processes and operations in a global environment.

The curriculum to reach these learning objectives consists of common Methodological studies (6 cr), advanced vocational studies (16 cr), optional vocational studies (8 cr) and a Master's Thesis (30 cr). The student can select from two alternative specialization modules, i.e. Product Development or Production Management. The detailed curriculum structure is described in Table 1.

Methodological Studies and Orientation (6 cr): The orientation in the beginning of the studies introduces to the content and practices of the program. The orientation also helps the students to find a common language for the team, develop study skills and to get started with the courses. The methodological studies provide tools for successful planning and implementation of the thesis project. Each student creates a portfolio during the studies. The role of the portfolio is to support development of the professional knowledge and skills, and to provide an opportunity for individual evaluation and reflection. During the learning process different goals are defined, analyzed, and evaluated. The portfolio will be assessed by the completion of the studies.

Communication, Leadership and Organization (8 cr): In modern organizations almost all work is done in close cooperation and interaction with other people. This module improves the students' ability to efficiently deal with daily collaborative situations, and to understand the different roles and flavors of management and leadership in organizations.

Industrial Business Processes (8 cr): The Bachelor's degree in Engineering provides good competences to analyze and solve technical problems. The challenges in many further positions of engineers require more knowledge in business processes, economical aspects and customer relations management. This module creates an overall insight to the technologically-oriented business environment. The students can focus in topics central in their own area of business and interests.

Product Development (8 cr), optional module: The success of product development and new product introduction processes plays a vital role in introduction and development of most business opportunities. Especially, in large international corporations an individual professional is typically responsible of a small detail in the chain. Thus, it is often a challenge to learn and understand how the different parts of the processes are coupled and operated. This module draws an overall picture of product development – from innovation to marketplace. Important themes are, for example, definition and implementation of technology strategy, standardization and industrial property rights, as well as product portfolio management.

Production Management (8 cr), optional module: Management and development of production operations in global environment requires a broad set of competences. Continuous strive towards new and innovative solutions, more and more efficient processes, as well as sustainable and creative team spirit is a challenge. This module provides views, for example, into modern production technologies and strategies, quality management, sourcing, and logistics.

Table 1: The curriculum (course list) of the Degree Program in Technological Competence Management [2]

Turku University of Applied Sciences
DEGREE PROGRAMME IN TECHNOLOGICAL COMPETENCE MANAGEMENT (MASTER OF ENGINEERING)
28.1.2008

CURRICULUM 2008-2010
DETAILED COURSE LIST

VOCATIONAL STUDIES							
Code		Course Name	Cr	A08	S09	A09	S10
Methodological studies							
11170001		Methodological studies and orientation	6				
	A	- Orientation		1			
	B	- Methodological studies			2		
	C	- Portfolio			1	1	1
Advanced vocational studies *							
11170002		Communication, leadership and organization	8				
	A	- Management and leadership		2			
	B	- Human resources development		2			
	C	- Strategy and change management		2			
	D	- Communication and negotiation skills			2		
11170003		Industrial Business Processes	8				
	A	- Business and profitability		2			
	B	- Process-driven operations		2			
	C	- Customer relations management and sales			2		
	D	- International business			2		
Optional vocational studies *							
11170004		Product development	8				
	A	- From innovation to marketplace			2		
	B	- Technology stategy				2	
	C	- Standardization and industrial property rights				2	
	D	- Product management				2	
11170005		Production management	8				
	A	- Management accounting			2		
	B	- Production information systems				2	
	C	- Production simulation and optimization				2	
	D	- Product data management				2	
		total	30	11	11	7	1

MASTER'S THESIS							
-		Master's Thesis	30				
	A	- Study and information acquisition plan		2			
	B	- Thesis seminar					2
	C	- Development assignment		2	4	8	12
		total	30	4	4	8	14
		Total	60	15	15	15	15

* Vocational studies can contain courses from other Master's degree programmes (shall be agreed in the personal study plan)

Master's Thesis (30 cr): A major part of the program is the Master's Thesis; a demanding real-life development assignment. The thesis project will enhance the student's professional competences, and serve the objectives of the stakeholders, too. High quality requirements shall be present throughout the process. During the definition phase of the thesis project the student writes an implementation plan including, for example, a competence and information acquisition plans. The main artifact to be evaluated and assessed at the end of the project is the thesis report that shall show a deep understanding of the problem setting, high-level analysis based on state-of-the-art scientific knowledge, as well as well documented and discussed results and conclusions. The thesis process is tutored and guided by an instructor and examiner from the university supported by the stakeholder's representative and a thesis seminar series.

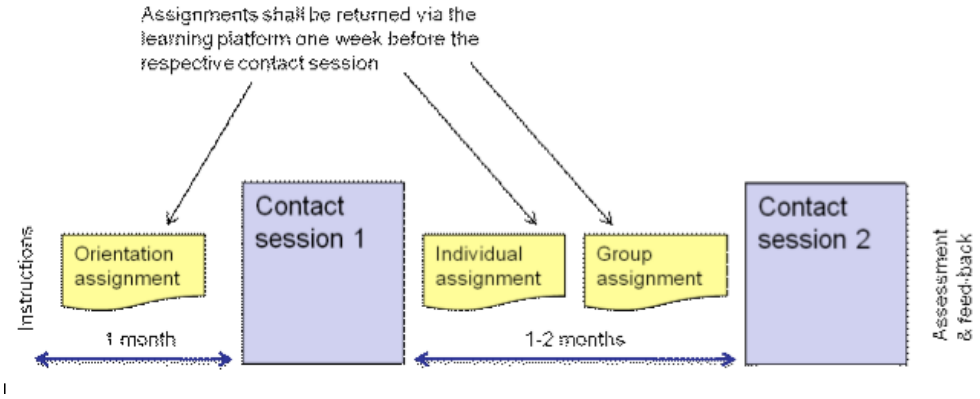
Implementation Model

In the beginning of the studies the students form small groups in which many of the learning activities will take place. Each group is supported by a tutor teacher during the entire span of the program. Each course module consists of a set of themes (see Table 1). Within these themes the students can focus on topics that support their personal interests and thesis projects. In addition to individual learning assignments, each group typically gets a common task per theme.

These tasks are fulfilled and reported jointly by the team members and the results are presented and discussed during the contact teaching sessions. There is a tight connection between the students, her/his employer and the program. Most of the learning assignments will be connected to the student's daily work and industrial experts will frequently join the program as visiting lecturers.

The studies are organized so that it is possible to complete them while working almost full-time simultaneously. Contact teaching is arranged as intensive periods, 2-3 full days per month. Typically, a theme of 2 cr (see Table 1) contains two contact teaching sessions (3 h + 3 h or 6 h + 3 h), usually a month between the sessions. Before the first session the students complete an orientation assignment, and between the sessions one or two larger learning assignments (the cycle is illustrated in Figure 2). Approx. 80 % of the student's learning activities are focused on the learning assignments.

Figure 2: Illustration of a typical learning cycle of a theme (see Table 1).

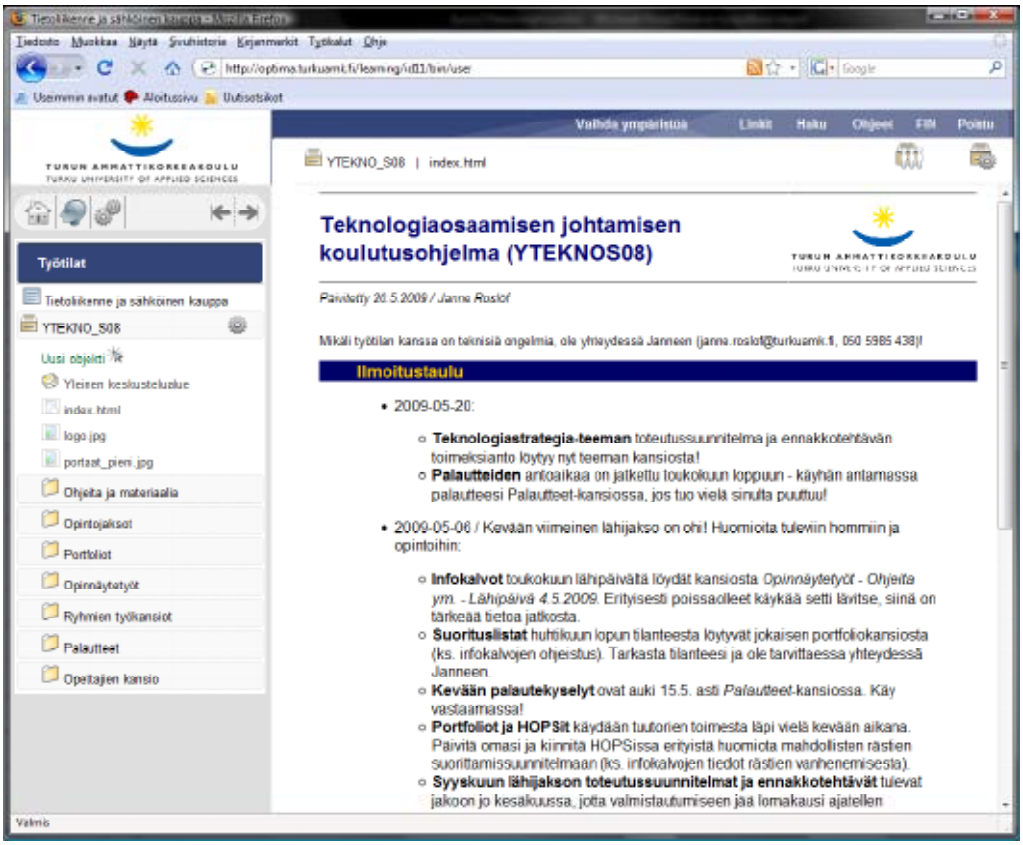


Team work and collaboration play a central role in the learning process. Moreover, one objective is to create such a network between the students that they can benefit from even outside the learning environment. The pedagogic framework for the program implementation is constructivist learning theory according to which the learning is an active, social process where learners should learn to discover principles, concepts and facts for themselves based on their earlier knowledge and skills. The instructors take more a facilitators' role in the learning process than the one of traditional class-room teachers'.

The student can plan the content of the studies individually. The thesis project topic is selected separately by each student, and the module themes contain many individually tailored assignments. It is also possible to include courses from other universities in the degree. These opportunities are discussed and set in the personal study plan that is updated regularly with the tutor.

An important tool in the daily operations is a virtual learning platform (built on a Discendum OPTIMA system [3]); see Figure 3. This portal serves a central point of information for both the students and teachers of the program. The portal contains general information folders, separate areas for each course and themes, learning portfolios, individual thesis project folders etc. The importance of this platform has been significant. As the students meet only during the intensive days and, moreover, most of the teachers come from different departments and enterprises, it is truly necessary to have a common information and collaboration platform.

Figure 3: A screen-shot of the program's learning platform.



Experiences on the first implementation

The first group started autumn 2008 with 34 students. The number of applicants was approximately twice the intake and the quality of the students was high; many applicants with good performance in the entrance examination were left outside. The most experienced student has almost 30 years of work experience before entering the programme; the average work experience was approx. 10 years (minimum entrance requirement was three years).
Also the motivation of the students has proven to be strong. – Although most of the students have made some type of working time arrangements with their employees, performing Master's studies while working simultaneously is a demanding task. After the first academic year there are only three dropouts. 2/3 of the students have completed each and every task so far, and the remaining 1/3 still have a varying amount of tasks pending. This ratio is higher than in most of the previous adult and continuous education groups of the faculty.

According to the first student feedback questionnaires, a great majority of the students have experienced the content of the courses useful despite the fact that many consider the past year been rather heavy. The studies contain a large amount of different learning assignments that require continuous and disciplined work.

The following group will start their studies in autumn 2010. The experiences from the first implementation suggest that no major changes in the core curriculum are needed. The learning objectives and course contents are rather well in place. However, it could be useful to merge some of the themes together to form somewhat larger entities (e.g. 3-5 cr each). This would decrease the number of lecturers a bit and allow more flexibility in the learning assignments. Moreover, it might be beneficial to have two months between the contact teaching sessions of a theme (currently only one month; in practice three weeks). This system would allow more degrees of freedom to the students when planning their study schedule (group learning meetings etc.) and enable a more robust implementation. That is, each learning assignment would have more flexibility, for example, in case of sickness, necessary business trips etc.

Discussion

In this paper, the structure of the curriculum and the implementation model of the new professional Master's (Engineering) program in Technological Competence Development were described. Moreover, the experiences gathered during the first implementation were discussed, and initiatives to further improve the program suggested.

According to the experiences and feed-back from lecturers, students and industry, the program curriculum and the implementation model have been successful. In addition, the requirement to have working experience prior entering the program seems to play an important role, too. The discussions with the students are fruitful, their motivation to learn is clearly high and many can apply their new knowledge and skills immediately in the daily work. In addition to the formal learning objectives of the program, the students are actively exchanging their experiences and thus expanding their professional network even outside the classroom.

References

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