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Working life based curriculum development and working life co-operation in Finnish engineering education

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ABSTRACT: This article is based on recent national development projects in Finnish higher education in the construction branch and the author's long-term experience in directing those projects. Finnish higher education institutions have been required by the Ministry of Education and Culture to increase their engagement with *working life* to ensure that study programmes meet the requirements of industry, and because of ineffective teaching performance [1]. Improving the co-operation between working life and educational institutions will improve graduates' opportunities for gaining employment by ensuring the compatibility between education and the needs of working life [2]. Working life-based study consists of study content development, working life influence and anticipation of future practices. It will ensure that real working competencies are developed by students and will improve employment [3]. Finnish higher education institutions have autonomy concerning their study programmes, study contents, and learning environment and practices. Co-operation with working life is mentioned in most institutions' strategies, but its realisation is varied [1].

Keywords: Life-long learning, *working life*, study programmes, development projects, industry requirements

INTRODUCTION

Universities of applied sciences have to meet their responsibilities in co-operation with local industry, *working life*, business and with Finnish and foreign educational institutions [1]. Working life-based curriculum development and working life co-operation in engineering education can be realised in many ways.

The Act of Parliament for universities of applied sciences allows institutions to have advisory councils with industrial members, and those councils can evaluate and provide guidelines for study programmes. The advisory council normally deals with the aims and content of study programmes [4]. Development of a single study programme can occur in co-operation with national professional bodies, something which is normally done with several institutions, for example building construction study programmes.

The development of a study programme can be done in co-operation with a single company in some cases, and that company will provide the knowledge of common or new working practices. Ideas for curriculum development can originate from the company or an institution. The extent of co-operation can vary between cases.

Companies can participate in project-based study projects by providing an actual problem from the company, and by participating in the study process and by evaluating the results. Problem-based learning (PBL) can be used in various requirement levels at different stages of the studies. Study courses can be combined into larger modules, where a company can be a partner in teaching or a participant in the problem-solving process. Demanding and advanced PBL cases can lead to bigger projects or thesis work.

An important form of co-operation in engineering education is practical training through placements in companies. The training can be provided through target oriented study courses or through work experience. Target oriented training is an obligatory part of the studies, and it provides the students with an opportunity to apply and test their knowledge and skills in practice.

One traditional practice is for teachers to undertake a period of *practical training* in a company to update their professional skills. The knowledge transfer can be to or from a company. This is often based on a teacher's personal relationship with the company. Lectures by visiting company staff can also enable them to pass on their experience of prevalent working practices, problems and challenges in that work and often also their special expertise in those areas.

CO-OPERATIVE STUDY COURSE DEVELOPMENT

The requirements of working life change all the time, and new jobs and new professions can appear. Universities of applied sciences are obliged to play an active role in taking notice of working life requirements [1]. Study programme development can be done in co-operation with a single company.
Professional skills consist of workers' competence and professional qualifications. Professional qualifications define the level and content of a profession [3]. The company will provide the expertise and knowledge of common or new work practices to achieve necessary qualifications. Ideas for curriculum development often comes from institutions, based on recognised needs of industry.

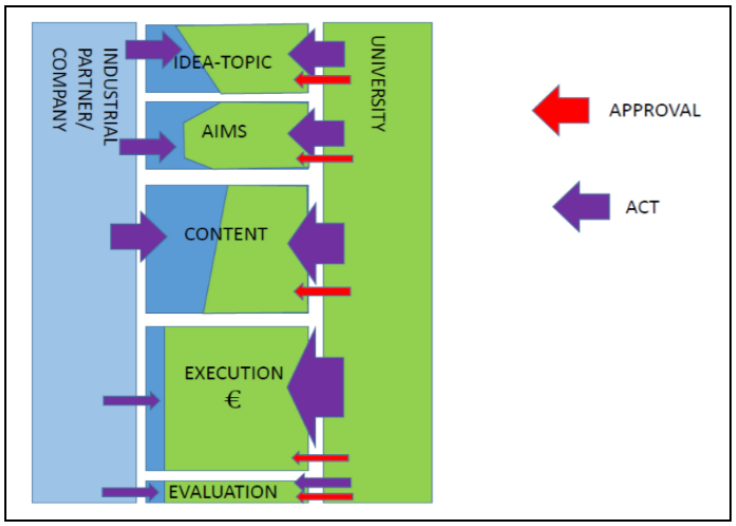

Figure 1: Development and content.

The necessity for course development comes from institutions, which do not have adequate expertise in that specific area. The main idea, aims and content are created in co-operation with the company. The role of the company is similar to being a consultant who brings targets and expertise into that course planning process. During the execution process, the company provides advice on content and on the basis for professional evaluation. The university buys services from the company and establishes the course as a part of non-obligatory studies. Executing the courses often requires professional training for staff. This model is used in the construction study programme in the building modelling course.

The realisation of this model begins by searching for a partner, one with the will and capability to co-operate. The first step is to focus on the aims and targets, so that they meet pre-set objectives. The company consults the institution in creating the content and action plan. During the execution, the company advises the university when needed. In the evaluation phase the company assists the university in study result evaluation as an expert.

STUDY COURSE DEVELOPMENT AND EXECUTION

Learning within higher education institutions is often built on theoretical studies and is focussed on the conceptual level. Working life, however, emphasises more practical tools and practical skills [5].

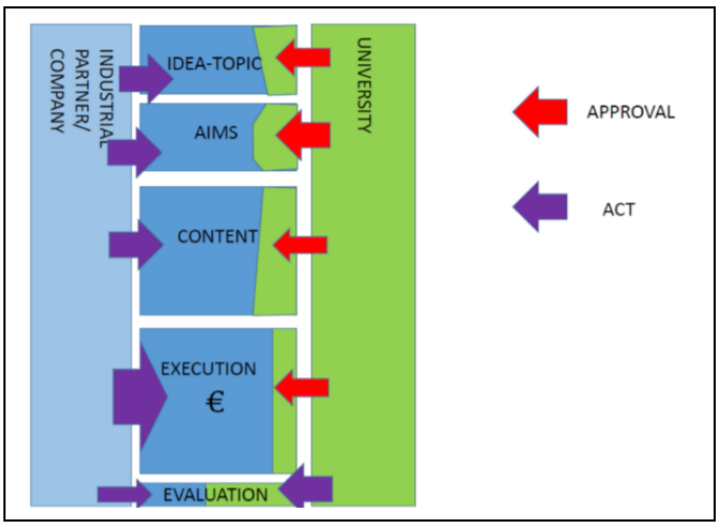

Figure 2: Development, content and execution.

When an initiative for a study course appears from a single company, study course development can be done in co-operation with that single company. The company will provide the content for that course and the knowledge of common or new working practices. The institution will scrutinise the course plan as a whole, based on common institutional requirements, such as aims, the level of knowledge, the work load and students having an equal chance to participate in that course.

The idea of the study course comes from the company based on the company's needs (professional qualifications). The purpose of the company is to get talented students to become trainees in that company in order to be tested for permanent employment. The company prepares the aims, targets and content for that course, and the university of applied sciences grades the course and accepts that course into the curriculum.

Student selection will be done by the company in co-operation with the institution. Students will come from many universities of applied sciences. All resources and other costs will be the responsibility of the company. The institution's personnel have a consultative role, and they will support students in their study. The course grade will be recorded by the institution, based on advice from the company. The student will normally get a work placement and thesis project after successful completion of the course. The relationship, in many cases, can lead to a work contract between the company and the student. This model has been carried out for many years through arrangements between one major construction company and seven institutions, and the process could also be adopted by other companies. The number of students is limited [6].

PROBLEM-BASED STUDY PROJECTS

In problem-based learning, the core of the learning is a real, existing problem. The teacher's role is like a tutor [7]. Companies can participate in project-based study projects by giving a real problem from the company, participating in the study process and by evaluating the results. PBL learning can be used at various requirement levels in different stages of the studies. Study courses can be combined into bigger modules, where a company can be a partner in teaching in the problem-solving process. Demanding and advanced PBL cases can lead to bigger projects or thesis work.

X-LAB gathers students from different fields of study and creates multidisciplinary teams that develop a concept and create a demo. Project ideas come from multiple industries, such as health and well-being, the environmental field and tourism.

In 2016, the Oulu University of Applied Sciences has started to realise the model for PBL learning with several companies. In that model, study courses have been created by the institution, evaluated by the companies and finalised together. The role of the company at the beginning is as an advisor, and later as a mentor for students. Mentoring is the process of empowering individuals by helping them capitalise on their personal strengths, giving them the support and guidance to challenge themselves and take risks, and helping them to find an appropriate and rewarding career path [8]. In the first phase of X-LAB, students develop concepts and learn about business, marketing, and new techniques for prototyping and creating demos. The next phase is dedicated to developing demos and refining the skills of each individual in his or her chosen role in the team. Teams work in an entrepreneurial-like mode and are supported by a group of coaches and tutors [9].

The PBL process consists of problem definition, problem analysing, gathering the information, searching the completing information, problem solutions and solution evaluating [10].

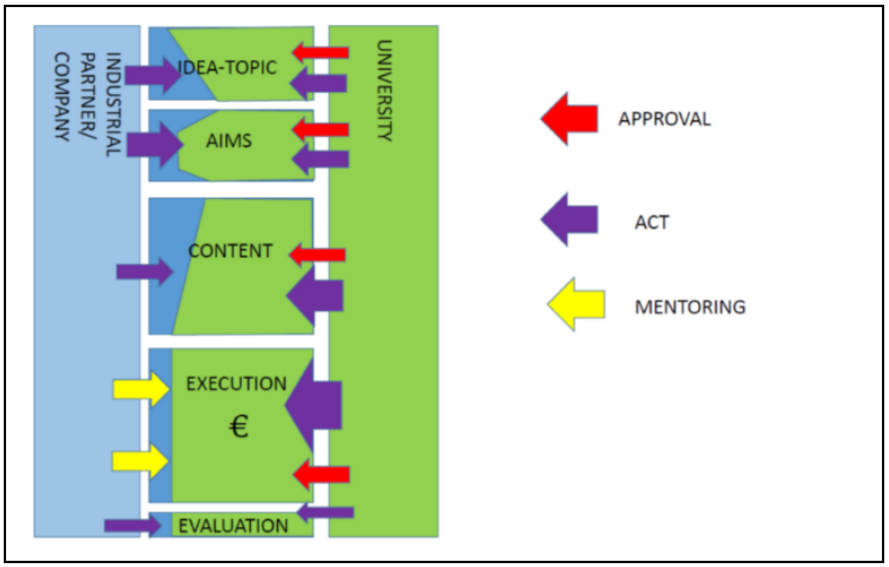

Figure 3: LAB-model.

In the X-LAB model, the topic of the course has been defined by the institution. The institution and students go to enterprises to find real problems for their development projects. During the development process the company will mentor students until the second elimination. In the next phase, the problem will be resolved and the demo will be finished. All immaterial product rights (IPR) will be owned by the institution, and these rights can be sold to interested bodies. In this model, there are no financial transactions between companies and the institution.

PRACTICAL STUDIES WITHIN COMPANIES

On-the-job learning is an essential part of vocational education. It is a one practice to arrange learning, and it is a study method where certain parts of the study content will be learnt in the working place [11]. Learning can be target-oriented study courses or just gaining work experience. Target oriented learning is an obligatory part of the studies, and it will give students an opportunity to apply and test their knowledge and skills in practice**.**

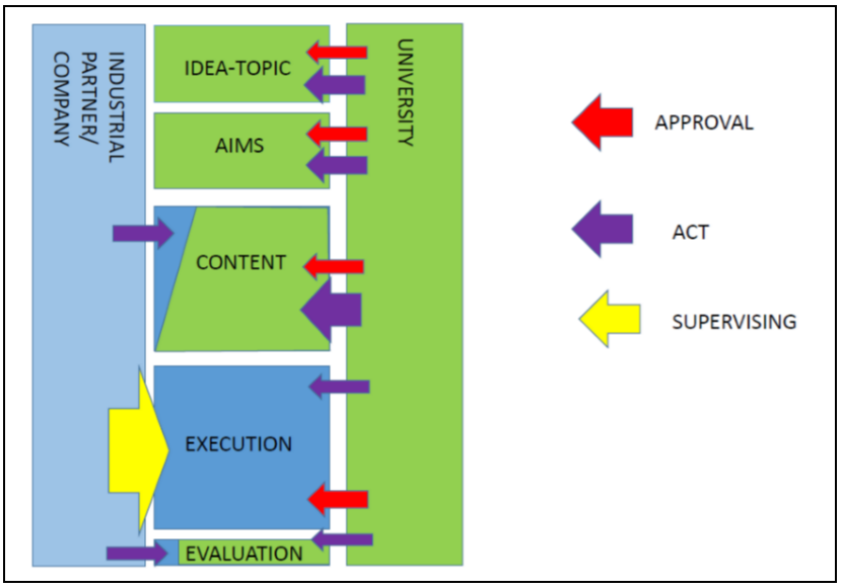

Figure 4: Studies in practice.

On-the-job learning is based on experimental learning, where students reflect on their praxis to understand phenomena and to create better conceptual understanding [12]. The idea, aims and content of the study course have been defined by the university of applied science. The detailed content and tasks will be agreed on with the company in the three party contract. The representative of the company will supervise and monitor the students during the study course. The study report will be assessed by the institution.

CONCLUSIONS

The realisation of working life co-operation in Finland is quite dispersed because of the autonomy and the insufficient co-operation between the universities, and the extent of co-operation can vary in different cases.

From the institution’s point of view, the co-operation with working life does not have a real goal, and it is often not connected to studies. Co-operation is too often dependent on personal relationships and it can also be a managerial problem for the institutions. Working life co-operation could be a systematic tool for the institutions to use, to respond to working life requirements, and it will provide industry with a quite strong influential position in engineering education.

Co-operation between companies and institutions is an efficient tool for updating the curriculum, teaching content and teaching methods.

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BIOGRAPHY

Mr Antero Stenius is a principal lecturer (construction technology) and a team manager (construction management) at Oulu University of Applied Sciences. Mr Stenius was born in Northern Finland on 10 June 1958. He graduated with an MSc in construction sciences from Oulu University in 1984 and a postgraduate degree LisSc in technology management from Oulu University in 2013. He has also a degree of the Vocational Teacher Qualification received in 1995, a higher degree of the Vocational Teacher Qualification received in 2009 and the Specialised Vocational Qualification in Management (Education) received in 2011. At the beginning of his professional career, he served as a production engineer and a project engineer in a Finnish construction company YIT in Finland and in the Soviet Union between 1983 and1989. Before commencing his university engagement, he worked as a development manager in YIT Northern Finland between 1989 and1991. At Oulu University of Applied Sciences, Mr Stenius worked as a Senior Lecturer, a Degree programme director and the Head of Department in the years 1991-2006. In the years 2007-2009 he worked as a Business Development Director in the Russian construction company YIT Uralstroi, the sub-company of the Finnish construction company YIT, in Jekaterinburg, in Western Siberia. Since 2009, he has been working as a Principal Teacher and from 2016 as a Team Manager in the construction management group at the University. In his career at the university, Mr Stenius has held such engagements as a course director or as a teacher in more than ten European Multinational Intensive Programmes in various European countries. He has been an active partner in many national educational development projects in engineering education and was a vice-chairman of the National Evaluation Board of Higher Education (construction) in 2001.