OPTIMIZING THE PROJECT BASED STUDENT PATHS IN HELSINKI METROPOLIA UAS

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ABSTRACT

The engineering degree programmes in Helsinki Metropolia University of Applied Sciences are currently going through a fundamental change. The old degree programmes are being merged and the new curricula are being designed for the students starting their studies in autumn 2014. The total number of almost 20 engineering degree programmes is decreased to 7. The studies in the different degree programmes will be given in 15 ECTS credit study modules each organized in one study period of 10 calendar weeks thus making it possible for the students to combine these study modules from different programmes. Most of these study modules are finally organized and assessed as one single 15 ECTS credit course and the teaching is based on project based learning and collaborative teaching. The study paths in the different programmes are combined since many of the old degree programmes did have same contents and from now on the study modules covering same topics are shared between the programmes. In order to realize this, the contents and the timing of the study modules have to be carefully designed in order to take into account all the prerequisites as well as other special needs of the degree programmes. Integrating the different topics to one large entity of 15 ECTS credits to be assessed and focusing on project based collaborative learning is as well a fundamental change for the teaching staff.

KEYWORDS

Project based learning, Collaborative teaching, Integration of studies, Standards: 3, 4, 5, 7, 8

BACKGROUND AND THE STRUCTURE OF THE CURRICULUM

The number of engineering degree programmes in Helsinki Metropolia University of Applied Sciences is decreased in 2014 and therefore many of the old degree programmes are merged and different majors or other study modules are combined in the new curricula to be launched in August 2014. Thus all the curricula were totally renovated in spring 2014. In this process as well the funding issues had to be taken into account. The total funding of the university is decreasing significantly and the funding is now based mainly on the number of graduates and as well the number of students making more than 55 ECTS credits a year (total number of credits organized each year is 60). The number of graduates has been increasing but only 40% of the engineering students make the required number of credits a year. Thus there is a huge pressure to improve that figure. The main reason for the poor result is that the studies are organized in small courses of mainly 3 ECTS credits only and if the students fail two of these courses a year, the goal is not reached. The bottleneck courses

are usually the courses in mathematics and physics during the first two years of study. Our task now is to integrate these courses to professional courses and focus on active teaching and continuous assessment throughout the larger integrated courses and study modules.

Therefore it has been decided that the studies in all the engineering degree programmes are organized in study modules of 15 ECTS credits, each lasting one study period of 10 calendar weeks. All of these study modules have professional learning outcomes and the basic studies (maths, physics, etc.) are integrated to the professional courses to support the professional studies. Most of the 15 credit study modules are as well assessed as one entity and as well organized by a larger group of academic teaching staff.

Each year of study then consists of 4 study modules (thus 60 credits a year for each student). Usually the first year of study is common to all the students in a new merged degree programme and after the first year the students then select their specialization/major. The studies of the second year are then common to all the students studying the specific major. During the last two years the students may rather freely select the studies based on their own interests etc. During these two years they have to complete as well two periods of practical training (altogether 20 calendar weeks / 30 ECTS credits) and their final year thesis project.

In each of the degree programmes the studies of the first year have to cover at least the introduction to engineering part and the first design-build project in order to fulfill the CDIO standards. The CDIO capstone project is organized during the third year of study, but most of the programmes organize as well other similar projects throughout the studies.

INTEGRATION OF STUDIES

In most of the engineering degree programmes all the basic studies are to be integrated to the professional studies. In practice it means that the learning outcomes of the study modules are defined as professional competences and the basic studies are to support the professional studies in this respect. However, it has to be guaranteed that the students have sufficient knowledge in mathematics and physics to support their further studies. In some cases the mathematics and physics courses are assessed separately, but in most cases they are integrated to the larger 15 ECTS courses. For example in the degree programme in Electrical Engineering and Automation Technology the total amount of these studies during the first year is one third of the total, but all of these topics are within these larger courses mainly evaluated by the professional assessment criteria.

The minimum requirements of mathematics and physics were defined in 2012 in a large common project in order to define the outlines of the new engineering curricula. These definitions were taken into account in designing the first year study modules, but the actual way of integration is to be defined by the academic staff delivering the courses. In most cases the total amount of hours in mathematics and physics is significantly higher than the minimum requirement. In Electrical Engineering and Automation Technology the first year contents in these studies is 100% larger.

Besides these studies there is as well a strong emphasis on soft skills throughout the studies. These skills include communication skills, language studies, project management etc. and they are as well integrated to the larger entities. In practice it means that in most of the courses there will be a large number of teaching staff including professional teachers,

mathematics and physics lecturers as well as teachers of communication skills and languages.

PROJECT BASED LEARNING AND COLLABORATIVE PEDAGOGY

The management board of the university decided in 2013 that the pedagogy throughout the university is based on project based learning (Capraro et al. 2013) and collaborative teaching and learning (Barkley et al. 2005). The initiative came from the pedagogical management team of the university. That team benchmarked five universities in Denmark and United Kingdom in 2012 and 2013 (Aalborg University, University College Copenhagen, University College London, Queen Mary University and Sheffield Hallam University). For example the drop-out rate in University College Copenhagen was decreased significantly after focusing on project based learning and integrating the fundamental studies to engineering studies (Friesel 2010).

In practice it means that all of the studies will be organized by a larger group of teachers with different backgrounds. These teachers will finally themselves plan and schedule the courses and define all the resources needed. The preliminary planning phase of the course realization takes place during the previous semester and the first courses based on this new model to be launched in August 2014 were planned in spring 2014. The teachers plan the actual contents in detail, share the teaching hours and define the learning assignments as well as the assessment. The main focus is on continuous assessment as well as active learning. Each course is divided into smaller tasks for the students that have to be fulfilled with a given schedule and the teachers have follow the students completing these assignments and give feedback to the students and assess their behavior throughout the course. Instead of large end exams the assessment is based on these smaller tasks making it sure that the students are active throughout the course thus maximizing the number of students passing each course.

Some of the courses may be organized as a single project course in which the student focus on the given project task only. Such a course is for example the CDIO capstone project (the Metropolia innovation project in the curricula) in the third year of study. In most cases the projects are smaller sections within each course. For example the first year CDIO project (Crawley et al. 2007) is integrated to other studies within a professional course in which there are as well other methods of teaching and learning including lectures, laboratory assignments etc. In most courses there still is one project to bind the different topics together. Some courses are as well based on problem based learning (PBL) in which the PBL cycles (Amador et al. 2006) are designed based on the learning outcomes of the course. In each of these methods the key thing is that the teachers integrate the course topics together, organize the courses through continuous assessment and active learning.

OPTIMIZING THE STUDY PATHS

In the new degree program structure many of the old degree programmes were merged and many of the new programmes have same specialization fields, topics and study modules. Such common topics are for example the modules in embedded programming as well as healthcare technology in the degree programmes of Electrical Engineering (in the Electronics major) and Information Technology and the modules in mechatronics in the degree programmes in Electrical Engineering (in the automation major) and Mechanical Engineering.

The contents of the common modules have been defined in cooperation between the degree programmes. It has as well been decided that the students in all the engineering programmes may select a minor of 30 ECTS credits from basically any Metropolia degree programme (definitely there are certain limitations based on the prerequisites etc.). Therefore the timing of the study modules is to be done very carefully to be able to offer these optional study modules as well as the common packages to all the students involved.

In theory it has been possible for the students to select studies from different programmes as well in the earlier curricula, but in practice the selection of smaller course packages from other degree programmes taken the schedule limitations into account has been at least very difficult if not totally impossible. Now that the courses are given in study modules lasting one 10 week period it is much more feasible, since in the new structure there will be periods reserved for such an activity. Definitely the students may select as well optional studies within their own degree programme if they want to focus more deeply in their own field instead of broadening their view by selecting something relatively different. Depending their own modular selections within their own field of specialization and the timing of their industrial placement and the CDIO capstone project, they will finally have multiple choices of orientation and they may rather freely design then timing of their third and fourth year of study.

The very much simplified modular student path structure of some degree programmes is shown in Figure 1.

The students apply to the new degree programmes and the first year of study is common to all students in the degree programme. In Figure 1 you may see the first year of the students in the degree programmes of Electrical Engineering and Automation Technology and Information Technology (tuition in Finnish) as well as the degree programme in Electronics which is organized totally in English (different application procedure). The first year (60 ECTS) as well as all the remaining years is divided to four study modules. After the first year of study the students in the degree programme in Electrical Engineering and Automation Technology select their specialization/major. The students may freely choose from three options: electrical power engineering, automation and electronics. The study modules of the second year are defined by this selection.

After the second year all the students plan their study path for the two remaining years. They have to complete two modules of practical training in the industry, the CDIO capstone project module, the final year thesis project as well as four study modules of which at least two must be from their own field of specialization and two may be optional study modules basically from any degree programme. These two modules will then be combined as a minor in the study record of the student. The actual study modules of the last two years will be organized once a year on a rather random timing and then the student may rather freely plan his studies based on the study module selection and add the required internships and capstone project module to the remaining slots.

It may be seen in the Figure that the study paths of the electronics students both in the English and the Finnish programmes are combined after the second year of study and after that all the electronics studies are given in English. It may be as well seen that the degree programmes in Mechanical Engineering and Electrical Engineering have common modules (in mechatronics). Similar co-operation between degree programmes is done for example between Electrical Engineering and HVAC Engineering in the field of electrical installations

and between Electrical Engineering and Information Technology in the fields of embedded programming and analog electronics.

The programme in Information Technology organizes a specialization/major of healthcare technology. That specialization is offered besides to the students in the ICT programme as well to students studying electronics in the Electrical Engineering programme. The electronics students may join the healthcare technology path after their second year of study.
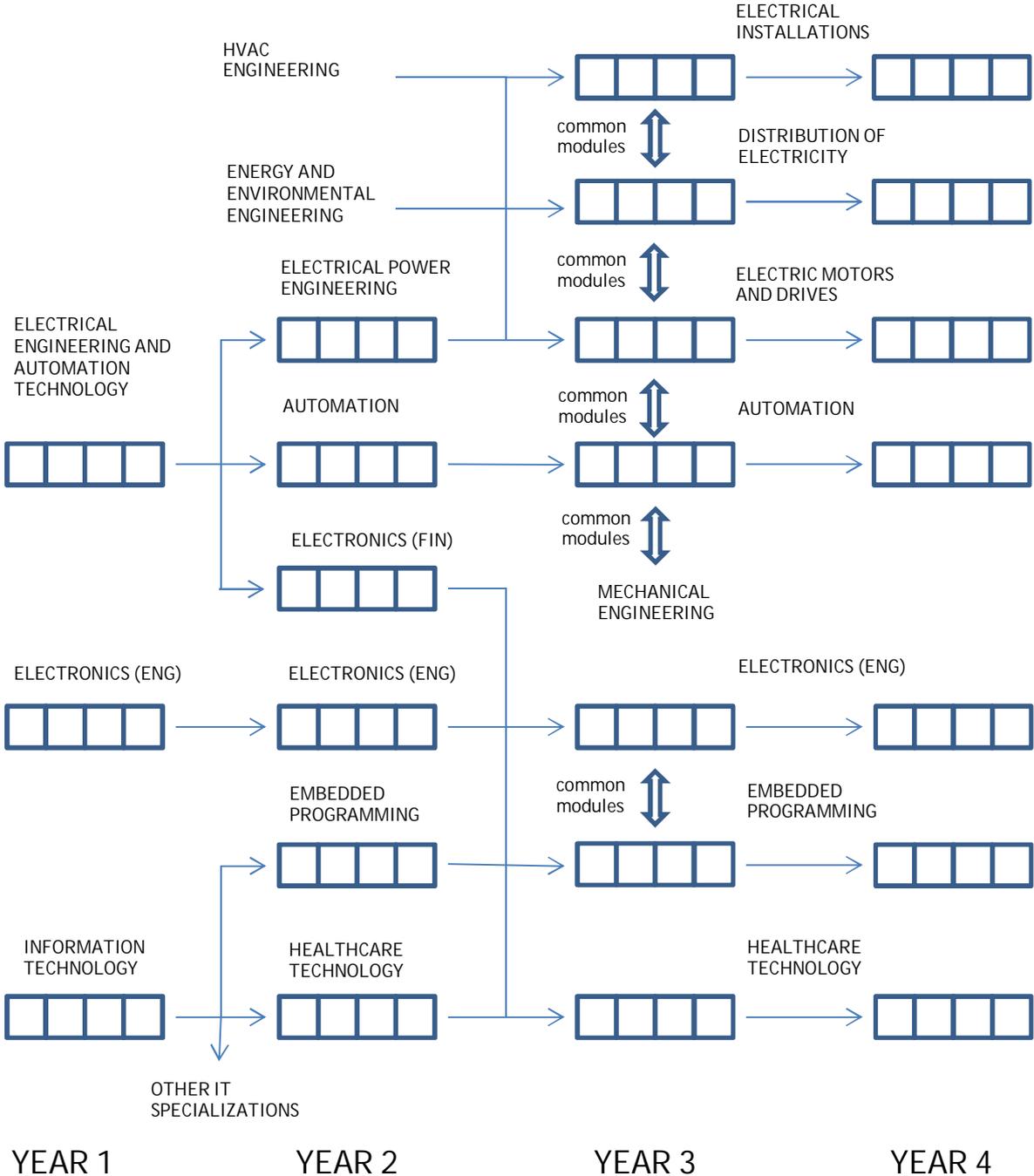

Figure 1. The possible study paths of the students studying in the degree programme in Electrical Engineering and Automation Technology.

Figure 1 shows only a small section of combined student paths for engineering students in Helsinki Metropolia UAS. Similar co-operation is done between most of the engineering degree programmes.

CONCLUSION AND FUTURE ACTIONS

The curriculum design work was completed in March 2014. The curricular structure in all the engineering degree programmes is based on the 15 credit study modules and in most of the programmes these modules consist of one single 15 credit course based on course integration. Some programmes still divide the modules to smaller entities to be assessed independently, but they are as well integrating the courses within a module through common project works etc. The practical means of integration, methods used in collaborative learning as well as the evaluation methods in the courses may vary in the different engineering degree programmes. These practical issues were solved and the detailed course planning was completed in April - May 2014.

The implementation of this approach will be monitored in detail during and after the first semester (autumn 2014). This monitor will include both student and staff satisfaction surveys as well as comparison of feedback and student performance data to previous years. One of the key future actions is as well to compare the different detailed methods of evaluation, course planning etc. in the different programmes.

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BIOGRAPHICAL INFORMATION

Heikki Valmu is the dean of the degree programmes in electrical engineering and business in Helsinki University of Applied Sciences. He is responsible of the pedagogical issues and student affairs management in 9 different degree programmes in these areas. His teaching activies are mainly related to different fields in electronics engineering.

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