

PART-TIME ENGINEERING MASTER PROGRAMS UTILIZE JOB ASSIGNMENTS OR PROFESSIONAL CHALLENGES AS MEANS OF LEARNING

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ABSTRACT

On the job learning, work based learning, problem based learning, phenomenon-based learning, learning on demand and many other approaches have been introduced in connection with higher education. How can we apply this knowledge within a continuing education and lifelong learning context which leads to academic degrees? This paper describes part-time Master programs with a curriculum that allows adult learners to bring work challenges or assignments into their Master's studies.

Keywords Part-time Master's programs, Professional Challenges, Adult Learners

INTRODUCTION

Adult learners, such as engineers working at companies or governmental agencies, have already gained a wealth of practical experience that can be expanded and aspire to learn more to contribute to the innovation capacity of the organisation at which they work. For the university, the flow of academic expertise gained from research is accelerated into practical application. With these continuing educational programs, they are satisfying their knowledge valorisation efforts and are ensuring access to resources and real-life cases. The main benefits for companies are a head start on fellow companies, motivated and sustainable deployable employees [1] and a structural link with a research community.

RESEARCH APPROACH

The research approach in this study is basically a review of diverse part-time master programmes in Finland and Denmark. In each country, one exemplary case has been selected to further describe format, process and procedures of applying real-life work challenges in a learning context. In Finland, at Metropolia University of Applied Sciences, the Master's programme of electrical engineering and automation, and in Denmark at Aalborg University the part-time master of Information and Communication Technologies (MICT) programme has been selected as the subject context for this investigation.

The literature review is expanded by empirical data that consists of job assignments or work challenges, which are compiled among the adult learners, demonstrating their ability to identify authentic problem within their everyday professional work and applying it as means for learning through their part-time master programme.

CASE: PART-TIME MASTER AT METROPOLIA UNIVERSITY OF APPLIED SCIENCES, FINLAND

Metropolia University of Applied Sciences is offering several masters programmes in the area of technology. All of them are based on 4-year bachelor degree, 240 ECTS (European credit transfer system) points and after that in minimum 3 years professionally relevant experience from working life. When the potential students are applying to the programme, they need to produce a document, which explains how they are planning to benefit the studies; what the connection is to their work and what kind of challenge they need to solve in their thesis work. The whole programme is 60 ECTS points. That is equivalent to a year as full time studies. The recommend study time as part time student is

one and half years, but it can be extended with an extra year.

In Finland, all the studies aiming at degrees are free from tuition fees for European students. Based on that, the admission needs to be very carefully evaluated to make sure that all the students have a realistic view and high motivation for the studies as the available number of seats is very limited. To support the management of one's studies and avoid drop-outs, a Gantt-chart form plan for the whole programme is made in the beginning of the studies. It is even suggested that the chart should be accepted by the student's close relationships.

This example is about the master's programme of electrical engineering and automation. In the course, there are around 25 students from different companies. Some of the students are researchers, some work in sales, some in quality management or general management etc. The age of the students is varying between 32 and 64 years. Some of the students are working in very small companies, some in medium size companies and some in global concerns. Additionally, there are students from hospitals, ministries and schools (teachers).

In the programme, half of the studies are courses (30 ECTS) and the other half thesis work. See figure 1.

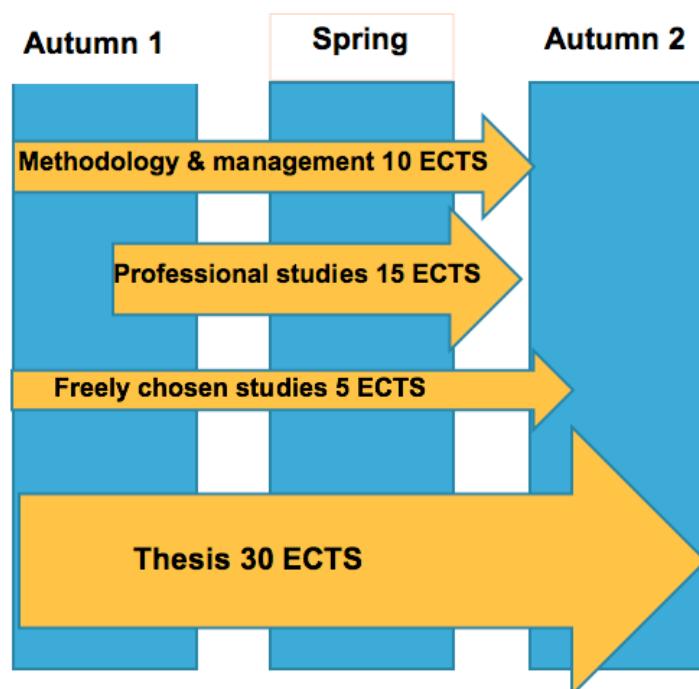


Figure 1. The structure of the master's programme of Electrical engineering and automation in Metropolia University of Applied Sciences

As the subject for the thesis work is already planned in the application phase, it means all the studies can be chosen and adapted so that they advance the needed competences of the student. In practise, that means that in the course called “research methodology”, the student already conducts literature searches from the right content and search engines. In the course of “developing as a manager”, the students can learn from each other how to be an employee, or a team leader or department manager. As in the course, there are students from so many very different backgrounds and different expectations, the studies can be organised very much based in discussion. This diversity enables in most of the courses finding new ways of thinking, benchmarking opportunities and possibilities inventing development areas.

The Academic Engineers and Architects in Finland made a survey 2016 about the needs of competences in the current work as an engineer. The target group of the survey was the engineers who already has a Master’s degree and are born in the year 1963, 1973 and 1983. The results for the question “How important you consider these skills, competences and attitudes in connection to your present work position?” are shown in the figure 5 [3]. This shows that there are so many areas of competences that are not usually covered in bachelor’s programmes and thus, were continuous development is needed in different age and position. That diversity of needs gives the option of benefitting the flexibility of the university opportunities in the offer of master’s programme.

The students of the master’s programme create a close group while they are studying. They are cross-sparring each other’s works and thus supporting each other. The diverse age and position enables excellent results in learning from each other. This is an effective way to build professional networks, which will then continue after graduation as alumni activities

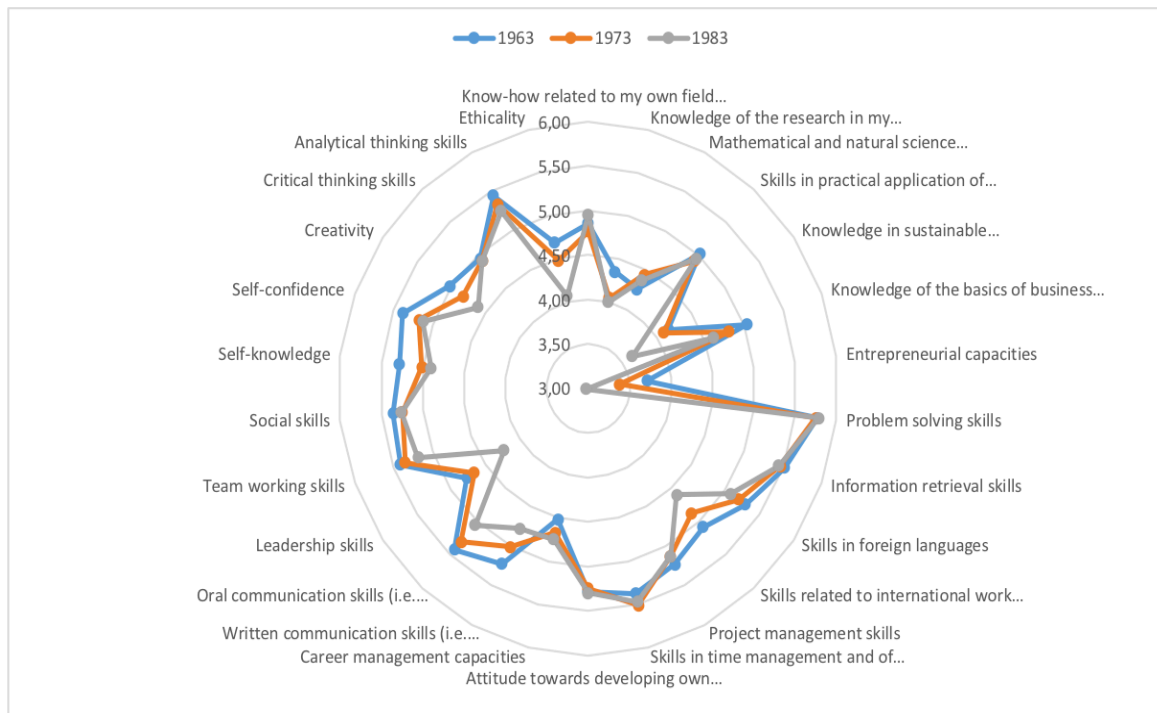


Figure 2. Importance of knowledge, skills and competencies when working with master of Science in Engineering. Diversity by the engineers born in 3 different years. [3]

During the programme, each of the students has four coaches from the university side additionally to the coach from the company. The programme leader and coordinator are regularly following up the advancement of the students. The 1st thesis coach visits the company and makes sure the tasks are understood in both ends in the same way.

The role of the company coach is to define the needs of the company; however, the needs are turned to research questions jointly with the company, student and thesis coach.

Furthermore, the 2nd thesis coach validates the evaluation and supports the 1st coach.

This close contact between company and university creates many additional benefits for all the parties. Teachers learn to know the companies, their products, processes and strategies meanwhile effective technology transfer from the university reaches the company. Furthermore, these activities strengthen the base for future cooperation - the colleagues of the student might apply for the next programme or some innovation projects for the students in Bachelor's programmes might be established. Even larger development projects have been initiated through these connections.

The studies are adopting the CDIO-approach (Conceive - Design - Implement - Operate) [2], this means that the students are supposed to first conceive the challenges by analysing their situation until the root causes are defined. After that, they need to design different options for solutions. Implementation of the chosen solution will be followed by study of

the added value of the change or new product. Furthermore, in operation phase the solution should be analysed and evaluated until the recycling or next steps of the change. In this way, the whole lifecycle of the executed work is included.

CASE: PART-TIME MASTER AT AALBORG UNIVERSITY, DENMARK

Aalborg University offers a wide range of Part-time Master's programs for employed adults within an extensive spectrum of academic fields. In 2016, a total of 2.225 fee-paying students were enrolled in Part-time programmes among which more than 60% were social science students and only 10% were engineering students [2]. The Part-time Master is not to be mistaken for the traditional Master of Science (MSc.) programmes, which according to the Bologna process [4] is a 2-year study (120 ECTS) following a bachelor degree 3-year study (180 ECTS). The Part-time Master programs are specially prepared to meet the need of employees who lack competence development within a specific identified area. Admission to the master programme in ICT (MICT) presupposes a relevant higher education at least at bachelor level and at least 2 years of relevant professional experience pursuant to the completion of a qualifying Bachelor of Engineering graduation. The Part-time Masters are aligned with Aalborg Universities' pedagogical approach problem-based learning (PBL) [5] which means that more than half of the study-time (35 ECTS) is dedicated to solving real-life problems. These problems are often identified within the adult learners' workplace.

The mICT is an international Part-time Master's program at Aalborg University designed for employed learners who work in the ICT industry and want to keep their job while they are participating in a Master's program. The curriculum is carefully put together to be attractive and exciting for both the ICT engineer and the ICT business professionals. The aim of mICT is to integrate students' knowledge of technology, users and markets to educate ICT professionals with both deep and broad competencies. The courses/seminars are mainly held in the evening and during weekends.

The cross-disciplinary profile addresses the growing need for ICT professionals who can combine knowledge from different areas:

- Internet, Communication and Broadcast Technologies and Converging Media
- Services and Platforms
- Development of User-friendly Applications, Solutions and Services
- Business Development and Business Models
- Security, Trust, Privacy; Legal and Ethical Aspects
- Organisational aspects of ICT

The programme is provided in three trimesters, where a trimester in the full-time (one year) version of the education is equivalent to four months, in the part time (two years) version is equivalent to eight months and in the part time (three years) version is equivalent to one year. The programme covers 3 main areas:

- Networks and services
- Design and users
- Market and regulation

1ST TRIMESTER	2ND TRIMESTER	3RD TRIMESTER
Theme: mICT-MII: Organizations and innovations mICT-ISP: Services and Platforms mICT-CIS: <i>Pending</i>	Theme: mICT –MII: Service Design mICT-ISP: Application Development mICT-CIS: <i>Pending</i>	Theme: Master's thesis
Work load: Courses: 10 ECTS* Project: 10 ECTS Total: 20 ECTS	Work load: Courses: 10 ECTS Project: 10 ECTS Total: 20 ECTS	Work load: Courses: 5 ECTS Master's project: 15 ECTS Total: 20 ECTS

Figure 3. Overall structure of the mICT programme [6]

The mICT programme is taught via extensive use of IT-supported distance education tools such as interactive courses with web-based support, platforms for group collaboration, Moodle and other support. However, at the seminars courses are taught face-to-face and teachers are facilitating learners project-work as well as learners are encouraged to engage in dialogues with fellow participants (peer-learning).

As the pedagogical approach is problem-based Learning (PBL), an internationally recognised method of active learning through problem solving. Key components also include

- Flexible knowledge
- Self-directed learning
- Intrinsic motivation
- Collaborative skills

More than half the programme content is project work (35 ECTS) and the other half is courses. This extensive amount of resources dedicated to project work allows the learners to in depth to identify, analyse and solve real-life problems, which might have been identified within the workplace of the learner or in collaboration with management or even problems of strategic relevance of the company. From a learning perspective, the context of the problem has to be as authentic as possible and if the context is the learners' workplace – the criteria for relevance must fulfilled

For each semester, a theme (or subject) is selected as the overall context area for the Master projects. This means the learners have to identify challenges or work assignment which matches this context. The Master project is performed individually or in small groups of a maximum of three members. At least one internal supervisor is assigned, who works with the primary subject within his/her research. Moreover, additional supervisors e.g. from industry can be involved in the project.

From the literature review of master programmes, two examples of research question identified by learners which has been applied into their Master's studies.

'How can a mobile app be designed to facilitate on site Grundfos OEM circulator pump re-placement, utilizing the soft configurability found in a modern pump platform?' [7]

'What implementation of idea management system would best support the fuzzy front end of the innovation process, while also driving employee engagement and participation in the innovation process?' [8]

The examples above are both inspired by the adult students' workplace and work tasks, which means they are research questions, real problems identified in the workplace, whose answers are not only relevant for the outcome of the adult learners' thesis but also for the employer.

CONCLUSIONS

Concluding these descriptions of part-time master's education show that is an excellent opportunity for adult learners to upgrade their degree from bachelor to master level, and that give meaning in their everyday working-life when challenges and job assignments can be integrated into learning. High motivation for continuous development, real employer commitment and close personal relationships are much needed as schedules are tight and the challenge is in prioritising all the activities.

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