LAPPEENRANTA UNIVERSITY OF TECHNOLOGY
Department of Electrical Engineering

BENCHMARKING PROJECT OF THE DEPARTMENT OF ELECTRICAL ENGINEERING OF LAPPEENRANTA UNIVERSITY OF TECHNOLOGY

MASTER'S THESIS

The topic of the thesis has been confirmed by the Department Council of the Department of Electrical Engineering on 11th September, 2006.

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ABSTRACT

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Benchmarking project of the Department of Electrical Engineering of Lappeenranta University of Technology

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At Lappeenranta University of Technology (LUT) the degree programme in Electrical Engineering EE adopted the two-cycle degree structure as a response to the Bologna Declaration and the new Universities Act on 1 August 2005. Along with the curriculum reform the Dept. of EE decided to secure the quality of EE degrees and to improve mobility of students and research staff.

The quality of the EE degrees at LUT is assessed and verified in a benchmarking (BM) project that gathers information on some European universities that offer M.Sc. and D.Sc. degrees in electrical engineering. This Master's thesis addresses the planning and implementing of the third step of the BM project. The thesis starts from some typical benchmarking methods; next, the ones assessed the best, such as the questionnaires and matrices, are selected as the tools in the BM project. The gathered information is analyzed with the help of the developed tools. The study also introduces some methods by which the staff of the Dept. of EE can proced in the search of the best practices.

TIIVISTELMÄ

Lappeerannan teknillinen yliopisto

Sähkötekniikan osasto

Hanna Niiranen

Lappeenrannan teknillisen yliopiston sähkötekniikan osaston benchmark-projekti

Diplomityö

2006

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Tekniikan tohtori Jussi Salo

Hakusanat: benchmarking, sähkötekniikan koulutuksen laatu, arviointi, sähkötekniikan opintosuunnitelma, web-pohjaiset kyselyt

Lappeenrannan teknillisen korkeakoulun sähkötekniikan osasto muutti 1.8.2005 sähkötekniikan tutkinnon kaksiportaiseksi ja vastaamaan näin Bolognan prosessia ja nykyistä Suomen yliopistolainsäädäntöä. Tutkinnonuudistuksen myötä osasto haluaa varmistaa sähkötekniikan tutkintojen laadun ja vertailtavuuden sekä parantaa opiskelijoiden sekä henkilökunnan liikkuvuutta.

Tutkintojen laatu ja vertailtavuus osoitetaan sähkötekniikan osaston benchmark-projektilla, jossa kerätään tietoja maisteri- ja tohtorintutkintoa tarjoavista eurooppalaisista yliopistoista. Diplomityö käsittää BM-projektin kolmannen vaiheen suunnittelun ja toteutuksen sekä sisältää teoriaa benchmark-projekteille tyypillisistä toimintatavoista. Hyväksi havaittuja menetelmiä, kuten kyselyitä ja matriiseja, on työssä käytetty soveltuvin osin sähkötekniikan osaston BM-projektin työkaluina. Näiden työkalujen avulla diplomityössä analysoidaan BM-kumppaneilta kerättyjä tietoja sekä esitetään ratkaisuja, kuinka sähkötekniikan osastolla voidaan vastedes jatkaa parhaiden toimintatapojen etsintää.

PREFACE

This thesis is a part of a BM project conducted in the Department of Electrical Engineering of at Lappeenranta University of Technology. The BM project started in year 2004, and hopefully continues also after this thesis with the existing and future partner universities. The accomplishment of the project requires support from the department's staff but also interest to analyze deeper the found results and adjust the educational processes towards better practices. This thesis is only a start the rest will depend on the reader.

While writing the Thesis and analyzing the results I have encountered various scenes. New places and people; I owe my warmest thanks to all of you! From fall 2005, I want to remember the atmosphere and all the people working and studying at the Department of Electrical Engineering in LUT, and of course the "kiltahuone". Spring 2006 brought new people and a new place to stay: Alcoy, Spain. Thanks to Belgians for their support and the encouraging "You can do it!" sentences. In summer 2006 a new period in life started in Helsinki with a challenging new job but also with the good old friends. It was great to hear the same encouragement also in Finnish: "Kyllä sinä siihen pystyt!". But first of all, I am very grateful to my family and parents from the support and long distance messages full of strength and proposals for new ideas for the writing process.

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ABBREVIATIONS

ACU	Association of Commonwealth Universities
AUQA	Australian Universities Quality Agency
BM	Benchmarking
B.Sc.	Bachelor of Science
CHEMS	Commonwealth Higher Education Management Service
CREST	Creative strategy thinking
Dept.	Department
Dipl. Eng.	Diploma Engineer
D.Sc.	Doctor of Science
ECTS	European Credit Transfer System
EE	Electrical Engineering
ENQA	European Network for Quality Assurance in Higher Education
FINHEEC	Finnish Evaluation Council of the Institutes of Higher Education
HE	Higher Education
KKA	Korkeakoulujen arviointineuvosto
KTH	Royal Institute of Technology
LUT	Lappeenranta University of Technology
M.Sc.	Master of Science
NACUBO	National Association of College and University Business Officers
PDF	Portable Document Format (TM of Adobe Corporation)
Ph.D.	Doctor of Philosophy
Tech.	Technology
TUL	Technical University of Lodz
TUM	Technical University of München
UCBL	Université Claude Bernard Lyon 1
UNESCO-CEPES	European Centre for Higher Education

1 INTRODUCTION

In Lappeenranta University of Technology (LUT), the degree programme in Electrical Engineering was developed as a response to the Bologna Declaration and the new Universities Act; the new two-cycle degree structure of a three-year Bachelor's degree and two-year Master's degree was adopted on 1 August 2005. The European Union and the Bologna Process are the basis of the development of the higher education and research in Europe. Finland is a part of this process, and therefore the Finnish universities have now to be able to compete for the best students and research resources available in Europe. The new situation raised questions in the Department of Electrical Engineering at LUT about the quality of education and congruence between the European degree programmes in electrical engineering. The functions, education and research of the Department of Electrical Engineering have to be competitive and comparative to the other degree programmes in electrical engineering in other European universities. At LUT, the degrees in electrical engineering at, bachelor, master and doctoral-level have to be recognized and comparable to similar degrees in other European universities.

The aim, the avowed education, is accomplished with the help of the Department's education and research quality assurance system. Information about the unit's educational and research processes is required for ensuring the quality. Therefore, the Department has to analyze with suitable European partner universities the basic elements of quality in the HE (Higher Education). This analysis is perceived as benchmarking and includes a closer comparison of the key educational processes between selected partner universities. This thesis is written as a part of the BM project (Benchmarking-project) between the Electrical Engineering departments of these partner universities.

1.1 Background of the benchmarking project

The benchmarking project officially started on 27 April 2004 when the new BM group held its first meeting. The group consists of the Head of the Department, Professor Juha Pyrhönen, Deputy Head of the Department, Professor Jarmo Partanen and D.Sc. (Tech) Jussi Salo, who was at that time responsible for the development of education and tutoring at the Department. In the first meeting, the benchmarking project of the Department of Electrical Engineering was sketched. The team saw that preparation work was necessary to be able to define the objectives and methods of implementation. After the meeting, technical student of technology and study advisor Hanna Niiranen was invited as the constructor of the BM project.

Before writing this Master's thesis and starting the final benchmarking project between the units of electrical engineering LUT (Lappeenranta University of Technology), TUL (Technical University of Lodz) and UCLB (Université Claude Bernard Lyon 1), a general comparison had been made between the degrees in electrical engineering in Europe. The ultimate purpose of the benchmarking with the European universities was to maintain and improve the quality of education provided at the Department of Electrical Engineering of LUT according to the Bologna Declaration. The benchmarking project covers only the Bachelor's and Master's degree programmes in electrical engineering. The progress of the BM project starting from the general comparison to closer study between three selected EE unit is shown in Figure 1.1.

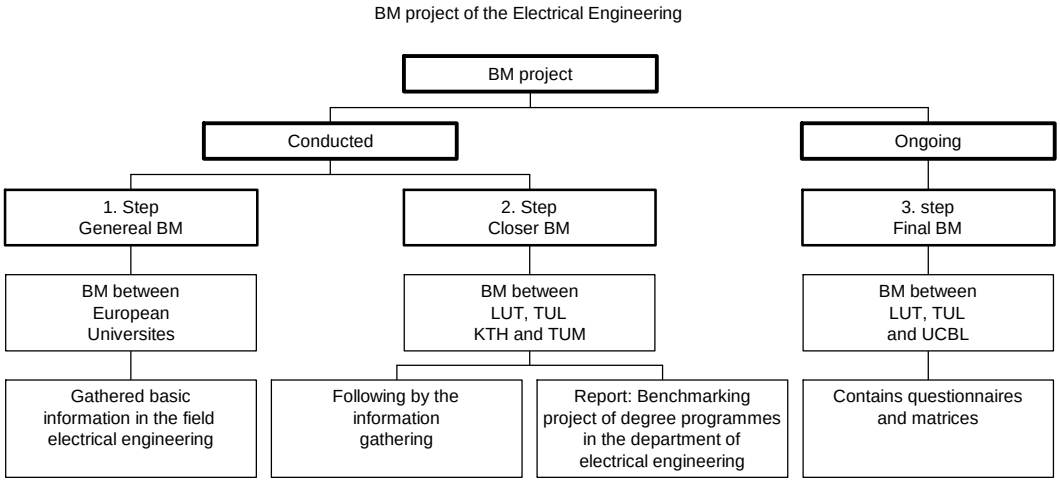


Figure 1.1. Progress of the benchmarking project.

The progress and continuation of the benchmarking project is divided into three main steps: general comparison, closer and final comparison. In the first BM step, the information was gathered from the web sites of the respective universities and institutions. In the second step, additional information was enquired from the partner universities by PDF and paper documents. The third step includes questionnaires addressed to LUT, TUL and UCBL staff and students for the purpose of information gathering and compilation of a matrix to exemplify the findings.

1.1.1 The main results of the first step

After the first step, an short article was published about the beginnings of the process in the publication *Benchmarking as a tool in syllabus work* (Benchmarking tutkintorakennetyöntyökaluna, Niinikoski 2005, in Finnish). Niiranen and Huovila (Niinikoski 2005: 40-43) find that the main difficulties met during the BM- project were a lack of recent study guides, the influence of the Bologna Process and the fact that some of the universities do not introduce themselves in English or German language nor offer course descriptions and student guides translated into English.

In total, there where 52 universities from which information could be gathered in a matrix representation. The matrix includes basic knowledge on the benchmarked Department of Faculties of Electrical Engineering, such as degrees (B.Sc., M.Sc., Dipl.Eng., Engineer, Ph.D. and Doctor), duration of studies, degree structure, educational profiles and specializations, and internationalization and research fields.

The main result of the first step was the confidence attained in the comparability of the education and research at the Department of Electrical Engineering at LUT to other European universities. After the first step, it was decided that interesting points of comparison are the following universities:

- TUL, Technical University of Lodz, Poland
- TUM, Technical University of München, Germany
- KTH, Royal Institute of Technology, Sweden

From these three universities more information was gathered for specific comparison that would have been impossible to conduct among all universities of the first step. The second step concentrated on the study fields and the deviations of the studies such as the number of the core subjects.

1.1.2 The core results of the second step

Niiranen and Salo (2006) have compiled a report *Benchmarking project of degree programmes at the Department of Electrical Engineering, Lappeenranta University of Technology* (in Finnis; Lappeenrannan teknillisen yliopiston sähkötekniikan osaston uuden kaksivaiheisen tutkintorakenteen kansainvälinen vertailu, in Finnish). The report includes the results of the second step. The report of the second step sums up the differences and similarities between the

universities under observation. Figures 1.1.1–1.1.4 (Niiranen 2006) show that the scope of the basic studies at LUT, TUL, KTH and TUM ranges between 98 and 168 ECTS. The contents of the studies are yet quite similar. In these universities, the basic studies mainly consist of mathematics, physics, information technology and electronics.

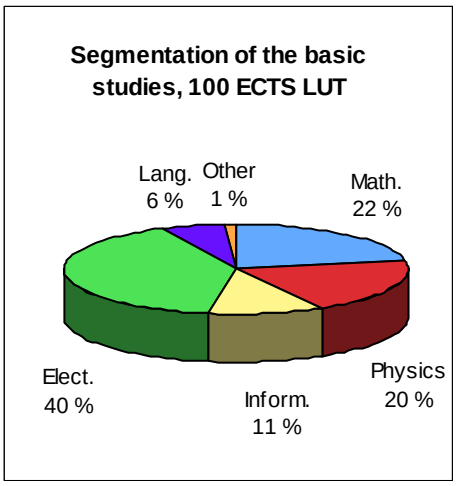


Figure 1.1.1. Basic studies at LUT.

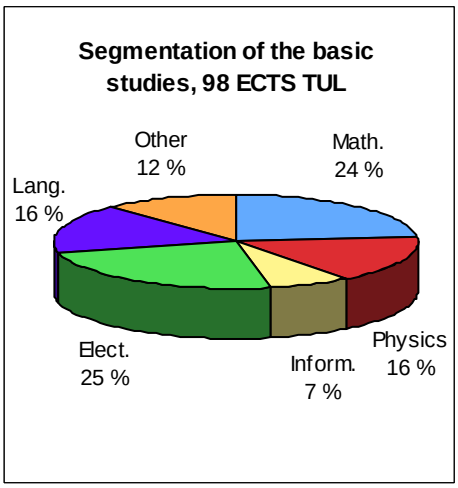


Figure 1.1.2. Basic studies at TUL.

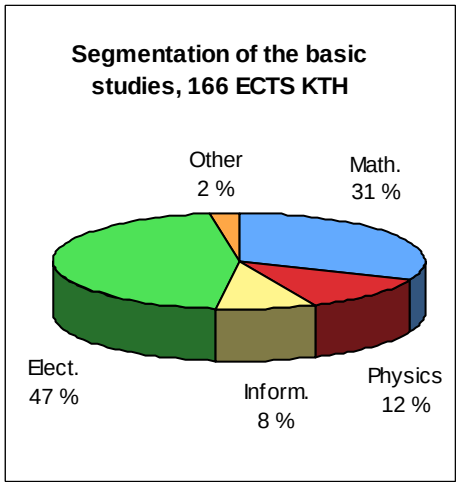


Figure 1.1.3. Basic studies at KTH.

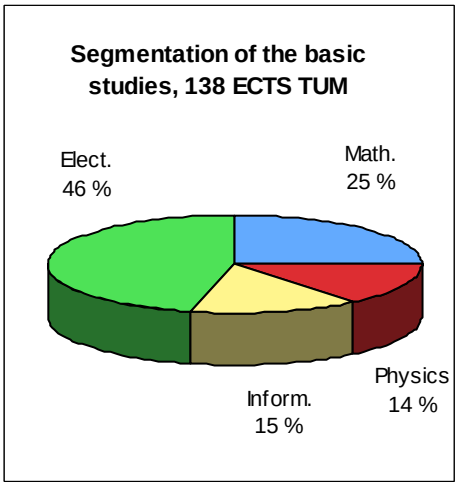


Figure 1.1.4. Basic studies at TUM.

The notable difference between second-step universities lies in language and supportive studies such as management and economics. If there are no languages icluded in the basic studies, there will be no language studies later in the studies

either. Economics instead may belong to later studies. Other studies shown in Figures 1.1.1–1.1.4 are supportive studies.

1.2 Aims of the third step, the closer benchmarking project

One of the purposes of this Master's thesis is to design the implementation of the third step of the benchmarking process of the Department of Electrical Engineering of LUT. Designing begins from the basic concept of the process: the continuation and relations between each different educational function such as planning the course, giving the lecture and achieving the basic knowledge on the subject. And thus, the third step is seen as a process benchmarking tool, where the educational processes follow on Deming's circle (plan, do, check and develop) as shown in Figure 1.2.

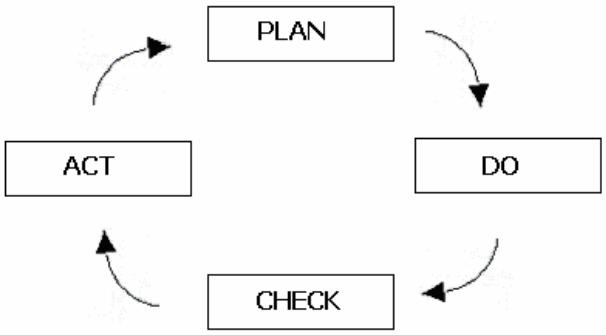


Figure 1.2. Deming's circle. (Neave 1990: 143)

The idea of the utilization of the Deming's circle in the third step came from the self-evaluation document for the quality assurance of the Department of Electrical Engineering. The document investigates the educational process through Deming's circle as a series of continuous events, -which have an impact on each other. Noteworthy in this approach is that every part of the circle, also feedback is produced to other parts of the process and the feedback has direct impact throughout the process. In educational environment the acts in the circle are

usually based on gathered feedback such as course feedback and grades. Feedback may be obtained also from yearly statistics.

Deming's circle has been one of the key elements when settling the aims of the final BM process, because it assists the quality assurance work. Some of the aims are common to all steps of the BM process and defined in the early meetings of BM group, but the third step of the process brings a new point of view and approach to the goals that have to be achieved. The common aims to all steps of the project are: to maintain and improve the quality of electrical engineering degrees at LUT and to improve the mobility of students and research staff.

The new approach concentrates on the department's quality system: the aim is to produce self-evaluation information that can be used in the quality system and auditing of electrical engineering education. To achieve these aims it is necessary to gather information from academic world, especially from the education of the electrical engineering in Europe. This includes the development of the comparison methods that the Department of EE of LUT can utilize when the educational processes are assessed. More specific goals of the third-step information gathering and analyzing part are introduced later in the implementation chapter.

2 METHODOLOGY

Benchmarking is a widely known method in business world to assess companies' quality against others. It is used all over the world to analyze the company performance and to gain the best practices. Because of the popularity of the benchmarking method, it is defined by many authors and in different ways. One generic definition for benchmarking is: "a basis of establishing rational performance goals through the search for industry best practices that will lead to superior performance" (Camp 1989: 250).

The benchmarking method as defined today was developed in the early 1980s at the Xerox Corporation in response to increased competition and a rapidly declining market. Xerox initiated a process called competitive benchmarking. BM was first started in manufacturing operations to examine a unit's manufacturing costs. These early stages of benchmarking were called product quality and feature comparison. In the early 80s, the senior management directed that all business units perform benchmarking and cost centres. This process was considered a focal issue in achieving quality in all products and processes. Xerox defined benchmarking as the continuous process of measuring the products, services, and business against the competitors or leaders of the field. (Camp 1989: 6–8).

Besides the fact that benchmarking has been developed as a response to the needs of business world, we have found out that it is useful tool for the development of education, and it is thus nowadays extended also into higher education.

2.1 Benchmarking in higher education

In higher education, benchmarking is usually connected to such concepts as "quality assessment", "quality evaluation", and "quality assurance". These terms are frequently used and also frequently misused. For that reason UNESCO-

CEPES (European Centre for Higher Education) took the initiative to produce a glossary of quality assurance and accreditation terms and definitions. As a result a glossary *Quality Assurance and Accreditation: A Glossary of Basic Terms and Definitions* was published (vlascenau 2004). The UNESCO-CEPES definition of benchmarking is:

> "A standardized method for collecting and reporting critical operational data in a way that enables relevant comparisons among the performances of different organizations or programmes, usually with a view to establishing good practice, diagnosing problems in performance, and identifying areas of strength. Benchmarking gives the organization (or the programme) the external references and the best practices on which to base its evaluation and to design its working process." (Vlasceanu et.al 2004: 26).

To get a wider perspective on academic benchmarking and its definitions, we have to introduce two more associations that are pioneers in the field of BM in higher education. Those two associations are NACUBO (the National Association of College and University business Officers) and ACU (Association of Commonwealth Universities). NACUBO is located in the United States, whereas ACU was founded in the United Kingdom. The largest university benchmarking organisation NACUBO defines BM in brief: the purpose of benchmarking is to provide managers with an external point of reference or standard for evaluating the quality and cost of their organization's internal activities, practices and processes. NACUBO's approach to benchmarking is statistical and financial. It looks for quantitative data from which it will derive benchmarks such as the average cost of health care benefits per employee or the average number of purchase orders for each supplier. Nowadays, several hundred universities from USA and Australia participate in the BM project of NACUBO (Fielden 1997: 1).

The ACU (Association of Commonwealth Universities) considers benchmarking as a way of finding and adopting good practices with a view to improving management practice. ACU runs an international "University Management Benchmarking Programme", for universities primarily, but not exclusively, from

the Commonwealth. The benchmark subject is varied each year and focused more on the effectiveness of university-wide processes and policies than departmental functions. Publications of CHEMS (Commonwealth Higher Education Management Service, a predecessor of ACU) are highly informative for example in the history of academic benchmarking (www.acu.ac.uk).

Even if the history of the academic benchmarking begins through the associations such as NACUBO and ACU, also the quality assurance agencies are great initiators of the BM method in higher education. Examples of those agencies are ENQA (European Network for Quality Assurance in Higher Education) and AUQA (the Australian Universities Quality Agencies).

2.2 History of academic benchmarking

The first countries to apply the BM in practice in Higher Education were the USA, Australia and the United Kingdom (ENQA 2003) and (CHEMS 1998). The associations such as NACUBO, ENQA and AUQA had a significant role in introducing the benchmarking to the academic world and they brought the benchmarking all over the world, also in continental Europe and Finland. After the good examples of the benchmarking clubs the institutions started to conduct their own benchmarking projects and eventually found the participants without any help of the associations. The benchmarking culture had extended to the academic world finally in the beginning of the 21st century.

According to Farquhar (CHEMS 1998:24) NACUBO has facilitated the nationwide collection and sharing of information on selected higher education functions in the USA since the 1960s. According to Fielden (1997: 2) the association was also among the first ones to launch the benchmarking in to the academic world in 1991. In the USA, in addition to NACUBO, there are several other specialized national projects to facilitate benchmarking in particular units of American universities.

In Australia, benchmarking became popular in higher education in the early 1990s as a result of an increased interest in quality assurance. Establishment Committee for Quality Assurance in Higher Education in 1991 was a significant initiator for benchmarking. According to Massaro (CHEMS 1998: 33-44), since 1995 also Australian universities and vocational education and training institutions have been able to participate in NACUBO projects. Nowadays, a number of Australian universities have joined the NACUBO exercise, and a few universities within CHEMS. According to Garlick et. al (2004: 12-13) AUQA (the Australian Universities Quality Agency) was established in 2000 and it has undertaken a series of university quality audits. As a result of participating in the audit process, some universities are seeing an increasing role for benchmarking to assist them with their quality improvement preparation. According to Bridgland (2005: 2) in Australia the turn of the 21st century was the key point in benchmarking, and since then it has been used more systematically in higher education as a tool in continuous improvement.

In the UK the early benchmarking tools and quality measurements have been used since the mid-1980s. According to Lund (CHEMS 1998: 44) benchmarking as a quality assurance tool in the UK higher education came to the forefront in 1997. Then National Committee of Inquiry into Higher Education proposed that benchmark information should be used by institutions, as a part of their programme approval process, to set degree standards. According to Garlick et al (2004: 16) in the UK, there is also a similar club as the CHEMS for the English universities, namely Universities Benchmarking Club.

Lund (CHEMS 1998: 60) sates that benchmarking is certainly alive and well in the UK universities, with examples to be found in most spheres of activity, both academic and administrative. However, Jackson (2001) admits that some people working in higher education may not find BM as a useful tool for the academic world, but adds that the collegiate values are also supporting more overt and explicit forms of BM. The usefulness and value of the BM in higher education is seen in Lund's, Jackson's and Thune's opinions. They all see the BM situation in

all over the Europe in a bright light. Thune writes: “Benchmarking as a higher education evaluation tool is used commonly but differently throughout Europe.” (ENQA 2003: 1)

The literature represents also opposite opinions. According to Schreiterer (CHEMS 1998: 61) “ - - - in most countries of continental Europe, up to 1998 benchmarking had not been widely practiced as a tool to improve academic performance. - - - The reasons for this were simply: In Europe nearly all systems of higher education are owned and operated by the state so there exist only few private colleges.” Even in the 21st, century the BM in higher education in Europe is not common, but a series of initiatives has already been developed (Vlasceanu et.al 2004: 26).

Besides the different opinions and policies concerning of the BM in Europe, the method has entered also the Finnish academic world. According to Lindqvist and Huttula (KKA 2002: 1), the Finnish Evaluation Council of the Institutes of Higher Education (FINHEEC), has supported several benchmarking projects since 2000, conducted by institutes of higher education. All benchmarking cases are unique, and they approach the assessment from their own point of view. A common feature of all these cases is the academic background, a will to improve educational process; every assessment is a learning process.

2.3 Benchmarking types and methods from the academic point of view

The literature consisting the benchmarking is extensive and even if the categorization is limited to academic point of view, there is still a flow of information. The history of academic benchmarking is quite coherent but there are differences in how the benchmarking is being defined and interpreted. According to Jackson (2001) all schemes for classifying benchmarking activities are

somewhat artificial because many benchmarking processes combine a variety of approaches and straddle different categories of a scheme.

Even though the BM cases may be somewhat difficult to classify or divide into different categories we introduce a distribution of the types and methods. The categorization is adapted from several sources and writers, and thus the definitions introduced here are combinations of the various types and methods.

There are a number of alternatives of carrying out the benchmarking; the selection of the BM type depends on the processes to be analyzed, the availability of data, and the available expertise in the institution. The basic types are primarily defined by Camp (1989), Alstete (1996) and Schofield (CHEMS 1998:14), who based the categories upon the voluntary and proactive participation of institutions:

1. **Internal benchmarking**, in which comparisons are made between different departments, campuses or sites within a university. The purpose is to find the best practice in the institution, without necessarily having an external standard to compare the results.

2. **External competitive benchmarking** analyzes processes with peer institutions that are competing in similar markets. This is much a more common mode of BM than the internal benchmarking but the process can be long and hard and it is usually mediated by neutral facilitators in order to ensure that confidentiality of data is maintained.

3. **Functional/industry, (external collaborative) benchmarking** usually involves comparisons with a larger group of institutions that are not immediate competitors. Methodology is usually relatively open and collaborative.

4. **Generic or best in class benchmarking** uses the broadest application of data collection from different industries to find the best operations practices available. Among some practitioners this is perceived to be the

most desirable form of benchmarking because it can lead to major improvements in performance, and has been described by NACUBO as the ultimate goal of the BM project.

5. **Implicit benchmarking** caters the situations where the initiative for some variant for benchmarking within higher education results from the market pressures of privately produced data, from central funding, or from co-coordinating agencies within individual systems.

Besides the types, authors categorize BM cases based on the different goals of the processes and especially based on the ways how the aims are reached and BM conducted in each case. However the difference between BM types and methodologies is not clear and some of the types can be understood as a methodology and vice versa. For example Norman Jackson divides BM activities in a different way than Alstete and Schofield and mixes the BM types and methodologies. Based on Schofield's methodology division (CHEMS 1998: 14-15) and Jackson's categorization (Jackson 2001: 4), the methodologies available for the institutions to be adopted in the BM are:

- **Vertical vs. horizontal benchmarking**, where the vertical part focus on the whole process and the horizontal part of the process as it manifests itself across different functional units.

- **Independent vs. collaborative benchmarking and ideal type standards vs. activity based benchmarking.** BM is independent when it is accomplished without partners, and collaborative when it involves a partnership. An ideal type standard BM is used in internal evaluation, in which case the models are the ideal best practices. An activity based benchmarking consists of analyzing and comparing activities between other selected institutions.

- **Quantitative vs. qualitative benchmarking**, in which quantitative BM is based on relevant statistics and performance indicators, whereas

qualitative BM is based on written information such as codes of practice and specifications.

- **Implicit or explicit benchmarking,** differ from each other in data collection. Implicit BM is a by-product of information gathering, whereas explicit BM is more deliberate and systematic.

- **Inputs, process or outputs**. The BM activities may be focused on one or more of the inputs to the process. In academic world inputs can be for instance students, staff and resources; examples of the process are for instance curriculum design, assessment and research supervision. Outputs can be for example a student's progression to employment and result profiles.

The field of the academic BM seems to be wide, and the categorization depends on the source; further, the definitions of the types and methodologies are diverse. ENQA (European Network for Quality Assurance in Higher Education HE) noticed the mixture of the classifications and simplified the categorization of the BM types. The Steering Group of the ENQA commissioned a seminar on BM in June 2002 where the group produced a simplified categorization of the BM types and methodologies. The intention was to establish and understand the principles for good benchmarking in the development of higher education, provide concrete examples of various BM practices with the view to establish good practices, to discuss strengths and weakness related to BM in evaluation and to reach conclusions on perspectives for European BM in HE.

A concrete result of the workshop is finding the common denominators in BM cases. ENQA identifies three distinct dimensions of benchmarking in HE (ENQA 2003: 8 and 11−12): national or international, external or internal, benchmarking concentrated either on the process itself or on the output, or both.

2.4 Steps of the BM process

The benchmarking project itself comprises separate parts such as planning, preliminary studies, partner search, data collecting and etc. All BM processes are unique, and in each case, the project proceeds through different phases and selections. Models have been created for conducting the BM process; these models include the recommended steps and matters to be considered in different kinds of BM projects.

One of the oldest BM process models is the ten-step model introduced by Camp in 1989 (Spendolini 1992: 6) The ten steps of the BM process are illustrated in Figure 2.4.1, which shows that the process consists of four main headlines that are: planning, analysis, integration and action. After all the steps it is gained the maturity and leadership position. Maturity defines that the practices are fully integrated into processes and signifies that the process has successfully completed.

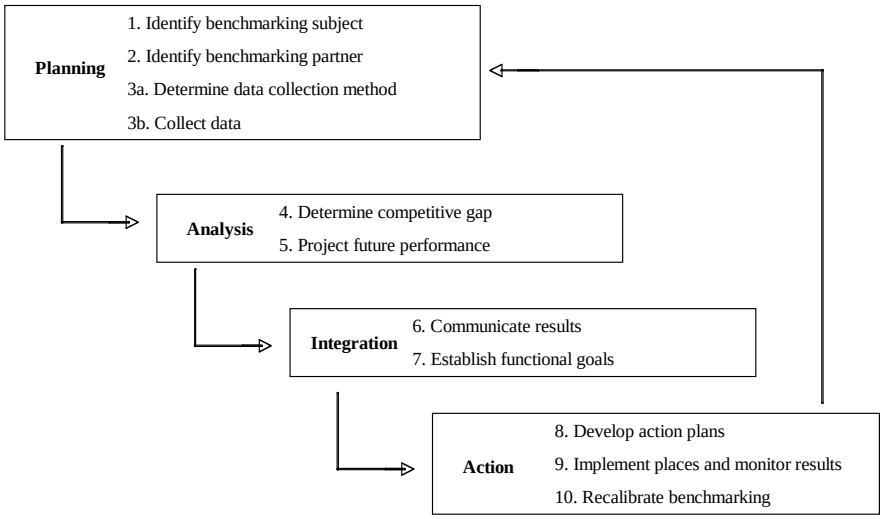


Figure 2.4.1. Benchmarking process according to Camp. (Camp 1989: 17, adapted)

Reaching for the maturity begins in the planning of the BM process. The objective of the planning phase is to design the benchmarking investigations. The essential steps are similar to any planning process of a development task: what, who and

how. The basic questions asked are: What is to be benchmarked? To whom or what will be compared? and How will the data be collected?.

The analysis phase consists of actual data gathering and accomplishing the analysis. According to Camp (1989: 18) the phase must involve a careful understanding of current process practices as well as those of benchmarking partners. The end of the analysis phase should provide a concrete vision of internal performances on which to assess and clarify the strengths and weaknesses. The basic strengths and weaknesses are analyzed with the questions: Is the benchmarking partner better? What best practices are being used now?

Integration is the process of using benchmark findings to set operational targets for change. It involves careful planning to incorporate new practices in the operation and to ensure that benchmarking findings are incorporated in all formal planning processes.

In the action phase, the benchmarking findings and operational principles based on them are converted to specific implementation actions. A periodic measurement and assessment of achievement is put in place. The persons actually performing the tasks are the most capable of determining how the findings can be incorporated into the work process. According to Camp (1989: 19) maturity will be reached when the best practices are incorporated in all business processes, thus ensuring superiority. Maturity is also achieved when it becomes an ongoing, essential and self-initiated facet of the management process.

Kaartinen-Koutaniemi (AKK 2003: 103) has contemplated the BM processes from a more academic point of view. The model shown in Figure 2.4.2 include five steps which are the definition of the development process, finding the BM partner, visits and comparing, analyzing and presenting the results and interpreting the results.

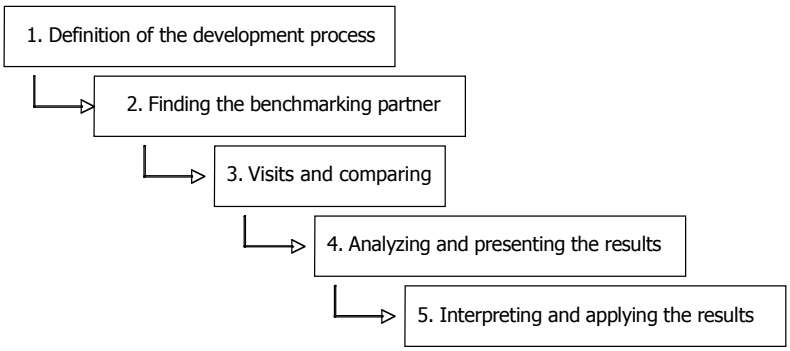


Figure 2.4.2. Five steps of a BM process, adapted from Kaartinen-Koutaniemi. (AKK 2003: 103)

In the academic world the BM process starts from the development process and it is defined with the help of self-assessments. In this phase, the present state is mapped and the development field(s) are determined. The most important task of the first step is forming the benchmarking team. The gathered team defines the timetable of the BM process and determines the content of the future steps. Before finding the actual benchmarking partner, the team should define also the aims of the future visits between BM partners. It is also necessary to gather background information and to decide the number of partners.

Real action and benchmarking begins in phase three. A Successful BM process requires that the collaborative part is planned carefully; it ensures that the process is implemented systematically step by step. It is advisable that the questions compiled in the meetings of the benchmarking team are sent in advance so that the partner will be prepared for the visit.

In the fourth step, the analyzing phase, process reports are compiled so that the detected weaknesses and good practices are shown. The gathered information is analyzed, and the new practices and development plans are introduced. The fifth and last step contains interpreting and applying the results. The results are transferred to practice and new aims are settled. Plans of action are made. The aims have to be specific, measurable, realistic, commonly accepted and scheduled. The results are documented and assessed.

2.5 Benchmark cases in higher education in Finland

At least 14 BM projects have been carried out in Finland between 2000−05 by different institutions of higher education. Most of these cases are public; they are published in the publications series of the FINHEEC (Finnish Higher Education Evaluation Council). The most significant cases for BM project of the Department of the Electrical Engineering department's BM project are:

- Hyyryläinen: Evaluation of the Learning Centre of the universities in Vaasa. In Finnish: Vaasalaisten yliopistojen oppimiskeskuksen arviointi (Hyyryläinen 2004)

- Kantola: International benchmarking of internships and project studies in professional higher education (Kantola 2003)

- Kaartinen-Koutaniemi: Development of the university students trainee programs. In Finnish: Korkeakouluopiskelijoiden harjoittelun kehittäminen (Kaartinen-Koutaniemi 2001)

- Karjalainen, Kuortti and Niinikoski: Creative benchmarking, designing sustainable international cooperation in higher education (Karjalainen et.al 2002)

- Lohiniva & Ylipulli-Kairala: Development of supervised practice in nurse education (Lohiniva et. al 2002)

- Löfström: Benchmarking in the development of universities language education. In Finnish: Benchmarking korkeakoulujen kieltenopetuksen kehittämisessä (Löfström 2001)

- Ihonen: Benchmarking between Tampere and Eindhoven University, information departments (Niinikoski 2005:21-26)

- Toikka and Hakkarainen: Benchmarking of counselling in the trainee programs in technical field. In Finnish: Opintojen ohjauksen benchmarking tekniikan alan koulutusohjelmissa (Toikka et.al 2002)

In these cases, the approach and focus are quite similar with the project of the Department of the Electrical Engineering. Naturally, these project deal with slightly different educational processes than this project. However, the starting point is the same. A department or university is willing to improve the educational process and learn from several partners. This is one of the reasons why we are studying these cases more closely and highlighting some of the issues and means to conduct the BM process. With the help of the introduced BM dimensions and types in section 2.3 and the case studies, common and typical features can be found that identify and separate the cases. The BM projects conducted in the academic field in Finland can be divided into:

- **International** vs. **national projects**

- **The partner is familiar** before the project, or the **partner selected** by pre-settlement

- **External** vs. **internal BM** (comparison is made inside an institution, for example between separate departments)

- **Independent** (based purely on role model(s)) vs. **collaborative BM**

- **Team** vs. **questionnaire** type BM project

- **Input**, **output,** or **process** oriented BM

In the example cases, certain similarities and differences are found that can be placed under the above headlines. The following chapters introduce cases closer and concentrate on the primary differences, and also the discovered matters that may help in conducting the BM of the Department of Electrical Engineering.

First, it is worth pointing out that the implementation of the introduced BM projects took a considerable time. BM processes typically lasted from a year (Löfström 2001: 11, Niinikoski 2005: 18–24) to three years (Toikka et. al 2002: 18). Usually it takes approximately two years to complete a BM project, including the preparation time of the project and the analysis and publication of project results. This means that the BM projects are tedious processes; in any case it requires patience to plan the steps of the BM, to gather the information and analyze the findings irrespective of the type of BM project.

2.5.1 Participants of the benchmarking process

All the BM projects were conducted with a partner, which made the process transparent. Usually the assessment is carried between several universities, and the possible foreign partners are located in Europe. Only in the case "Development of the practical training of the nursing students" some of the partners were selected from overseas universities in the United States. If the BM project is planned to be international, a common problem was to find a partner institution from abroad. Institutions that were suitable and willing to cooperate in the BM projects were almost without exception found by previous personal contacts. Kantola (2003) states in the case "International benchmarking of internships and project studies in professional higher education" that because the role models were selected otherwise than on the basis of background information of the assessed process, the project as such is not a classic benchmarking case. However, the selected partners functioned as role models in the comparison between European higher educational institutions.

Also the search of Finnish BM partners was usually carried out by using the existing contacts. The educational institutions expressed their interest via some known contact person, who in turn introduced the planned BM project to the whole organization. In some cases also the institution's geographical location was a relevant matter, as in the BM case concerning the development of language

education in universities (Löfström 2001), in which all the institutions are located in the metropolitan area. The geographical location is a relevant matter if the cooperation continues and a target is to offer for example courses or to provide material and equipment together. The location was a decisive factor in the Löfström case because of the aim of collaborative language teaching.

The case “benchmarking of counselling in the trainee programs in technical field” (Toikka et. al 2002) differs notably from other examples since the BM project was realized in the meeting of the participating institutions. The role models were selected with the secretary of FINHEEC (Finnish Higher Education Evaluation Council) and the participating institutions were selected on grounds of a national evaluation project of educational guidance.

The cases point out that even if the role model or the collaborative partner has not been selected on grounds of facts, the preliminary settlement or only the best-practice organization of the BM project have yet been successful learning processes for each participant. Karjalainen (2002: 34) found that ”you can always learn something new from another organization, whether they are best in-class or not”. The best in-class comparison becomes important and valid only when it is really tries to determine if the institution is capable to compete with other organizations in the same league as the great ones.

2.5.2 The method of the benchmarking process

In these cases, the participants of the BM projects were usually all involved somehow in the project, but there was a leading university or a vocational high school that made the initiative. In none of the cases the evaluation was made by an external agency.

An example case of an external BM project is “Benchmarking in the development of universities’ language education”. Löfström (2001) describes the BM –project

as an external process benchmarking, because the participants functioned as separate higher educational institutions although there was a mutual action field. In the case, a participant, one at the time, took the position of a role model while the others compared themselves against the model.

The case “Evaluation of the Learning Centre of the universities in Vaasa” Hyyryläinen (2004), is different from the other example cases, and does not use partners or role models in the benchmarking work. The process was internal, and the assessment was made based on a customer questionnaire. Usually the cases that started their BM project by internal benchmarking continued the assessment with external partners.

The popularity of external benchmarking can be explained by the achieved changes; these changes are more significant in the external BM than in the case in which the partners are departments or institutions in the same university. A possible explanation of the abundance of external BM projects can be found from the funding criteria of the FINHEEC for the evaluation project of higher education institutions in 2000. According to the selection criteria the projects had to be interesting, international and joint ventures of several higher educational institutions.

It can be said that the most of the cases are external including collaborative partners. Usually the external partner had an active role in the benchmarking project too, and its input in the project was equal to the initiator institution. Only a few of the cases were carried out according to the passive example model, as the university compared itself to another university. However, also in these cases (cf. the role model BM case, Toikka et. al 2002), the example institutes have learned a lot and have gained new inspiration to their work.

Nevertheless also some criticism has been expressed on the role model BM. In the case “International benchmarking of internships and project studies in professional higher education” (Kantola 2003: 59), it was shown that the role model would had needed more guidance to the project in order for the participants

to be more prepared to the discussions in the workshops. Now, the starting point was that the home team learned from role models that were not selected based on the classical BM method. In this kind of an arrangement the investment in advance to the workshops is not worthwhile from the role model's point of view. The initiator university should ensure that all the participants of the project understand what they can achieve and prepares them well in advance for the forthcoming situations and tasks.

2.5.3 Data collection in the benchmarking project

Certain questions have always to be asked when conducting a BM project. *How, who, what* and *why* are the most common questions when the target is to clarify the best practices. These questions were in the example cases mostly open, and the respondent was a small team gathered from every BM partner institution. The team of 4–6 members consisted of administrative staff, teachers, and professors. Sometimes there were also one or two representatives of students.

The most common methods to conduct the benchmarking projects were self-evaluations, SWOT analyses, interviews, and negotiations. Self-evaluations were conducted by a person responsible for the BM project alone or by a small team. In the example cases, the teams of the partner institutions met after the self-evaluations in workshops or seminars to follow up the benchmarking and analyze the detected differences.

BM projects that base only on questionnaires are rare, because analyzing the results is laborious and no discussion is raised around the benchmarked subject. Questionnaires are used to settle the workshops and the closer assessment of the BM project. For example in the case "Development of supervised practice in nurse education" (Lohiniva 2002: 32-33), an extensive paper questionnaire form was used. The answers were obtained from about 100 students and most of the teachers in every Finnish BM participant. The questionnaire was followed by a

comparison with foreign partners. This comparison was conducted by teams in workshops. Also Toikka et.al (2002) used an opinion questionnaire that was directed to the students of the BM project initial institution. Questions were of multiple-choice type and the answering was thus unambiguous. Also to the staff was given a multiple-choice questionnaire asking about the process itself and about the opinions of how it was working. The comparison to the role model partners was conducted by a small team in workshops by using open questions handling the same subjects as the questionnaires. In those cases in which only the initial institution used questionnaires beforehand, the partners were not so well prepared or enthusiastic in workshops even if they had performed the other tasks such as self –evaluations and analysis.

The only case, in which there was a questionnaire also for the external partner was the case "Higher education as a pathway to entrepreneurship" (Alasaarela et. al 2002). The case differs from the others because it applied the CREST-analysis method and program for the assessment and questionnaires. Unfortunately, the web pages of the CREST analysis do not exist anymore on the Internet, and thus the only source of if the analyzing programme is the case Alasaarela et al 2002 (KKA 2002: 81–85). The idea was that the questionnaires were filled online and the program analyzed the results so that making conclusions was easy. The Internet applications make it possible to increase the number of the respondents and thus increase the reliability of the results.

The case "Evaluation of the Learning Centre of the universities in Vaasa" (Hyyryläinen 2004) is a good example how wrong everything can go when the questionnaire forms are used incorrectly. The BM based only on extensive questionnaires, which were directed to students and clients of the Learning Centres, most of them were teachers. The questionnaires were filled in the premises of the Learning Centres by anyone who had time to do so. The customer questionnaire was a slight disappointment because of the small number of responses in some participant institutions (79 responses altogether), 57 in the University of Vaasa, 17 in the Åbo Akademi and 5 in Svenska Handelshögskolan.

The uneven distribution of responses in separate institutions made the analysis of the results almost impossible and only suggestive answers to the problems could be obtained. Further the questions type used was open questions, and therefore the answers where rather different from each other even if the opinions were similar. Also some respondents did not answer all the questions. The questionnaire directed to the students ran into the same problems as the questionnaire to the clients.

2.5.4 The orientation of the benchmarking project

Subjects of the described BM cases varied significantly from very specific goals such as development of practical training to wider goals of the benchmarking of a whole department. In some cases the targets were unsettled and the main aim was to obtain some foreign know-how. Most of the benchmarking projects were assessments between the degrees and curricula; in the projects, conducts and practices in the home and partner institutions were compared. Also the completion of practical training is a common subject in benchmarking projects. In the example cases BM concentrated usually on the process itself and the assessment of the working habits, and thus the obtained result was how to reach these achievements (cf. Kaartinen-Koutaniemi 2001). None of the cases concentrates only on the output, such as curriculum and skips the whole process preceding it.

In the most BM cases, there is an administrative point of view, and the real performers of the BM work are the departmental staff such as the head of the department and planning officers. Educational staff and student representatives are also included in the teams of BM projects, yet students participating in the workshops are quite rare. Only in the cases “Benchmarking between Tampere and Eindhoven university information departments” (Ihonen 2005) and “Creative benchmarking, designing sustainable international cooperation in higher education” (Karjalainen et. al 2002) students were allowed students to participate also in the final workshops and they were not just let to fill in the matrices,

preliminary questions or self assessments. For example in the case “International benchmarking of internships and project studies in professional higher education” (Kantola 2003) students and educational staff participated only in the self-assessments. The visits in the partner institutions were made by the project team comprising only administrative staff of the institution.

In the case “Benchmarking in the development of universities language education” (Löfström 2001) BM is carried out totally without students although no foreign partners are involved. The lack of students in the BM project is acceptable if it is known that the other (usually foreign) partner sees that the BM must be carried out between high-level counterparts. However, the lack of the student viewpoint in the workshops and sometimes also in the whole BM project seems an absurd thought because the educational processes and its development highly affect the students and their studies. If the BM examines the processes also from the students’ point of view for example by questionnaires, yet the students are left out the workshops, the gathered answers might remain defective, misleading or too superficial.

These studied example cases and the theory of BM in the academic field give a basis and tools to be adopt in the planning and implementing of the BM-process of electrical engineering.

2.6 Adapting of the methodology

The BM project of EE is examined through BM methods, types and steps that are introduced in Chapter 2. The benchmarking was adapted also to academic world as an initiative of the different associations. As a consequence the Finnish Higher education became a familiar with the BM method and the studied example cases conducted in Finland introduced a general view of the tools used in academic BM.

The BM project of EE is based on academic benchmarking methods that are the most proper ones for finding the best practices starting from a wide group to a small-scale comparison between two BM partners. The BM project of EE compares the different EE departments and the purpose is to find the best practice, without organizing the participants to the order of superiority. This is the definition of the method of internal benchmarking. The project also involves characteristics from the functional or external collaborative benchmarking where the comparison is made between a larger group of institutions that are not immediate competitors and the working method is relatively open and collaborative. Even if the EE departments work in the same field, the location of the Universities in Europe diminish the immediate atmosphere of competition, and thus the working methods can be more collaborative than between the EE units located in Finland. However, the Bologna Declaration improves the possibilities of mobility in Europe, which is the reason why the functional method is adapted with certain limitations: the deeper comparison is made between two partners that are selected through larger group comparison.

One of the aims of the BM project of EE is to find the best possible practices for the processes used in the education of electrical engineering. The aim is reached by clarifying the progress and factors of the processes. The information is gathered from the actual producers, developers and participants of the processes. With this definition it is obvious that the BM project of EE is vertical benchmarking focusing on the whole educational process. The empirical study of the BM is performed based on relevant statistics and the web questionnaires filled by the respondents in their home countries; the BM method is quantitative and an explicit benchmarking, which is defined as deliberate BM.

The steps of the BM project of EE follow the features of the models of Camp (1989) Figure 2.4.1 and Kaartinen-Koutaniemi (2003) Figure 2.4.2. The planning part of the Camp model contains also the identifying of the BM partner and data collection steps which are regarded as their own steps in the model of Kaartinen-Koutaniemi, who sees the data collection is seen as a visits and comparisons made

in teams. The third step of the BM project of EE and this Master´s thesis concentrate on the steps adapted from Camp and Kaartinen-Koutaniemi: finding the benchmarking partner, determining the data collection method and collecting data, and finally, analyzing and presenting the results. The following steps, integration and interpreting of the results are planned during the third step. The effects of the example cases are presented in the implementation section as the arisen ideas and developed methods and tools.

3 IMPLEMENTATION OF THE BM PROJECT

The implementation of the BM project includes preliminary work that is done in the EE department of LUT, but it includes also partner universities and is also dependent on their efforts when finding the best practices, similarities and differences between electrical engineering units. The selection of the partner universities is based on the second step findings and universities own willingness and interest in participating in the BM project. The first contacts to the second steps universities, KTH, TUM and TUL were prepared in 1 September 2005. It was decided that the best way to raise interest is to send an abstract where the results of the second step are described in brief; here, the willingness to participate in the third step of more in-depth BM was inquired. Head of the Department, Professor Juha Pyrhönen, sent all the abstracts. The abstract was sent also to UCBL (Université Claude Bernard Lyon 1), because there already was an existing contact of D.Sc. Jussi Salo.

The model of the abstract is shown in the Appendix 1. After discussions concerning of the BM project that based on the abstract TUL and UCBL were selected as the participants of the third step. As a result the LUT Department of Electrical Engineering has external collaborative partners that are highly valued all over Europe. The basic principles of the third step BM were to find good practices of each other without competition

The aim of the BM project is to evaluate the whole educational process including the students' and teachers' points of view, because the best process evaluators are the participants themselves. That is the reason why the students and the teaching staff are involved in the BM process from the very beginning, even thought in most of the example cases the BM is carried out by the administrative unit. The BM-cases show that the succeeded project can be conducted with collaboration of students and staff when the participants have different backgrounds and the difvergences of opinions is wide. Cases and great initiators to this project that introduce students and teachers role as an important factor in success of the BM,

are the cases Karjalainen et.al (2002) and Ihonen (2005). Based on the example cases the best way to carry out the BM itself is to use the preliminary questionnaire for all participants and the self-evaluations as quality matrices. The final step moves toward the team assessment in order to get deeper into the obtained results and to clarify the differences and best practices. The example cases show that the questionnaire must be carefully planned and clear; closed questions are preferred. The questionnaires must also be easily available or handed out personally to be filled in. To gain best possible benefit from questionnaire and responses it is necessary to organize meetings both separately in each participating university and also together. The meetings have to be well prepared and instructed. And importantly, the initiator university has to make sure that the partners feel that they are able to get equal advantage and profit from the BM project as the inviting university. The all participants must understand the expectations, aims and tasks to ensure that the BM project is fruitful.

The accurate headlines of the compared issues are conducted from the main aims of this study described in Chapter 1. The selected method to search and decide the benchmarked issues was workshop. The teaching and laboratory staff worked together and presented their ideas and suggestions for the comparison of the educational processes. With the help of the staff, the ideas and matters where examined from different point of views. Based on the results and ideas presented during the workshop the questionnaires and quality matrix concentrate on

- Teaching methods, evaluation and feedback
- Students’ studying habits and results, counselling
- Planning and development of the education

The following chapter discusses and clarifies the methods by which the issues are examined and contains the implementation steps of BM project of Electrical Engineering. The Preliminary work of the project can be seen as two independent parts: the questionnaires for information gathering and a matrix for classifying the

findings. The implementation of the BM project started with the compilation of the questionnaires and headed towards the completion of the matrices.

3.1 Questionnaires

While waiting for the correspondence from the selected partner universities, the information-gathering part of the BM project started by outlining the questionnaire forms on the web. This form enables quite a large number of respondents in different countries. The questionnaire was prepared with Internet-based survey software Webropol, http://www.webropol.com/en/index.html

The problems to be solved before compiling the questionnaire were: what to ask and how, and further whose responses are the most useful and informative. Frisk (2005: 20-25) presents ideas of how to evaluate learning and how to make good questionnaires. She divides the assessment of learning, into three main categories:

1) **Diagnostic assessment** clarifies the initial level of the student in the beginning of the education. The aim is to get information about student's educational process know-how, experiences and expectations.

2) **Formative assessment** gives information to student and teacher about the guidance of learning; the aim is to clarify the strength and weaknesses in the learning process.

3) **Summative assessment** gathers the learning results in the end of education; it expresses how well the student has achieved the educational aims.

The BM project of the Dept. of Electrical Engineering, and thus hence also the questionnaire concentrate on the formative assessment. Questions enabling

diagnostic and summative assessment are asked too, but the primary aim is to clarify the learning process. When formulating the questions the example cases gave useful ideas and revealed also some obstacles to avoid. Thee example cases show that the BM questions are usually open and guide the respondent, and therefore the way of expression and the content in answers may vary considerably between participants. According to Frisk (2005: 61-67), the problem with the open questions is how to get the correct information for the development work. As a conclusion, open questions are better suited to the final step of the BM project, when discussion is possible between rather small teams and questions have only a suggestive role.

In this BM project, more precise answers from several respondents were sought in order to enable comparison between the participants. In addition to the example cases, this is the main reason why the questionnaires questions are mostly closed and alternative answers are already given. Closed questions are also easier to analyze than the answers obtained by open questions. The problem of the closed questionnaire is that the respondent answers only the asked questions, and thus some essential information may be lost. The compilers of the BM project are aware of this problem, and this is one of the reasons why the BM is followed up by team discussions.

The first idea was to publish two different questionnaires according to Alstete's defined inputs: the staff and students would be questioned about the educational processes in the department of electrical engineering. Basically the questions sought for answers in issues over which the department and staff has some influence. During the compilation process, it proved that the questions and answers did not yield enough information on the issue of contents of the educational process, that is, how it is formed. The suggested questionnaires only produced answer to the questions of how well the process works and whether there is anything that could be done better. It was understood that an extra questionnaire is required to clarify the contents of processes and thus, because of the extra questionnaire, it was not necessary to ask the teaching staff and students

all those questions that were mostly related to administrative issues such as curriculum work. As results, we ended up having three different web-based questionnaires: 1) opinion questionnaire to educational staff, 2) opinion questionnaire to B.Sc. and M.Sc. students, and 3) questionnaire about the processes to administrative staff.

Responding to the questions was carried out by the Webrobol system. The questionnaire form was entered through the individual website given in the e-mail sent by the software to every respondent. The individual link ensures that a respondent can fill in the whole questionnaire only once. The questionnaire was open as long as the respondent clicked the “submit” button at the end of the questions. By saving the answers, it was also possible to continue answering the questions some other time, by saving the answers. In the cross-box questions, there was a selection of alternatives, and in the radius boxes, only one answer was accepted. There were also some open questions, in which there was room for answers as long as necessary. To ensure that the partner universities would know what kind of survey was going to be conducted the questionnaires were sent in advance to the contact persons as PDF documents. The covering letter that contains the questionnaires is shown in Appendix 2.

3.1.1 Questionnaire to administrative staff

The administrative staff questionnaire contains the headlines: curriculum, planning of study modules, student admission and study guidance, student evaluation, content of the degree in electrical engineering, teaching, student counselling and quality assurance. The questionnaire contains all the same factual information as the student and staff forms and is broadened towards administrative issues such as quality assurance. The administrative points of view are compared against students’ and teachers’ answers, and the answers that are common to all questionnaires are analyzed (such as student counselling).

The questionnaire addressed to administrative staff is shown in Appendix 3. It was thought that the contact persons can fill in the questionnaire with the help of the staff whom the questions may concern, e.g. in LUT with the student coordinator. Before filling in the questionnaire, the partner universities were asked to send a contact list of the e-mail addresses of students and staff to be able to send the covering letter to the questionnaire also to them.

3.1.2 Opinion questionnaire to educational staff and students

At first, there was an idea that the preface letter to the staff and to the students could be same for every university. However, based on the tests and suggestions obtained, it was considered better to write an own letter in Finnish to the LUT department to make the questionnaire more attractive to the teaching staff and to the B.Sc. and M.Sc. students. The covering e-mail letter contains the link to the questionnaire form and instructions how to fill in the form. The letters to teaching staff and students of foreign partners in English are almost similar; the other is shown in Appendix 4 (teaching staff). The Finnish version can be found in Appendix 5 (students).

After the corrections, the questionnaire contained questions under the headlines: personal information, planning and organization of the studies, feedback and counselling, motivation and studying habits, background of students and student admission. The personal information section does not reveal the identity of the respondent, and it is used for categorization reasons only. The teachers and students forms are quite similar; thus it is possible to track the differences and similarities in the students' and teachers' answers concerning the educational processes. The final form to teaching staff is shown in Appendix 6 and to students is shown in Appendix 7.

The covering e-mail letters were first sent to the students and teaching staff of the LUT Department of Electrical Engineering. The letters were sent by Webropol

system on 23 November 2005. Respondents of the partner universities TUL and UCBL received the covering letter to questionnaire forms on 3 January 2006. After that the letter was sent again two times to those respondents who had not filled in the questionnaire. Simultaneously, when waiting the responses, the compilation of the evaluation matrix of electrical engineering was started.

3.2 Evaluation matrices

The next step would be the self-evaluation matrix that would deepen the BM and to reveal the thought processes from somewhat different perspectives than the questionnaires. The matrix works also as a reference material together with the analyzed questionnaires in the further BM and possible workshops. The evaluated areas in the matrix are mostly the same as those dealt with in the questions, yet some areas are broadened and adjusted to answer the purpose better. Matrices have been used extensively in benchmarking projects; the ones compiled by Karjalainen et. al (2002) and McKinnon et. al (2000), were found to be appropriate ones for the purposes of this study. Karjalainen et. al (2002) used matrices successfully and the benchmarking project of the departments of the University of Oulu. The example matrix handles some of the issues we are interested in: the curriculum, teaching methods, support services of teaching and learning, quality assurance and internationalisation. The matrix is easy to read; it is also quite clear, as the questions are divided into main categories and into separate arrays. Finally, after the participants' self-assessments, the answers are gathered in arrays side by side.

Another source of information that had a significant influence in the matrix work was the work *Benchmarking, a manual for Australian Universities* by McKinnon et. al (2000). McKinnon et. al analyze 67 issues that are somehow related to the academic world and working of a university. The issues are gathered together under nine headlines, which are: governance, planning and management, external

impacts, finance and physical infrastructure, learning and teaching, student support, research, library and information services, internationalisation and staff.

The most significant issues for the matrix to the Dept. of electrical Engineering matrix are the student support and learning and teaching. The manual of McKinnon gives a different approach to using matrices in the BM evaluation or quality assurance. The manual defines first the good practices of the assessed areas and then the objectives set for each level from 1 to 5. For example, for the benchmarking subject 'space utilisation', good practice is defined as: "Universities should have a space management plan which provides for: an accurate and well-managed data base of space; electronic mapping of space linked to facilities management; space norms used to quantify space requirements; and a system for measuring space utilisation rates and allocating space based on timetabling software programs.". The requirements of the space utilisation levels are shown in Table 3.1.

Table 3.1. Levels in the area of space utilisation. (McKinnon et.al 2000)

1	**2**	**3**	**4**	**5**
Limited database. No comprehensive systems for electronic mapping of space or timetable software.		Database of space exists but limited systems for measurement and allocation.		Database supported by systems for measuring space utilisation and allocating space based on software programs.

With the help of McKinnon matrix, the universities or units are only graded and the matrix itself doesn't contain any comments on the reasons behind the given grade. The matrix is intended to be a checklist to show the university's position and the processes that have to be improved to get the best possible grade. The matrix can be used for self-evaluation purposes or as a peer's guide in an accreditation situation. The matrix of Karjalainen et.al (2002) is designed for a

benchmarking purpose. The participant´s self-evaluations are gathered into the same matrix including only comments, not any placements or grades.

3.3 Matrix of the Department of Electrical Engineering

The self-evaluation matrix of the Department of Electrical Engineering is based on the aims and questionnaire forms of the BM, on the example matrix of Karjalainen et.al (2002) and on the manual by McKinnon et.al (2000). The example matrices give a thorough and fruitful basis to work with the matrix of the Dept. of Electrical Engineering because the issues handled in matrices are mostly the same we are interested in.

The McKinnon matrix gave the outward appearance: the arrays for self-comments for the matrix of the Dept. of Electrical Engineering, as well as the idea of the grades from 1 to 5. The distribution is the same as in the questionnaires, and thus the matrix justifiably continues the benchmarking process. The matrices by both, McKinnon and Karjalainen give good ideas for the comparison that can be conducted based on the questionnaire findings. However, the usage of grades is not the best alternative in the collaborative benchmarking, because the aim is to clarify the best possible ways to conduct the processes, not to find out the best possible producers of educational processes. The matrix of EE would be used as a summarizing information table that gives to the reader a quick overlook of the BM project by presenting the findings in a compact form. The matrix is a tool for participant universities in the development processes of the education and the idea of the matrix is that it can be used in feedback and assessment meetings among the staff and BM-partners. The matrix developed for the purpose is shown in Appendix 8.

4 FINDINGS

The findings of the third step of the BM project are based on the questionnaire studies. The questionnaires were addressed to the Electrical Engineering units of UCBL, LUT and TUM. Similarities and differences between BM partners are found with the help of Webropol program and the obtained results are illustrated with figures.

The basic information is examined based mostly on the administrative questionnaire. These findings concentrate on the specialization areas of the units: offered majors and research areas and contents of the curriculum. Administrative questionnaire clarifies also the processes used in EE units when planning and carrying the curriculum, teaching and student admission. The information collected from the opinion questionnaires addressed to the staff and students is mostly exploited to strengthen and weaken the obtained results from the administrative questionnaire. The findings are categorized under following headlines: backgrounds and levels of the units, staff and students, content of the curriculum, teaching methods and student evaluation.

All benchmarked units were asked to fill in the administrative questionnaires and to provide a sufficient amount of the e-mail addresses of the teachers and students to gather different opinions and information. The number of participants required for BM project from partner universities was estimated to be around 30 students and teachers to ensure that the gathered information is reliable. The appropriate number of respondents was asked in the covering letter that was sent to the units contact personnel. The letter is shown in Appendix 2. However, the number of the actual respondents varies between universities as shown in Table 4.1. The number of the respondents of UCBL staff and students end up being too small to make any general conclusions. As a result the UCBL is benchmarked only based on the administrative questionnaire.

Table 4.1. The number of the respondents of benchmarked universities.

University	Number of student responses	Number of teaching staff responses
LUT	129	26
TUL	26	25
UCBL	2	5

The opinion questionnaires give us some detailed information about the TUL and LUT respondents. The basic findings between the staff and students of LUT and TUL concern the ages and working and studying years. The age deviation of the teaching staff differs considerably. Figure 4.1 shows that the teaching staff of TUL is in average 10 years older than the staff at LUT.

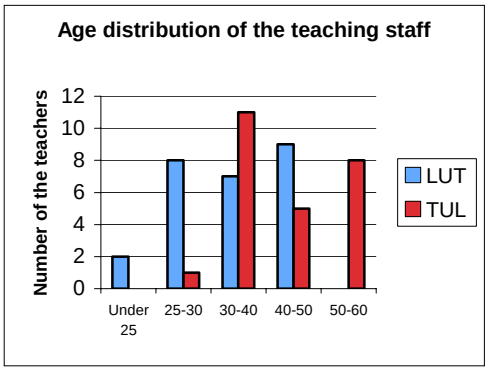


Figure 4.1. Age distribution of the teaching staff of LUT and TUL.

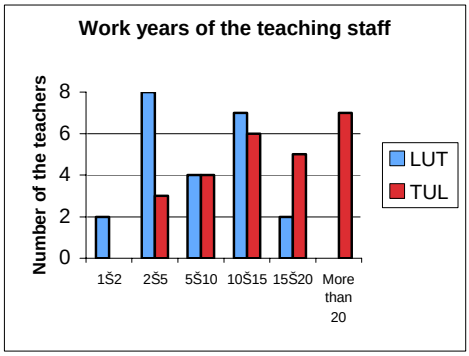


Figure 4.2. Work years of the teaching staff of LUT and TUL.

The age deviation explains the teaching experience shown in Figure 4.2. A remarkable fact is that most of the teachers at TUL (7) have been teaching over 20, whereas most of the LUT teachers (8) only from 2 to 5 years. The relatively short teaching experience of the staff of LUT may partly be explained by the age of the Department, which is only eight years old. The Departments of the EE in TUL and UCBL are older so the professors and teaching staff may have grown with the departments. There are also students working in the Dept. of the

EE in LUT whose tasks include teaching. In TUL the students are allowed to work only in research projects. Students of the UCBL do not have a possibility to participate in research projects or teaching.

According to the administrative questionnaire the average age of the freshmen is different in all universities. First-year students are usually 18–19 years old at TUL, 20–21 years old at LUT and 23–24 years old at UCBL. Deviations in the age distribution can also be seen among student respondents. The age distribution of the students at LUT is larger than at TUL as seen in Figures 4.3–4. The distributions of students at LUT and TUL according to the study years are shown in Figures 4.5–6.

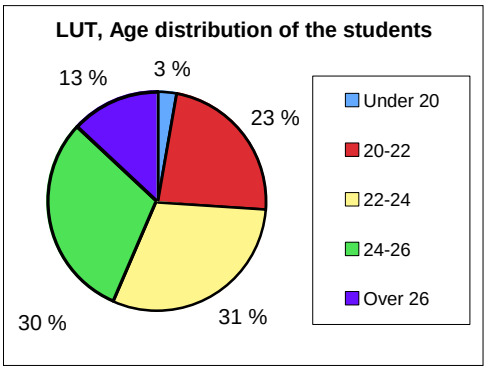


Figure 4.3. Age distribution of the students of LUT.

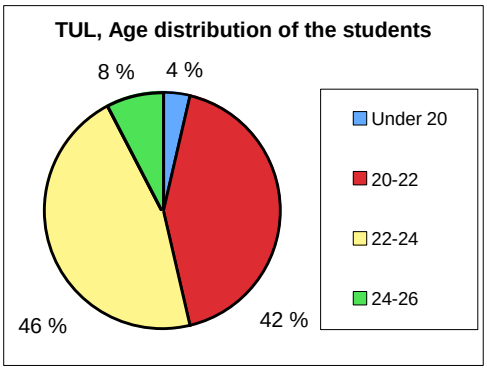


Figure 4.4. Age distribution of the students of TUL.

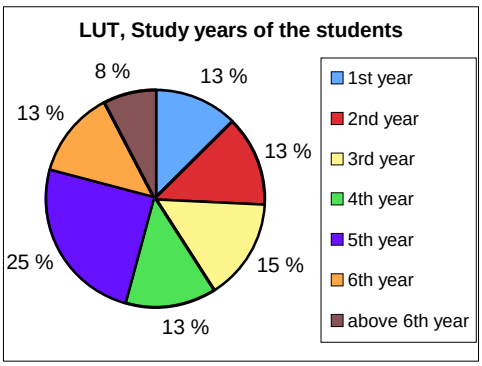


Figure 4.5. Study years of the students in LUT.

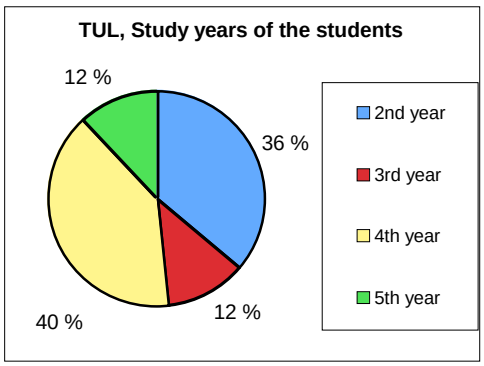


Figure 4.6. Study years of the students of TUL.

The number of student respondents of LUT is almost equally distributed between the first and 6th study years. Figure 4.5 shows that 8% of the student

respondents of LUT have studied more than six years, most of which are 7th -year students. However, there are also some “senior” 9th -year students. The distribution of students of TUL is not so wide than at LUT students; TUL students have studied from 2 to 5 years.

4.1 Backgrounds of the units

According to the administrative questionnaire the EE units of LUT, TUL and UCBL have been accredited by state and they have right to grant B.Sc., M.Sc. and doctoral degrees in Electrical Engineering. The main difference between the units is concerns the quality assurance system. LUT and TUM apply a permanent quality assurance system for all activities at the department, whereas UCBL has no permanent system. The quality assurance systems of LUT and TUM are not certified, but at both departments there is a person who is responsible for issues concerning quality assurance.

The regulations related to the courses and study modules are given university-wide in all three benchmarked universities. However, the faculty council of TUL, the Department Council of EE of LUT and the Department Council of UCBL define the study modules, such as major and minor subjects in the Electrical Engineering units. The actual producers of the education participate in the curriculum planning in every department. At TUL and UCBL the development and planning group of educational issues consist of teachers, and at LUT the planning group has a student and teacher delegate when the actual basic planning is carried out in the laboratory groups that comprise the teachers who teach the courses of the respective laboratory.

Even if the planning of the curriculum and study may modules differ all benchmarked universities concentrate on electronics, only the particular areas of expertise vary. The curriculum of the Department of Electrical Engineering of LUT is focuses on industrial electronics, which contains electronics,

automation and electrical drives, technical physics and electricity markets. The Department of EE of TUL concentrates on industrial establishment dealing with manufacture, transmission and usage of electrical energy in different field of industry. The particular areas of expertise at TUL are construction and operation of the electric power stations, transmission networks, installation and substation. The curriculum of the Dept. of EE of UCBL is focused purely on electronics.

The differences of the curriculum of EE between universities are seen in the specification areas of the staff teaching. The major part of the teachers of LUT concentrates on electrical power engineering or electronics and communication, whereas the distribution of the majors of the teachers at TUL is wider: the focus also covers computer science and automatic control. The specification areas of the teachers of the LUT and TUL are shown in Figures 4.1.1–2.

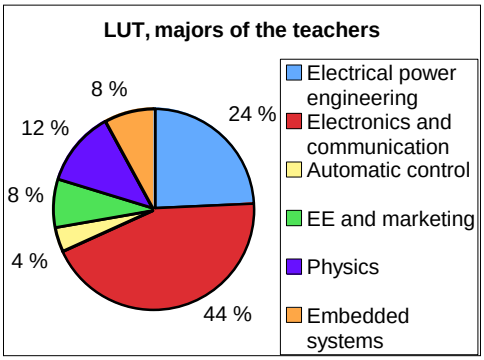


Figure 4.1.1. Specification areas of the teaching staff of LUT.

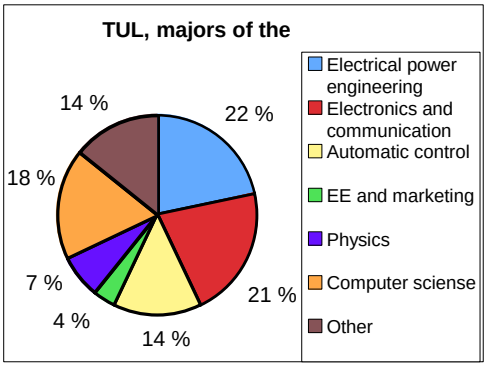


Figure 4.1.2. Specification areas of the teaching staff of TUL.

In Figures 4.1.3 and 4.1.4 show the majors of the EE students at LUT and TUL. More than a half of the students at LUT study, similarly as teachers, concentrate on the electrical power engineering or electronic and communications. The most popular major at TUL is electronics and communication studied by about 70% of the students.

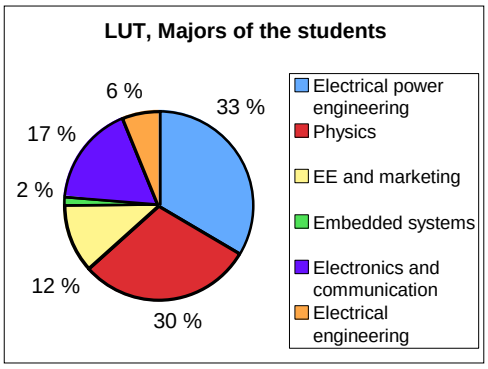


Figure 4.1.3. Majors of the students of LUT.

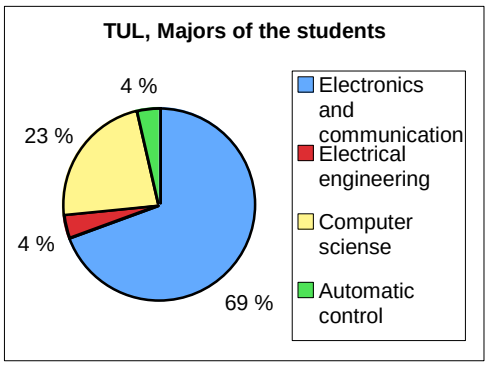
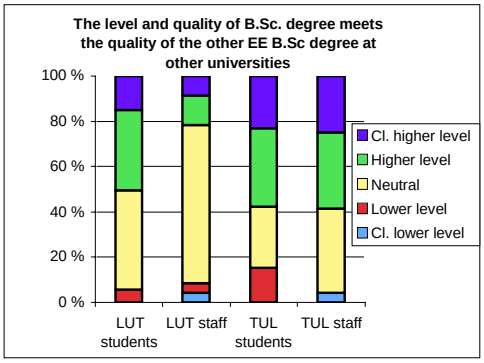


Figure 4.1.4. Majors of the students of TUL.

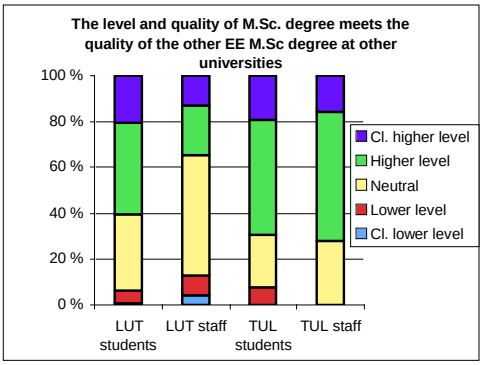
It should be noted that the study majors of the staff and students are not similar with each other. As an example, 21% of the teachers of TUL are specialized in electrical power engineering but none of the students have it as their major. There is an equal situation at LUT: 13% of the staff teaches physics, but there are only 1% of the students have physics as their major. The difference between these percentages can be explained by the curriculum of the LUT because some the physic subjects are compulsory to all students of LUT, and therefore the teachers of physics teach physics to all students of technology at LUT.

The students of LUT and TUL have a possibility to include studies of other domestic and foreign higher education in the degree in electrical engineering. UCBL students are not allowed to include other studies in the EE degree. LUT and TUL allow their students to study in other higher education institutions and most of the students and staff find that the studies in other universities are at least at the same level with their own university.

Figure 4.1.5 shows the opinions of LUT and TUL teachers and students concerning the level of the B.Sc. degree in their home university. 60% of students and staff of TUL consider quality and level of their B.Sc. degree higher than at other universities. Most of the teaching staff of LUT find that the B.Sc. education is at the same level as at other universities.



4.1.5. Opinion of the students and staff of LUT and TUL concerning the level and quality of the B.Sc. degree.



4.1.6. Opinion of the students and staff of LUT and TUL concerning the level and quality of the M.Sc. degree.

The distribution of the opinions of LUT and TUL teachers and students concerning the M.Sc. degree level is almost similar as the distribution at the B.Sc. level. The most optimistic are the TUL students and teachers: 70% find the quality of M.Sc. degree higher than at other universities. Figure 4.1.6 shows that approximately 60% of the LUT staff finds the level of the M.Sc. degree as good as in other universities and 60% of the LUT students believe that the level is higher at LUT than at other universities.

TUL students and teachers share their opinion concerning the level of the EE degrees. In contrast, LUT students and teachers disagree with each other and think somewhat differently about the quality of EE degrees.

4.1.1 Backgrounds of the teachers

When examining the similarities between LUT and TUL teaching staff, it was noticed that the degree distribution is almost the same in both universities. The number of M.Sc. and doctoral degrees of the LUT and the TUL staff are shown in Figure 4.1.7. A noticeable difference between the faculties of the EE units lies in the number of post-graduated as teachers. Seven post-graduated students are responsible of teaching at LUT when the number at TUL is three.

Beside the fact that LUT teaching staff is younger, it is also less experienced in teaching. The age distribution and work years of teaching staff are reflected in the their pedagogical shown in Figure 4.1.8. Most of the teachers of the LUT have not taken any pedagogical studies skills while at TUL almost all teachers have some education in teaching. The teachers of TUL have a two semester pedagogical training before they are granted a permit to teach while LUT and UCBL do not require any training.

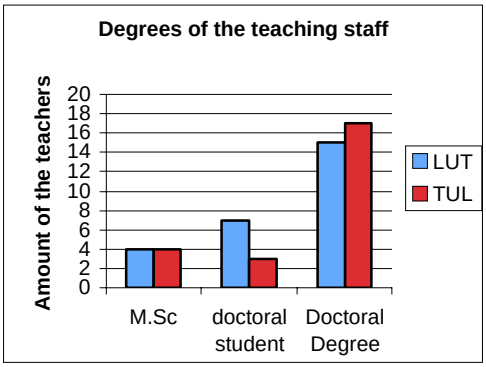


Figure 4.1.7. Degrees of the teaching staff of LUT and TUL.

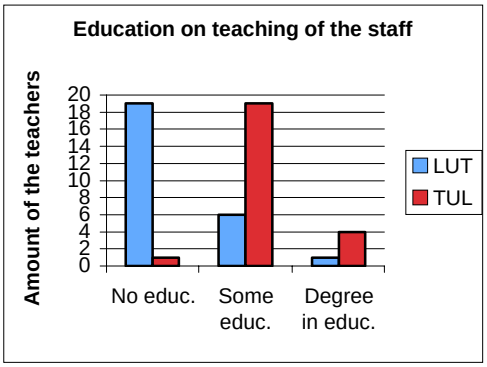


Figure 4.1.8. Degrees or education on teaching staff of LUT and TUL.

None of the benchmarked department expects the teaching staff to update their pedagogical studies. However, based on the organization questionnaire the staff of the TUL takes pedagogical courses and the staff of LUT are participating the pedagogical training or consultation offered to teachers when the home university is organizing it. The teachers of UCBL are least interested in pedagogical studies and do not participate on pedagogical courses. The opinion questionnaire does not correlate with the administrative opinions, because a half of the staff of TUL consider themselves qualified enough and do not participate pedagogical training. Reason for the difference might be the fact that a half of the respondents have already taken all the offered courses and do not see any reason to update their skills. Figure 4.1.9 shows that a half of the staff at LUT is participating or is willing to participate in pedagogical courses.

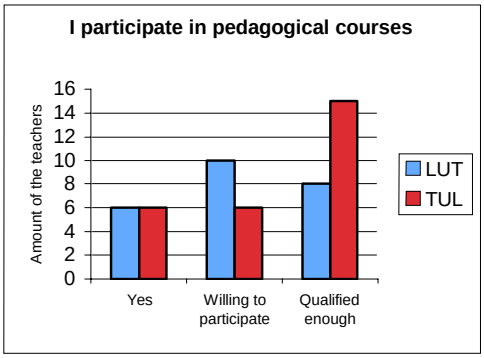


Figure 4.1.9. Opinions of the teachers on participating in pedagogical courses.

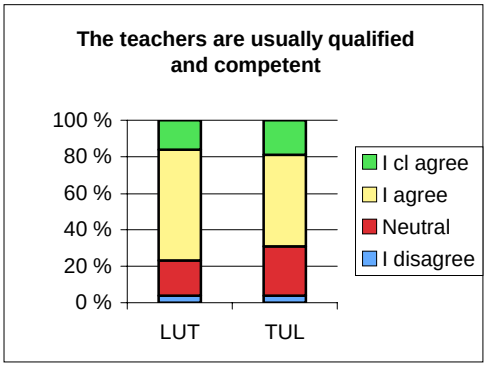


Figure 4.1.10. Opinions of the students of LUT and TUL concerning their teachers' educational competence.

Although there is a considerable difference in the requirements of pedagogical education between LUT and TUL, the amount (or lacking) of pedagogical education does not affect the students´ opinions on the teachers´ competence and teaching skills. Figure 4.1.10 show the opinions of the LUT and TUL students about their teachers' educational skills. The students in both universities share their opinion of teachers' qualifications irrespective of the pedagogic studies the teachers have taken. 80% of students are satisfied with their teachers' competence: very few are of totally opposite opinion.

In every benchmarked EE unit the teaching staff is participating in the research projects. The EE units of LUT, TUL and UCBL are performing research work in the field of advanced studies. The divergence of research work lies in the number of hours spent in research: the amount of research work varies considerably between the staffs of different universities. There are more teachers at LUT whose tasks are linked to research projects than at TUL as can be seen in Figures 4.1.11–12.

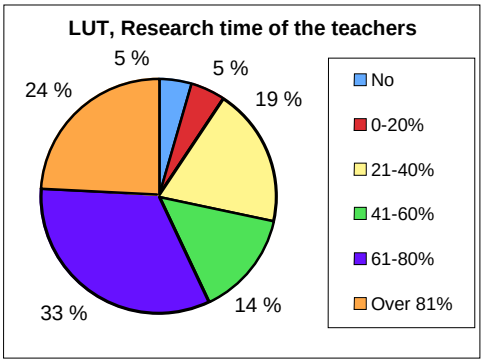


Figure 4.1.11. Time spent in research among LUT staff.

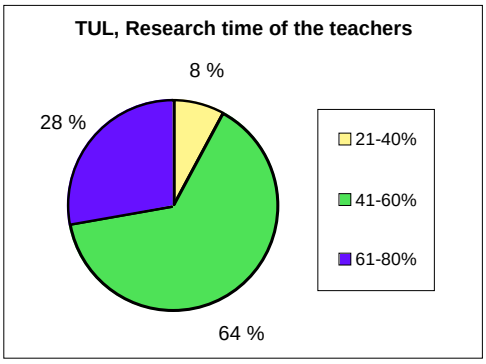


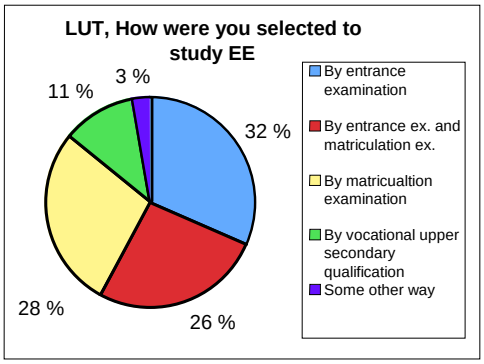
Figure 4.1.12. Time spent in research among TUL staff.

More than a half of the teachers of LUT spend more than 61% of their working hours in research work and approximately 20% spend almost all their working hours in research projects. There is a clear difference between the distribution of the teachers working hours because only 28% of the TUL staff spend over 61% of their working hours in research work and none of them over 80%. It is more common for the TUL staff to be a half-time researcher and a half-time teacher. Based on the study, it can be said that at the Dept. of EE at LUT the researchers teach and at TUL the teachers research.

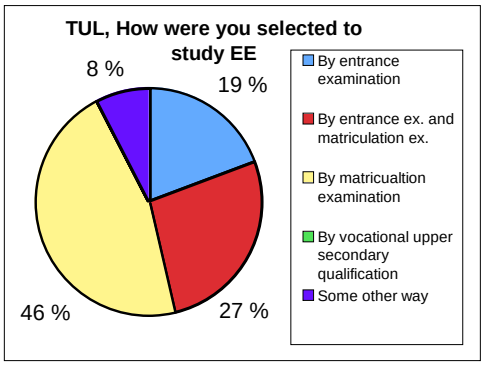
4.1.2 Backgrounds of the students

All universities require some kind of previous education for eligibility, which is for benchmarked universities TUL and LUT the matriculation examination and for UCBL vocational college diploma or higher vocational diploma. Eligible students have to apply separately for the M.Sc. program after B.Sc. even inside the same field of study at TUL and UCBL. At LUT the students apply initially for both B.Sc. and M.Sc. programs. The universities of TUL and UCBL do not use an entrance examination for the studies in electrical engineering. Contrary to others, the Dept. of EE of LUT requires two entrance examinations: mathematics and physics or chemistry.

When the students were asked about the selection method to study EE it was found that also TUL has some kind of an entrance examination. The proportions of selection methods at LUT and at TUL are shown in Figures 4.1.13–14.



4.1.13. Selection of the students to study EE in LUT.



4.1.14. Selection of the students to study EE in TUL.

The proportion of admitted students of the total number of all applicants is 50–60% in UCBL and 71–80% in LUT and TUL. Based on the student questionnaire 93% of the students of LUT and 62% of the students of TUL find it easy to get in to study EE. Only 3% of the students of LUT and 4% of students of TUL have applied twice for admission to study, the rest have been selected on their first application.

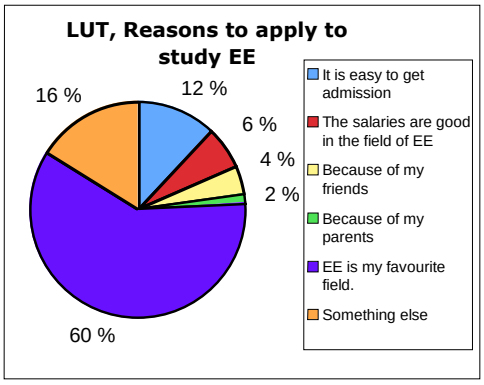


Figure 4.1.15. Reasons to apply to study EE: the students of LUT.

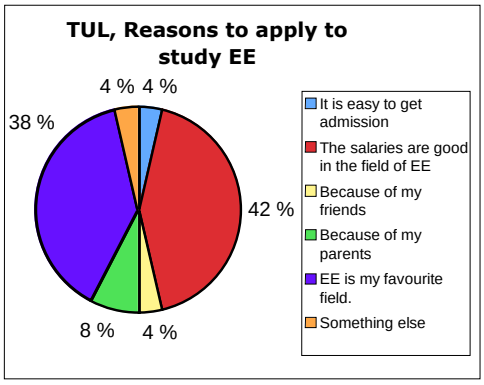


Figure 4.1.16. Reasons to apply to study EE: the students of TUL.

The distribution concerning the reasons to apply to study EE varies between TUL and LUT as shown in Figures 4.1.15-16. The students of the LUT applied mostly based on their interest, while the expected good salaries attract almost a half of the students at TUL.

4.2 Contents of the curriculum

B.Sc. and M.Sc. degrees of EE consist of major and minor subjects, from which students are able to choose according to their interest. The major subject means the main field of study including intermediate and advanced studies. The minor subject refers to additional studies containing basic and intermediate studies. The both subjects include compulsory and elective studies, which can be specified within the electrical field to be something more general such as economics.

The curriculum of EE is examined through the amount of elective/compulsory studies and general/specific studies. The differences of curricula of EE of LUT, TUL and UCBL can be investigated by analyzing the amounts of ECTS in certain study modules and subject sections, such as electronics, mathematics, physics, information technology, automation, languages and practical training. All the ECTS credits shown in the tables of this chapter are based on the administrative questionnaire. The distributions of opinions concerning the amount of certain studies are shown in the following figures. The data of the figures is gathered from the questionnaire studies for the staff and students.

Besides the ECTS credits and students´ and staff’s opinions on the curriculum and the field of technology, we examine the skills obtained from the curriculum. At the end of the chapter, the students´ and staff’s opinions on the work situations compared to the actual work placements of the graduated students of EE of LUT are compared.

4.2.1 Structure of the curriculum

Credits of the basic and advanced studied included in the curriculum of Electrical Engineering of LUT, TUL and UCBL are shown in Table 4.2.1. In this study, basic studies refer to such courses as electromagnetism, circuit technology and electromagnetic compatibility. The B.Sc. degree of TUL contains the least basic studies and the B.Sc. degree of LUT contains the most basic studies. There is a difference of 25 ECTS between B.Sc. degrees of TUL and LUT. Basic studies are not included only in the B.Sc. degree; in the benchmarked universities also the M.Sc. degrees of EE contain basic studies between 10 to 30 ECTS.

The degrees of TUL and UCBL contain almost the same amount, 75 to 80 ECTS of advanced studies in their M.Sc. degree. LUT is exception; the amount of advanced studies in M.Sc. degree varies between 36 to 90 ECTS depending on the study field and student's major.

Table 4.2.1. ECTS credits of basic and advanced studies in EE degrees in LUT, TUL and UCBL.

University	Basic studies in B.Sc.	Basic studies in M.Sc.	Advanced studies in M.Sc.
LUT	35-40	10-15	36-90
TUL	15-20	25-30	75
UCBL	20-25	15-20	80

The amounts of the elective studies between partner universities are shown in Table 4.2.2. The main difference is found in elective studies in B.Sc. degree. The B.Sc. degree of UCBL contains 80 ECTS and the B.Sc. degrees of LUT and TUL contain 10 to 20 ECTS elective studies. UCBL offer most elective studies also in the M.Sc. degree: 40 ECTS. The M.Sc. degree of LUT contains

10-15 ECTS and the M.Sc. degree of TUL contains 20–25 ECTS of elective studies. The difference of the amount of elective studies is considerable; the difference might be consequence of the concept of elective studies. There may be a free subject of elective studies or the elective studies have to be selected from the given list of studies depending on the major or minor subject.

Table 4.2.2. ECTS credits of elective and electronic studies in EE degrees in LUT, TUL and UCBL.

University	Electives in B.Sc.	Electives in M.Sc.	Electronics in B.Sc.	Electronics in M.Sc.
LUT	10-15	10-15	25-30	17-30
TUL	15-20	20-25	10-15	15-20
UCBL	80	40	33	33

Electronics is one of the basic components of EE degrees. The amount of electronics studies varies between universities, being between 10 to 33 ECTS in B.Sc. degree and 15 to 33 ECTS in M.Sc. degree. The curriculum of TUL contains the least electronics studies and the curriculum of UCBL contains the most electronics studies as shown in Table 4.2.2. B.Sc. and M.Sc. degrees of LUT, TUL and UCBL contain also other studies such as mathematics, physics, practical training, languages, and information and automation technology.

4.2.2 Amount of mathematics and physics

Mathematics and physics form the fundamental base of the electrical engineering studies. Studying mathematics guide students toward scientific thinking and gives tools for problem solving. The importance of mathematics for electrical engineering students is well understood in all benchmarked units,

and thus the degrees contain at least 30 ECTS of mathematics as shown in Table 4.2.3. The amount of mathematics included in the B.Sc. degree is almost similar in all universities; being typically 20–30 ECTS. The difference between units appears in the degree of M.Sc. TUL requires a double amount of mathematical studies compared to LUT and UCBL.

The opinions of the staff and student of LUT and TUL concerning the amount of mathematics are shown in Figures 4.2.1. The opinions do not correlate with the amounts. The EE curriculum of TUL contains approximately 20 ECTS more mathematics than the EE curriculum of LUT and still about 20% of the teaching staff of both universities find that the amount of mathematics studies is insufficient in the EE curriculum. The imbalance is seen even more clearly in the students' opinions. LUT students find the amount of mathematics more often to be too much than the TUL students. Almost 30% of the students of the LUT and only 10% of the students of the TUL think that there is too much mathematics included in the M.Sc. degree.

Table 4.2.3. ECTS credits of mathematics and physics in B.Sc. and M.Sc. electrical engineering degrees in LUT, TUL and UCBL**.**

University	**Mathematics in B.Sc.**	**Mathematics in M.Sc.**	**Physics in B.Sc.**	**Physics in M.Sc.**
LUT	20-25	10-15	20-25	6-45 (major)
TUL	25-30	32	15-20	15-20
UCBL	25-30	10-15	36	0

The amount of the physics included in the electrical engineering studies differ more than the amount of the mathematics as can be seen in Table 4.2.3. In UCBL all physics studies are included in the B.Sc. degree, when physics studies are divided into both B.Sc. and M.Sc. degrees at LUT and TUL. Table 4.2.3 shows that EE curricula include around 30 ECTS credits of physics

studies. The students of UCBL study more physics in bachelor degree than the students of LUT and TUL who continue their physics studies in the M.Sc. phase.

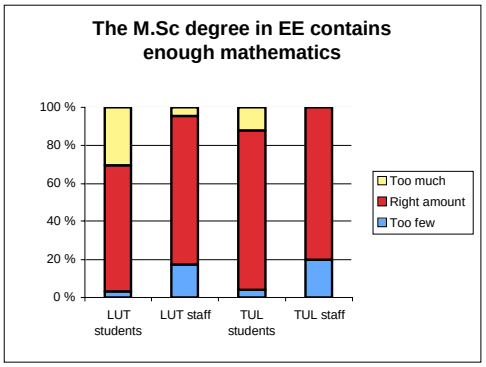


Figure 4.2.1. Opinions of the staff and students of LUT and TUL about the amount of mathematics studies.

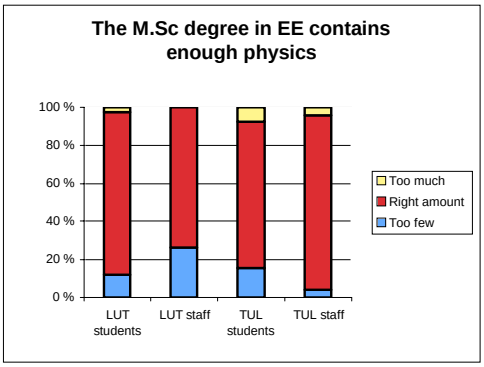


Figure 4.2.2. Opinions of the staff and students of LUT and TUL about the amount of physics studies.

The degrees of EE of TUL contain approximately 5 ECTS cr. more physics than the degrees of LUT. The difference is also seen in the opinions of students and staff as shown in Figure 4.2.2. One fourth of the teachers of LUT find that EE degrees contain too few physics than the percentage among TUL teachers is 5. However, most of the students and teaching staff of LUT and TUL find that the M.Sc. studies contain right amount of physics.

4.2.3 Amount of practical training and language studies

The amount of practical training is almost similar between LUT and TUL; the both degrees contain approximately 5 ECTS credits of training. The degrees of EE of UCBL contain more practical training: the amount is over triple compared to the amount in LUT and TUL as shown in Table 4.2.3.

Table 4.2.3. Amount of practical training and languages in B.Sc. and M.Sc. EE degrees at LUT, TUL and UCBL. The column of languages includes also the ECTS credits of other academic skills such as communication skills.

University	Prac.training in B.Sc.	Prac.training in M.Sc.	Languages in B.Sc.	Languages skills in
LUT	<5	5-10	6-10	2
TUL	<5	<5	10-15	9
UCBL	5-10	27	33	20-25

The opinions of the respondents correlate with the amounts of training and languages studies, and thus the less the curriculum contains those studies the more often the staff and students find that the amount is too small. Figure 4.2.3 shows that most of the teachers and students of LUT and TUL would like to include more practical training in the EE degrees.

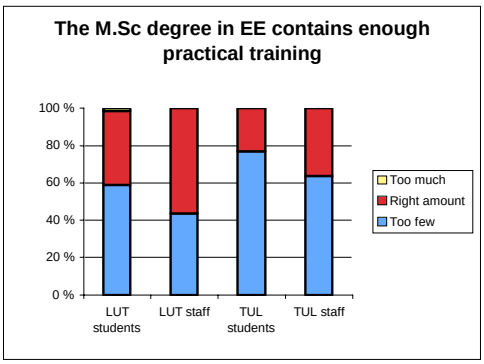


Figure 4.2.3. Opinions of the staff and students of LUT and TUL about the amount of practical training.

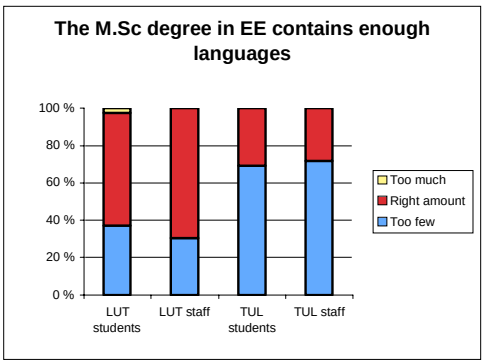


Figure 4.2.4. Opinions of the staff and students of LUT and TUL about the amount of language courses.

The BM project examined also the amount of languages and other academic skills included in EE degrees, which are shown in Table 4.2.3. Academic skills include such subjects and issues as information collection and communication and presentation skills. A notable finding is that UCBL includes notably more language courses and academic skills in its B.Sc. and M.Sc. degrees than LUT

and TUL. The degrees of UCBL contain approximately 55 ECTS cr. of languages and other skills when the degrees of LUT and TUL contain only 10 to 15 ECTS credits.

Figure 4.2.4 shows that this difference is also reflected in the opinions of the students and staff about the proper amount of language. Common for the student and staff opinions of the TUL and LUT is that almost nobody finds that the amount of languages and academic skills or practical training included in the EE curriculum is too large.

4.2.4 Amount of information and automation technology studies

All benchmarked units have automation and information technology in their electrical engineering degrees. The study shows that LUT differs from the BM partners by the fact that some EE major subjects at LUT may not contain informatics and automation at all in the M.Sc. degree. Other benchmarked universities require at least 10 to 15 ECTS credits more information technology and automation in the master degree in addition to the studies included in the bachelor studies. The difference in the amount of IT and automation studies is significant only in the M.Sc. degrees, while the degree of B.Sc. contain almost the same amount of informatics and automation in all units. Table 4.2.4 shows that the amount of information technology included in the B.Sc. degree of EE is approximately 15 ECTS cr. in all the benchmarked universities.

Table 4.2.4. ECTS credits of information and automation technology in B.Sc. and M.Sc. EE degrees at LUT, TUL and UCBL.

University	IT in B.Sc.	IT in M.Sc.	Automation in B.Sc.	Automation in M.Sc.
LUT	10-15	0-10	15-20	0-20
TUL	15-20	15-20	10-15	15-20
UCBL	15-20	15-20	15-20	10-15

EE studies in TUL include more information technology than the EE studies at LUT. According to figure 4.2.5 the students and staff of TUL would like to have even more information technology when compared to the opinions of students and staff of LUT. At LUT most of the students and staff are satisfied with the current amount of information technology studies.

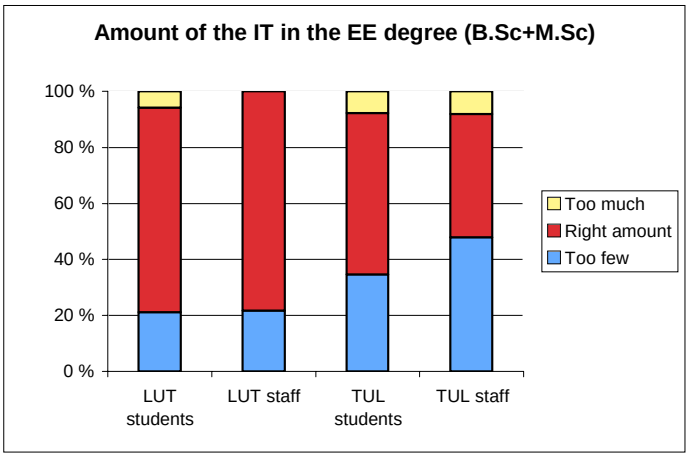


Figure 4.2.5. Opinion of the teachers and students of LUT and TUL about the amount of information technology.

Amount of automation and automatic control engineering studies in B.Sc. and M.Sc. degrees of EE are shown in Table 4.2.4. Studies in automation technology vary more between M.Sc. degrees than between B.Sc. degrees. At LUT automation and control engineering is an elective minor subject of 20

ECTS credits. UCBL and TUL require a total amount of 10–20 ECTS cr. automation studies in the M.Sc. degree.

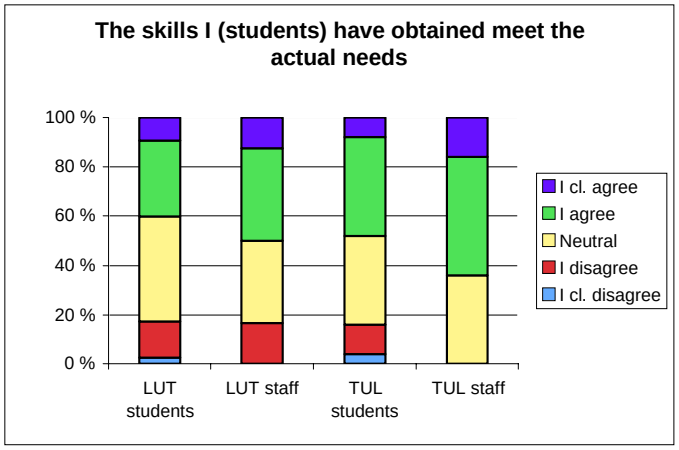
4.2.5 Skills obtained from curriculum

Curriculum is developed and planned differently in every benchmarked university. LUT and TUL rely on the group work when it comes to planning and development of the education. The Electrical Engineering unit of the UCBL has personnel for that kind of work. LUT and TUL have a planning or strategic working group for the development and planning of educational issues such as curriculum and practical training. In the group, there is also coordinator for these issues at the Dept. of EE of LUT. UCBL is the only BM partner in which the development work of educational issues in entrusted to only on the one person.

In order to develop the education, the universities gather feedback from industry, commerce and students. The information to be gathered concerns the skills and competence of the graduated students. TUL collects information from graduates about the obtained skills and actual needs once a year and UCBL gathers the information during the students training period in the industry. LUT gathers feedback continuously in various occasions: by constant contacts with industry and commerce for instance in connection with different research projects.

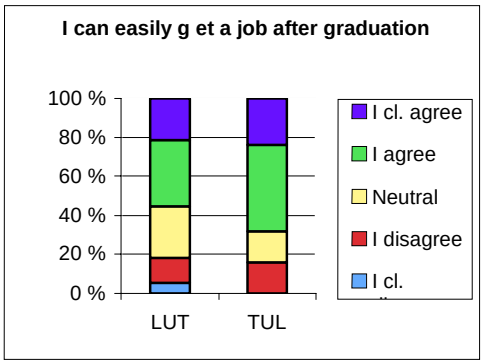
Questionnaires of the student and staff manifest the opinions on the skills obtained during studies but also on how the competence of the students meets the actual needs of the working life and industry. Figure 4.2.6 shows the opinions of the teachers and students of LUT and TUL concerning these skills. The students of LUT have the most negative opinions on their achieved knowledge and skills. Only 40% agree that their skills meet the actual needs.

The most positive group among the LUT and TUL respondents were the TUL staff, with 60% believing that their students have the required information.

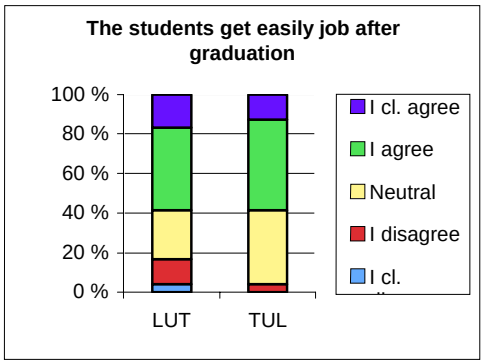


4.2.6. Opinions of the staff and students of LUT and TUL on the correspondence of the skills that students obtain during M.Sc. degree of Electrical Engineering and the actual needs of working life and industry.

The respondents' opinions about the graduates' (future) employment situation are a good indicator of the expectations and needs se to the electrical engineering education and the offered curriculum. Figures 4.2.7–8 show the prospects towards employment situation among the LUT and TUL respondents. It seems that LUT students are somewhat more pessimistic when considering their future than the TUL students. Approximately 55% of LUT students and 65% of TUL students believe that they can easily get a job after graduation.



4.2.7. Opinions of the LUT and TUL students on the employment situation after their graduation.



4.2.8. Opinions of the LUT and TUL staff on the employment situation of the graduates.

The student affairs office of LUT gathers information from graduated students about their working situations. It is carried out by a web-based questionnaire that is addressed to every student at the time of graduation. The statistics of years 2004 and 2005 are shown in Table 2.4.1.

Table 4.2.1. Statistics of the employment situation of the graduated EE students in 2004 and 2005 according to student affair office of LUT.

	2004	**2005**
Number of graduated students.	36	32
Number of graduated students respondents.	27	29
Number of those student respondents who had a working place at the time of graduation.	24	18
Percentage of the students who had a working place at the time of graduation.	88.9 %	62.1 %

60% of the LUT students and staff find that there are working places for students after the graduation. These opinions correlate highly with the statistics, which show that 62% of the students had a working place at the time of graduation in 2005. The percentage was even higher in year 2004 when almost

90% had a working place. The statistics are quite reliable because the percentage of the graduated student who responded to the questionnaire was in the previous year 90% and in year 2004 75%. The BM project shows that LUT teachers and students have very realistic thoughts about the employment situation of EE students.

4.3 Educational processes

The implementation of the curriculum requires support activities and processes that are essential for the education. Educational processes are related to each other and include the activities carried out before, during and after the teaching situations. The processes are independent, such as gathering of the course feedback, but they still have an effect to the previous or following processes, in this case to the planning and arrangement of a specific course. For that reason, it is difficult to draw a line between unique processes, that is, where one process ends and the other starts.

The BM project of the Electrical Engineering divides the processes by following a structure that can be, in many cases, different from the one that has typically been applied to. We start the investigation of the educational processes from teaching arrangements and methods and then head towards the feedback and student evaluation. Finally we take a closer look to the student counselling, which is an independent process from teaching.

4.3.1 Teaching arrangements

Before analyzing the processes is necessary to explain how the teaching is scheduled during the year, weeks and days at LUT, TUM and UCBL. The academic year is divided into two semesters in every benchmarked university, but

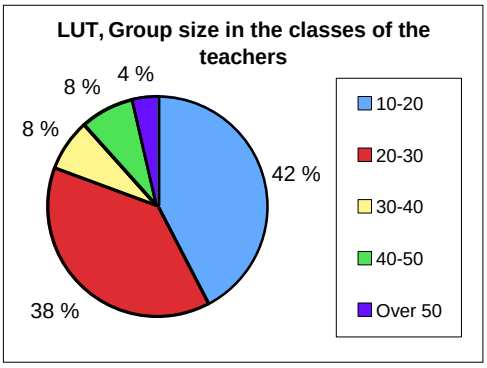
the teaching periods differ between the universities. The teaching period at TUL and UCBL lasts from 4 to 5 months and at LUT from 1 to 2 months, because LUT divides the semester into two periods with an examination week in between for the division of the workload. The lessons are organized during weekdays (Monday-Friday), and none of the departments offer courses or examinations in weekends, summer or during other holidays. However, there may be common examination days or courses organized by the whole university also outside semesters. During the teaching period the lessons are scheduled between 8-19h at LUT and between 8-20h it TUL and UCBL. The universities of southern Europe have a common lunch break between the lectures, while the students and staff of the LUT take a take a brake when they have a spare moment for that.

Another highly effective matter for the course arrangements and the selected teaching methods is the number of students and teachers in each learning situation. The number of student per teacher is depends on the circumstances: whether the lessons are kept in classroom, computer class or in a laboratory. The ratios of teacher/student in teaching situations are different in the benchmarked universities as shown in Table 4.3.1. The administrative questionnaire shows that the smallest teaching groups are at LUT and the largest in UCBL. At LUT there are about 20 students participating in the lectures and at UCBL 30 students per teacher. The ratio of teacher/student in laboratory works is obviously smaller than the ratio in classroom situations, and thus the ratio it LUT is 1/10 and it UCBL 1/20.

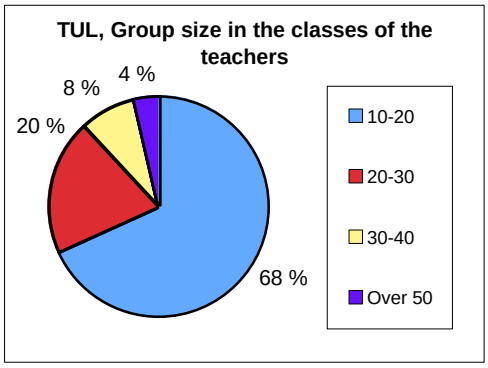
Table 4.3.1. The ratio of teacher/student in teaching situations.

Ratio of teacher/student	LUT	TUL	UCBL
Classroom	1/20	1/25	1/30
Laboratory	1/10	1/15	1/20

Group sizes and ratios where asked also from LUT and TUL teachers and the responds correlate with the administrative figures as shown in Figures 4.3.1–2. Almost 90% of the teachers at TUL and most of the teachers at LUT estimate their group sizes to lie between 10–30 students.



4.3.1. Opinions of the teachers of LUT on the group size in their classes.



4.3.2. Opinions of the teachers of TUL on the group size in their classes.

TUL groups contain usually 5 students more than the groups at LUT. Despite the fact that the divergence is small it can be seen in the opinions of the staff and students. The TUL teachers and students find the groups too large more often than the staff and students of LUT. Figure 4.3.3 shows that approximately 20% of LUT staff and 40% of TUL staff find that there are too many people in their class.

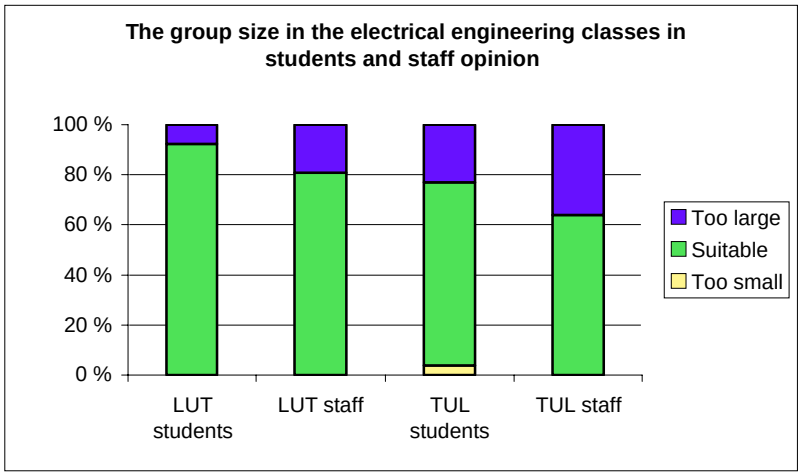


Figure 4.3.3. Opinion of the LUT and TUL staff and students on the group sizes in Electronic Engineering classes.

Teaching periods and group sizes are basic limitations that have to be taken into consideration when planning the education. Time spent on planning and teaching by teachers is not shown in the monthly salary at TUL, LUT and UCBL. The different duties such as teaching, research and administrative matters are included in the monthly salary in all benchmarked departments. The staff of the EE units uses their working hours differently as shown in section 4.1.1 and in Figures 4.3.4–5. It has been shown that LUT teachers use more time to research work than TUL teachers and thus is understandable that TUL staff spends more time in teaching than the LUT staff. The amount of contact lessons in a week is approximately between 4 and 12 among TUL staff and between 1 and 8 among the LUT staff. It is significant that none of the teachers at LUT has more than 12 contact lessons while some of the teachers of TUL may teach even more than 20 hours per week.

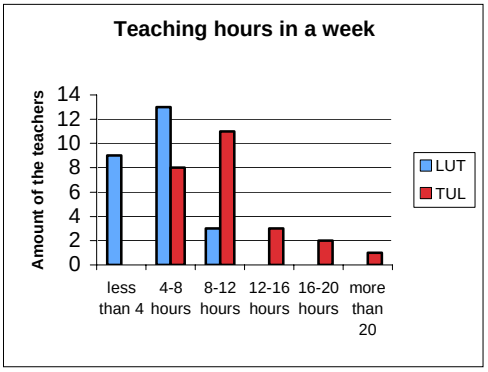


Figure 4.3.4. Amount of the contact teaching hours of the teaching staff of LUT and TUL.

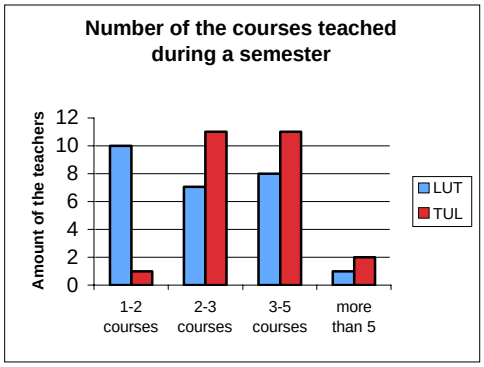


Figure 4.3.5. Amount of the courses that the TUL and LUT teacher teach during the academic year.

The large teaching workload of the TUL staff is based on the amount of courses taught during the academic year shown in Figure 4.3.5. However the difference between the teachers' courses at LUT and TUL is not so clear as the workload measured in hours. Figure 4.3.5 shows that almost all teachers at TUL are responsible for 2 to 5 courses. The teaching staff of LUT is not as uniform as the TUL staff, and the distribution of workload is larger. Most of the staff at LUT teaches 1 to 2 courses but almost equal amount teaches 1-5 courses during a semester.

Normally, teaching includes, preparation work made individually or in groups. The amount of the contact hours of the teachers reflects the amount of the planning hours as shown in figure 4.3.6. The curves follow the Gaussian distribution and a workweek of the teachers contain approximately 10–15 hours of planning work of the courses and lessons.

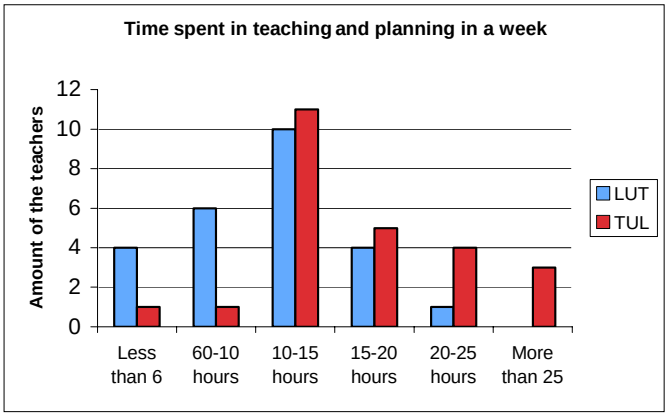


Figure 4.3.6. Planning hours for the courses and lessons of the teaching staff.

When planning hours correlate with the lectured hours, it is expected that the opinions of the staff and students concerning the planning work are similar between LUT and TUL. The most significant finding is the difference in the LUT and TUL staff opinions: 40% of LUT staff completely agrees that they have a clear plan for the content and schedule of their courses, whereas the percentage at TUL is 60. However, Figure 4.3.7 shows that approximately 90% of the LUT and TUL teachers plans and schedule their classes.

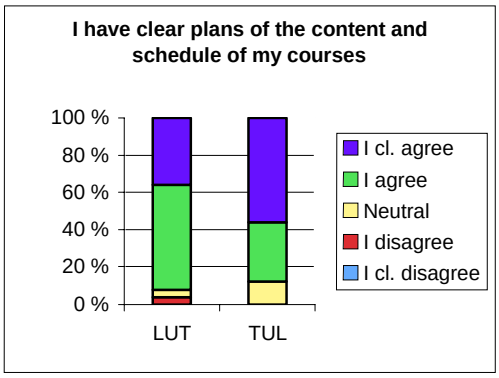


Figure 4.3.7 Teachers opinion on their preparation for the courses.

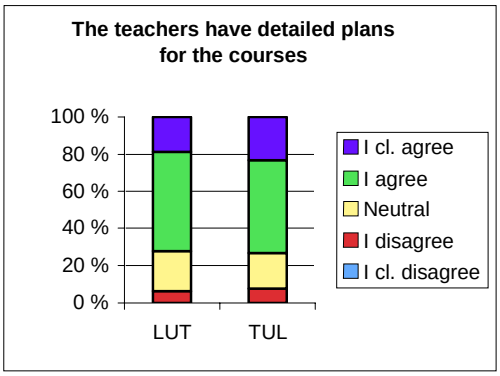


Figure 4.3.8 Students opinion on the planning of the courses and classes.

Students share their opinions with the teachers. According to the BM questionnaire for students, the teachers plan their courses and prepare the classes very well in both universities. Approximately 70% of the students find

that teachers have usually detailed plans for the courses they teach as shown in Figure 4.3.8

For the planning of the courses teachers have to define the used course material and the focus of the course. They have to specify the issue and material for each teaching situation. About a half of the students of LUT and TUL find that the course material is appropriate and first quality in EE classes. The questionnaire shows that the general atmosphere among students and staff is content on the courses and lectures arranged in electrical engineering. The opinions on the focus of the courses are shown in Figures 4.3.9–10.

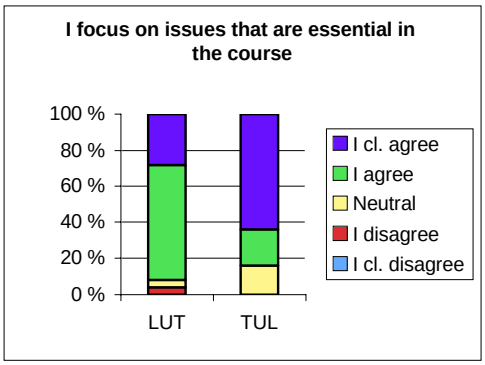


Figure 4.3.9. Opinion on the staff of the course issues.

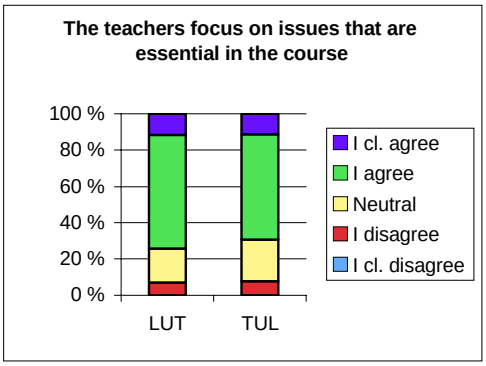


Figure 4.3.10. Opinion on the students according the course issues.

The divergence between opinions is small and it is connected to the sentences “I completely agree” and “I agree”. The essential finding is that approximately 70% of the LUT and TUL teaching staff agree that they concentrate on the essential issues during the lectures. The student share the opinion of the staff and 70% find that the teachers focus on issues that are important in the course.

4.3.2 Teaching methods

Teaching arrangements such as the plans, schedules, group sizes and rooms create the circumstances for teaching. The technology is also one initiator of the teaching

especially of the applied devices that also affect the teaching methods. The rapid expansion of computers has brought the information technology to the teaching in academic world. For example, Power Point shows in lectures are even more common than the white board. The BM-study shows that computer practices are nowadays common both at LUT and TUL universities. Figure 4.3.11 shows that 50% of TUL and LUT teachers include computer exercises in their courses.

The applied teaching methods do, not just depend, on the development of technology; more ordinary matters have a strong impact on the applied methods and set the limits for the organization of the courses. For example, it is clear that the class with 50 students does not fit in the same laboratory at the same time. However, laboratory work is one of the most common teaching methods together with lectures and exercises used at LUT and TUL. Figure 4.3.11 shows the distribution of the utilization of working methods in different courses. LUT and TUL teachers use lectures, exercises, laboratory works, seminars and computer classes. The teaching staff of LUT uses more exercises and seminars as a teaching method than the staff of TUL. Another visible difference concerns laboratory works: EE courses of TUL contain more lab exercises than at LUT. When asking the students for the best methods of learning it was found that the TUL and LUT students regard lectures, exercises and laboratory works as the best ones. These three methods are also the most common ones in Electrical Engineering classes of LUT and TUL.

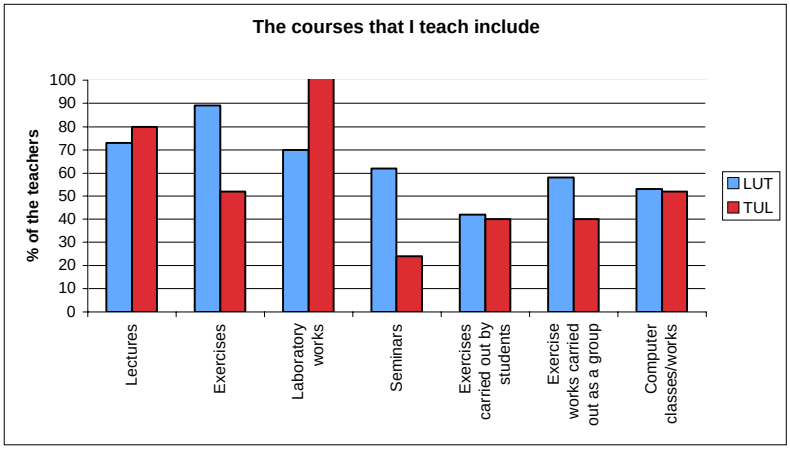


Figure 4.3.11. Opinion of the LUT and TUL teachers on the course contents.

The usage of computers is not limited only to computer classes or works. LUT and TUL Electrical Engineering teachers use information technology and Internet to support their everyday teaching and learning. During the lessons computers are mostly used to show power point shows, pictures, simulations and information pages from Internet.

Figure 4.3.12 shows the differences concerning the opinions of the TUL and LUT students about the LUT and TUL teachers' customs to apply technology and computers during their courses. Differences basically concern the usage of Internet, videos and Web-based learning environments. The staff of TUL uses more Internet and videos as a part of their teaching than the staff of LUT. And vice versa, the teachers of LUT use more often web-based learning environments than TUL teachers.

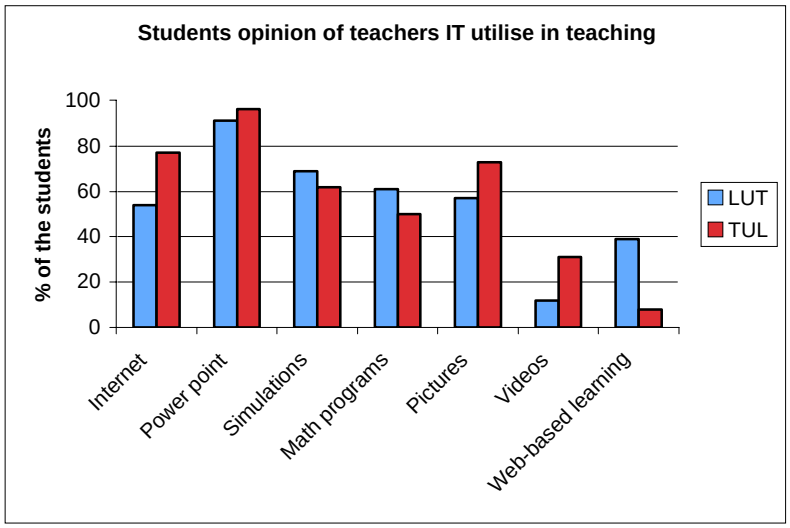
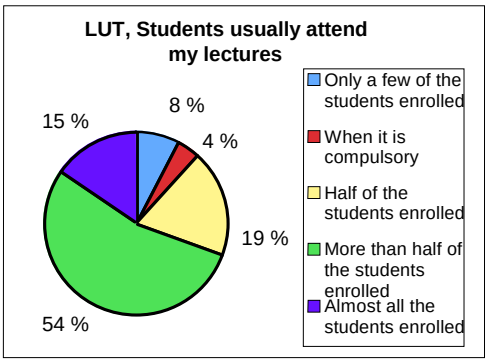


Figure 4.3.12. Opinion of the TUL and LUT students about their teachers´ usage of IT to support their teaching.

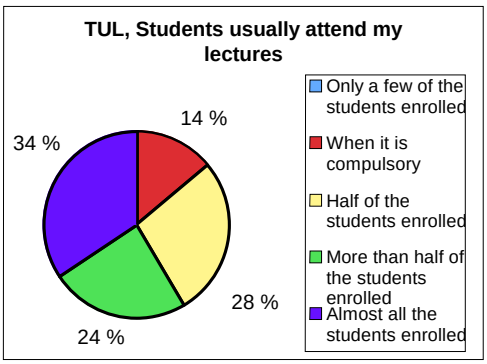
According to the BM organization study, TUL and LUT offer all the information concerning the electrical engineering studies on the web. However, only 75% of the teachers of TUL admit that the course pages are updated regularly. The staff of LUT is more optimistic: 95% of LUT teachers find that they or their assistants update the pages regularly. The difference is not shown in the student opinions;

60% of the students of LUT and TUL find that their teachers are using web as an information source and update the course pages regularly.

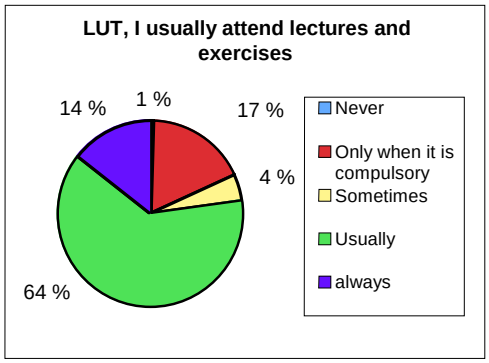
The BM project showed that the applied teaching methods are quite similar at LUT and TUL. The difference lies more in the customs how the teaching situation is defined and whether it is obligatory or elective to attend teaching. According to administrative questionnaire the attendance is usually obligatory for UCBL students in laboratory works, for LUT students in laboratory works and seminars and for TUL students also in exercises and computer classes. Figures 4.3.13–14 show the students' attendance in teaching situations from the staff point of view. The teachers of TUL are the most optimistic and 34% find that almost all the students enrolled on the course are attending in their lectures. The corresponding percent at LUT is 15%, and thus the divergence is wide (20%). The large percent difference is explained by the available options. The LUT teachers chose more the option "more than a half of students enrolled participate" when the TUL teachers picked up the first option "almost all the students enrolled". And thus 54% of LUT staff is of the opinion that more than a half of the students enrolled are participating in the teaching situations when the corresponding percentage at TUL is 24.



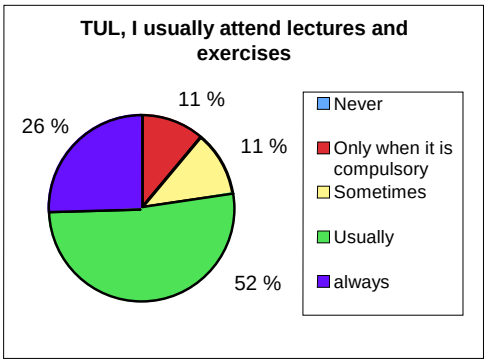
4.3.13. Opinions of the LUT staff on the students' attendance in lectures and tutorials.



4.3.14. Opinions of the TUL staff on the students' attendance in lectures and tutorials.



4.3.15. Opinions of LUT students on the their attendance in lectures and tutorials.



4.3.16. Opinions of TUL students on the their attendance in lectures and tutorials.

The students of TUL and LUT are somewhat more optimistic than the teachers when it comes to the attendance in the teaching situations. Approximately 80% of students say that they participate in lectures and exercises always or at least usually whereas the LUT teachers find that only 54% of the enrolled students participate in the lectures. Figures 4.3.15–16 show that 17% of LUT students and 11% of TUL students attend teaching situations only when it is compulsory.

4.3.3 Course feedback

Course feedback is examined based on the opinion questionnaires at LUT and TUL universities. Both universities collect feedback but in different ways. Web-based questionnaires are used at LUT, whereas at TUL course feedback is gathered by written form or orally. When we examine the responses we are able to state that teachers and students at LUT have nearly the same opinion about the teachers' habits of collecting course feedback and TUL teachers while students disagree slightly about the feedback practices. Figures 4.3.17–20 show that approximately 70% of the staff and students of LUT find that the feedback is gathered by web, while the opinions between TUL staff and students do not correlate with each other.

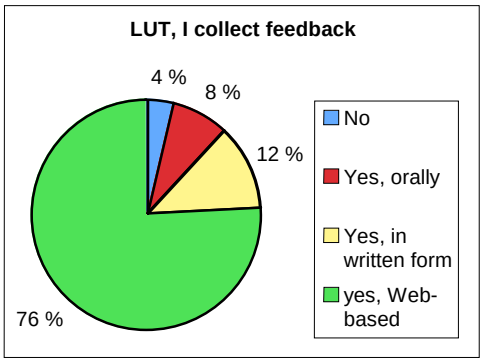


Figure 4.3.17. Situation of the collected feedback according to LUT teachers.

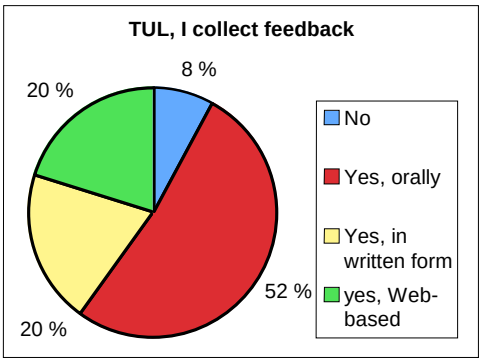


Figure 4.3.18. Situation of the collected feedback according to TUL teachers.

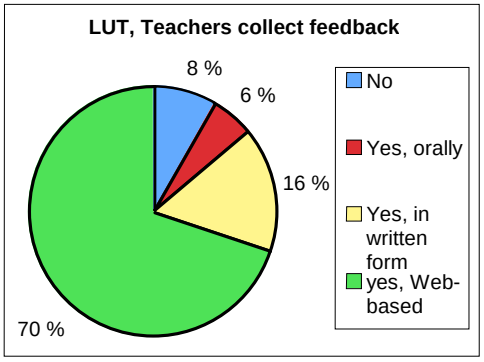


Figure 4.3.19. Situation of the collected feedback according to LUT students.

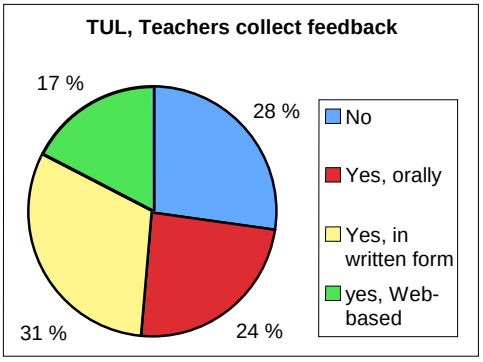


Figure 4.3.20. Situation of the collected feedback according to TUL students.

Most of the teaching staff of LUT and TUL has recognized the value and usefulness of course feedback gathered from students. According to the BM staff questionnaire 70% of the staff of LUT and 80% of the staff of TUL find that the collected feedback from student is useful. The rest of the teachers find the feedback less relevant detail and go on teaching by the way they find the best. When most of the staff finds that the feedback is useful, students disagree with the fact that teachers find their ideas and course feedback helpful. Only about 45% of students at both universities think that their feedback to teachers is useful. The difference between LUT and TUL students do not correlate with teachers' opinions because about 26% of TUL and 15% of LUT students disagree or completely disagree with the fact that their feedback from courses is useful. Thus, based on the study, the TUL staff and the LUT students are the

groups that find the feedback gathering most helpful and the TUL students find that their opinions are not considered valuable.

Another indicator of the usefulness and utilization of the feedback is teachers' responses to student feedback. The same trend is seen in the responses as in the collection of feedback. The LUT teachers respond to student feedback by web-based reports, while the TUL teachers give the feedback orally. The amount of the teachers that respond to feedback is the same in both universities: 20% of the staff of TUL and LUT give feedback as a response to the feedback given by students. Students disagree with the teachers and it is surprising that most of the students find that teachers usually respond their feedback. 70% of the LUT students and 80% of the TUL students find that they obtain some feedback from teachers concerning their opinions of the courses. Figures 4.3.21–22 show the opinions of LUT and TUL students about the situation of teachers' response to feedback, which shows a relationship with the customs of the collection of the information.

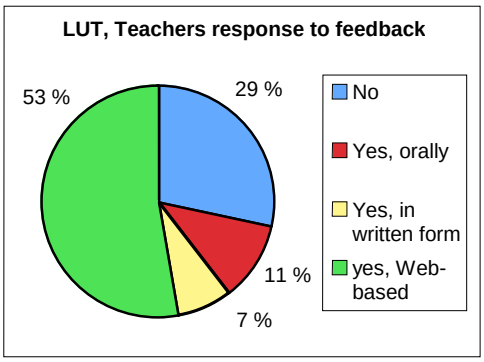


Figure 4.3.21. LUT students' opinion on teachers' habits to respond to course feedback.

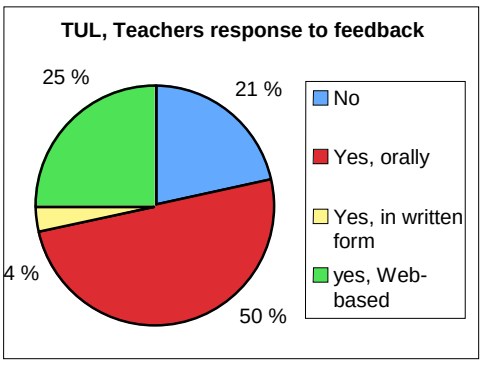


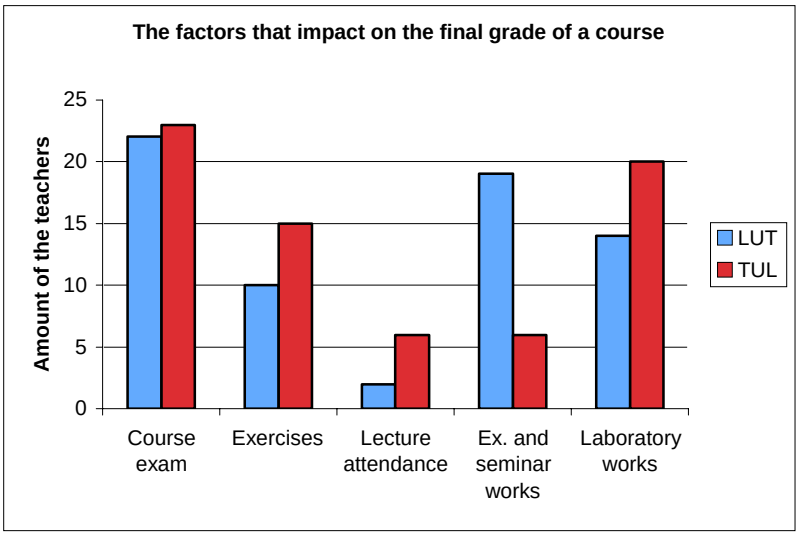
Figure 4.3.22. TUL students' opinion on teachers' habits to respond to course feedback.

Besides the collected feedback there are several other ways to gather information concerning the course. Course exams, final works and examinations are the means to evaluate various issues, such as course contents and focuses, teaching methods and other basic issues (e.g. group sizes).

Examinations and course grading are also useful indicators for students of their level.

4.3.4 Student evaluation

BM organization study reveals that the course grade is usually comprised of the course examination, laboratory works and small exercises. However, the focuses and tasks that has an effect on course grades differ largely between the benchmarked universities. At LUT course grades are based on several factors such as course examination, seminars, practical exercises, laboratory works, small exercises and their combinations. At TUL similar are utilized tasks are utilized when grading the students except the fact that seminars do not have an impact on course grade. UCBL differs from others and it mentions only the course exam that affects the students' course grade. Figure 4.3.23 shows the factors that teachers of LUT and TUL mention to have an impact to students final grade of a course. The major difference between the grading systems concerns the exercise and seminar works. At LUT those assignments have an impact on the course grade, whereas at TUL they have no effect. The TUL teachers base the course grade more on the final examination and laboratory exercises and/or smaller exercise tasks.



4.3.23. Factors that teacher of LUT and TUL mention to effect on the final course grade. Exercises mean small and completed exercises during the course. Exercise and seminar works are individual larger assignments made only once or twice in each course.

There is only one minor noticeable difference between the opinion questionnaire and organization questionnaire. Some of the teachers pay attention also to students lecture attendance when giving the grades. The BM organization shows that students lecture attendance does not have any impact on the grade.

Factors of the final grade are not the only matter that differs between the benchmarked universities. A significant finding is the wide divergence of the used grading scales. Every university has an own grading system. LUT applies the scale from 0 to 5, in which the student pass with the grade 1, and the highest possible grade is 5. The system at TUL is quite similar with LUT: the grading scale is from 2 to 5 and the student fails with 2, and the next grades when student is passed are 3; 3,5; 4; 4,5; and 5. The UCBL grading scale is the most different and the students are graded with the grades from 0 to 20, where a grade below 10 is failed.

The BM project shows that the wide range between the each grading scales is one of the main problems when standardizing the student evaluation in the EU

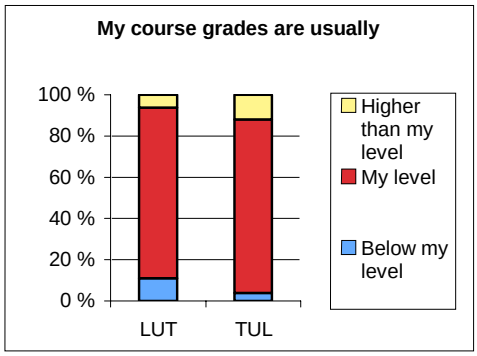
area with the assistance of Bologna Declaration. The grading scales of LUT, TUL and UCBL are each unique. The number of grades included in the scale is the key point when comparing the grades with each other. Now, when the amount of grades varies, the evaluation of students is demanding and some correlation between the scales has to be calculated. This can lead to a situation where the studies conducted in foreign countries and evaluated by a different grading scale are marked as a pass of failed at the home university. An unintended change in the course grade may happen even if the grade is obvious and unambiguous.

Despite the fact that grading scales are different the grading system seems to work at least at LUT and TUL. Almost all the respondent EE students find the applied grading system equitable to all students. Approximately 8% of the students of TUL and LUT discover some faults of the given grades:

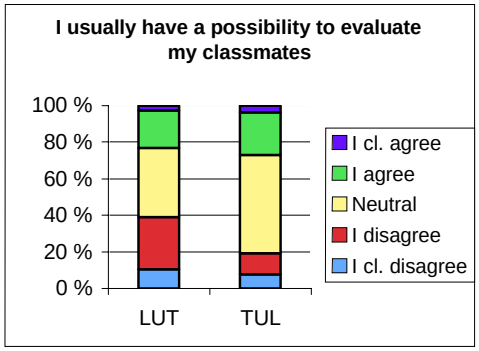
- The amount of points that student gets is not in line with the total work that you have to do to get those point. Teachers use different criteria to evaluate students and sometimes students with the different level of knowledge get same grade because it is only based on the final exam.
- Often-repeated questions in the final exam of some courses might influence the grade, and the students may rather study just those questions to pass the exam than try to really study the subject. It seems to be more important to have a good memory than to learn and understand something.
- Exercise works are graded with the scale passed/failed and that does not provide enough feedback for extensive work required for the assignment, usually tens of hours work.
- There are a number of favourite students, for example working as an assistant, who are treated differently and they get better grades.

When asked about the course grades that the students usually get, approximately 90% of the LUT and TUL students find that their final course

grades correlate with their learned skills and level of knowledge. Figure 4.3.24 shows that approximately 10% of students of both universities consider their knowledge to be higher or below the grades they have got.



4.3.24. LUT and TUL students' opinion of their course grades.



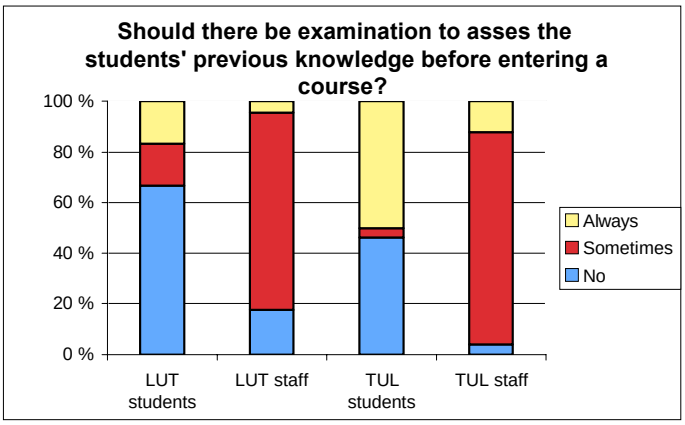
4.3.25. LUT and TUL students' possibility to evaluate each other.

Normally, teachers decide the grades that students are going to get for each course. In some cases, the students have a possibility to evaluate each other thus being able to affect also the final grades. According to the BM opinion questionnaire 60% of the LUT and 50% of the TUL teaching staff make the students evaluate their classmates. The evaluation concentrate on presentations, seminars or exercise works of the students. The students of LUT and TUL see the situation concerning the evaluation somewhat differently than the teachers. Approximately 20% of students of the LUT and TUL find that they have a possibility to evaluate their classmates as shown in Figure 4.3.25. Almost a half of students of LUT and 20% of TUL find that they usually do not evaluate project works or presentations of their classmates.

The most significant factor of the students´ course grade is the final examination usually right after the course. However, there are also examinations before or during the course as a measuring the students' level or as an admittance exam for certain courses. A half of the teachers of Electrical Engineering units of LUT and TUL utilize the tests to assess the students' levels and knowledge before starting a course. However, the results of the tests do not effect to students' course admittance or their final course grade. 10% of

the LUT and TUL teachers always have, and 40% of the teachers sometimes have, some kind of a test to assess the students' previous knowledge in the beginning of the course.

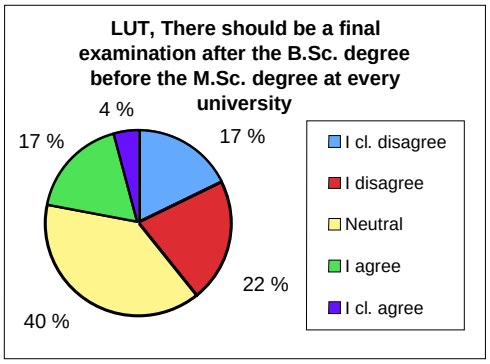
Opinions of the teachers are different from each other when asking the significance of tests for entering a course. Figure 4.3.26 shows that the opinions of LUT and TUL students and staff vary a lot concerning the assessment tests that screens the students allowance in a certain course. The LUT students are most against the assessment: 65% find that it is not necessary to measure their previous knowledge before entering a course. 95% of TUL staff has the opposite opinion and they think that there should always or at least sometimes be an examination to evaluate the students' skills.



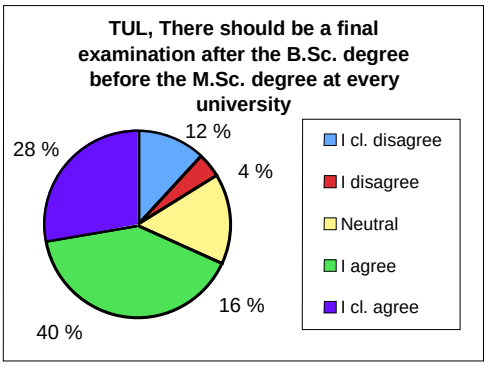
4.3.26. Opinions of the LUT and TUL staff and students concerning the assessment of the students' pervious knowledge before admitting the student to participate the course.

The BM project analyzed also the opinions concerning the examinations before students are allowed to proceed to higher classes or writing the master thesis. Among the LUT and TUL students there is a wide divergence concerning the admission to higher classes. 20% of the students of LUT and 60% of TUL find that there should be examinations before they are allowed to proceed to higher classes. The rest of the student respondents said no to allowing examinations. The same student distribution can be found also when concerning the final examinations of electrical engineering before writing the master thesis.

The staff questionnaire also pays attention to the admittance examinations before M.Sc. studies because of the Bologna process and the increased opportunity of mobility. Figures 4.3.27–28 show that there is big difference between the LUT and TUL staff opinions concerning the examinations after the B.Sc. degree before the M.Sc. degree at every university.



4.3.27. LUT staff opinion on the examination before entering M.Sc. programs.



4.3.28. TUL staff opinion on the examination before entering M.Sc. programs.

Most of the teachers at TUL, 68%, agree that every university should keep final examinations to students before they are eligible to study M.Sc. in EE. The teachers of LUT disagree with the teachers of TUL and only 21% of the LUT staff is supports the examination while 40% have no opinion on the issue.

4.3.5 Student counselling

This chapter summarizes the student counselling in benchmarked universities. The student guidance covers all grades starting from freshmen to students who are writing their final works. The guidance includes several issues such as the support of studies and examinations, writing the thesis and utilization of the information technology. Besides those issues we examine the effects caused by the lack of counselling and the reasons behind the students' dropouts.

The basic information source in all the benchmarked universities is the study guide that includes the degree requirements, study modules and course content printed in one book. The student guide is also available on the websites of electrical engineering units of TUL, LUT and UCBL, on which the students can find the updates made after the published version. The students of UCBL get a new printed guide every year, whereas the students of TUL and LUT get the guide for free only in their 1st year. The EE department of TUL is the only one that provides the student guide also in English and it is available on the web too.

The Compilation of the study guide differs between the universities. At LUT the student coordinator, at TUL the head of the department and at UCBL the department council is responsible for the compilation of the guide. Also the information gathering for the compilation of the guide differs between the universities. The collection of information is done at UCBL at the university level and at TUL the guide is produced based on the feedback that the teachers give. LUT uses also the feedback given on the past year's education, which is collected mainly from teachers and students. The Dept. of EE of LUT has a curriculum group that makes the development plans and the department council composes the yearly study program and the courses. Finally the study coordinator collects all the information and the student office of LUT edits the study guide of the whole university.

Besides the study guide, every department offers also tutoring and student counselling to support studying. Tutoring is given personally or in a group. According to BM organization questionnaire the issues that students are advised on differ between the EE units. LUT organizes tutoring and/or guidance in such issues as learning environment, student life, schedules, computers, information technology and major studies. TUL informs students on learning environments, student life and schedules. UCBL pays attention only to the schedules. There are differences in methods, customs and tools used in student counselling at the benchmarked universities. Table 4.3.2 shows

summary of the utilization of different counselling methods in the benchmarked units. The collected information is based on the organization and opinion questionnaires.

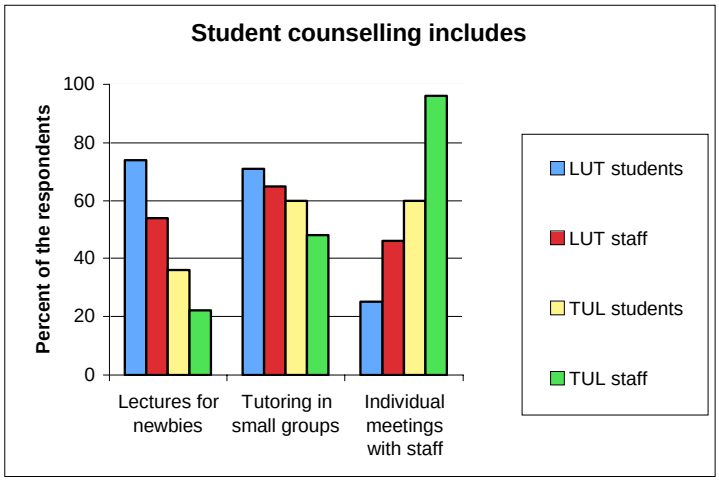
Table 4.3.2 Utilization of different counselling methods and tools in the EE units of LUT, TUL and UCBL according to the organization and opinion questionnaires.

Counselling method or tool	**LUT**	**TUL**	**UCBL**
Study guide	X	X	X
Study guide offered in English		X	
Study guide offered in WEB	X	X	X
Individual study plan	X		
Small group tutoring	X	X	
Information lectures for studies	X		
Introductory course	X		
Information lectures for writing the Thesis	X	X	
Regular meeting with professor when writing the Thesis		X	X

LUT is the only benchmarked university that organizes information lectures to students concerning the major and minor studies. Lectures are elective and held once or twice a year. The EE unit of LUT includes also a compulsory study module in curriculum that is an introductory course in studies and student life. TUL and UCBL do not offer any information and introductory lectures or courses.

The Electrical Engineering units of TUL and LUT organize lectures and workshops for writing the thesis while UCBL does not. For TUL students the participating for the course is elective and for LUT students compulsory. LUT and TUL teachers/professors have an obligation to guide the writing of the B.Sc., M.Sc. and doctoral thesis. For the UCBL staff, this is not compulsory.

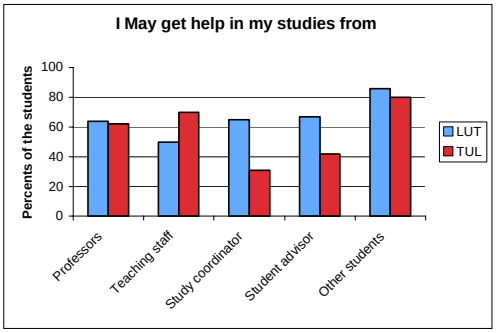
However, all the UCBL and TUL teachers who are responsible for the guidance of writing the thesis have regular meetings with the student concerning the progress of the work. Some professors at LUT do not arrange regular meetings with the students.



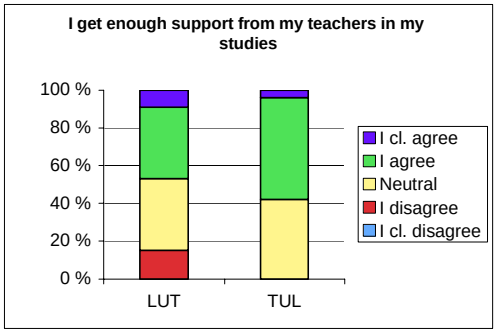
4.3.29. Opinion of the LUT and TUL respondents concerning of the contents of the student counselling.

The divergence of student counselling is reflected in the student and staff opinions. Figure 4.3.29 shows that LUT pay more efforts to lectures for freshmen and small group tutoring than TUL. Counselling of the students of TUL is based more on individual meetings with the staff. Every benchmarked unit has nominated personnel(s) among the staff responsible for the study guidance and student meetings. At UCBL there is a study coordinator, at TUL a student advisor and a study coordinator and at LUT student advisor, study coordinator and tutor teachers. Figure 4.3.30 shows the students' opinion of from who they can get help in their studies. Differences between LUT and TUL are found from the students' attitudes towards the study coordinator and student advisor. Approximately 70% of the students of LUT feel that they can get help from coordinator and advisor. The percentage at TUL are lower than at LUT: 30% of the students of TUL find the study coordinator helpful and 40% feels that they can get help from the student advisor.

Besides the counselling staff also the professors of the EE units of LUT and TUL are responsible for the guidance of the students. The system at UCBL is different and thus the professors of the UCBL do not have such requirements. However, the meetings with the professor depend on the students' willingness and needs, because benchmarked departments do not require regular meetings with the staff concerning students' progress in their studies. The lack of the regular meetings with staff correlate with the opinions of the LUT and TUL staff: approximately 80% of the both departments' staff finds that they do not have any obligations to supervise the students' study progress. 90% or more of the students of LUT and TUL have the opinion that no one is supervising of their studies.



4.3.30. Students' opinions from whom they can get help for their studies in the EE unit.



4.3.31. Opinions of the students of LUT and TUL about their teachers' support in their studies.

Figure 4.3.31 shows that even though the teachers are responsible for the guidance of their students, only about 45% of the students of LUT and 58% of the students of TUL feel that they get enough support from their teachers. A notable finding is that almost 20% of the LUT students need more guidance and support from their teachers.

Figures 4.3.32–33 clarifies the fact why students of TUL feel more often that they get enough support from their teachers than LUT students. The explanation is simple: the teaching staff of TUL is more interested of students' study success than the LUT teachers. According to BM questionnaire addressed to the staff, almost 90% of the teaching staff of TUL is very interested in their

students study success while the percentage in LUT is 63%. There is a difference also at the other end of the scale: 10% of the LUT staff disagree with the sentence “I am very interested in my students study success” while none of the teachers of TUL finds the progress of their students uninteresting.

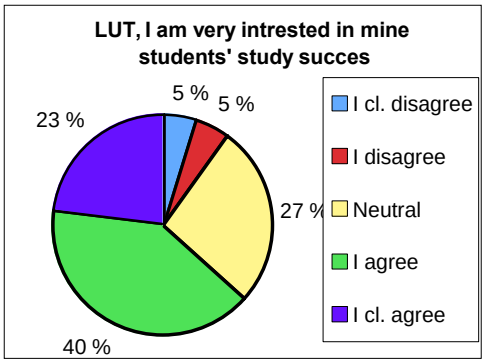


Figure 4.3.32. LUT teachers’ interest in their students’ study success.

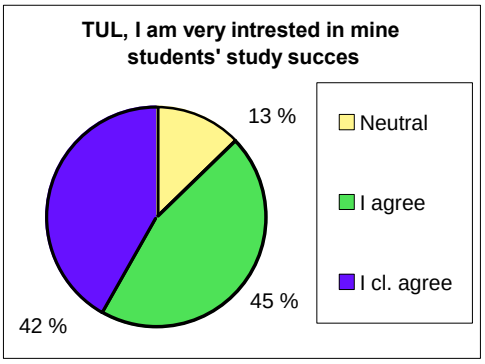
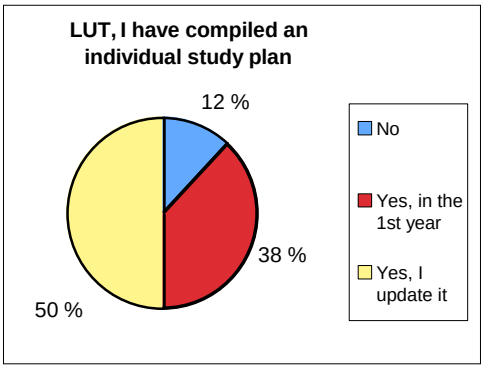


Figure 4.3.33. TUL teachers’ interest in their students’ study success

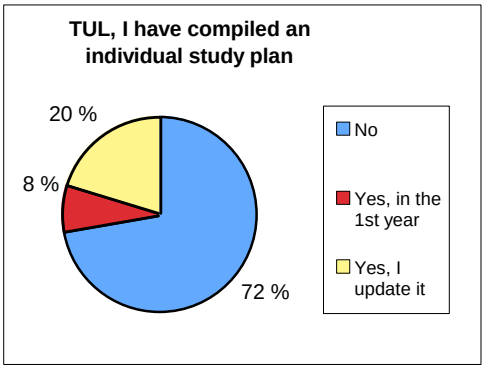
Based on the organization questionnaire, lacks of the study counselling or the help from the staff do not have an effect on the reasons behind the delays or dropouts. Major factors for delays in studies are work and financial matters among UCBL students and leisure activities and financial matters at TUL. Primary reasons for delays at LUT are students’ leisure activities and poor planning of studies. Common reasons for dropping out during B.Sc. and M.Sc. programs are at LUT and UCBL changes of the field of study and in TUL social exclusion. LUT ads one more reason: the students’ lack of interest. All benchmarked universities mention work-related reasons for dropping out during M.Sc. studies.

According to the BM organization questionnaire of LUT the primary factor causing delays in studies is the poor planning of studies. However, LUT is the only department where the compilation of individual study plan is compulsory for student. The difference is seen also in the students’ actions. 88% of the students of LUT have made an individual study plan and 50% of students update it regularly as shown in Figure 4.3.34. Even though the compilation of an individual study plan is not compulsory at TUL, 28% of the students have

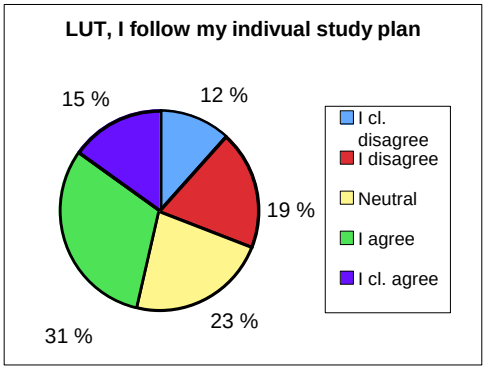
made it as it is shown in Figure 4.3.35. The main difference is found in the amount of students who study without any plan. The BM study reveals that 12% of the students of LUT and 72% of the students of TUL conduct their courses and study modules without the help of an individual written study plan.



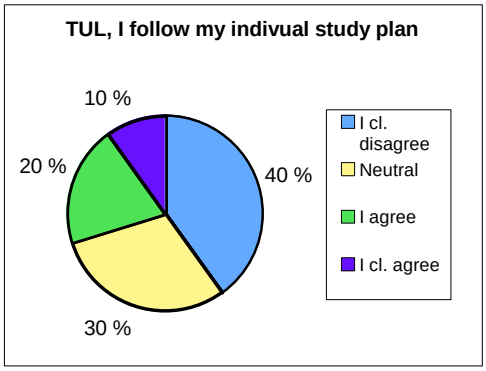
4.3.34. Compilation of an individual study plan among students of LUT.



4.3.35. Compilation of an individual study plan among students of TUL.



4.3.36. Following of the individual study plan among students of LUT.

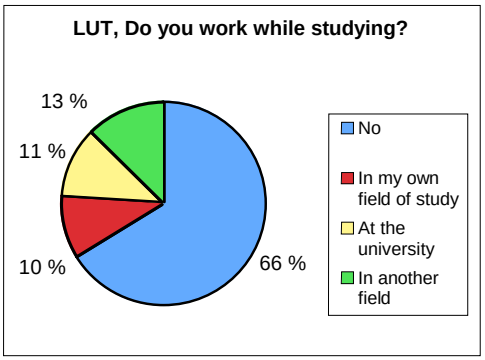


4.3.37. Following of an individual study plan among students of TUL.

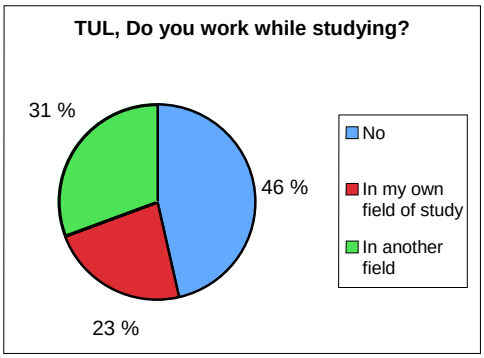
LUT organization's note: "poor planning of studies" is confirmed also from the students' side. Figures 4.3.36–37 show that less than a half of the students of LUT and TUL follow their individual study plan. 31% of the students of LUT and 40% of the students of TUL say that they do not follow their individual study plan. As mentioned earlier, a half of the students of LUT update their study plan, and thus it is easy to understand that 46% of students also follow it. Those students of TUL who have compiled their individual study plan also follow it.

A significant finding is that the obligatory compilation of individual study plan is not the ultimate solution to assist students in conducting their studies. 30% of students of LUT have made the study plan and put it down afterwards. The study shows that other ways have to be considered to encourage students to update their individual plans, to provide better possibilities to follow the study plan and eventually to increase the number of students graduating in a shorter time.

One factor to the extended duration of studies are work-related reasons. The organization questionnaire shows the effect of work especially in the M.Sc. studies. According to the opinion questionnaire, work-related reasons for delays and dropping outs are more common at TUL than at LUT. The students of TUL work more often than the students it LUT. 54% of the students of TUL and 34% in LUT work while they are studying.



4.3.38. Work situation of the students of LUT.



4.3.39. Work situation of the students of TUL.

Figures 4.3.38-39 show that 46% of the TUL students and 66% of the LUT students do not have a working place during studies. The students' working situation is related to the policy of the universities and the EE units, which differs with respect to the students' allowance to work at the EE unit. TUL students are not able to work at the university while the LUT students are, and thus 10% of LUT students work at the university.

5 CONCLUSIONS

One of the aims of the BM process and this Master's thesis was to develop comparison methods that Department of Electrical Engineering of LUT can utilize when assessing the educational processes. The comparison methods include a tool for finding different processes and subjects, a tool for gathering information on the issues and finally, a tool for summarizing the differences and similarities of the BM partners.

The comparison is based on the method and tool used for finding those issues and subjects that are essential to the educational processes, and at same time, worth of gathering; this way the differences between BM partners can be found. The workshop turns to be an ideal tool for finding the common processes how every laboratory and teacher work, and eventually the processes that are the most interesting and thereby the ones that the staff is willing to develop further. When the staff is a part of the project and the basic ideas come from the users and experts of the processes the conclusions that will be made, will be related to the right issues. It is advisable to discuss the process and make conclusions together with the workshop group, not just to introduce the similarities and differences. A conversation with the department staff is required about the drawbacks, insufficiencies and suggested improvements of the selected benchmarking methods and tools.

The selected tool for BM project's information gathering is the web-based questionnaire. The developed questionnaires are easy to adjust to respond to any specific needs arising from the issue or subject under consideration. The utilization of the web-forms is a suitable tool for gathering information when the BM partners are located far from each other. Web-questionnaires also enabled the comparison between LUT, TUL and UCBL. The questionnaires are published by using Webropol, which provides some applications to manage and analyze the results. However, due to their nature, the questionnaires of the BM-process could not be analyzed with the assistant of the Webropol, and therefore, the responses

were examined with Excel. The final version of the developed tool for studying and analyzing the responses, for example in workshops, is the matrix of the Electrical Engineering that presents the results briefly in their own arrays. With the help of the matrix, the information can be shown clearly and the differences between the BM partners can be rapidly detected.

The conclusions on the benchmarking project of the Electrical Engineering are made in three different aspects; 1) the results of the BM project, 2) the selected approaches in the BM project, and 3) the number of the BM-partners.

First we examine the findings based on 3 administration staff responses, 157 student responses, and 56 teaching staff responses at LUT, TUL and UCBL. The conclusions are based on the responses and are mainly the results of the whole project and the chapter sums up the main differences and similarities between the benchmarked universities and electrical engineering degrees. We pay attention also to the project itself and go trough the selected approaches and methods in the BM project. Finally, we study the effects of the number of the selected partner universities and how the number of the partners affects the benchmarking.

5.1 Results of the benchmarking project

The questionnaires addressed to the LUT, TUL and UCBL organizations, staff and students show that the contents of the curriculum are quite similar in each EE department. At every university, the curriculum of the Electrical Engineering consists of core subjects such as mathematics and physics, main subjects such as electronics, automation and electrical engineering, and supportive subjects such as languages, other academic skills and practical training. The benchmarked EE degrees contain also compulsory and elective studies that are either freely or partially elective. The main difference between the electrical engineering curricula in different universities does not lies the content of studies, but chiefly in the sizes of certain subjects and studies. The sizes of core, main and supportive subjects

vary between benchmarked universities, similarly as the amount of compulsory and elective studies. The greatest difference can be detected in the elective studies included in the B.Sc. programmes. The B.Sc. studies of UCBL contain 80 ECTS credits of elective courses while the amount at LUT is 10-15 ECTS credits.

The BM study confirms the similarity of the education of electrical engineering in different universities. The daily routines, practices and timetables of the teaching situations are quite similar aside from certain cultural differences, such as the siesta and afternoon break that are not known in Finland. The teaching methods and arrangements are similar at LUT, TUL and UCBL. The Most common teaching methods in every benchmarked university, such as lectures and exercises, are also the ones that staff and students prefer. The major difference between the universities lies in the utilization of web-based learning environments, which is not as common teaching method at TUL and UCBL as it is at LUT.

In every benchmarked EE unit the final course evaluation is based on the skills that student has achieved during the course. The main components of the evaluation are the final course examination and practical assignments. However, the applied grading system differs in each university and the scales do not correspond to each other. The diversity of the used grading scales is the most confusing issue that has an effect on the mobility of the students.

Planning of the electrical engineering studies proceeds from the whole curriculum towards the study modules and separate courses. In every benchmarked unit there are planning groups that are responsible for the general outlines and decisions concerning the teaching and courses. The composition of the groups varies between benchmarked units, but the planning groups comprise at least administrative and teaching staff. In every university, the teacher who is responsible for a course is also responsible for the planning the teaching situations. Opinion of the teachers and students at LUT and TUL correlate with the planning work; they find that teachers have a clear plan for the content and schedule of their courses and the focus is on essential issues of the subject.

The teaching staff of every benchmarked EE unit is responsible also of the research work, and consequently, the researchers teach and teachers research. The difference lies between the workloads of the staff and the amount of the hours spent on teaching and research work: the researches of the LUT teach and the teachers of TUL research.

The greatest difference between the educational processes of LUT, TUL and UCBL concerns the student counselling. The study shows that the amount of personnel(s) for study guidance does not depend on the size of the EE unit or the number of students, but on the different counselling processes carried out at the department. LUT has more personnel for guidance than in TUL and UCBL, because the duties of the study guidance, such as the compilation of the study guide, are divided differently in each EE unit. The students of TUL and UCBL more often solve their study problems in individual meetings with their professors than at LUT. This may also affect to teachers' opinions; the staff at TUL finds more often that they are interested in students' study success than the teachers at LUT. The students share the opinion and students at LUT feel somewhat less than the students of TUL that they get enough support from the teachers. The Department of EE of LUT relies more on the specific tutor teachers, small group tutoring and information lectures as a part of the guidance process than the partner universities. Beside the personnel for study guidance the students get information from each other; further LUT uses peer tutors, fellow students, to guide freshmen.

5.2 Approaches of the benchmarking project

The information of BM process of electrical engineering was gathered by web-questionnaires. The electronic multiple-choice questionnaires are a convenient way to collect information and opinions of the staff and students when the number of response is high as in this case. However, the number of the responses varies a lot between universities, for example at UCBL responded 5 teachers, at LUT and

TUL from 25 to 26. The unequal distribution of the respondents affected to the BM project causing deficiencies in the required background information.

To avoid uneven distribution of answers, first, it should be ensured that there would be an equal number of respondents in every benchmarked university. This means that the number of respondents in each target group to fill in the questionnaire have to be decided and chosen beforehand. The sampling is large enough if, for example, the student questionnaire is addressed randomly to 20 students in the grades from 1st to 6th. That would help to ensure an equal number of responses in each grade, and thus a large number of the answers from the first of fifth year students would not dominate the responses or give the wrong impression about the students' general opinion or distribution. However, it is impossible to guarantee an equal number of respondents; it cannot be achieved even by sending the questionnaire to same number of people because of some respondents' lack of interest to fill in the questionnaire. Now the numbers and percentages of the received answers can be used as an indicator of the general willingness to improve the education and the effort that each respondent is ready to make. When we are paying more attention to the addressing of the forms to the possible respondents, it is more probable that we obtain an equal amount of respondents (at least almost equal) at each level in different universities. This guarantees more even distribution of the opinions and makes the comparison easier.

When the respondent group is selected we have to remember to consider the time limits we are ready to set for the responds. Now the deadline was unclear and we had to ask the respondents to fill in the questionnaires several times because of the low respond number. An undefined deadline and the delayed responses caused extra work: the questionnaires had to be analyzed, and the figures plotted, twice. To avoid these kinds of harmful effects there should be an exact schedule that includes enough time for responding. We learned that one month is suitable for the deadline.

The biggest problem concerning the questionnaires of the BM project was not the information gathering or the availability of the responses but the planning and analyzing of the forms. The BM project comprised three different forms for each response group and the questionnaires were well planned and tested by several respondents, but still there where some differences between the student and staff questions, also in the case when they had to be identical. There have to be very close comparison between the forms to make sure that each question is measuring the same thing. For instance, word selection is of crucial importance: selecting a slightly different term (synonym) for a certain concept in another questionnaire may change the whole sentence, or at least, the word selection may influence the respondents' way of thinking. The small differences between the forms do not affect the relevance of the subjects but may cause differences in the responses, end therefore the opinions are no longer as comparable as they were meant to be. As a conclusion, it is better to use the same questionnaire form for all respondents whenever possible, or at least to use more time to carefully check and double-check the forms to reduce the usage of the synonym expressions.

Another relevant issue concerning of the questionnaires used in the BM project is the length of the forms and the amount of the compared issues. The questionnaires should be long enough to clarify the issues but not as long as the BM-questionnaires for electrical engineering student and staff, because many of the interviewed students admitted that they paid somewhat less attention to the questions at the end of the form than the to first ones. Furthermore, the save option did not help as we hoped: very few of the respondents saved the form and continued the filling later with better time. The forms are filled usually at once and the respondents seemed to believe beforehand that there would be only a few questions, as in the typical questionnaires they had filled in previously (e.g. course feedback questionnaires applied at LUT). Now, with this experience, it is clear that the appropriate way to design the questionnaires is to divide the used form into two different parts so that the respondents have more patience also at the end to read the question and choose the most suitable option not just the correct one. The analyzing of the long forms and the large number of responses is a laborious

process, and therefore it is convenient to do it in two parts and not to try to assess all educational processes at once. The BM project included a wide area of the educational issues, and thus the questionnaires became quite long and some of the information gathered turns out to be additional information. Concerning the BM, it is better to concentrate on two different areas in one questionnaire form than to try to cover all areas.

The study showed that when the number of respondent is as large as in this BM project is better to use multiple or cross-box questions than open questions. However, the used BM-forms contained had a major deficiency: the forms did not include any open question or any room for the general opinions that arise in filling of the forms. The respondents need an open room to give feedback or any another opinion they have on the issues asked in the questionnaire. The lack of the open questions is not a major problem if there is a workshop between all BM partners after analyzing the questions. The group for workshop has to contain an equal number of the different respondents from every participant university. In this BM project the best group composition will be achieved with two teachers, two students and one administrative participant of LUT, TUL and UCBL. That makes 15 participants in total in the workshop, which is a small group enough to ensure an intensive conversation, yet large enough to provide different points of views in every issue. The student members should represent lower and higher grades, whereas the teachers should be specialized in different majors. The divergence of the participants secures diversified of the information sources, and thus the participants actually represent the whole EE department.

We all know that in a group of 15 participants, to have an in-depth conversation in which all pay attention to the others' opinions, no matter who the participants are, is a hard task. The other problem is time; the workshops are always competing against it. For these reasons the workshop involves also small group tasks to compare and go deeper into different subjects, such as teaching arrangements, examinations, course and final grading, feedback gathering, student counselling, curriculum and workloads. When each group, one at the time, introduces their

topic and discusses the differences and similarities that they have found, and leads the conversation in the workshop with all participants, the discussion will be much more controlled and the number of the speakers can be managed. One of the small group tasks should be accomplished with separate groups consisting only students, teachers or administrative staff to guarantee a possibility also for students to represent their objective opinions. That ensures a safe atmosphere for conversation, and thus students do not have to be afraid of any disrespect.

The case study shows that the workshop between the BM partners is a useful method to go deeper into the benchmarked issues and the discovered similarities/differences. This and the successful workshop arranged in the beginning of the BM project are the main reasons why the Dept. of EE of LUT is willing and should organize a workshop between LUT, TUL and UCBL. Without the workshop the results achieved in this thesis will remain unclear and some of them are even useless. When the staff of LUT is familiar with the results based on the questionnaires it begins to plan and arrange a meeting with the partners to describe the compared issues and even to create a new fruitful partnership.

5.3 Number of the BM partners

The BM project of Electrical Engineering proceeded from information collection among the 52 European universities towards the comparison between couple of EE units. When starting the closer comparison, it became obvious and reasonable to conduct the project with several partners, and thus the Department of EE of LUT selected three partner universities. Finally the questionnaires were sent to two partner universities located in Poland and France. However, in this case, when the department's comparability is proven with several partners, it would have been better to conduct the final benchmarking only with one partner, because previous studies show that the peer group is thus equal. Even if the closer study between several partners is a common benchmarking method, one partner for the Department of EE of LUT would have been more appropriate due to the

differences in the studied processes between the analyzed universities. The BM project with three partners is more complicated, and thus the number of issues causing distortion is larger than with one partner. In this case, the lack of the responses from the UCBL staff and students is a good example of a possible failure of the process.

The problem in the projects with several partners is the motivation and equality between the partners. How to ensure that the all partners are as motivated as the leader university of the BM project? There has to be one responsible person for the project at each university to support the participants to respond to the questionnaires. LUT and TUL were motivated, but the third part, UCBL, was not as interested in the project as the others, and thus the contact personnel of the UCBL did not paid enough attention to encourage students and staff to respond to the questionnaires. One reason behind the lack of the motivation might be the previous electrical engineering BM projects, in which the UCBL did not participate.

It became obvious that BM conducted with two universities ensures the equality of the partners and offers a more confidential and open atmosphere, and it also guarantees that the both the units conduct the same tasks, and thus the information gathering is not threatened. Furthermore, benchmarking with one partner offers a more fruitful basis to long-lasting partnership and cooperation than a benchmarking project with several partners. The successful benchmarking increases possibilities for the students and teachers to exchange between the partner universities. In this case, TUL, LUT and UCBL are all participating in Socrates exchange program that allows the students to exchange between foreign universities. However, UCBL does not accept any electrical engineering students from LUT; nevertheless on the basis of this study, there seems to be no real reason why the students of electrical engineering could not go to spend a year also at UCBL. TUL offers posts also for post-graduate students and doctoral students of electrical engineering. The BM study shows that, similarly as the students' exchange is possible between these universities, the teachers and researchers

exchanges are worth promoting, especially between LUT and TUL where the language of the M.Sc. and D.Sc. degrees is English and the educational processes are more similar to each other than the ones used at UCBL.

As mentioned earlier, there should always be a time limit, a deadline in the BM projects; this time limit has an effect on the issues to be studied and analyzed. The information on the subjects that are collected from several partners is more general than in benchmarking projects carried out in pairs. One aim of the BM project of EE was to clarify the difference of certain course contents, for example the headlines and focuses of the electromagnetism. With two benchmarking partners that aim was not reached during the time available and the studied subjects stayed at a more general level such on the focus of the curriculum. The lack of the time was the main factor when it was decided to leave out from this Master's thesis the actual filling in of the developed EE matrix. It was also found that it is preferable if the person responsible for the matrix is a full-timed staff member and a participant in the possible workshop.

To achieve more accurate and deeper comparison, it is better to conduct the BM with only a single partner when the best practices are obtained concerning of the all factors of processes. The more partners, the more difficult it is to find the best practices and especially the reasons that make some of the used processes better than the others.

As a conclusion, this kind of project that studies numerous educational processes, and collects information also in exact factors better to conduct with pair benchmarking than with several BM-partners.

6 SUMMARY

This Master's thesis has been written as a part of the benchmarking project of the Department of Electrical Engineering of Lappeenranta University of Technology. Thesis examines the benefits of the benchmarking in the academic world and especially in improving of the education of the electrical engineering. Based on the benchmarking (BM) literature and example cases of different projects BM contains various methods and tools for finding the best practice. The BM project of EE (Electrical Engineering) is adopts the best of them: questionnaires, matrices and workshops for information gathering and its analyzing.

Questionnaires were addressed to LUT (Lappeenranta University of Technology), TUL (Technical University of Lodz) and UCLB (Université Claude Bernard Lyon 1) students, teaching and administrative staff. Based on 3 administration staff responses, 157 student responses, and 56 teaching staff responses are analyzed the educational processes such as contents of the curriculum, teaching arrangements and methods, course feedback, student evaluation and student counselling.

During the BM process and with the help of the BM tools we found that the Electrical Engineering B.Sc. and M.Sc. degrees of LUT are competitive European university degrees and the education of electrical engineering of LUT is comparable between different countries. The ultimate purpose of the BM project is to maintain and improve the quality of education provided at the Dept. of EE of LUT according to Bologna Declaration. This BM study shows that the students and staff at LUT and TUL are generally satisfied with the quality of the B.Sc. and M.Sc. degrees of their unit. They see the teaching arrangements, applied methods and material, and offered support activities, such as students counselling appropriate.

After the made conclusions it is clear that EE units of TUL and UCBL are suitable partners for LUT and for further co-operation. However, a more suitable partner for a long-lasting co-operation is the unit of EE of TUL rather than the unit of EE

of UCBL because of the detected differences between the teaching methods, student guidance and international policies at LUT and UCBL.

The third phase of BM project hopefully continues with the help of the developed tools, the matrix for the Dept. of EE and the planned workshops between staff and students of the departments of LUT, TUL and UCBL.

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Appendix 1. An abstract addressed to the KTH

LAPPEENRANTA
UNIVERSITY OF TECHNOLOGY

INVITATION TO BENCHMARKING PROJECT OF DEGREE PROGRAMMES

Dear Professor Roland Eriksson

We are pleased to invite your institution to join the project of benchmarking university degree programmes. Next autumn from August 1st, 2005 onward, Finnish universities introduce into education a new degree structure based on a two-cycle model. In accordance with the Bologna Declaration, the first cycle, lasting a minimum of three years, ends in a Bachelor-level degree. The second cycle, lasting a minimum of two years, ends in a Master's-level degree. Correspondingly to the new, two-cycle degree system, the Department of Electrical Engineering of Lappeenranta University of Technology has reformed its study programme.

The objective of our new degree system is to achieve easily readable and comparable degrees with a view to strengthening the quality assurance of learning and education. In actively creating the means to this end European cross-border co-operation with a view to promoting free movement of students and teachers, international postgraduate education and research activities will be obtained.

In the course of the past year we have made a preliminary comparative study on European universities providing education in electrical engineering. The focus of the study is on the respective degree structures of 52 European universities providing education in electrical engineering. As the outcome of the preliminary study, three universities have been selected for closer investigation. In the second stage of the study we compared the degree programmes in electrical engineering of Technical University of Lodz (TUL), Poland, Technical University of München (TUM), Germany, and Royal Institute of Technology (KTH), Sweden, the structure of the respective degree programmes, more specifically as regards the amount of education - determined in ECTS study credits - in mathematics, physics and informatics technology in proportion to the other studies of the degree programme. The results are interesting and encourage us to get into contact with you with the purpose of continuing the investigation work more profoundly. Attached you will find an abstract of the study.

In order to obtain reliable results we see it useful to compare the structure of our study degree programme with the structure of your study degree programme. Which are the learning tasks you adapt, which are the ways of educating you practise, which are the assessment methods you use, how is education planned at your institution, which is the procedure for the intake of new students at your university, how do you keep in contact with interest groups, in which way your student process learning, which are the learning facilities at your institution and, finally, do you support and promote study guidance?

With the results obtained from this benchmarking we might conclude that the objectives of our reformed degree programme are achieved in line with the harmonization of European higher education degree systems and we might continue to improve the procedures for the assurance of the quality of our degree programme.

LUT functions as the co-ordinator of the benchmarking project. Assembling of data and information is done in co-operation with the partners participating in this benchmarking project. The results of the project work are available to all participants. Data are assembled by means of internet inquiries and visits that will be organized during next autumn. We ask you to spend some time to answer the inquiries. We also need you to appoint a contact person with whom we may get in contact for the realization of this project.

We do hope that you will be interested to participate in this benchmarking project the results of which undoubtly will benefit all the parties involved.

Sincerely Yours

Juha Pyrhönen
juha.pyrhonen@lut.fi
Professor in Electrical drives technology
Dean of the Department of Electrical Engineering
Lappeenranta University of Technology

Appendix 2. Covering letter to the contact persons in the TUL and UCBL

Third phase of the Benchmarking Project

The benchmarking project has proceeded to the third phase, the conduct of the questionnaire study. With the help of questionnaires, information is gathered about the planning and implementation of the educational processes at the partner universities. All the responses to the questionnaires are processed as confidential. Only the Project Coordinator Jussi Salo, D.Sc., and the researcher Hanna Niiranen (compiler of the questionnaires) have access to the results obtained from the questionnaires.

The gathered information is classified and assessed with the help of the evaluation matrixes. The summary is made based on the information gathered from the matrixes and questionnaires. The publication of the gathered information is discussed with the collaborative partners, and the outcomes of the survey are published only by mutual agreement.

To achieve best results and development ideas for every participant university, we would appreciate a possibility to visit the partner universities and discuss the outcomes of the questionnaire study. After summarizing the results of the questionnaires, we will prepare a report for a workshop that will guide us in the follow-up of the results and in the discussion for more detailed information. The probable time for a visit could be in the early spring 2006.

(continous)

General information about the questionnaires

There are three different kinds of questionnaires:

• A questionnaire about the educational processes, directed to the administrative staff of the university; *BM organization*

• An attitude questionnaire for the teaching staff; *BM staff*

• An attitude questionnaire for students; *BM students*

Responding to the questions is carried out by an Internet-based software called Webrobol Oy (http://www.webropol.com/en/index.html). The questionnaire form is entered through the website given in the e-mail. The website includes the user name and password, so that one respondent can fill in the whole questionnaire only once. The questionnaire is open as long as the respondent clicks the "submit" button at the end of the questions. By saving the answers, it is also possible to continue answering the questions some other time. Saving can be carried out by selecting the "break" option. In the cross-box questions, there is a selection of alternatives, and in the radius boxes, only one answer is accepted. There are also some open questions, in which there is room for as long answer as necessary. To become acquainted with the forms, the questionnaires are sent in advance to the contact persons as PDF documents.

(continues)

BM organization

The target of the BM organization questionnaire (educational processes) directed to the administrative staff is to gather information at the department level. At the department, the questionnaire can be filled in either by a single person or by several persons; however, the questionnaire form is filled in the unit only once. If there is a group answering the questionnaire, it is advisable that everyone uses the same form. In that case, the respondents share a common username and a password (the website attached to the e-mail); we will send the username to the contact person. The contact person will also receive general information about the survey, e.g. about the used terminology.

We would also appreciate if you could send us your latest English study guide, for instance as a PDF document, or a website, on which the guide is available.

BM staff

The questionnaire for the teaching staff collects information from teachers, and includes questions about the attitudes to educational processes. The answers are assessed against the students' answers. In order to be able to conduct this questionnaire, the personal e-mail addresses of the teaching staff are required. On the basis of the e-mail addresses, we will send the respondents an individual username and password for the Webropol questionnaire by e- mail. In the mail, we will also give some advice in filling in the questionnaire. Further, some of the terminology used in the survey will be defined.

The Webropol system separates the teachers' identities and their answers from each other, and thus, we will not know, which answer belongs to which respondent. The

(continues)

identities of the respondents are hidden, and they are not published anywhere. The purpose of the answers is to analyze the differences between different participant groups, and therefore, no single recognizable response is not published anywhere.

BM student

The student questionnaire corresponds to the staff questionnaire, and thus the same privacy rules are valid also for student respondents. The system separates the students' identities and their answers from each other, and thus it is not possible to connect an answer to a respondent. The identities of respondents are hidden, and they are not published anywhere. The purpose of the answers is to analyze the differences between different participant groups, and therefore, no single recognizable response is not published anywhere.

The questionnaire for the students includes opinion questions, and students' answers are assessed against the teachers' responses. To be able to perform the inquiry, we would need a selection of students for instance from certain classes or a selection of participants in certain courses. The number of student respondents should be large enough (30 at the minimum) to ensure that the gathered information is reliable.

Do not hesitate to contact us for any kind of question about the Benchmark-project.

Sincerely Yours

D. Jussi Salo Ms. Hanna Niiranen
jussi.salo@lut.fi hanna.niiranen@lut.fi
Co-ordinator of the project Researcher

Project www-site: http://www.ee.lut.fi/en/bm/

Appendix 3. Organization questionnaire addressed to the administrative staff

BM Organization

LAPPEENRANTA
UNIVERSITY OF TECHNOLOGY

Curriculum

1) Are there university-wide regulations concerning courses and study modules?

- Yes
- No

2) How are the aims set in the degree programme of electrical engineering manifested in the structure of the (master's) degree?

3) Who defines the study modules, such as major and minor subjects in the Electrical Engineering unit (department, faculty or other)?

- Faculty Council / Scientific Council (LUT)
- Department Council
- Staff of the Laboratories
- Professors
- Some other decision-making body, what?

4) How is the development and planning of educational issues such as curricula, practical training programmes, and major subjects organized at the university?

- There is a planning or strategic working group for these issues at the unit
- There is a coordinator for these issues at the unit
- Something else, what?

5) How the actual producers of the education, i.e., the teachers, participate in the curriculum planning?

6) In order to develop the education, how and how often the department gather feedback from industry and commerce about the skills and competence of graduated students?

7) Are there any particular areas of expertise that the curriculum focuses on? What are they?

- Electronics
- Automation
- Technical physics
- Electricity markets
- Something else, what?

Break

Next -->

LAPPEENRANTA UNIVERSITY OF TECHNOLOGY

Planning of study modules

8) Do the teachers plan their courses by themselves or as a group?

- By themselves
- As a group

9) If as a group, who are the members of these planning groups?

10) How is the scope of courses (in ECTS credits) determined? Who defines the scope of studies (courses, study modules)?

- Laboratory staff
- Department Council
- Professor(s)
- The teacher of the study module in question
- Study coordinator at the unit
- Somebody else, who?

11) Who determines basic conditions for the courses? (ECTS credits, position of the course in the study module (e.g. in basic studies or advanced studies), lecture hours and their position in the semester, allocated resources such as classrooms, etc.)

12) Is there systematic student feedback collection for the development of study modules at the department?

- No
- Yes, orally (direct communication)
- Yes, with questionnaires in paper form
- Yes, with electronic questionnaires on the web

13) Is the study module evaluated annually? How is the development of the module implemented?

14) What kind of initial education is required for eligibility for higher education?

- Matriculation examination
- Vocational upper secondary qualification
- Vocational college diploma/higher vocational diploma
- Something else, what?

Break

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LAPPEENRANTA UNIVERSITY OF TECHNOLOGY

Student admission, study guidance

15) Who is responsible for the compilation of the study guide at the unit?
- Student coordinator
- Department Council
- Professors
- Head of the Department
- Somebody else, who?

16) What kind of a process is the compilation of the study guide?

17) Are the degree requirements and the study modules and courses included in the same study guide?
- No
- Yes

18) Do the students get the study guide for free?
- No
- Yes, in their 1st year
- Yes, in the 1st year the study guide is free and after that it has to be purchased.
- Yes, they get a new guide every year.

19) Is the study guide available also on a university web site?
- No
- Yes, partly
- Yes

20) Is the student guide also provided in English?
- No
- Yes, in paper form
- Yes, on the web
- Yes, both

21) What kind of an entrance examination is there for the studies in electrical engineering?
- There is no entrance examination
- Examination in mathematics
- Examination in physics
- Examination in chemistry
- Examination in information technology
- Examination in mathematics and physics or chemistry
- Examination based on literature

22) If there is a something else entrance examination, what is it?

23) Do the students have to apply separately for the M.Sc. programme? (If not, do they apply initially for both the B.Sc. and M.Sc. programmes?)
- No
- Yes, if the student wishes to change the field of study
- Yes, even inside the same field of study

24) Is there a final examination at the end of a degree programme or entrance examinations for the higher degree programmes? You may choose more than one option.
- No, there is no final examination or entrance examinations
- No, there is no final examination before graduation (Bachelor's or Master's Thesis is not considered an exam)
- No, there are no entrance examinations
- Yes, there is for example an examination after B.Sc. studies for admission to M.Sc. studies
- Yes, there is a final examination

25) What is the average age of the freshmen?

- Under 18, how old?
- 18-19
- 20-21
- 22-23
- 23-24
- Older than 24, how old?

26) What is the proportion of admitted students of the total number of applicants?

- Under 50, how many per cent?
- 50-60%
- 61-70%
- 71-80%
- 80-90%
- Over 90%

27) How long does it take for an average student to complete a B.Sc, M.Sc, and a doctoral degree?

- B.Sc.
- M.Sc.
- Doctor

28) What is the percentage of drop-out students in B.Sc., M.Sc. and doctoral studies?

- B.Sc. %:
- M.Sc. %:
- Doctor %:

29) What is the common reason for dropping out during B.Sc. studies?

- Change of the field of study
- Work-related reasons
- Social exclusion
- Family reasons, such as parenthood
- Something else, what?

30) What is the common reasons for dropping out during M.Sc. studies?

- Change of the field of study
- Work-related reasons
- Social exclusion
- Family reasons, such as parenthood
- Something else, what?

31) What are the major factors for delay in studies?

- Parenthood
- Work
- Financial matters
- Leisure activities
- Something else, what?

Break

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LAPPEENRANTA
UNIVERSITY OF TECHNOLOGY

Student evaluation

32) Are there university-wide regulations concerning the principles of student evaluation at the end of each course?
- No
- Yes

33) The grading scale for a course is usually
- 0-5
- 0-3
- E-A
- pass/failed
- Something else

34) If the grading scale for course is something else, what is it?

35) The ratio of teacher/student is usually about
- 1/10
- 1/20
- 1/30
- 1/40
- More, how much?

36) The ratio of teacher/student in the classroom is usually about
- 1/5
- 1/10
- 1/15
- 1/20
- 1/25
- More, what?

37) The ratio of teacher/student in laboratory work is about
- 1/5
- 1/10
- 1/15
- 1/20
- More, what?

38) What factors have an impact on the course grade?
- Course examination
- Seminars / practical exercises
- Laboratory works
- Small exercises
- Class attendance
- Active participation in the classroom
- Something else, what?

39) Do teachers give their students feedback on exams (in addition to a grade)?
- No
- Yes

40) Do teachers give their students personal feedback on student performance (in addition to a grade)?
- Yes
- No

41) Do teachers give their students a group feedback (other than a grade)?
- Yes
- No

Break

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LAPPEENRANTA
UNIVERSITY OF TECHNOLOGY

Content of the degree in electrical engineering

42) Who decides the grade that a student gets from the course? You may choose more than one option.

- Professor
- Professor with assistants who teach the course
- Teacher(s)
- Classmates
- Somebody else, who? _____

43) How much practical training is included in the M.Sc. degree in electrical engineering?

- Less than 5 ECTS
- 5-10 ECTS
- 10-15 ECTS
- 15-20 ECTS
- More than 20, how much? _____

44) How much practical training is included in the B.Sc. degree in electrical engineering?

- Less than 5 ECTS
- 5-10 ECTS
- 10-15 ECTS
- 15-20 ECTS
- More than 20, how much? _____

45) How much mathematics is included in the M.Sc. degree in electrical engineering?

- Less than 10 ECTS, how much? _____
- 10-15 ECTS
- 15-20 ECTS
- 20-25 ECTS
- 25-30 ECTS
- More than 30, how much? _____

46) How much mathematics is included in the B.Sc. degree in electrical engineering?

- Less than 10 ECTS, how much? _____
- 10-15 ECTS
- 15-20 ECTS
- 20-25 ECTS
- 25-30 ECTS
- More than 30, how much? _____

47) How much physics is included in the M.Sc. degree in electrical engineering?

- Less than 10, how much? _____
- 10-15 ECTS
- 15-20 ECTS
- 20-25 ECTS
- 25-30 ECTS
- More than 30 ECTS, how much? _____

48) How much physics is included in the B.Sc. degree in electrical engineering?

- Less than 10, how much? _____
- 10-15 ECTS
- 15-20 ECTS
- 20-25 ECTS
- 25-30 ECTS
- More than 30 ECTS, how much? _____

49) How much information technology is included in the M.Sc. degree in electrical engineering?

- Less than 10, how much?
- 10-15 ECTS
- 15-20 ECTS
- 20-25 ECTS
- 25-30 ECTS
- More than 30 ECTS, how much?

50) How much information technology is included in the B.Sc. degree in electrical engineering?

- Less than 10, how much?
- 10-15 ECTS
- 15-20 ECTS
- 20-25 ECTS
- 25-30 ECTS
- More than 30 ECTS, how much?

51) How much electronics is included in the M.Sc. degree in electrical engineering?

- Less than 10, how much?
- 10-15 ECTS
- 15-20 ECTS
- 20-25 ECTS
- 25-30 ECTS
- More than 30 ECTS, how much?

52) How much electronics is included in the B.Sc. degree in electrical engineering?

- Less than 10, how much?
- 10-15 ECTS
- 15-20 ECTS
- 20-25 ECTS
- 25-30 ECTS
- More than 30 ECTS, how much?

53) How much basic courses, such as electromagnetism, circuit technology and EMC are included in the M.Sc. degree in electrical engineering?

- Less than 10, how much?
- 10-15 ECTS
- 15-20 ECTS
- 20-25 ECTS
- 25-30 ECTS
- More than 30 ECTS, how much?

54) How much basic courses, such as electromagnetism, circuit technology and EMC are included in the B.Sc. degree in electrical engineering?

- Less than 10, how much?
- 10-15 ECTS
- 15-20 ECTS
- 20-25 ECTS
- 25-30 ECTS
- More than 30 ECTS, how much?

55) How much automation and automatic control engineering is included in the M.Sc. degree in electrical engineering?

- Less than 10, how much?
- 10-15 ECTS
- 15-20 ECTS
- 20-25 ECTS
- 25-30 ECTS
- More than 30 ECTS, how much?

56) How much automation and automatic control engineering is included in the B.Sc. degree in electrical engineering?

- Less than 10, how much?
- 10-15 ECTS
- 15-20 ECTS
- 20-25 ECTS
- 25-30 ECTS
- More than 30 ECTS, how much?

57) How much languages and other academic skills are included in the M.Sc. degree in electrical engineering?

- Less than 10, how much? [ ]
- 10-15 ECTS
- 15-20 ECTS
- 20-25 ECTS
- 25-30 ECTS
- More than 30 ECTS, how much? [ ]

58) How much languages and other academic skills are included in the B.Sc. degree in electrical engineering?

- Less than 10, how much? [ ]
- 10-15 ECTS
- 15-20 ECTS
- 20-25 ECTS
- 25-30 ECTS
- More than 30 ECTS, how much? [ ]

59) Can a student include studies in other domestic higher education institutions in the degree in electrical engineering?

- No
- Yes, but only of corresponding content
- Yes, but only of other field of study
- Yes

60) Can a student include studies in other foreign higher education institution in the degree in electrical engineering?

- No
- Yes, but only of corresponding content
- Yes, but only of other field of study
- Yes

61) What is the amout of advanced studies in the M.Sc. degree?

- Less than 15 ECTS, how much? [ ]
- 15-20 ECTS
- 20-25 ECTS
- 25-30 ECTS
- 30-35 ECTS
- More than 35 ECTs, how much? [ ]

62) What is the amount of elective studies in the M.Sc. degree?

- Less than 10 ECTS, how much? [ ]
- 10-15 ECTs
- 15-20 ECTS
- 20-25 ECTS
- 25-30 ECTS
- More than 30, how much? [ ]

63) What is the amount of elective studies in the B.Sc. degree?

- Less than 10 ECTS, how much? [ ]
- 10-15 ECTs
- 15-20 ECTS
- 20-25 ECTS
- 25-30 ECTS
- More than 30, how much? [ ]

Break

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LAPPEENRANTA
UNIVERSITY OF TECHNOLOGY

Teaching

64) Is the academic year divided into semesters?
- No
- Yes, in 2
- Yes, in 3
- Yes, more than 3, how many?

65) Are the semesters of the academic year divided into periods (quarters)?
- No
- Yes, in 2
- Yes, in 3
- Yes, in 4
- Yes, more than 4, how many?

66) How long are the periods?
- Less than 1 month
- 1 month - 2 months
- 2-3 months
- 3-4 months
- 4-5 months
- More than 5 months, how long?

67) Are courses offered in summer or during other holidays?
- No
- Yes

68) Is there particirarly exam weeks for example after periods? How many of exam weeks there is and when they are kept?

69) Do students have a possibility to participate in research projects or teaching? As compensation, do the students get credits or money?
- No
- Yes, in research projects
- Yes, in teaching
- Yes, both
- They get credits
- They get money

70) How are the lessons (teaching) organized during a week (Monday-Friday)?
- Between 8-16h
- Between 8-20h
- Between 8-14h and/or 14-20h
- Some other time, what?

71) Is there a lunch break every day between the lectures?
- No
- Yes

72) Is there lectures or examinations on Saturdays?
- No
- Yes, examinations
- Yes, lectures
- Yes, both

73) Who compiles the schedules at the department?
- Teachers compile their own schedules individually
- Teachers compile the schedules together
- Student coordinator compiles the schedule
- Student advisor
- somebody else, who?

74) Attendance is usually obligatory for students in

- Lectures
- Seminars
- Excersises (tutorials)
- Computer classes, such as simulations
- Laboratory works
- Something else, where?

75) How much is the teaching duty of teachers (hours/week)?

- Professor, hours/week?
- Assistants
- Lecturers
- Post-graduate students, if they teach
- Under-graduate students, if they teach

76) Is there research in the field of advanced studies at the department?

- No
- Yes

77) Do the teachers research?

- Yes
- No

78) Do the researchers teach?

- Yes
- No

79) Are there usually several teachers in one course?

- No, never
- Yes, but not simultaneously. For instance, one teacher gives lectures and the other arranges the tutorials (exercises)
- Yes, sometimes

80) Is teaching included in the monthly salary or is there an extra payment for teaching?

- Included
- Extra payment

81) Are there any pedagogical qualifications for teachers?

- No
- Yes, what?

82) Do the teachers take any pedagogical courses?

- No
- Yes, but only when the University organizes pedagogical training or consultation for teachers
- Yes

83) Do the teachers have to update their pedagogical studies?

- No
- Yes, University organizes pedagogical training or consultation for teachers
- Yes

Break

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LAPPEENRANTA
UNIVERSITY OF TECHNOLOGY

Student counselling

84) Tutoring and/or guidance is organized at the university for freshmen in issues concerning
- Learning environment
- Student life
- Schedules
- Computers and information tecnology
- Major studies
- Minor studies

85) Are there information lectures concerning major and minor studies?
- No
- Yes, are these lessons compulsory or elective?

86) Is there an introductory course for a study module (basic, advanced, intermediate studies)?
- No
- Yes, it is elective
- Yes, it is compulsory

87) For students, personnel for study guidance, such as
- Student advisor
- Study coordinator
- Tutor teachers
- Somebody else, who?

88) Is an individual study plan compulsory for each student, and when it is compiled?
- No
- Yes, it is done individually in the 1st year.
- Yes, it is a part of an introductory course for studying at the university.
- Yes, it is done later, when?

89) When do the students compile their individual plans, and is there an obligation to follow the plan? Who approves of the individual plans?
- No
- Yes, but the students follow up the plan only by themselves
- Yes, the study plan is approved of by:

90) How is the guidance for the compilation of an individual study plan organized?
- There is no guidance
- It is included in some appropriate course
- Students compile it together with department staff, with whom?
- Some other way, how?

91) Do students have regular meetings with deparment staff about their progress in studies?
- No
- Yes, with whom?

92) Is the professor in the student's major studies also responsible for the guidance of the student?
- No
- Yes

93) Are there lectures or workshops for writing the thesis?
- No
- Yes, elective
- Yes, compulsory

94) Do the teachers/professors have an obligation to guide the writing of the (B.Sc., M.Sc., doctoral) thesis?
- No
- Yes

95) Do the teachers/professors arrange regular meetings with the student about the thesis?

- No
- Yes, some do
- Yes, all do

96) Is all the information about studies available on the web?

- No
- Yes

Break

<-- Previous Next -->

BM Organization

LAPPEENRANTA UNIVERSITY OF TECHNOLOGY

Quality assurance

97) Does the department use a permanent quality assurance system?

- No
- Yes, for teaching only
- Yes, for all the activities at the department

98) Is the quality assurance system based on some standard?

- No
- Yes, which standard? _____

99) Is the quality assurance system certified?

- No
- Yes, by whom? _____

100) Is there a person at the department who is responsible for issues concerning quality assurance?

- Yes
- No

101) What instance grants accreditation?

- State
- Certification office
- Some other instance, what? _____

102) The department has a right to grant

- B.Sc. degree
- M.Sc. degree
- Doctoral degree
- Teacher's qualification in B.Sc. degree studies
- Teacher's qualification in M.Sc. degree studies
- Teacher's qualification in doctoral degree studies
- Some other degree, what?

Break

- I want to submit my answers

<-- Previous Submit

Appendix 4. Preface e-mail in English addressed to the teaching staff

With your assistance, this questionnaire study gathers information about electrical engineering educational staff's attitudes towards educational processes in the unit of electrical engineering. Your answers help us to find the good practices and the faults that need to improve. Just click your individual link given at the end of the e-mail to enter the questionnaire form! The Department of Electrical Engineering at Lappeenranta University of Technology conducts a benchmarking project with partner universities that aim at developing and improving their education. You can find more information about background and objectives of this study at link:

http://www.ee.lut.fi/en/bm/bm_en_abstract.pdf.

All the responses are processed as confidential, and the Webropol system separates the students' identities and their answers from each other, and thus, we will not know, which answer belongs to which respondent. The purpose of the answers is to analyze the differences between different participant groups, and therefore, no single recognizable response is not published anywhere.

Thank you for answering and promoting the development of education!

Project coordinator Jussi Salo and researcher Hanna Niiranen

Some tips and terminology for filling in the questionnaire.

* In some questions, you may choose more than one option.

* In open questions, you may write as much as needed, even if the text does not fit in the reserved space.

* You can save the answers by selecting the "break" option and continue filling in the form at some other time with the password and username that the system gives after pushing the break button.

* The questionnaire is open as long as you click the "submit" button at the end of the form.

***** Major subject: The main field of study, includes intermediate and advanced studies.

***** Individual study plan: a plan in which the student and the institution agree on what studies the student will pursue and in which order.

* Study coordinator: Advises the student in all study-related questions and is responsible for student guidance and administrative tasks at the department, compiles the study guide and schedules.

* Student advisor: Student working part-time at the department. Helps the students to plan their studies. Participates in planning and organization of training for new student tutors and compiles schedules together with study coordinator.

* Thesis: Written final project in which the student shows that he/she has attained the required knowledge and skills for a degree.

Appendix 5. Preface e-mail in Finnish addressed to LUT respondents

Kysely opiskelijoille

Tämä kysely on suunnattu sähkötekniikan opiskelijoille. Sen avulla on tarkoitus kerätä opiskelijoiden mielipiteitä sähkötekniikan osaston käyttämistä opetusprosesseista. Vastaavanlainen kysely suunnataan myös sähkötekniikan opetushenkilökunnalle. Kyselyyn pääset viestin viimeisenä olevasta henkilökohtaisesta linkistä. Kysely on osa sähkötekniikan osaston benchmark -projektia, jossa on mukana eurooppalaisia yliopistoja. Projektin tarkoituksena on kehittää osaston toimintaa ja varmistaa laadukas sekä eurooppalaisittain kilpailukykyinen opetus. Projektin taustatiedot ja päämäärät löydät täältä: http://www.ee.lut.fi/en/bm/

Kiitoksia panoksestasi opetuksen kehittämisessä!

Terveisin: Jussi Salo ja Hanna Niiranen

Vastauslomakkeen kieli on englanti, sillä myös ulkomaiset kumppanit vastaavat samoihin kysymyksiin. Sen vuoksi alla on hiukan sanastoa ja vinkkejä kyselyn täyttämisen avuksi:

* Joistakin kysymyksistä voi valita monta vaihtoehtoa, vastausvaihtoehdot ovat tällöin neliöitä.

* Voit kirjoittaa avoimiin kysymyksiin niin paljon kuin haluat, vaikka teksti ei mahtuisikaan sille varatulle tilalle.

* Kyselyn voi tallentaa break –nappulasta ja jatkaa sen täyttämistä myöhemmin. Tällöin Webropol antaa sinulle automaattisesti käyttäjätunnuksen ja salasanan (tämän sähköpostin mukana tullut henkilökohtainen linkki), joilla pääset takaisin kyselyyn.

* Major: The main study field, include intermediate and advanced studies.

* Individual study plan, in which the student and the institution agree on what studies the student will pursue and in what order.

* Study coordinator: Advices the student in all study-related questions and is responsible for student guidance and administrative tasks at the department, compiles the study guide and schedules.

* Student advisor: Student working part-time for the department. Help the student to plan their studies. Participates in planning and organization of training for new student tutors and compiles schedules.

* Thesis: Written final project in which the student shows that he/she has attained the required knowledge and skills.

Appendix 6. Opinion questionnaire addressed to the teaching staff

BM Staff

LAPPEENRANTA
UNIVERSITY OF TECHNOLOGY

Personal information

1) I am teaching at
- Université Claude Bernard Lyon 1
- LUT, Lappeenranta University of Technology
- TUL, The Technical University of Lodz

2) I am
- under 25
- 25-30
- 30-40
- 40-50
- 50-60
- over 60 years old.

3) Do you have a degree or education on teaching?
- No
- Yes, some education
- Yes. I have degree in teaching, what kind of? _____

4) What kind of degree do you have?
- I am M.Sc student
- I have M.Sc degree in electrical engineering
- I am doctoral student
- I have doctoral degree in electrcical engineering
- I have other degree, what kind of? _____

5) I have teached
- less than 1 year
- 1-2 years
- 2-5 years
- 5-10 years
- 10-15 years
- 15-20 years
- More, how many years? _____

6) The (major) subject I am teaching is
- Electrical power engineering
- Electronics and communications
- Automatic control
- Electrical engineering and economics/marketing
- Something else, what? _____

Break

Next -->

LAPPEENRANTA UNIVERSITY OF TECHNOLOGY

Planning and organization of the studies

7) In my opinion, the group size in the classes in electrical engineering is typically

- All too small
- Too small
- Suitable
- Too large
- All too large

8) The group size in my classes is typically

- under 10 students
- 10-20 students
- 20-30 students
- 30-40 students
- 40-50 students
- over 50 students

9) How many teaching hours do you have approximately in a week?

- less than 4 hours
- 4-8 hours
- 8-12 hours
- 12-16 hours
- 16-20 hours
- more than 20 hours, how much?

10) How much time (approximately) do you usually spend in teaching and planning the courses and lessons in a week?

- less than 6 hours
- 6-10 hours
- 10-15 hours
- 15-20 hous
- 20-25 hours
- more than 25 hours, how much?

11) How many courses do you usually teach during a semester/academic year?

- less than 1 course
- 1-2 courses
- 2-3 courses
- 3-5 courses
- more than 5

12) Evaluating myself as a teacher (on a scale 1 - 5), I am as good a teacher as any other colleague of mine in electrical engineering.

	1	2	3	4	5	
1 = I am much worse than other teachers.						5 = I am much better than other teachers.

13) I participate in pedagogical courses to improve my teaching skills.

- Yes
- I am willing to participate in the future
- I am already qualified enough for my tasks
- How much pedagogical studies do You have in ECTS credits?

14) Course materials in electrical engineering are usually appropriate and of first quality.

	1	2	3	4	5	
1 = I completely disagree.						5 = I completely agree.

15) I usually prepare new material for my courses, for example handouts.

- No, never
- No, I use old material whenever possible
- No, my assistant does the material
- Yes, I update the old material
- Yes, I always prepare new material

16) I experiment new teaching methods regularly.

	1	2	3	4	5	
1 = I completely disagree.	☐	☐	☐	☐	☐	5 = I completely agree.

17) I have clear plans for the content and schedule of my courses.

	1	2	3	4	5	
1 = I completely disagree.	☐	☐	☐	☐	☐	5 = I completely agree.

18) I focus on the issues that are essential in the subject (course).

	1	2	3	4	5	
1 = I completely disagree.	☐	☐	☐	☐	☐	1 = I completely agree.

19) Do you use computer in teaching? If yes, then which of the tools listed below do you use?

- ☐ Power point shows
- ☐ The Internet
- ☐ Math programs
- ☐ Simulations
- ☐ Pictures
- ☐ Videos
- ☐ Web-based learning environment
- ☐ Something else, what? _____

20) I update or my assistant updates the web pages of the course on a regular basis.

- ☐ No
- ☐ Yes

21) The courses that I teach include

- ☐ Lectures
- ☐ Tutorials, exercises
- ☐ Laboratory works
- ☐ Seminars
- ☐ Excercise works carried out individually by students
- ☐ Excercise works carried out as a group
- ☐ Computer classes/works
- ☐ Something else, what? _____

22) Please name three teaching methods that you find the best or the most efficient.

23) I collect feedback systematically from my courses.

- ☐ No
- ☐ Yes, orally
- ☐ Yes, in written form
- ☐ Yes, web-based student feedback

Break

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LAPPEENRANTA UNIVERSITY OF TECHNOLOGY

Feedback and student counselling

24) I give feedback as a response to the feedback given by students.
- Yes
- No

25) In my opinion, the feedback I get from courses is useful.

	1	2	3	4	5	
1 = I completely disagree.						5 = I completely agree.

26) I make the students evaluate each other for example as a part of their seminar course work.
- Yes
- No

27) My courses are usually graded
- From 0 to 5, where 0 is failed and 5 is the highest grade
- From A to H, where A is failed and H is the highest grade
- Mark failed/pass
- Some other grade, on a scale:

28) What other factors have an impact on the final grade of a course?
- Course examination
- Completed excercises
- Attendance in the lectures, active participation in the classroom
- Exercise(s), seminar work(s)
- Laboratory works
- Something else, what?

29) Student counselling includes
- Lectures for freshmen
- Tutoring in small groups
- Individual meetings with the professor

30) What else the student counselling includes?

31) If the students don´t get enough help, why not, and what kind of help is needed?

32) In my opinion, it is obligatory for students to make their individual study plans.

	1	2	3	4	5	
1 = I completely disagree.						5 = I completely agree.

33) Students get enough help and information when planning and completing their studies. Guidance is given for example by student advisors or professors.
- Yes
- No

34) I am very interested in my students' progress and success in their studies.

	1	2	3	4	5	
1 = I completely disagree.						5 = I completely agree.

35) I have an obligation to regularly supervise a number of students in their studies.
- No
- Yes

36) If yes, how the supervising is organized and what it includes?

LAPPEENRANTA
UNIVERSITY OF TECHNOLOGY

Motivation and studying habits

37) I know that electrical engineering is the right field for me.

	1	2	3	4	5	
1 = I completely disagree.	☐	☐	☐	☐	☐	5 = I completely agree.

38) I am intrested in electrical engineering and I regularly follow the development in the field.

	1	2	3	4	5	
1 = I completely disagree.	☐	☐	☐	☐	☐	1 = I completely agree.

39) I also do research work along with teaching.

- ☐ No
- ☐ Yes, how many per cent of the total working hours? _____

40) I think that it is easy for the students to find employment in the field of electrical engineering after graduation.

	1	2	3	4	5	
1 = I completely disagree.	☐	☐	☐	☐	☐	5 = I completely agree.

41) The skills and education obtained at the university meet the actual needs and requirements in working life.

	1	2	3	4	5	
1 = I completely disagree.	☐	☐	☐	☐	☐	5 = I completely agree.

42) I am satisfied with my students' success in studies.

	1	2	3	4	5	
1 = I completely disagree.	☐	☐	☐	☐	☐	5 = I completely agree.

43) Students usually attend my lectures and tutorials.

- ○ No, only a few of them have enrolled on the course.
- ○ Yes, approximately a half of the students enrolled on the course also attend the classes.
- ○ Yes, but only when it is compulsory
- ○ Yes, more than a half of those enrolled on the course.
- ○ Yes, almost all of those who have enrolled on the course also attend the course.

44) Do the students usually work during their studies?

- ☐ No
- ☐ Yes, in their own field of study
- ☐ Yes, at the university
- ☐ Yes, in some other field

45) Students are highly motivated when they start their studies as a freshman.

	1	2	3	4	5	
1 = I completely disagree.	☐	☐	☐	☐	☐	5 = I completely agree.

Break

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LAPPEENRANTA UNIVERSITY OF TECHNOLOGY

Background of students, student admission

46) At the beginning of a course, I usually have some kind of a test to assess the students' previous knowledge about the subject.

- No, never
- Yes, sometimes
- Yes, always

47) Should there be some kind of an examination to assess the student's previous knowledge before entering a course?

- No
- Yes, sometimes
- Yes, always

48) There should be a final examination after the B.Sc. degree studies or an entrance examination before the M.Sc. degree studies at every university.

	1	2	3	4	5	
1 = I completely disagree.						5 = I completely agree.

49) Should there be some kind of an examination to assess the student's knowledge and skills before writing the thesis?

- No
- Yes

50) The level and quality of B.Sc. degree at my university meets the level and quality of the B.Sc. degree at other universities.

	1	2	3	4	5	
1 = B.Sc. degree at my university is of lower level than the corresponding degree at other universities.						5 = B.Sc. degree at my university is of higher level than the corresponding degree at other universities.

51) Drop-out students and delayed studies are a serious problem.

	1	2	3	4	5	
1 = I completely disagree.						5 = I completely agree.

Content of the M.Sc. degree in electrical engineering

52) The M.Sc. degree in electrical engineering contains enough mathematics.

- No, there are too few courses in mathematics included in the degree.
- Yes, there is a right amount of mathematics included in the degree.
- No, there are too many courses in mathematics included in the degree.

53) The M.Sc degree in electrical engineering contains enough information technology.

- No, there are too few courses in information technology included in the degree.
- Yes, there is a right amount of information technology included in the degree.
- No, there are too many courses in information technology included in the degree.

54) The M.Sc degree in electrical engineering contains enough languages.

- No, there are too few language courses included in the degree.
- Yes, there is a right amount of languages included in the degree.
- No, there are too many language courses included in the degree.

55) The M.Sc. degree in electrical engineering contains enough physics.

- No, there are too few courses in physics included in the degree.
- Yes, there is a right amount of physics included in the degree.
- No, there are too many physics courses included in the degree.

56) The M.Sc. degree in electrical engineering contains enough practical training.

- No, there is too little practical training included in the degree.
- Yes, there is a right amount of practical training included in the degree.
- No, there is too much practical training included in the degree.

57) The level and quality of M.Sc. degree at my university meets the level and quality of the M.Sc. degree at other universities.

	1	2	3	4	5	
1 = B.Sc. degree at my university is of lower level than the corresponding degree at other universities.						5 = B.Sc. degree at my university is of higher level than the corresponding degree at other universities.

Break

I want to submit my answers

<-- Previous Submit

Appendix 7. Opinion questionnaire addressed to students

BM Student

LAPPEENRANTA UNIVERSITY OF TECHNOLOGY

Personal information

1) I am studying at
- Université Claude Bernard Lyon 1
- LUT, Lappeenranta University of Technology
- TUL, The Technical University of Lodz

2) I am
- under 20
- 20-22
- 22-24
- 24-26
- over 26 years old.

3) I am
- a 1st year student
- a 2nd year student
- a 3rd year student
- a 4th year student
- a 5th year student
- a 6th year student
- above 6th year, my class is

4) My major subject is
- Electrical power engineering
- Electronics and communications
- Automatic control
- Information technology
- Electrical engineering and economics/marketing
- Something else, what?

Break

BM Student

LAPPEENRANTA UNIVERSITY OF TECHNOLOGY

Planning and organization of the studies

5) In my opinion, the group size in the electrical engineering classes is typically
- All too small
- Too small
- Suitable
- Too large
- All too large

6) The teachers of Electrical Engineering are usually qualified and competent.

	1	2	3	4	5	
1 = I completely disagree.						5 = I completely agree.

7) The course materials of Electrical Engineering are usually sufficient and of first grade.

	1	2	3	4	5	
1 = I completely disagree.						5 = I completely agree.

8) The teaching staff of Electrical Engineering experiments new teaching methods.

	1	2	3	4	5	
I = I completely disagree.						5 = I completely agree.

9) The teachers of electrical engineering have usually prepared detailed plans for the courses they teach.

	1	2	3	4	5	
1 = I completely disagree.						5 = I completely agree.

10) The teachers of Electrical Engineering focus on issues that are essential in the course.

	1	2	3	4	5	
1 = I completely disagree.						5 = I completely agree.

11) The teachers of Electrical Engineering utilise computers to support their teaching, e.g. by using

- Internet
- Power point shows
- Simulations
- Math programs
- Pictures
- Videos
- Web-based learning environment
- Something else, what

12) The teacher regularly updates the course pages on the Internet.

- No
- Yes

13) Courses in electrical engineering include

- Lectures
- Exercises, tutorials
- Laboratory works
- Seminars
- Exercise works carried out individually by students
- Excercise works carried out as a group
- Computer classes/works

14) What are the most common teaching methods at the Department of Electrical Engineering? Please name three.

15) In my opinion, the three best methods are

Break

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BM Student

LAPPEENRANTA UNIVERSITY OF TECHNOLOGY

Feedback and student counselling

16) The teachers of electrical engineering systematically collect feedback from their courses

- Yes, orally
- Yes, in written form
- Yes, on the web
- No

17) If teachers collect feedback, they also respond to it.

- No
- Yes, orally
- Yes, in written form
- Yes, on the web

18) I think that my feedback to teachers about courses is useful.

	1	2	3	4	5	
1 = I completely disagree.						5 = I completely agree.

19) I get enough support from my teachers in my studies, e.g. in doing exercises.

	1	2	3	4	5	
1 = I completely disagree						5 = I completely agree

20) I usually have a possibility to evaluate my classmates' seminar or exercise works in the courses in electrical engineering.

	1	2	3	4	5	
1 = I completely disagree.						5 = I completely agree.

21) The grading system used at the Department is appropriate and equitable to all students.

- Yes
- No

22) If the grading system used at the Department is not appropriate and equitable to all students, why?

23) In my opinion, my course grades in the subjects in electrical engineering subjects are usually

- Below my level
- My level
- Higher than my level

24) Student counselling includes

- Lectures for newbies (freshmen)
- Tutoring in small groups
- Individual meetings with the professor
- Something else, what?

25) I may get help and information when planning and completing my studies from

- Professors
- Other teaching staff
- Study coordinator
- Student advisor
- Other students
- Somebody else, who?

26) If, in your opinion, the guidance is insufficient, what kind of counselling would be needed?

27) I have compiled an individual study plan

- No
- Yes, in the 1st year, and have completely forgotten it
- Yes, I follow it and update the changes

28) I follow my individual study plan in my studies

	1	2	3	4	5	
1 = I completely disagree.						5 = I completely agree.

29) Someone at the Department of Electrical Engineering supervises the progress of my studies

- No
- Yes, who?

Break

<-- Previous Next -->

LAPPEENRANTA
UNIVERSITY OF TECHNOLOGY

Motivation and studying habits

30) I know that electrical engineering is the right field for me.

	1	2	3	4	5	
1 = I completely disagree.	☐	☐	☐	☐	☐	5 = I completely agree.

31) I believe that when I graduate I will easily get a job in my own field of study.

	1	2	3	4	5	
1 = I completely disagree.	☐	☐	☐	☐	☐	5 = I completely agree.

32) The skills and education I have obtained at the university meet the actual needs and requirements in working life.

	1	2	3	4	5	
1 = I completely disagree.	☐	☐	☐	☐	☐	5 = I completely agree.

33) I am interested in electrical engineering and I regularly follow the news in the field

	1	2	3	4	5	
1 = I completely disagree.	☐	☐	☐	☐	☐	1 = I completely agree.

34) I am satisfied with my study success.

	1	2	3	4	5	
1 = I completely disagree.	☐	☐	☐	☐	☐	5 = I completely agree.

35) My study success is as good as the study success of any other fellow student in electrical engineering.

	1	2	3	4	5	
1 = I completely disagree.	☐	☐	☐	☐	☐	5 = I completely agree.

36) I attend lectures and exercises (tutorials).

- ☐ No, never
- ☐ Yes, sometimes
- ☐ Yes, but only when it is compulsory
- ☐ Yes, usually
- ☐ Yes, always

37) I study as hard as any other fellow student at the department.

	1	2	3	4	5	
1 = I study much less.	☐	☐	☐	☐	☐	5 = I study much more.

38) Do you work while studying?

- ☐ No
- ☐ Yes, in my own field of study
- ☐ Yes, at the university
- ☐ Yes, in another field

Break

<-- Previous Next -->

LAPPEENRANTA
UNIVERSITY OF TECHNOLOGY

Background of students, student admission

39) Why did you apply to study electrical engineering?
- It is easy to get admission to study at the Department.
- The salaries are good in the field of electrical engineering.
- I applied because of my friends.
- I applied because of my parents.
- Electrical engineering is my favorite field.
- Something else, what?

40) How were you selected to study electrical engineering at your university?
- By entrance examination
- By entrance examination and Matriculation Examination
- By Matriculation Examination
- By vocational upper secondary qualification, vocational college diploma, or a higher vocational diploma
- Some other way, how?

41) I really wanted to study electrical engineering when I applied for admission to study at the university.
- No, it was a pure accident that I got in
- No, it was my least favoured option
- Yes, it was my first or second option
- Yes, I obtained a right to study electrical engineering without entrance examination

42) How many times did you apply for admission to study electrical engineering?
- once
- twice
- 3 times
- more, how many times?

43) Did you find it easy to get in to study electrical engineering?
- Yes
- No

44) Should there be examinations before you are allowed to proceed to higher classes?
- Yes
- No

45) Should there be an examination to assess the students' previous knowledge before starting a course?
- No, never
- Yes, sometimes, when?
- Yes, always

46) Should there be a final examination in the subjects of electrical engineering before writing the Master's Thesis?
- No
- Yes

47) The level and quality of the B.Sc. degree at my university meets the level and quality of the B.Sc. degree at other universities.

	1	2	3	4	5	
1 = I completely disagree.						5 = I completely agree.

48) The level and quality of the M.Sc. degree at my university meets the level and quality of the M.Sc. degree at other universities.

	1	2	3	4	5	
1 = I completely disagree.						5 = I completely agree.

Content of the M.Sc. degree in electrical engineering

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- Yes, there is a right amount of physics included in the degree.
- No, there are too many courses in physics included in the degree.

53) The M.Sc. degree in electrical engineering contains enough practical training.

- No, there is too little practical training included in the degree.
- Yes, there is a right amount of practical training included in the degree.
- No, there is too much practical training included in the degree.

Break

- I want to submit my answers

<-- Previous Submit

Appendix 8. Self-evaluation matrix

1. Curriculum

The object of the curriculum evaluation is to asses how well the syllabus responds to the needs of the students, staff and the field in general: it is continuously developed towards these demands. A good curriculum includes both scientific and practical vision and is unique, consistent, flexible with certain boundaries and constantly updated. In the unit at least one person is nominated to be responsible for the curriculum work. This person gathers, when needed, a team to develop the contents of the curriculum.

Curriculum and subject descriptions should set out the learning objectives directly linked to assessment tasks, they should be intelligible to students, and clearly provide all essential information, such as course work requirements, marking arrangements, modes of teaching and expected standards. It is very important that all students appreciate the value of the curriculum and are aware of the offered options so that they can create their own individual study plan.

(continues)

Appendix 8 continues

SYLLABUS				
1	**2**	**3**	**4**	**5**
Key objectives of the education are not clear and curriculum is unfinished and does not respond to any requirements. There is no development or any updating in curriculum.		Some key objectives are defined for the education but the curriculum is defective and does not respond to all requirements. Development and updating work of curriculum is regular.		Key objectives of the education are specific and both scientific and practical visions are emphasized in the curriculum. The curriculum is checked and updated at least yearly in workshops to respond the fields', students', teachers' and researchers' requirements.
Courses are separate and there is no clue how they are connected to each other. There is no division of the study blocks and students conduct their courses arbitrary order.		Courses are recommended to be taken in some order but clear modules and study blocks are missing. Students conduct courses with in an illogical order.		The individual courses are connected to each other's to form modules. There is a clear logic and common thread between different courses. Common core subject, majors, minors and advanced special studies are logical and students proceed from lower level to upper level.
No individual curriculum is expected of the students and they can choose subjects freely on the other hand there is no elective ones at all.		Some students compile, follow and update their individual curriculum, even if the curriculum work is directed and monitored poorly. The curriculum includes some freely electives studies.		All students compile their individual curriculum, update and follow it. The students' curriculum work is directed and monitored from the very beginning to end. An individual curriculum may differ from the unit's recommended one within the set limits. There is possibility to get a minor from other study field and even from another university.
The practical vision is neglected in the curriculum and training is not accepted as a part of studies in the curriculum.		There is no encouragement towards practical training but it is possible to get credits from it.		Students have a practical training period that is included in curriculum. Students usually take the training in companies and get salary for the training time.
Self assessment and comments:				

(continues)

Appendix 8 continues

2. Teaching methods

Good teaching depends on the extent to which the staff is committed to the teaching an how it is rewarded for a scholarly approach to it. The best teaching is engendered in an environment where the staff is expert, enthusiastic, skilled and well supported. The teaching loads must be reasonable and linked to teacher's know-how. There has to be opportunities for staff development, both pedagogical and personal, so it is possibility to launch new teaching methods. The staff encourages students to develop their basic skills, such as, communication skills. The used grading system used must be objective and all teachers must grade students equally.

(continues)

Appendix 8 continues

TEACHING METHODS				
1	**2**	**3**	**4**	**5**
Only lectures and tutorials are organized. Only few students participate in the organized teaching lessons if they are not compulsory. Interactivity between students and teachers is poor.		Interactivity between students and teachers is limit to teaching and used teaching methods are versatile. Several students participate in the teaching situations even if it is not compulsory.		Teaching staff uses various teaching methods (lectures, case studies, laboratory works etc.) and the interactivity between students and staff is high inside the teaching situations and in the campus. All students participate in lectures and tutorials even if it is not compulsory.
Basic skills such as communication skills are promoted only by few teachers and in few courses.		The unit promotes students' basic skills but the role of the unit is quite small.		Certain basic skills such as communication and social awareness are promoted by all teacher e.g. by seminars and projects.
The grading system is unequal to students and it is not comparable to other used systems lsuch as ECTS.		Some students feel that the used grading system is unequal. The system is comparable to other systems such as ECTS.		The grading system used at the unit is appropriate and equitable to all students and the grades are based on a combination of exams and self-assessment. System is comparable to other used systems such as ECTS.
There is some development of teaching methods.		New teaching methods are developed but usually the development work is forgotten even if the selected method seems to be sufficient.		New teaching method are developed and tested regularly and the best ones are adopted. (e.g. group tutorials in lectures and group exams)
Students are not allowed to participate in the unit's research groups or assist and teach younger students.		Students can participate in different kinds of projects or teach younger students, however, it is voluntary work and thus, they don't get salary or credit points.		The students can get credits points and/or salary by participating in research projects of the unit and they have a possibility to teach (officially) younger students.
Self assessment and comments:				

(continues)

Appendix 8 continues

3. Support services of teaching and learning

Leading support services of teaching and learning are IT&T (Information technology and telecommunications), student counselling and assuring the teaching quality. IT&T are integral to the operation of modern international university. For a university to be world-class, its IT&T services must at least sustain that status. Access to efficient, networked computing facilities including access to the Internet and Intranet are aspects of the infrastructure expectations of staff members and students.

A high teaching quality requires facilities and equipment such as fully equipped classroom to meet the set requirements for immaterial support. The proportion of academic staff with doctoral degrees is an important indicator of the overall staff strength. In an ideal case all teaching staff have up-to-date pedagogical (didactic) knowledge and satisfactory completion of an approved higher education teaching course. The unit maintains and improves the quality of teaching by coursing the staff to improve their knowledge and teaching skills. All teachers participate regularly in the courses. The teaching is regularly evaluated to improve quality and to find the best methods.

Student counselling is a key point of functional education and individual learning because students take different workloads according to their personal circumstances. Counselling and other advice should improve the match between the expectations and the capacity of the students. A good counselling practice therefore takes into account the different study loads that students are able to manage. The information between unit ad students must be fluent, fast and efficient.

(continues)

Appendix 8 continues

THE AVAILABILITY AND USAGE OF IT&T				
1	**2**	**3**	**4**	**5**
Only a half of the staff has full updated computer and access to the net. The IT support is poor, updates come late and in problem situations the getting help takes a long time There is a serious lack of computers that the students are allowed to use is large and the time to use the computers is limited. Only a half of the staff and students have off-site access to the network. The feedback is collected without IT support. The application of web-based learning environments is irregular and insignificant. The unit's www-pages include some old information.		There is a minor lack of updated computers and an access points to the net. The IT support works usually well and there are courses for the development of the IT skills of students and staff IT skills. Student's computer classes are always full or not working/not appropriate for the purposes. Students have access to the classes whenever they want. There is a minor lack of off-site access to the net among the staff and students. Power-point and the Internet are widely used tools in teaching and other computer-based tools are used regularly (simulations.). The feedback is usually collected by IT. The unit's www pages are updated sometimes too late.		The staff of department has full updated computers with modern tools and an access to the net. The unit supports the development of IT skills of staff and students by offering courses and help desk. All students have access to the computer class whenever they want, the classes are provided wit the internet access and modern programs. All staff and students have off-site access to the network (whether they use it or not) Computer-based tools are widely used in teaching and IT is used regularly in the collection and processing of student feedback. The web-based learning environments are in active use. The departments and all courses www -pages are updated regularly.
Self assessment and comments:				

(continues)

Appendix 8 continues

TEACHING QUALITY				
1	**2**	**3**	**4**	**5**
The evaluation of teaching is under valued. Only some teachers are qualified but the unit encourages the staff to improve their teaching skills and organizes some opportunities for that. The teaching and research do not meet in the department. Teachers are highly overloaded or under employed. Teachers get some support, e.g. money for producing new materials. Courses remain the same and the feedback does not lead to any changes. Teaching conditions are passable and group sizes usually good.		Teaching evaluation is performed sometimes and it is usually implemented by student reviews. Teachers are usually qualified and the unit encourages the staff to improve their teaching skills and organizes events to improve the skills. Researches are also teachers but the research results are not usually linked to teaching situations. The staff can manage their workload. The unit ensures that the quality of teaching material is good and the unit gives some support to improve it. Courses are developed towards the demands when necessary- Teaching conditions are good but there are some insufficiencies in the equipments		Evaluation of teaching is regular and effective. It is based on peer or student reviews. All teachers have up-to-date pedagogical (didactic) knowledge. Courses are offered courses to promote pedagogical knowledge and teaching skills, and the teachers participate regularly in the courses. Teachers bring their latest research-based knowledge in the teaching and include their own research findings in their teaching. The workload of the teaching staff is in balance between the staff's experience, number of personnel and course offerings. The production of high quality teaching material is supported and the course material is always updated. Courses are developed constantly and new teaching methods are used. Course development involves external peer and industry input. Teaching conditions are good, classrooms fully equipped and the group size is always appropriate.
Self assessment and comments:				

(continues)

Appendix 8 continues

STUDENT GUIDANCE				
1	**2**	**3**	**4**	**5**
The unit concentrates on regulations and timetables in tutoring. There are no tutors or any free time activities. There is no special staff addressed to guide students. There is offered bachelor's and master's thesis supervisor. Students need more support in conduct their studies. The information transfer is slow between different levels e.g. administration-teaching staff. The information that students get is old and difficult to find.		The department tries to easier freshmen start in the university and offers some activities for them. New students have a student tutor and the meetings are regular at least at the start point. The department has some special staff member to solve students' problems. There are offered bachelor's and master's thesis seminars available. (In addition to supervisors' ´support.) The students are satisfied with the support they get and there is a match between the services available and their actual usage. Students get updated information on courses and regulations.		The department secure the optimal start of studies and offers special activities (tutoring, older students and teachers, studying skills courses etc.) Each new student has his/her student tutor as well as a teacher tutor, and the meetings are regular. The department has a student coordinator or –advisor who can help students in their problems or in choices concerning the subjects and majors/minors. There are bachelor's and master's thesis support groups or seminars available. (In addition to supervisors' ´support.) There is a good match between the services available and their actual usage. The students are highly satisfied with support they get. Students have an easy access to updated information on courses and regulations.
Self assessment and comments:				

(continues)

Appendix 8 continues

4. Quality assurance

A comprehensive and effective review process indicates well the academic quality of department's courses and the quality of students learning experiences. The unit's degree programs, goals and values are assessed regularly and it uses the results are utilized to improve the practices. Quality assurance ensures for example that the degree programs contents of degree are being taught at appropriate level, the contents form a coherent intellectual map of the area, the assessment practices and criteria reflect the aims and objectives, learning experiences are simulating, the teaching methods to be applied are more explicit and workloads match the timing and type of the studies/courses.

A good quality assurance also requires a feedback cycle, integrated with evidence from graduates and employers. Feedback ensures that the fit between the course and the desired attributes are constantly approaching each other.

(continues)

Appendix 8 continues

QUALITY ASSURANCE SYSTEM				
1	**2**	**3**	**4**	**5**
The unit takes little effort to gain accreditation or to manage well in evaluation.		There are major efforts to obtain an accreditation or to obtain better results in evaluation.		The department has a national or international accreditation, certification or evaluation.
The quality assurance system is under development.		The quality assurance system is assessed.		The quality assurance system is assessed and developed regularly.
The progress of the students is monitored insufficiently.		The progress of the students is monitored only formally.		Student progress in their studies is monitored formally and informally. (statistics indicating the degree awarded, teaching staff identifies students that seem to be having problems etc.)
Actions to improve interuption trends unsystematic.		Identification of courses and spot efforts to diagnose the reasons for the most serious declining and below drop out rates.		Courses where the drop out rates are below others are identified and the reasons are diagnosed systematically so that systematic the modifications could be done.
No explicit learning and teaching plan. No linking of proposals to resources or an overall university plan for the delivery of courses. No implementation arrangements specified.		A learning and teaching plan that sets out strategies. A plan that only generally relates to the resources and implementation arrangements.		There is learning and teaching plan that sets out strategies for market research, curriculum development, accreditation process, learning delivery arrangements, learning and other support to courses. A plan that links resources, defines individual responsibilities, implementation arrangements and approaches to continuous improvement.
Self assessment and comments:				

(continues)

Appendix 8 continues

FEEDBACK				
1	**2**	**3**	**4**	**5**
There is no feedback cycle. The modification of a course proceeds on traditional discipline criteria. Evaluation of outcomes by graduates and employers not undertaken. No gathered feedback.		The attributes desired of graduates are defined. There are substantial attempts to incorporate the attributes into the courses, but teaching to those outcomes is not specific. There is no feedback cycle. The modification of courses proceeds on more traditional discipline criteria. Some evaluation of outcomes by graduates and employers The feedback leads to some modifications of courses, teaching and learning arrangements.		The attributes desired of graduates are defined and there is integrated feedback cycle where the outcomes of courses, evaluated by peers, graduates and employers, are mapped to the desired attributes. There is a permanent quality assessment system of teaching (self-evaluations, open workshop for staff and students etc.) Actual outcomes of feedback lead to the modification of courses, teaching and learning arrangements.
Self assessment and comments:				