HAAGA-HELIA
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Technical communication – the missing discipline in ICT studies

An investigation how to best introduce technical communication as part of the ICT studies curricula in Finnish universities of applied sciences

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Abstract

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Technical communication skills are essential in the field of ICT. However, ICT graduates often lack these skills or their skills do not reflect the needs and expectations of employers. It is necessary for the students to learn already during their studies proficient communication skills and the ability to both write and speak clearly, concisely and effectively on technical subjects to benefit them later on in work life.

The purpose of this thesis was to investigate how to best introduce technical communication as a part of the ICT studies curricula in Finnish universities of applied sciences.

The thesis was carried out as follows: in the study, an evaluation startegy was used. The methodology relied on qualitative methods that drew on the quantitative research described in the resources. In the study, different models of technical communication education offered in the United States and Europe were examined, and semi-structured interviews were conducted.

The thesis indicated that a general consensus exists abroad among employers, universities and alumni about the position of technical communication as an important part of education for engineering and ICT students. Hi-tech companies consider it an important part of their organization and an invaluable skill that contributes to both individual and corporate success. In addition, the thesis revealed that the expansion of the Internet has opened up infinite possibilities for teaching technical communication.

The thesis concludes that technical communication is well established in the USA, but less so in Europe. In Finland, education in technical communication is still rather limited, especially in UASs. This presents a unique opportunity for a leading, innovative UAS to fill the gap in the ICT education. Experienced teachers being rare in the field, this task is not easy. However, it is a worthy undertaking and the potential rewards for the UAS that succeeds in implementing professional technical communication program are considerable.

Keywords
Technical communication, communication skills, education, ICT, engineering, university of applied sciences

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Glossary

APCOMTEC

The Associação Portuguesa para a Comunicação Técnica is the Portuguese Association for Technical Communication. It was founded on 2006 (Apcomtec 2012).

CRT

The Conseil des Rédacteurs Techniques is a professional society that represents French technical communicators and students that study in technical communication programs (Conseil des Rédacteurs Techniques).

EHEA

EHEA is the European Higher Education Area. It is the area of the 46 European countries that participate in the Bologna. Process has been implemented as of 2010. The principles underlined in the aim to provide tools for connectivity transparency in the EHEA while preserving the independency of the participating national educational systems. The objectives are to improve transparency, degrees and academic qualifications recognition, mobility, and exchanges between institutions between higher education systems. The most important reform is perceived to be that all participating countries have agreed on a comparable three cycle degree system for undergraduates (Bachelor degrees) and graduates (Master and PhD degrees). (European University Association 2012.)

ICT

ICT stands for Information and Communication technologies. It is like Information Technology (IT) but focuses also on communication technologies. (ICT 2010.) It is often used as a synonym for information technology.

SME

SME stands for Subject Matter Expert. Technical writers and communicators often collaborate with SMEs to produce manuals and other technical communication products. The writer may have to conduct a number of interviews with the SME to find out all the information relevant to the user.

STC

The Society for Technical Communication is the world's largest professional association that is dedicated to advancing the field of technical communication (STC 2012a).

STIC Netherlands

Studiekring voor Technische Informatie en Communicatie is an association for technical information and communication specialists in the Netherlands (TCeurope 2009c).

STVY

Suomen Teknisen Viestinnän Yhdistys is the Finnish Technical Communications Society. It aims to promote the profession and the field of technical communication, enhance professional, national and international co-operation and provide training for both the members and non-members of the society. (Finnish Technical Communications Society 2012.)

TCeurope

TCeurope is the European umbrella organization for technical communicators. It integrates most of the national organizations in Europe. Its goals include improving the quality of technical documentation in general, promoting exchange of information and knowledge between technical communication specialists in Europe, standardizing qualifications for technical communicators in Europe, and improving vocational, academic and further training in all European countries. (TCeurope 2009a.)

tekom

tekom (Gesellschaft für technische Kommunikation e.V.) is a German speaking European professional association for technical communication. (tekom 2010.)

UAS

UAS stands for University of Applied Sciences. The UASs are also known as polytechnics. In Finland, together with the universities the UASs form the Finnish higher education system. (ARENE 2012.)

YEDA

YEDA International Writing School was founded as the YEDA Center for Technical Communications in 1993 by Dr. Mati Schwarcz in Tel Aviv. (YEDA International Writing School. 2012a.)

1 Introduction

This chapter covers the background of the research problem, purpose and importance of the study.

1.1 Background

> *"If technical communication once was the companion to engineering, it is now a partner in the business of information technology"*
>
> (Hart-Davidson 2001, 145)

There is a body of research indicating that technical communication skills are essential in the fields of engineering and information technology. Nevertheless, when ICT and engineering[1] students graduate, they often lack these skills or the communication skills that they have learnt are not related to the needs and expectations of employers. Learning proficient communication skills ensures that students are capable of both writing and speaking clearly, concisely and effectively on technical subjects, not only during their studies but especially later on when they enter work life. (Reave 2004; Boiarsky 2003; Riemer 2002; Sageev & Romanowski 2001; Andrews 1976.)

Technical communication has existed as an academic and professional field since the twentieth century, first appearing as an extension of applied science and engineering. It has inherited elements from both engineering and English communication. This inheritance is reflected in different programs, some emphasizing the humanities influence, others emphasizing the engineering aspects. Furthermore, programs are also influenced by input from local industry. (Killingsworth 1997, 245-247.)

[1] Broadly defined, ICT uses computers and software to manage and communicate information. It often refers to both traditional computer-based technologies and digital communication technologies. Computer engineering is a hardware engineering field that teaches the design of hardware components, and the assembly of those components into a larger hardware system. In this study, ICT and engineering are used interchangeably.

In recent decades, international awareness for technical communication has increased and courses are now offered in a variety of formats and delivery methods. However, in Finnish universities and especially in Finnish universities of applied sciences[2], technical communication education is still rather limited. Technical communication programs in mixed formats are offered only in three Finnish universities, whereas Finnish universities of applied sciences do not offer any technical communication programs. Those Finnish universities of applied sciences that do have technical communication in their curriculum offer it only on a very limited scope. (Suojanen 2000, 4; Isohella 2007, 8)

1.2 Purpose of the research

This study examines technical communication programs in the United States and Europe. The purpose of the study is to investigate how to best introduce technical communication as a part of the engineering studies curricula in Finnish universities of applied sciences. The specific research questions that my research seeks to address are*:*

R1: What kind of technical communication education is available?
R2: What are the skills (core competencies) needed in technical communication?

I addressed the research questions by examining different models of technical communication education offered at colleges and universities in the United States and Europe. The study also tried to establish the importance and value of technical communication skills[3] for engineering students by examining the approaches to technical communication. As the empirical part of the study, I conducted semi-structured interviews. These interviews offered an examination of a technical communication certificate program that has succeeded over time in providing its

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[2] Finnish Universities of Applied Sciences were formerly called 'polytechnics' in. English. In 2006, the Rectors' Conference (ARENE Ammattikoulujen rehtorineuvosto) recommended a new English name. In this research, the names are used interchangeably.
[3] Technical communication skills are in this research understood as the ability to communicate knowledge in a clear, concise, convenient, correct and complete manner to answer the needs of the intended target group.

graduates with a comprehensive set of skills needed in work life. Based on the answers found to the two research questions through the interviews and the examination of various models, I expected to be able to conclude *what would be the best technical communication education model for Finnish UASs*.

1.3 Importance of the research

Having a technical communication background, I see technical communication as an intrinsic part of the work processes in hi-tech organizations. The research question arose from a personal interest as to why technical communication is not being taught in all engineering schools although employers highly value good technical communication skills.

The results of the study can be far reaching for both Finnish universities of applied sciences and their students. Benefits of incorporating technical communication in the curricula of ICT studies in Finnish universities of applied sciences can far outweigh the effort and investment. Graduates can gain both the skills for communicating complex information clearly and the awareness that clear communication is an organizational approach that benefits all stakeholders from investors to customers. Business organizations look for people who are able to work independently, can function as team members and be responsible and dependable. (Meyer & Bernhardt 1998, 90-91.) Well designed, a technical communication course could address these needs. It could help develop essential communication and problem solving skills; ability to work within given time limits and resource constraints; and ability to function as a team member with fellow students or work with people outside the course.

With ever-expanding global markets and increasing competition between global market players, gaining and maintaining a competitive edge is more important than ever before. Thus, the importance of technical communication is well established in the corporate cultures of market leading companies in the United States and Western Europe. (Schwarcz, M. 29.2.2012.) Companies recognize that technical documentation is a vital part of their products and are ready to invest in communication products more heavily than before (Suojanen 2000, 3.) Therefore, I believe that the importance of the results of this study will not be limited only to Finnish universities of applied sciences and their graduates. The results can benefit also Finnish ICT companies and their stakeholders.

1.4 Research outline

This section ends Chapter 1, which provides the background of the research problem, and states the purpose and importance of the study. The rest of the study is organized as follows:

Chapter 2 provides a review of the literature relating to the field of technical communication and education in the field.

Chapter 3 describes the research methodology and methods.

Chapter 4 presents the main findings.

Chapter 5 discusses the main findings. The chapter concludes with the critique of the study.

Chapter 6 provides research summary, presents main conclusions, and discusses the implications of this study to Finnish UASs.

2 Theoretical part

In Chapter 1, I presented background to the research and the purpose of the research. I also explained my own interest in researching the topic. This chapter provides a review of the literature relating to technical communication and the education in the field. It starts with a description of technical communication and its characteristics and is followed by descriptions of the position of technical communication and the education in the field. By reviewing the research in the field, I aim to show that my research is timely and fills a gap in studies done in Finland.

A variety of material has been published on technical communication. A considerable number of academic studies exist that focus on technical communication education in the United States and specifically on technical communication education for engineering students. There is, however, little research about teaching technical communication in Finnish universities and UASs.

2.1 What is technical communication?

Society for Technical Communication (STC 2011c) defines technical communication as a broad field that includes any form of communication that exhibits one or more of the following characteristics:

- Communicating about technical or specialized topics (computer applications, medical procedures, etc.)
- Communicating technological knowledge by using computer technology (web pages, help files, etc.)
- Providing instructions about how to do something.

The Finnish Technical Communications Society defines technical communication as

> A process where information about products is designed, created, and communicated to end users. The end users of the target group may use this data to support their use of the product. The main objective of technical communication documents is to provide

users with information that supports the effective use of the product or service in question. (STVY)

Hargis et al. (2004, 1-2) attach to technical information the following characteristics:

- It is information about a technical subject; it is meant for a particular audience,
- it has a stated purpose
- it must be easy to use, understand, and find. (see Table 1 on page 8)

Burnett (2005, 4) sees technical communication as "…a broad field that touches nearly every profession because it connects ideas, people and their activities." She goes on to define technical communication as the rhetorical "art and craft of communicating technical information appropriately and persuasively to intended audiences, in complex contexts, for particular purposes." (Ibid.)

TCeurope defines technical communication very much along the lines of Burnett calling it "the art and science of conveying factual information accurately, appropriately and effectively to intended audiences for specific purposes." (TCeurope 2009c.) The TCeurope guidelines refer to technical communication also as the methodical process of creating and managing "the production of usable information, also referred to as documentation, at key points along the life-cycle of technical products, software or services." (TCeurope 2005, 5.) By usable information, the definition refers to the extent to which specified users can use a product to achieve specified goals with effectiveness, efficiency and satisfaction in a particular context of use. In the TCeurope guidelines (Op. cit., 4), usability of documentation is defined in accordance with ISO 9142:2003, which refers to the effectiveness, efficiency, satisfaction and safety, as follows:

- **Effectiveness** – refers to the accuracy and completeness with which specified users achieve specified goals in particular environments

- **Efficiency** – refers to the ease of information retrieval in relation to the accuracy level and comprehensiveness (of achieved goals) of said information
- **User satisfaction** – refers to the comfort of use and acceptability of the documentation by the target audience
- **User safety** – refers to the anticipation and prevention of dangers, accidents and damages arising from using the documented product.

Suojanen (2000, 1) quotes Barnum and Carliner in what is perhaps one of the most succinct, albeit general, definitions for technical communications referring to it as the transfer of knowledge from those who have knowledge to those who need it. On the practical side, she suggests to view technical communication as the production of communication products, manuals, technical specifications, and marketing material.

2.2 Characteristics of quality technical communication

Technical communication is good and effective when it is "accurate, clear, concise, coherent and appropriate." (Perelman, Barrett & Paradis 2001.) Accuracy refers to precise use of language and accurate use of technical and specialized terms. Technical text can often be complex and highly specialized, but it can be clear if the writer keeps the sentence syntax simple. Conciseness can be achieved by using a minimum amount of words to express the idea clearly yet sufficiently for the purposes of the intended audience. Text is coherent when the text flows, and develops the topic in a way that the intended audience can easily follow the line of thinking. When a text is appropriate, it is presented in a way that complements its purpose and audience. (Ibid.)

A major part of technical communication deals with conveying technical information. Hargis. et al. (2004, 3) argue that developing quality technical information has been a concern of businesses for many years. Table 1 on page 8 shows a summary of what they describe as the three main characteristics groups of quality technical information.

Table 1: Characteristics of quality technical information

Easy to use		
	Task oriented	Aims to help users do tasks associated with the product
	Accurate	Factual and free of errors
	Complete	Includes only the needed information – but ALL of it
Easy to understand		
	Clear	Written so it cannot be misunderstood
	Concrete	Includes apt examples, scenarios, graphics, and specifics.
	Stylish	Uses appropriate writing conventions, words and phrases
Easy to find		
	Organized	Arranged in parts according to the user's rational
	Retrievable	Presented so users can quickly and easily and access items
	Visually effective	Achieves ease of use, clarity, enhancement of meaning and overall attractiveness by use of graphical devices such as layout, typography, illustrations, icons, color

2.3 A shift in technical communication from its engineering roots to IT

Almost all professions and disciplines use or deal with technical documents in one form or another. However, technical communication has traditionally been associated with professions such as engineering and construction. (Burnett 2005, 4; TCeurope 2009b.)

According to Hart-Davidson (2001, 145), "if technical communication once was the companion to engineering, it is now a partner in the business of information technology." He argues that the shift to information technology has been followed by a rise in the status of technical communicators. This rise in status is linked to the increased awareness in the organizations regarding the added value contributed by quality technical communication. (Ibid.)

Allen and Benninghoff (2004, 157-158) point out that the continued growth in work positions for graduates in technical and professional communication programs increases the complexity of developing Technical and Professional Communication (TPC) program curricula because of the need to address ever changing employer expectations. They quote George Hayhoe, who reported that in 1985 30% of STC members worked in the IT field. By 1990 the number had doubled from 30% to 60%.

Wick (2000, 521) sees knowledge in the new economy no longer as a mere tool, but rather as the focus of business. Johnson-Eilola and Selber (2001, 406) support this view by saying that in an information economy, technical communication has grown to be a key product. This trend is also reflected in the proliferation of academic programs in the field as hundreds of programs have been developed in technical communication. These include doctoral, bachelors and masters of art and science, as well as two-year, certificate, and undergraduate minors. In addition, there are numerous courses offered as general education requirements. (Ibid.)

2.4 Overview of technical communication education

In this section, I give a brief summary of technical communication education in the United States and Canada, in a number of European countries, including Finland, and in India and Israel. Because the discipline is well developed in the United States, more information can be readily found about the technical communication education in the United States. Also, the source material I used is mostly in English, mainly because my skills in other languages, for example, German and French, are insufficient for extensive use of material.

Other researchers too have addressed this issue and opted for heavier use of American resources for reasons of both professional proliferation and language fluency. Suojanen (2001, 32) speaks of the United States dominance in the field stating that "Today, the United States is the forerunner in technical communication, with an abundance of academic studies, textbooks, professional activities and different types and levels of education programmes." (Ibid.). Suojanen (Op. cit., 33) further elaborates the problems in researching technical communication in Finland by saying that tracking the development of Finnish technical communication is difficult because of the lack of comprehensive studies in the field. The same applies for other countries in the EU.

Despite the apparent difficulties stemming from the language barriers and, to a degree, from the lack of related publications, I chose to gather available information about the technical communication education also in EU countries. This can help establish both the growing level of awareness to the field in the EU and the approaches to teaching. To gather material, I sent an e-mail to the technical communicator societies in Germany, Italy, the Netherlands, Portugal, Spain, and Sweden. I received replies from Germany, the Netherlands, Portugal, and Sweden. From Germany, I received information from tekom. The material was in German and included a comprehensive overview on bachelor and master programs and further training courses at universities. (Lohmüller, 10.4.2012.) The secretary of STIC Netherlands informed me that they do not have any technical communication education in the Netherlands. (van Loggem, 12.4.2012.) From Portugal, I received a reply from the vice-president of APCOMTEC that they are not aware of any communication courses in Portugal. They only have some optional classes connected to translation studies. Technical communication, she wrote, "…is still a very unexplored field that has a lot of place to grow in Portugal"." (Santos, 4.5.2012.) From Sweden, I received information from a senior lecturer in Mid Sweden University to whom my e-mail was forwarded. Most of the material was in Swedish and included links to institutions that offer technical communication courses. (Öberg, 19.4.2012.)

United States and Canada

In the United States, technical communication is mainly offered in post-secondary educational institutes, which include colleges and universities. According to the STC Academic Database (STC 2012b), technical communication is taught in more than 220 programs. Table 2 shows the breakdown of technical communication programs in the United States according to their qualification type.

Table 2: Breakdown of U.S. technical communication programs by qualification type

TYPE	NUMBER	% of all types listed
Bachelor of Arts	146	65.47%
Master of Science	14	6.28%
Associate of Applied Science	1	0.45%
Bachelor of Science	30	13.45%
Doctorate of Philosophy	5	2.24%
Undergraduate Certificate	6	2.69%
Master of Arts	12	5.38%
Associate of Arts	1	0.45%
Graduate Certificate	8	3.59%
TOTAL	223	100.00%

In the United States, educational programs that lead to degrees in engineering are accredited by the Accreditation Board for Engineering and Technology (ABET), which is the sole agency responsible for accreditation. In fall 2001, ABET adapted Engineering Criteria 2000 (EC2000) as the accreditation criteria for all engineering programs. EC2000 lists the ability to communicate effectively as one of the most important skills for engineers. (Online Ethics Center 2012; Reave 2004, 463).

The enactment of the EC2000 by the ABET has had a significant impact on technical communication programs and pedagogy in the United States. In engineering studies, there has been a clear shift in emphasis toward so called 'soft skills' which include an ability to communicate effectively (Williams 2001, 153).

According to Williams (2001, 153-154), EC2000 is remarkable in that it shifted the evaluation emphasis in engineering programs from "documentation through program requirements to the documentation of evidence of student learning outcome." (Op. cit., 153.) This means that evaluators focus on the documented results of what students have learnt rather than whether students have passed the required courses. This, in turn, requires engineering students to develop their technical communication [documentation] skills in order to best document their knowledge and ideas. Following is the list of skills in which, according to EC2000 criterion 3, graduates of engineering programs must demonstrate their learned ability to:

1. apply knowledge of mathematics, science, and engineering
2. design and conduct experiments, as well as to analyze and interpret data
3. design a system, component, or process to meet desired needs
4. function on multi-disciplinary teams
5. identify, formulate, and solve engineering problems
6. understand professional and ethical responsibilities
7. **communicate effectively**
8. use their broad education in a manner necessary to understand the impact of engineering solutions in a global and societal context
9. recognize the need for, and engage in life-long learning
10. keep up with contemporary issues
11. use the techniques, skills, and modern engineering tools necessary for engineering practice. (Ibid.)

Reave (2004, 452) surveyed 73 top-ranking US and Canadian engineering schools. She found that technical communication courses are required in about 50% of the U.S. schools and 80% of the Canadian schools. In Canada, technical communication is taught in various forms at universities and colleges. Universities such as the Vancouver Island University (Vancouver Island University) and the Simon Fraser University (Simon Fraser University SFU) offer online certificate programs in technical communication as well as various technical writing courses and workshops. Other forms of technical communication education offered by universities include Professional Writing Minor Programs (University of Victoria), Technical Writing Associate Certificate programs (British Columbia Institute of Technology) and Written and oral communication in engineering courses (University of British Columbia 2007). Technical communication education offered by colleges varies from Business and

Technical Writing Certificate Programs (Vancouver Community College 2012) to online Technical Writing Certificate programs (Humber College 2011).

India

India has possibly the largest number of technical writers outside North America. In India, technical communication did not exist as a field till the 1990s. In 1990s, the number of technical communication professionals went up tremendously. (STC 2012d.) The number of technical communication professionals is estimated to be is around 12,000 to 15,000. (Pandit, M., Talwar, G. 2012.)

There are many colleges throughout India, particularly in Mumbai and Bangalore, that offer training in technical communication. The colleges have a wide range of communication coursesto answer the growing demand. (eHow 2012.) There are also many private companies and colleges that offer technical communication training and consulting.

Israel

As a center of hi-tech, Israel boasts the largest number of start-up and software companies ouside Silicon Valley and a proportional percentage of highly-trained technical communicators. Compared to European countries, Israel has a thriving technical communication community. Many technical communicators in Israel are graduates of the YEDA technical communication certificate program. Others may have gotten their training in courses offered by YEDA graduates. (Schwarcz, M. 21.3.2012.)

Germany, Austria and Switzerland

The information provided by tekom refers to technical communication education in three German speaking countries: Germany, Austria and Switzerland. Whereas in 2007, Isohella reported eight German UASs offering education in technical communication, today undergraduate programs in technical communication are currently offered in eleven German UASs, as well as advanced degree programs in four German UASs and at one university. In Austria, an undergraduate technical communication program is offered in one UAS and an advanced degree technical communication program is offered by one university. In Switzerland, one undergraduate technical communication program is offered at the Zurich University of Applied Sciences. (tekom 2012, 5-17, 35-40) On average, both the undergraduate and advanced degrees programs take 6-7 semesters, including a one semester internship. (Ibid.) The faculties responsible for the programs are various, including Faculties of Philosophy; Engineering, Product Engineering, Electrical and Computer Engineering; Information Management and Media; Mechanical Automation; and Applied Linguistics. The degrees earned from the undergraduate courses are B.A, B.Sc. and Bachelor of Engineering, and from the advanced degree courses, M.A and M.Sc. (Ibid.)

Some of the technical communication programs are interdisciplinary. This means that students major in communication studies, and have, for example, computer science, mechanical or electrical engineering as their second major (RWTH Aachen University). Each university has its own focus. Some universities, such as University of Aalen, emphasize solid technical knowledge together with media skills and usability technology, whereas other universities, such as Zurich University of Applied Sciences, emphasize linguistic excellence together with the ability to manage communication processes. (Ibid.)

France

According to CRT (Conseil des Rédacteurs Techniques 2002), at least one French university offers a Bachelors degree in the field. Following is the list of technical communication education offered in France[4]:

- **Limoges University**:
  Professional first degree in Technical Writing

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[4] As I do not speak or read the language fluently, it was somewhat difficult to read most of the material published by the French universities.

- **Rennes 2 University of High Brittany**:
  Master 2MT & C2M (Translation, Multimedia, and Multilingual Communication Jobs)
- **University Paris Diderot - Paris 7**:
  Master and professional first degree CDMM (Design of Multilingual Documentation and Multimedia)
- **Caen University**:
  Master RADI (Writing, Applications, Networks and Images)
  Master LID (Language, Image and Document)
- **University of Western Brittany**:
  Professional Master in Literature and Languages (Specialty Language and Communication - Subspecialty French-English Writer-Translator)
  Note: As this program was listed by the French technical communication association, I presume that this specialty includes technical communication studies.
- **Université Blaise Pascal, Clermont-Ferrand**:
  Master Language and technical communication

(Ibid.)

The technical communication education offered in French universities reflects one of the significant differences between the state of the discipline in the United States and Europe. In the United States, it is not necessary to be competent in multiple languages to obtain a degree or be able to work in the field. However in Europe because of its multilingual and multicultural nature, the theory and practice of translation and language have had strong influence on technical communication education. (Suojanen, 2000, 9; Zemliansky 2009.)

Finland

Researchers in Finland (Suojanen 2000; Isohella, 2007) have addressed the state of technical communication education in Finland. Suojanen (Op. cit., 33) notes that comprehensive studies on technical communication are absent in Finland. The situation today has not significantly improved from the days of her research. There are only two universities that offer and have offered Master-level education in Finland since 1990's. In Tampere, technical communication is offered as a specialization program in the Department of Translation Studies, whereas the University of Vaasa offers technical communication as a degree program in cooperation of the Faculty of Philosophy, Business Studies and Technology.

Suojanen (2000, 9) points to certain similarities between technical communication and translation professional concepts. For example, both professions require practitioners to analyze target audiences, consider contexts, use creativity to solve problems, and draw information from multiple resources. Furthermore, translators working as technical communicators have a good understanding of the challenges involved in translating technical documents. (Ibid.) This raises the issue of localization and arouses questions regarding possible optimizations of technical communication processes and products in order to expedite localization and reduce costs. Addressing this question is, however, outside the scope of this study.

Technical communication is offered also at the University of Oulu. There it is a a 25-study point (15 study-week) program that is designed in cooperation with the Department of English and language professionals that work in the field of technical communication in information technology companies (University of Oulu 2011).

Suojanen (200, 4) underlines also the difficulties to find educators who could offer adequate training to professionals. There is a lack of educators in Finland with the necessary knowledge, skills, and understanding of a technical communicator's work. This, according to Suojanen results from the lack of experience and tradition in technical communication education in Finland.

Isohella (2007, 8-14) has examined the technical communication education at UASs in both Finland and Germany. The results of her development project study reveal that the extent of technical communication education in UASs varies greatly between these two countries from individual courses to extensive degree programs. German UASs offer extensive degree programs of technical communication in different fields, whereas Finnish UASs offer mostly basic communication courses that belong to various degree programs in engineering and technology. Although Isohella's study dates back to 2007, a quick examination shows that to date the situation has not improved much since the days of her report. Courses that focus on actual technical communication are rare in Finnish UASs, and even those courses that are offered have a rather limited scope (two credit points). In some cases, the name of a course can be misleading as the name refers, for example, to 'technical report writing' but actually the course aims at helping students prepare their final project. (Ibid., 8-9.)

Haaga-Helia UAS, for example, offers no technical communication studies per se. It does, however, offer communication studies as both compulsory courses for Bachelor's degree and a dedicated Master's degree program in Communication Management. First degree programs, such as the Finnish degree program for Multilingual Management Assistants and the English degree program for Business Information Technology (BIT[5]) include compulsory courses in communication. The Multilingual Management Assistants program requires the compulsory course called Purpose and Practices of Organizational Communication worth two credit points. The English Business Information Technology degree program (BIT) has two compulsory courses, Finnish and Communication 1 and 2, which are basically Finnish language courses addressing some business correspondence, meetings, and presentation situations. (Haaga-Helia University of Applied Sciences 2012a; Haaga-Helia University of Applied Sciences 2012b; Haaga-Helia University of Applied Sciences 2012c; Haaga-Helia University of Applied Sciences 2012d).

Haaga-Helia offers also a course in communication and presentation skills, which is part of the Finnish "Tietojenkäsittelyn koulutusohjelma" (TIKO; day courses for

[5] In the Haaga-Helia web site, the Degree program in Business Information Technology is referred to as either BITE or BIT. In this research, these two abbrevaitions are used interchangeably.

young students; evening courses for adults). The course aims to give students a general idea of the meaning of communication in an organization. It also helps students to understand how verbal and written communication skills are part of an ICT professional's skills. (Haaga-Helia ammattikorkeakoulu 2012.)

Sweden

In Sweden, some technical communication courses are offered at the university level. For example, the Mid Sweden University offers a course that focuses on the use of XML in technical communication. Furthermore, there are courses that combine multimedia and technical communication and a course that focuses on basic technical communication. All the courses are at 7,5 ECTS credits. (Öberg, 19.4.2012.)

According to Lewis-Sturmhoefel (TC-FORUM 1998), technical communication education is offered by the University of Karlstad in its Centre of Excellence in Technical Communication. Bengt Nilsson, the head of Ericsson Programatic's Technical Communication Department, helped develop this three-year distant learning course that was launched in 1988.

The course emphases are as follows:

- acquiring practical communication skills - first year
- acquisition of academic and professional knowledge - second year
- research methods - third year

The course[6] does not include engineering or technology because it was designed as a continued education for qualified engineers and technicians wishing to improve their communication skills and create better technical communication products. (Ibid.)

[6] I could not find the listing for this course. This may be due to a number of reasons including a change of program name or a cancelation.

The University of Gothenburg (Chalmers) offers a number of elective technical English and communication courses at their Technology Center for Language and Communication. The offering includes the following: Technical writing for Master's studies, Technical and scientific communication channels, audiences and purposes, and Tutoring and supervising technical communication: Improving the communication of colleagues. (University of Gothenburg 2009.)

United Kingdom

In the United Kingdom, technical communication education is offered mainly by two universities, Sheffield Hallam University and the University of Portsmouth. Sheffield Hallam University offers technical communication as a distant learning postgraduate program. The course combines the theoretical aspects of technical communication with practical approaches to writing in technical and business contexts. The course is meant for experienced technical communicators who are looking for a qualification in the field or want to expand their knowledge and skills, or for graduates who want to enter the growing field of technical communication. (Sheffield Hallam University.)

The University of Portsmouth offers a Masters program that provides knowledge and skills in a range of technologies that emphasize modern communication (University of Portsmouth 2011). The programs both at the Sheffield Hallam and Portsmouth Universities have three different levels: Postgraduate Certificate level (60 credits), Postgraduate Diploma level (120 credit), and Master level (180 credits).

Technical communication courses are offered by technical authoring and training companies such as Cherryleaf (Cherryleaf 2012) Armada (Armada 2012) and Eston Training (Eston Training 2004).

2.5 Communication skills in light of employer expectations

Employers expect engineering students to be capable of communicating effectively. Engineering students must acquire a range of communication skills if they want to get their ideas accepted and the products they design developed. (Boiarsky 2003, 251.) There is a body of research (Andrews 1976; Riemer 2002; Sageev & Romanowski 2001; Reave 2004) on the importance of communication skills for engineers. These studies show that most graduates are inadequately prepared for the communication demands that they face at work.

Already Andrews in her research from late 70's (1976) and later Riemer (2002, 91) point out the importance of communication skills for engineering students who seek to carry out their professional practice in the global arena. They bring up the issue of a lack of a direct fit between the skills of graduate students and those required by industry. The lack of communication skills is apparent when compared to the needs of industry internationally. Andrews' research also shows that not only engineering students themselves complained that technical communication courses are not relevant to their area of study, but also industrial employers aired complaints of students lacking adequate preparation in writing in the college curricula (Andrews 1976, 446).

Riemer (2002, 91) underlines the need for common code for communication and the need of education institutions to meet the requirements of the engineering industry. Quoting Dean of Engineering at Duke University, Riemer writes that more and more employers seek graduates who are able to communicate well. Being adept at communication gives students a considerable advantage over those who are not.

According to Lang et al. (1999, in Reave 2004, 453), a survey in which 420 engineers and engineering managers were surveyed shows that the participants ranked communication skills higher than, for example, the ability to design a product, system, or process. Evans, et al. (1993, in Reave 2004, 453) describe the results of another study, in which effectiveness in communicating ideas was rated as the second most important skill right after problem-solving skills. Tryggvasson et al. (in Reave 2001, 453) report of a survey that was held amongst three graduating classes of engineers. In that survey, communication and interpersonal skills were rated as the most important skill in professional life, "…higher than design, mechanics, manufacturing economics, or computer skills." (Ibid.). However, despite the importance placed by employers and practicing engineers on communication skills, researchers indentified a large gap between workplace need and engineering graduates' communication skills.

Sageev and Romanowski (2001, 685-691) surveyed recent engineering graduates who had been working for three to five years. The graduates were asked what percent of their time overall they spent on writing communications, formal oral presentations and on other oral communications, and what percent of their work is teamwork. The results showed that engineers spend 64% of their work time on some form of communication (32% on writing, 22% on oral presentations, and 10% on other oral discussions). The message conveyed by the survey was that technical communication is an important aspect in the engineering life and communication is crucial for success and career advancement. According to the respondents, technical communication instruction improved their ability to function successfully as engineers and added a differentiating value to the employers. On the other hand, those that felt that their communication skills were insufficient said it resulted in a disadvantageous position at work. The results of Sageev and Romanowski study suggest that technical communication must become an integral and even mandatory part of engineering curricula and technical communication modules should be included in most engineering courses; the instruction should start early enough; students should be taught new communication technologies and other skills as well as teamwork.

Williams (2001, 150) emphasizes that in addition to superior technical skills, it is important that engineering students communicate well and understand how to perform in the global workplace. Sloat's research (1994, 65) supports this view by stating that the ability to write clear, concise, and accurate technical reports is one of the most important skills that an engineer needs to develop. She quotes Professor Branch, who says that he and his colleagues have seen "…very very good engineers not be able to communicate their knowledge, they couldn't make a presentation, they couldn't write, their writing style was awful, and they really hurt their career." (Ibid., 93.)

2.6 Core competencies of technical communicators

Rainey, Turner and Dayton (2005, 323) have presented in their research core competencies for technical communicators. Other researchers (Hart-Davidson 2001; Allen and Benninghof 2004; Boiarsky 2004) share the view of Rainey, Turner and Dayton of these being competencies that students should learn during studies. The most important competencies are grouped into four categories: collaboration, writing, technical, and self activation/evaluation. The researchers examined the ten largest undergraduate programs and conducted a survey in which technical communication managers rated core competencies. **Error! Reference source not found.** lists the core competencies.

Table 3: Core competencies for technical communicators

The most important competencies	
	Skills in collaboration with subject-matter experts and with co-workers
	Ability to write clearly for specific audiences and for clearly defined purposes
	Ability to create communication products that are factual and free of errors
	Ability to assess and learn to use technologies
	Ability to take initiative and evaluate one's own work and the work of others
Secondary competencies	
	Ability to use technologies to produce documentation in various media
	Ability to write, edit, and test various technical communication documents
Tertiary competencies	
	Skills in usability testing, single sourcing and content management
	Skills in instructional design, budgeting and oral presentations
	Skills in research, multimedia, and awareness of cultural differences

Basic skills in writing effective engineering documents include skills in analyzing the following aspects of a document:

- audience
- purpose

- context in which it is being written and read, and
- the proper conventions to use for a particular type of document.

Learning these basic skills helps students achieve the core competencies required of good technical communicators (Boiarsky 2004, 252).

2.7 Approaches to teaching technical communication to engineering students

More and more engineering faculties are introducing communication into their technical courses as a result of their industrial experience. Communication is added to the engineering curricula because it is an important asset in students' future work as engineers. Writing assignments help students improve their ability to communicate within their own discipline and increase their understanding of engineering concepts.

Although there are clear advantages to incorporating writing and communication in engineering curricula, there are also many obstacles that prevent faculties from even trying to do so. Faculties see the following as major obstacles:

- the problems in developing effective assignments that both emphasize engineering concepts and encourage good writing,
- the workload that is involved in assigning and evaluating writing,
- the lack of support to engineering faculties for their efforts, and
- too much time is spent on writing, which leads to neglecting of important technical content. (Williams 2001, 157-158)

Hart-Davidson (2001, 150) presents a list suggested by Johnson-Eilola of four kinds of value-added activities that technical communicators perform: experimentation, collaboration, abstraction, system thinking. Hart-Davidson continues by saying that each [area] is also endemic to building ICT products and systems that improve social relationships in businesses and organizations. That is, the ICT product that eventually succeeds will rely on someone doing each of these four things well in the course of its development.

Cargile Cook (2002, 7-18) has presented a six-level theoretical frame for technical communication pedagogy (basic, rhetorical, social, technological, ethical and critical literacy). Each level includes specific skills that are needed in technical communication and which could be used when planning instruction in such a multidisciplinary field as technical communication:

- **Basic literacy** refers to the ability to communicate with focus on completeness, consideration, clarity, courtesy and correctness. To assess students' basic literacy skills instructors cannot suffice with evaluating their correct grammar and writing but must instead ask the students to explain why they made certain choices in their writing.
- **Rhetorical literacy** refers to the communicators' versatility to conceptualize, design, and create communication products for the purpose of specific audiences. To asses this ability instructors must review a wide variety of student tasks in a variety of genres; created for specific clients and situations.
- **Social literacy** refers to the ability to collaborate and work well with others, whether present or not. To asses this ability instructors must observe and review team work where the students demonstrate their effectiveness in different capacities of working with others; coauthoring (direct collaboration), or brainstorming and strategizing (indirect collaboration), group grading for well defined teams and roles (formal collaboration), individual grading for work in loosely defined groups (informal collaboration). Instructors may chose to include in these assignments team reports written by each team member.
- **Technological literacy** refers to the working knowledge of the technologies used to create communication products. This includes an understanding of how the 'involved audience' (that is both, collaborators to creation and users of communication products) work with said technologies and what are their preferences. In this sense too, the technical communicator is a "user advocate and facilitator." (Op. cit., 14.) The instructors must assess not only technological proficiency but the consciousness of the students to user-centered

design and to usability (of communication products, their technological platform, and the documented product itself).

- **Ethical literacy** refers to the ability to consider professional and ethical standards in correlation to the concerns of the stakeholders involved in a given communication situation. Practically any area of the curricula may involve ethical considerations which influence decisions about the following aspects of a communication product: "purpose, audience, development, contents and delivery methods." (Op.cit., 16.) One approach to teaching and assessing ethics is classroom examination of ethical cases. Also discussions where students are required to explain ethical choices they made in their projects.
- **Critical literacy** refers to an ability which is hard to define "because its practice is so enmeshed in situations requiring other forms of literacy." (Cargile Cook (2002, 16.) However, Cook defines it as the ability to consider "ideological stances and power structures and the willingness to take action to assist those in need." (Ibid..) In other words, technical communicators must be able to contextualize and address the situations in which they are communicating with consideration to the concerns of all stakeholders and not only the powerful and financially significant stakeholders. For example, communicators should be attentive to the needs of individuals who are inarticulate, mute, and even have little buying power. The critical literacy can be layered (taught and assessed) with the other abovementioned forms of literacy. For example, critical assessment of technology can be considered as a component of technological literacy, and so forth.

2.8 Existing models in technical communication education

> *"The ideal curriculum in information product development includes writing, transferable lifelong learning skills, software tools, communication theory, the history and impact of technology on culture and human lives, and internships or practice which sharpens the students' focus on tasks they will perform in industry."*
>
> (STC Academic industry workshop 1993)

Hardner and Rich (2005, 209) researched trends in undergraduate curricula of scientific and technical communication programs and found no standard curriculum for these programs. According to them, this is caused by the lack of an accrediting board. They see this lack as a positive thing that allows the educational institutes to develop individual courses and programs that best address local industry needs. Also Little (1997, 275-276) points out the advantages of the lack of standardization in structure and design which allows greater flexibility to the local needs and changes dictated by industry. Conversely, she argues that the lack of accreditation inadvertently raises questions about the quality of such programs.

The range of courses and programs in which technical communication is offered is wide. There are technical communication service courses, two-year college courses or programs, certificate programs, and four-year degree programs. Different models of technical communication are designed for specific purposes. In this section, I describe some of the existing models.

2.8.1 Technical communication courses

Andrews (2003) describes a pilot advanced writing course that was arranged in the Ohio State University for engineering and science students. The course was based on assumptions that corresponded to the recommendations made in an earlier survey of 160 universities. The recommendations included continual instruction and criticism to help students maintain good writing skills; emphasis on the need to teach writing where it is used (for example, in engineering class) and on the need of students to write abundantly and receive abundant criticism from each other and from the instructors.

During the course, students were required to write weekly reports and thorough reviews of literature on assigned aspects of the given field. In the beginning of the course, students were asked what they see as problems in their writing. These problems were then the focus of the following sessions. The course contained workshop sessions in which students went through and edited the reports together, evaluated the readability of what they read. The students received feedback from instructors either in written comments or as comments that were recorded. The latter feedback method was found successful as it allowed the instructor to "converse with the students about their reports." (Andrews 2003, 448-450.) Andrews reports that the results of the approach of the pilot course were encouraging. Students felt that the course improved their writing skills, as well as the expression and organization of their reports. They told that the course also encouraged them to look carefully at their writing and provided tools that assisted them in writing. (Ibid.)

Technical communication education is often offered as service courses, which are mostly intended for students who are studying in technical, technological and professional areas. These service courses are either more theory oriented or they pay more attention to workplace applications. Service courses are designed to develop students' communication skills related to their major subjects, to help them become better practitioners of their occupation, and to meet employer expectations regarding the communication skills of the students as prospective employees. There are several models of these courses. They can be required courses for all students in a college of technology, elective or preferred elective courses for students in vocational programs, courses that are open to all students, or courses that each school within a university or college tailors to the specific needs of its students. (Pickett 1997, 287-295).

2.8.2 Technical communication degree programs

In addition to technical communication courses, there are various technical communication programs, which include certificate programs, 2-year college programs and four-year programs. Whereas technical communication courses are designed to develop students' communication skills related to their major subjects, technical communication programs aim at preparing students to become professional technical communicators or editors.

Technical communication certificate programs

Technical communication certificate programs are offered at the undergraduate and graduate levels. They serve both students who want to obtain entry-level knowledge and those who seek to upgrade their knowledge. Compared to other technical communication programs, certificate programs are easy to implement, because they involve less bureaucracy and are quick to put into place. For example, certificate programs typically use many courses that already exist as part of other programs, which reduces the need to add new courses or resources such as instructors or equipment. Certificates are also quicker to earn as certificate programs usually entail fewer hours than other technical communication programs. This aspect of certificate programs attracts students who already have a degree but seek to move to another career field. A further advantage that certificate programs have over other degree programs is the adaptability and flexibility to respond to local needs and diverse backgrounds and goals.

Certificate programs are often closely connected to industry and business outside the academic environment. The program design pays attention to the needs of industry and business, who can contribute by providing internship and employment opportunities. On the other hand, these advantages raise a question regarding the program quality. A program that enjoys lesser degree of monitoring and inspection because of a lack of legislated or mandated standardization inevitably gains also less acceptance and respect (Little 1997, 273-279).

Two- and four-year college programs

Two-year college technical communication programs are varied in their emphases and goals, which allows them to meet diverse needs. These technical communication programs are offered in both degree and non-credit formats, for example, the Associate and Certificate are terminal degree credentials that allow for transfer to four-year programs" (Staples 1997, 262). The non-credit technical communication courses have the potential to attract partnerships with industry. Geonetta et al. (in Staples 1997, 263) describe for two-year programs a model curriculum that ties "courses in written, spoken and visual communication to courses that teach technical skills and knowledge." (Ibid.) In essence, two-year programs' curricula reflect similar long-term educational goals to those of four-year programs. That is, rhetoric, audience awareness, technical skills, logic, creative thinking and decision making. (Southard and Reeves in Staples 1997, 263).

The main difference between these types of program is, given the limited duration of two-year programs, the scope and breadth of studies. And while two-year programs often aim to prepare graduates for entry level positions as technical communicators they must also offer the possibility of credit transfer to four-year programs. As the technical communication field gains awareness and practitioners occupy positions of growing importance in industry, the bachelor degrees of BA or BS are increasingly becoming an important credential for entry level positions in technical communication. (Staples 1997, 259-264.)

Whereas the two-year programs seem relatively rare compared to the other programs, the number of four-year programs has been increasing. (Staples 1997, 265.) Geonetta (1997, 251-253) links the growth of these programs to the growth of information products and services and to the value that they add to the Gross National Product (GNP). Pointing out that in the U.S. bachelor degree programs form the foundation of technical communication education, he predicts that "further growth is anticipated as society turns to science and engineering to solve its problems and as more technology comes into the hands of end users." (Ibid.)

As a rationale for universities to offer Bachelor's degree in technical communication, Geonetta points to the importance of the emerging role of technical communication in products' life cycle. "Technical communicators will also assist scientists and engineers when they are called on by their colleagues and the public to explain their ideas to decision makers and to articulate their ideas to the public that pays for and uses technology." (Geonetta 1997, 253.) Also TCeurope in their guidelines (TCeurope 2005, 41) urge [European] universities and institutions of higher vocational education to create both bachelor and masters degree academic programs as well as doctorate level education in technical communication. Although the qualification systems in European higher education currently differ, the Bachelor-Master qualification system as agreed in the Bologna declaration will, as of 2010, bind the EU countries participating European Higher Education Area (EHEA).

The design of a four-year program in technical communication is a complex issue, both for academic and faculty considerations. Technical communication does not appear to have the departmental or institutional identity associated with well-established disciplines such as mathematics or journalism. Neither does it seem to have the same institutional clout to achieve the independent departmental status that is often associated with an established discipline such as English or psychology. Only a few four-year degrees exist in independent departments of technical communication. Most are housed in departments of English, where technical communication or technical writing is an 'option', 'concentration', or 'emphasis.' (Geonetta 1997, 253-254.)

Southard and Reeves (in Staples 1997, 263) describe a combination of communication courses as a model curriculum for a four-year program. This curriculum combines courses in rhetoric, audience awareness, technical skills as well as logical and creative thinking to train students in making professional decisions regarding technical communication products and processes. Geonetta (1997, 254) speaks of two main approaches in curriculum design. One approach is to draw on sources that provide guidance about the current demands of business and industry and the current thinking about what a technical communication undergraduate program should include. Surveys and observations of technical communicators, and professional technical communication educators provide input of the state of the profession. These sources define the state of the profession through surveys of practitioners and observations of professional technical communication educators. They allow curricula to be defined by the current needs articulated by business and industry.

The other approach in designing a four-year degree program is to focus on the future trends in information design, work methods, and tools. Taking this approach the designer must project the future professional needs of their students based on apparent trends in the practice of technical communication. Corey and Gilbertson (Geonetta 1997, 255) have concluded: “Of necessity, most industries live in the present; curriculum designers must live in the future.”

3 Empirical part

In Chapter 2, I reviewed and analyzed the relevant literature on technical communication and education on the field. In this chapter, I describe the research methodology and methods.

3.1 Research methodology

As the research strategy, I chose evaluation. Evaluation is a process of acquiring and assessing information. Trochim (2006) defines it as "the systematic acquisition and assessment of information to provide useful feedback about some object." The purpose of the study was to collect data on existing technical communication education models and core competencies, and by using a comparison, to analyze and evaluate what would be the best model to introduce into the curricula of Finnish UASs. The data for the study was collected by two methods: literature research and interview.

The examination aroused questions regarding the exact implementation of a technical communication course or program and possible barriers to the implementation and ways to overcome them. Addressing all these questions is, however, outside the scope of this study.

3.2 Research methods

In an evaluation research, mostly qualitative research methods, such as interviews, questionnaires, observation, and case studies are used (Silver 2004). In my study, I relied on qualitative methods that drew on the quantitative research described in my resources. Denscombe (2003, 131) sees that the choice of methods "will be influenced by the strategy itself, but it will also reflect preferences about the kind of data that the researcher wishes to obtain, and practical considerations related to time, resources and access to sources of data." (Ibid.)

As my methods, I chose literature research and interviews via Skype. Taken into account the purpose of the research, the limited budget, time and resources of the project, I believe I chose the most suitable methods for my research.

Literature research

For the theoretical part of my study, I carried out literature research. Reviewing existing literature, I collected data to examine current models and trends in teaching quality technical communication. I then evaluated and analyzed the data collected from existing literature.

I found data on web sites and in books and journals. Denscombe (2003, 212) describes such forms of media as containing "the accumulated wisdom …and the latest cutting-edge ideas which can shape the direction of the research". (Ibid.) The purpose of collecting the data was to provide an up-to-date overview of literature on the issues relevant to my research topic, that is, to get an idea of the current situation and developments in the field and find out the best model for Finnish universities of applied science.

Interview

The empirical part of my research comprised qualitative interviews. Interviews are conversations that have a structure and a purpose defined and controlled by the researcher. An interview may not provide objective information, but it describes views that the subjects have on a relevant topic. Most importantly, personal interviews provide in-depth and comprehensive information. Unlike in quantitative research, in qualitative research the subject matter consists of meaningful relations that the researcher interprets. (Kvale 1996, 6). In qualitative research interviews, the researcher tries to elicit views and opinions of the interviewees (Creswell 2003, 188).

Research interviews do not have a common procedure, but there are stages that are common to most interviews: thematizing, designing the interview (to addresses the research questions), the interview itself, transcribing, analyzing, verification and reporting (Kvale 1996, 6). One of the advantages of conducting qualitative interviews is that the researcher can probe for more details and make sure that the interviewees interpret the questions the way they were intended. Another advantage is that the researcher can apply his knowledge, expertise, and interpersonal skills to deal with unexpected ideas or themes raised by interviewees. Disadvantages of qualitative interviews include the subjective nature of the interviews, which constitutes also a potential risk of the interviewer bias; the fact that it is time-consuming to analyze and interpret qualitative interviews, and the fact that interviewees may consider them as more intrusive than quantitative approaches. (Sewell 2010.)

I conducted three interviews with Dr. Mati Schwarcz, the founder of the YEDA International Writing School. He founded the school in 1993 in Tel Aviv, as the YEDA Center for Technical Communications. During the 1990's, with the growing success of the school's graduates in the hi-tech field the school gained the reputation of an excellent technical communication training center. Dr. Schwarcz attributes the school's success to its thorough training methods and its ongoing sensitivity to emerging changes in media, publication technologies and the requirements of industry.

Since its foundation, the school has trained hundreds of academics from all over the world and often placed its graduates in hi-tech and engineering companies as technical and marcom writers. Nowadays, the school offers an online technical communications certificate course and other online training programs. (YEDA International Writing School 2012a.) In a preliminary interview that I held with Dr. Schwarcz in February 2012, he articulated that nowadays with competition between global market players ever increasing, gaining and maintaining a competitive edge is more important than ever before. The importance of technical communication is well established in the corporate cultures of market leading companies in the United States and Western Europe. In recent years though, the waking giant economies of Asia seem to be quickly learning this lesson too. Dr. Schwarcz told that his school is receiving an increasing number of applicants from India and China. "Clearly, these globally competing economies have grasped the importance of good technical communication to the success of products and companies in the field of IT." (Schwarcz, M. 29.2.2012.)

The interviews took place on 29.2.2012, 19.3.2012 and 21.3.2012. They were semi-structured, one-to-one interviews with a list of topics to be addressed. Advantages of one-to-one interviews lie in the ease of arranging and controlling them and in that the data is collected from one source. Semi-structured, in-depth interviews offer a flexible way to collect information in situations in which the interviewer asks "open-ended questions that elicit depth of information from relatively few people." (Guion, Diehl & McDonald 2012.) Before carrying out the interviews, I planned in advance the broad topics and prepared a clear set of questions. However, this type of interview allows the researcher to "adapt the research instrument to the individuality of the research respondent" (Miller & Brewer 167) and to be flexible regarding to the order of the topics, to react to the answers along the interviews, and let the interviewee elaborate on the issues raised by the researcher. (Denscombe 2003, 167-168.) I conducted the interviews over the Internet (Skype) and they involved only two individuals, the researcher and the interviewee. Notes were taken during the interview to jot down the key points.

4 Results

In Chapter 3, I described the research methodology and methods. In this chapter, I present the results of the literature research and the interviews.

The overall strategy in my study was evaluation. I examined what kind of technical communication education is available and what would be the best technical communication education model for Finnish UASs. In this study, qualitative methods of literature research and interviews were used. To answer the research questions, I first examined technical communication education and its current trends in the United States and in Europe. Then, I carried out the interviews to collect in-depth information from a professional technical communication educator.

By carrying out a literature research and by conducting interviews, I aimed to answer the research questions **R1** *("What kind of technical communication education is available?")* and **R2** *("What are the skills [core competencies] needed in technical communication?")*. Based on the answers to these questions, I drew conclusions as to *what would be the best technical communication education model for Finnish universities of applied sciences?*".

4.1 Results from the literature research

Based on the literature review, it is clear that most of the definitions of technical communication are fundamentally identical. Common to most definitions is that the definition concerns communicating information, usually technical or specialized, for a particular audience for a particular purpose and that the information is used to support the use of a product. The division of characteristics of quality technical communication into three main groups that Hargis et al. have presented (easy to use, easy to understand and easy to find) includes most of the characteristics others have used to describe good technical communication.

Traditionally connected to engineering, technical communication has nowadays become part of information technology. As knowledge is seen more as the focus of business and not as a mere tool, technical communication has become a key product. There is a general consensus amongst employers, alumni, and universities abroad that technical communication has become an important part of education especially for engineers and IT students. It is an invaluable skill that has been demonstrated to contribute both to individual and corporate success in business. Earlier, technical communication was either expected, for example, in the form of support documentation or required, for example, in the form of environmental impact statements. Whether expected or required, it has hardly been at the center of important work. Only in recent decades, with the shift of western economies from manufacturing to information economies, technical communication has become a key commodity.

A number of studies (Andrews 1976; Boiarsky 2003; Riemer 2002; Sageev & Romanowski 20011; Reave 2004) have also shown that engineering graduates often lack communication skills or their communication skills do not reflect the expectations of employers. Both students and employers see that learning adequate communication skills are necessary for success in work life. Insufficient communication skills can hinder career advancement.

The literature review shows that technical communication has long become a field in focus by international employers and universities, with the United States being world leader in both market demand and academic education. Technical communication is taught in the United States in more than 220 programs. Furthermore, the importance given to technical communication is reflected in the fact that technical communication courses are required in 50% of U.S. top engineering schools and in 80% of the Canadian top engineering schools (Reave 2004, 452). Outside North America, India and Israel are two big centers of technical writing. Whereas in North America education in technical communication is offered mainly by universities, in India and Israel the education is mainly offered by private institutes.

In Europe, Germany is one of the leading countries in technical communication education. The teaching of technical communication in Germany has traditionally focused in UASs. Undergraduate programs in technical communication are offered in 11 German UASs, and graduate programs in four UAS and at one university. In France, the undergraduate and graduate programs in technical communication are offered mainly at universities. The content of the programs reflect the strong influence that the theory and practice of translation and language has on the technical communication education

The development of Finnish education in the field has so far lagged behind. The lack of comprehensive technical communication courses and programs in most Finnish UASs represents a potential problem to higher Finnish education. The lack of experience and tradition in technical communication education in Finland may present difficulties in finding educators who can offer adequate training to professionals. There is a lack of educators [in Finland] with the necessary knowledge, skills, and understanding of a technical communicator's work. Universities have not yet managed to produce enough graduates as to support a 'cycle of tradition' in the field, where professionals with experience return to universities in order to teach and research. The lack of quality teachers of technical communication may compound the difficulties facing those who wish to introduce comprehensive technical communication education to Finnish UASs. (Suojanen 2000; Isohella 2007)

Finnish UASs do not currently offer comprehensive courses or degree programs in technical communication. Haaga-Helia UAS does not offer any course in technical communication. It does however offer communication studies on both an undergraduate and graduate level. A number of Bachelor's degree programs include compulsory communication courses on a limited scope (two credit points). A Master's degree program of 90 credit points is dedicated to Communication Management. Also other Finnish UASs either offer no technical communication studies at all or offer it on a very limited scope. When courses related to the field are offered, for example Technical Writing, they are typically offered as courses of only 2 study points, which indicates their limited scope. Other courses named Technical Report Writing may simply aim at preparing the students for writing their final project.

The lack of proper education in technical communication is why my research is important, timely and highly relevant. It has a role as both a wake-up call to Finnish UASs to recognize the lack of this discipline and as a set of recommendations how to best introduce quality technical communication education. I undertook this study because I believe that it is high time that Finnish UASs will take a clear stance on the issue of teaching technical communication. I hope that my work will stimulate discussion in Finnish UASs in general, and in Haaga-Helia UAS in particular, how to best introduce technical communication as part of the ICT studies curricula.

As shown in the literature review (Section 2.8) there are a number of education models offered. The models vary from technical communication service courses through certificate programs to two- and four-year programs. Service courses are usually intended for students studying in technical, technological and professional areas. The goal of those courses is to develop student communication skills in their major subjects, to help them succeed in their occupation, and to meet industry expectations regarding the communication skills.

Technical communication programs prepare students to become professional technical communicators or editors. These programs include certificate programs, as well as two- and four-year programs. Certificate programs are usually easier to implement because they involve less bureaucracy. Such programs may range from modular courses assembled from existing courses or other programs within the school to self-sufficient dedicated courses that have proven themselves as certificate courses of merit. A good example of such a self-sufficient certificate course is YEDA's Technical Communication online course. This course is intensive enough to teach those who aim to become professional technical communicators, but it can also greatly benefit students who wish to specialize in technology, software development or project management. After all, everyone stands. At the very least, they learn a lot to gain from being able to document a GUI, write software specifications, or create sharp web page and presentations.

The next level in technical communication programs are the two- and four-year programs. The latter are far more common because, nowadays that the field is becoming increasingly more competitive and challenging, a Bachelor's degree simply makes more sense as an entry level qualification for technical communicators. The two-year programs are college programs that offer terminal degrees and the possibility of credit transfer to four-year programs. In essence, the curricula of two-year programs reflect similar educational goals as those of four-year programs: rhetoric, audience awareness, technical skills, logical and creative thinking and decision making. However, the two-year duration limits the scope of studies.

4.2 Results from the interviews

Business communication versus technical communication

The two fields are often confused because they share a name and some characteristics. Both, for example, need to be written clearly. However, technical communication is about hi-tech products and services to enable people to use them; business communication is about communicating ideas for furthering commercial activity. The demands of technical communication are greater as in technical communication you are reaching an audience who needs the documentation to use a product. As a documentation specialist, every statement you make will, in a sense, be tested by the user. As a technical communicator you must not only write clearly enough to be understood, you must write so clearly that you cannot be misunderstood. So you need to know exactly what you are writing and you will be well advised to perform some usability tests before publishing. The results of bad documentation are often much more critical [than bad business communication]. (Schwarcz, M. 21.3.2012.)

Role of technical communication in the field of ICT

Technical communication plays an important role for ICT students when they enter work life. In ICT organizations, information is important and the effective sharing of it can affect the performance of the organizations. Workers in IT departments within an organization often need to give instructions, for example, how to back up your information, or how to use the network drive. All these should be written well. Naturally, all depends on the corporate culture, in the sense of what is considered as acceptable behavior and standard of work. If an organization suffices in low level writing, this is then how corporate culture stands. According to Dr. Schwarcz's experience, what leading companies around the world share as a denominator is a corporate culture that requires clear and professional communication. (Schwarcz, M. 21.3.2012.)

Programmers, for example, would greatly benefit from being able to provide any form of documentation, ranging from specifications of a promised software module through programmer notes to actual installation and operation instructions. Furthermore, they would also benefit from being able to communicate any idea for innovation or proposed solution to a problem or to make a proper rhetoric whether in writing or verbally. Studies amongst engineers have shown that they have come to value communication skills nearly as high as technical skills. Programmers should also be able to document their code clearly, which can save a great deal of documentation efforts down the line and in effect shorten a product's time-to-delivery. When a software product reaches the market earlier than the competition, it does not only save money on implementation activities it also gains a competitive edge.

The YEDA technical communication course teaches the process of documentation, that is, what to do in each step, how to gather information, and what kind of questions to ask in interviews with subject matter experts. The course gives the students a methodology to follow and teaches them how to methodically produce professional communication products. Once the methodology is in place, if the students stay within the guidelines, they should not have any problem. All the necessary points are addressed and rehearsed in class. (Schwarcz, M. 21.3.2012.)

Dr. Schwarcz's course is designed to benefit also students who do not wish to become technical communication professionals, but instead want to enhance their communication skills. The background of students who take the course is wide: English teachers, programmers, IT specialists, engineers, mathematicians, business managers, students who have majored in literature and linguistics, etc. Dr. Schwarcz told me of a recent case where two students from the United States enrolled to his e-learning course:

> They were both in process of working on their Master's degree and they felt that their professional writing skills were not all they could be. They completed my course successfully and gave me very positive feedback as to their personal improvement. They felt that it helped them in writing a much higher level of a Master's thesis. (Schwarcz, M. 21.3.2012.)

Latest trends in technical communication and its education

One of the biggest changes in technical communication and its education has been the expansion of the Internet. It has presented both problems and opportunities. In terms of technical communication, technical communicators have lost the centralized control and the monopoly [they once had] on delivering information. Traditionally, people had to seek technical information from the manuals created by technical communicators. This is no longer the exclusive case. To find technical information, most people nowadays go the web and run a search in Google. (Schwarcz, M. 19.3.2012.)

While it is true that technical communicators have lost some of the control they had on publishing manuals, they have gained new avenues for inexpensive publication. Printing manuals used to be a major expense for IT companies. This expense is now largely reduced. Also, the costs of correcting errors in writing have significantly diminished. Errors may occur in both the correctness of information as well as in the technology of print, for example, that some pages are missing. Imagine the effort required to recall and redistribute a manual. Nowadays, information can be published in the web, in an official website or in a users' forum. The official web site may offer online help and downloading of online books. (Ibid.)

In user forums, the writing must address the contextual needs of the specific forum. This presents somewhat of a problem until one learns the needs of each community. But more than anything, it presents an opportunity to provide good customer service and ultimately increase customer loyalty to the brand and increase bottom-line sales. In a way, participating in the forums is one of the least expensive and most effective advertising forms to date. Either way, thanks to the Internet, publication and update costs are greatly reduced. This can mean better customer service from those corporations who are committed to customer service. The content of communication products must still be as professionally written as ever. In addition, it now has to be properly designed for the special circumstances of the web. (Schwarcz, M. 19.3.2012.)

In terms of technical communication education, Dr. Schwarcz emphasizes that the e-learning over the Internet opens up infinite possibilities for teaching technical communication. The benefits offered by the Internet are considerable. It offers much more than a mere platform for manuals and information sharing. It provides an ideal setting for courses. Students can better apply themselves by learning at their own pace. Unlike in 'real' classes where the lecture is read out live by the lecturer, the Internet allows students to listen to the lesson as many times as they want and repeatedly review information and examples. Also, the feedback capabilities are immensely improved now that new online sets of tools are available. (Ibid.)

In short, the e-learning environment enables better student learning. The lecturer can have virtual meetings with students and work with them individually. Virtual classrooms allow the students see the instructors lecture on a split screen and write information on a 'blackboard'. The instructors can give tasks and watch the students work on the tasks. Virtual classes have a real classroom feel to them, students ask questions and the instructors can ask students to demonstrate their knowledge and solutions on the blackboard. In fact, virtual classrooms are more effective than regular classes because the learning is more intense and it is easier for the instructor to quickly see the comprehension level of the students and give immediate help and feedback. Compared to a regular class, giving feedback is much more immediate in a virtual classroom. Using various e-learning tools, instructors can respond in ways that are not possible in traditional teaching: by giving traditional review of work and immediate feedback, or by creating videos to teach complex software procedures or to present a work environment situation (for example, a writing project in which the instructor acts as the subject matter expert). Instructors can also create individual videos for giving feedback to students. In such videos, student's work can be covered line by line either with corrections or by showing them how to properly do it. Students can then view the video until the topic is completely clear. Both students and the instructors consider this a great benefit, because it means that the student feedback is not merely red marks on a paper. Dr. Schwarcz explained that in his evaluations, he gives a fully detailed narrative that thoroughly addresses the student's submitted work and goes over the required correction, line by line. Using various e-learning tools, he does not only point out problems and demand corrections, but also gives guidance. Bringing examples as needed, he can explain the theory behind his reasoning. According to him, the e-learning environment has been a highly positive experience for his students. In his experience as an educator of many years, it has made a world of difference. (Schwarcz, M. 19.3.2012.)

Another benefit that e-learning environment offers is that students from around the world can easily attend classes. Because they do not have to spend any time on travel to school, they have more time to study. Dr. Schwarcz predicts that this form of teaching, providing that it is well designed, will increasingly replace the older style of lectures. The benefits are just overwhelming. (Ibid.)

Advantages of e-learning technical communication course

E-learning, as done in YEDA, permits students to develop their skills and competencies to a higher level than a classroom course for the following reasons:

- Students can study at their own pace. This allows them to thoroughly master areas that might take them longer than classroom time permits, Mastering writing skills differs from person to person -- this is not a matter of digesting facts or learning correct syntax (as in programming); writing requires a network of skills and talents that students need time to discover and draw upon.
- Teachers can more thoroughly concentrate on students' work, and spend more time coaching than in a classroom setting.
- Students learn to do things on their own without having their hand held. Writing requires discipline and this is more readily acquired in an online course.

Core competencies of good technical communicators

When thinking of the communication skills that students need at work, the most important competency is to be able to figure out unfamiliar things, such as processes, tools, interfaces, and concepts. Technical communicators are typically required to grasp essential ideas for which they often have no in-depth training - as opposed, for example, to programmers and engineers who are required to have extensive training in their field. While writers may have lots of training in writing and publishing, they still have to very quickly understand the concepts and workings of new technologies in fields that range from medicine to electronics, telecommunications, software, mechanics, hydraulics, and so on. The question is whether this can be taught. Dr. Schwarcz believes that it can, as long as there is at least some innate skill at learning new things. He believes that students can be taught strategies for rapidly learning new technologies and mobilizing this knowledge to create clear, readable documentation. (Schwarcz, M. 21.3.2012.)

Communication skills that are often required at work include the ability to summarize complex info and distill it into an easily readable format; the ability to interview subject-matter experts (SMEs) and get the right information; the ability to write clearly and accurately and to recognize the important points within diverse pieces of information and integrate them into a coherent document. (Ibid.)

Content of the YEDA online technical communication course

The YEDA course is intended for anyone who works in hi-tech and who needs to communicate complex information and communicate their ideas in writing. This includes technical writers, managers, and IT specialists. A prerequisite for the course is the ability to write grammatical English. The course emphasizes communication skills, although emphasis is also put on the skill of how to understand unfamiliar technologies.

The online technical communication course consists of four modules: Technical Writing, Marcom, Desktop Publishing, and Technology (see Appendix 2 on page 71). In the Technical Writing module, students learn the fundamentals of documenting complex systems in clear, easy to read terms. They learn to simplify complicated language, to investigate a hi-tech system, and to write effective instructions and powerful explanations. In the second module (Marcom), students get comprehensive training in analyzing target markets, developing powerful messages, and turning the messages into successful copy. The Desktop Publishing module provides students with the skills they need to use a wide range of software programs. The Technology module teaches students the key concepts behind today's hi-tech systems. (Course Structure, 2012.) The course is comprehensive and the subsets of the course material can be extracted for various audiences. (Schwarcz, M. 21.3.2012.)

YEDA graduates

YEDA graduates can be found anywhere in the hi-tech industry around the world: in the U.S., U.K., Norway, Sweden, Finland, and so on. In recent years, the YEDA course has seen increase of applicants especially from Israel and India. Besides the U.S., these are the countries that have the largest number of technical writers. By far, these countries have a much more thriving technical communication activity than countries such as Sweden, Finland, or even England. In India, hi-tech is booming, and Israel continues to be second only to Silicon Valley in the number of start-ups and software companies, and of course, in the accompanying percentage of technical writers.

The fact that YEDA was the first school to train writers for Israel's phenomenal hi-tech industry, and the fact that its graduates are managers of documentation departments in companies such as HP, Intel, Amdocs, SAP and many other companies, gives the school a lot of credibility - especially as it is widely acknowledged that Israel is a world leader in hi-tech and software development (as India is rapidly becoming). In a sense, the presence of a thriving technical communication community is an indicator of the health and vitality of the hi-tech sector itself. (Schwarcz, M. 21.3.2012.)

5 Discussion of results

In Chapter 4, I presented the main findings of the literature research and interviews. In this chapter, I discuss the main findings. The chapter concludes with the critique of the study.

5.1 Discussion of the main findings

The research findings show that technical communication has become an important part of information technology. Research conducted in North America indicates that good technical communication skills are valued by employers, universities and alumni alike. In recent decades, as a result of growing global competition, information is increasingly seen as the focus of business and a key product, and not as a mere tool.

Technical communication is well established in North America. This is reflected in Reave's (2004) research of top engineering schools in North America. It shows that already in early 2000, technical communication courses were required in 50% of the U.S schools and in 80% of the Canadian schools. Certain core competencies are widely accepted and present in the curriculum of most programs yet no standard curricula exists in the field.

Bachelor's degree programs form the foundation of technical communication education in the U.S. Both Geonetta (1997) and Staples (1997) in their respective studies predict further growth of these four-year programs. In providing rationale for universities to develop and offer Bachelor's degree programs in technical communication, Geonetta points to the growing importance of technical communication in products' life cycle. Staples postulates that as the technical communication field grows in importance, Bachelor's degree becomes an important credential for entry-level positions in technical communication.

With India and Israel being active centers of programming and hi-tech, the demand for technical communicators has driven the popularity of certificate programs. However, in these countries, the education in technical communication is not centered in universities but is mainly offered by private educational institutes. The preference for certificate courses may be linked to the rapid development of these hi-tech industries.

Compared to the situation in North America, India and Israel, technical communication is clearly less developed in Europe. However, unlike in India and Israel, the education offered in Europe comes mainly from universities and UASs. In Finland, technical communication education seems to be rather limited. In Germany, which is the stronghold of technical communication in Europe, teaching of technical communication has traditionally been offered by UASs. This is indicative not only of the high standards in German UASs, but also that in Germany technical communication is perceived as a practical and applied science. This approach stands in stark contrast to the limited scope of technical communication education in Finnish UASs.

Finnish education in the field has so far lagged behind. The lack of comprehensive technical communication courses and programs in most Finnish UASs represents a problem to the accomplishment and competitiveness of higher Finnish education. As the literature review shows, Suojanen (2000) connects the lack of comprehensive education in the field to the lack of experience and tradition in technical communication education in Finland. This lack has lead to the situation where it is difficult to find educators with the necessary knowledge, skills, and understanding of a technical communicator's work. Universities need to produce enough graduates to support a 'cycle of tradition' in the field, where professionals with experience return to universities in order to teach and research. The lack of quality teachers of technical communication may constitute a problem for those wishing to implement comprehensive technical communication education in Finnish UASs.

One of the biggest changes in technical communication and its education has been the expansion of the Internet. The benefits offered by the Internet are considerable. For example, e-learning over the Internet opens up infinite possibilities for teaching technical communication. It permits students to develop their skills and competencies to a higher level than a classroom course. Dr. Schwarcz predicts that this form of teaching, providing that it is well designed, will increasingly replace the older style of lectures.

Having become such an important part of information technology, technical communication plays an important role for ICT students when they enter work life. Being able to provide any form of documentation and communicate ideas for innovation or proposed solution to a problem would greatly benefit, for example, programmers. Because in ICT organizations information is essential, effective sharing of it can affect the performance of the organizations. As Dr. Schwarcz suggests, what leading companies around the world share as a denominator is a corporate culture that requires clear and professional communication.

Researchers such as Lang and Evans (in Reave 2004) have shown that engineers and engineering managers rank good communication skills high, often higher or almost as high as problem-solving skills or the ability to design a product, system, or processor. As surveys (Sageev and Romanowski 2001) prove that engineers spend more than 50% of their work time on some form of communication, it is important that their education addresses the need for good communication skills. Mere technical skills are not enough for engineering students to perform well in the global workplace. By communicating well, they can add a differentiating value to the employers. The studies should furnish students with core competencies that include ability to interview and collaborate with SMEs and co-workers, figure out unfamiliar things, summarize complex information and distill it, and write clearly for specific audiences for clearly defined purposes.

5.2 Critique of the study

In this section, I examine the limitations that this study has, and external validity of the results. This study has a number of limitations that should be considered. They include the representativeness of the sample; the way the interview was administered; the choice of the interview type and the questions; and the interviewer effect.

Representativeness of the sample

The method for data collection in this study was convenience sampling, which is a form of non-probability sampling. In convenience sample, the units included in the sample are selected because they are the easiest to access. This type of sample is often preferred in undergraduate and Master's level dissertations because of its low cost and ease of use. (Laerd dissertation 2010.) I chose this sampling method because it is inexpensive, fast, and easy and it allowed me to obtain basic data regarding my study without having to use a complicated randomized sample. Convenience sampling should, however, be treated with caution. Its disadvantages include the sampling bias and the sampling not being representative of the entire population. It can be criticized because of the limitation in generalization and inference making about the entire population. (Experiment Resources 2012.) For example, the number of interviewees in this research was too small to be considered representative.

Interview administration and quality

The way the interviews were administered may have affected the results. The respondent may have considered an interview via Skype somewhat less serious than a face-to-face interview or an interview that uses other methods. Although time and cost-effective, interviews using Skype could be completed in a few minutes without giving interviewees much time to think about their answers. Thus, the respondent may have given less thought-out answers to the questions. Also, Internet-based interviews, such as interviews via Skype, are dependent on proper access to reliable technology and good quality reception. Even though interviews via Skype allow a two-way interaction between researcher and respondent, the fact that the interviewer cannot see the interviewees to gauge their response can be considered as another disadvantage compared to non face-to-face interviews.

A poor quality of the interview questions may be considered a possible limitation of this research. Had I asked different questions or more of them, I might have been able to obtain more valuable information.

Interviewer effect

The interviewer effect can be linked to the way interviewer behaves, addresses questions or responses to answers. Interviewees can be affected by the mere presence of the interviewer, for example, because of his race or ethnicity. Internet-based, telephone or e-mail interviewing usually reduces the problem of interviewer effect because human factors, such as facial expressions, body language, or the above-mentioned race and ethnicity are omitted.

Plausibility of data

Denscombe (2003, 187) brings up the notion of plausibility of the data. When researchers assess the credibility of information that was obtained from interviews, they must determine to what extent they can expect the interviewee to know about the topic that is being discussed and whether the interviewee is in position to comment authoratively on the topic. Also, it is important the interviewer is knowledgeable about the area he wishes to research.

External validity of results

The scope for generalization of this study is limited by the use of only one interviewee. As mentioned earlier, the number of interviewees in this research was far too small to be considered representative. However, non-random sampling does not select subjects that are representative of the entire population, but intentionally targets individuals within a population. And as Kennedy points out, for single case studies, generalizations "should not be made by the evaluator. Instead, it should be made by those individuals who wish to apply the evaluation findings to their own situation" (Kennedy 1979, 671-672).

The above-mentioned limitations could be considered as a problem to the validity of my research. However, the purpose of my study is to suggest a way how to best introduce technical communication into the curricula of Finnish UASs, the limitations do not reduce the value of my research. Therefore, I believe that, regardless of the limitations, the results of this research make useful contribution to the Finnish UASs and to the field of ICT in Finland.

6 Conclusion

In Chapter 5, I discussed the results and the limitations of this research, and the external validity of the research findings. In this chapter, I provide research summary and present main conclusions and discuss the implications of this study to Finnish UASs.

6.1 Research summary

Technical communication skills are essential for engineering and information technology students in today's competitive workplace. Despite the importance of those skills, research shows that engineering graduates are not well equipped to meet the workplace demands. Also, there seems to be a clear gap between the employer expectations and the graduate communication skills.

To answer the research questions, I carried out literature research and conducted interviews. For the study, I formulated two research questions:

- *R1: What kind of technical communication education is available?*
- *R2: What are the skills (core competencies) needed in technical communication?*

Based on the answers to the research questions, I expected to conclude *what would be the best technical communication education model for Finnish UASs*. Material for the literature research was collected from books, web sites, journals, and e-mail messages (see 2.4). The participant in the interviews I selected as a convenience sample.

6.2 Main conclusions

The research set out to investigate how to best introduce technical communication as part of the ICT studies curricula in Finnish UASs. The main conclusion of my research is that proper technical communication teaching is missing from Finland. Based on the research findings, I recommend developing a degree program in stages. Obvious difficulties can be foreseen, mainly in finding quality technical communication teachers that are experienced in work life. By trying to design a 4-year program immediately, a UAS may find that it is reaching for too much too soon. On one hand, hasty development could mean forgoing quality; on the other hand, developing a quality program could take fartoo long. Already years ago Suojanen (2000) and Isohella (2007) pointed out the lack and problems in this field in Finland but hardly anything has changed. Now, time is of the essence.

Given the possibile difficulty of implementing a Bachelor's degree program in technical communication, a more pragmatic approach may be required. The solution may lie in collaborating with an expert in the field, such as Dr. Schwatcz. This will allow a two-phase approach to be adopted. In the first phase, YEDA's certificate program would be implemented to provide an immediate solution. In the second phase, drawing on the experience of Dr. Schwarcz, a degree program would be. In this way, a UAS could make a real difference for both its graduates and the Finnish ICT industry.

6.3 Implications for the UASs and the ICT field in Finland

My research has produced descriptive data about the different education models of technical communication abroad. By pointing out on one hand the importance of good technical communication skills in work life and on the other hand the lack of professional education in the discipline in Finland, I hope to draw attention to this problem. Also, I hope to start a discussion in Finnish UASs that will lead to the introduction of technical communication as part of the ICT studies curricula.

By describing existing education models in technical communication and widely-accepted core competencies in the field, the study benefits prospective course designers. As Suojanen points out, there is a lack of experienced technical communication educators in Finland. Therefore, my study further benefits Finnish

UASs by introducing Dr. Schwarcz, an experienced educator in the field who could be approached for guidance and services.

The value of my research lies in the contribution that it makes to the body of knowledge of research in technical communication education in Finland. The results of the study can be far reaching for both Finnish UASs and their graduates. Benefits of incorporating technical communication in the curricula of ICT studies can far outweigh the effort and investment. The timing of my research is opportune. The relative underdevelopment or lack of technical communication education in Finnish UASs represents a unique opportunity to act promptly and create fresh technical communication programs that draw on the most current practices, for example, in the United States. A UAS that will act fast but not hastily, can gain positive reputation.

I believe that the importance of the results of this study will not be limited only to Finnish universities of applied sciences and their graduates. The results can benefit also Finnish universities, ICT companies and their stakeholders.

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Appendices

Appendix 1. Technical communicator competencies

Table 4 shows technical communicator competencies presented in the research by Rainey, Turner and Dayton (2004, 324). The table lists the top 38 competencies that were ranked from 4 to 2 (top 38 out of 63 competencies rated from 0 to 4.). Based on a 156 course descriptions from the top 10 (by student enrollment) undergraduate programs in Technical and Professional communication in the United States, a preliminary list of 141 competencies (somewhat overlapping) was extracted and later trimmed to 63.

Table 4: Technical communicator competencies (ranked in descending order)

Rate	Ability to:	Rate	Ability to:	Rate	Ability to:
4	collaborate with subject-matter experts	3.1	tackle conflicts in communication arising from diversity in a group	2.42	reach new audiences with new technologies
3.96	collaborate with coworkers	3	thoroughly edit a document	2.4	design and produce a range of TC products; instructions, style sheets, etc.
3.8	write clearly for specific audience and purpose	3	conduct contextual inquiries (on-site interviews and observations for user and task analysis	2.4	conduct secondary research through texts

Rate	Ability to:	Rate	Ability to:	Rate	Ability to:
3.54	analyze user needs	3	use DTP SW	2.3	
3.5	asses and learn new technologies	2.9	Assess the work of other technical communicators	2.3	
3.5	Asses own work	2.75	Use page design and enhance content presentation	2.3	
3.5	Use word processors and document design software	2.75	Write a manual and test it	2.2	
3.4	Establish an effective tone in documentation	2.6	Make legal and ethical considerations in writing	2.1	
3.3	Achieve a set of expectations	2.6	Use graphic and drawing SW	2.1	
3.3	Develop production-quality documents	2.5	Prepare complex reports	2.1	
3.25	Conduct interviews – to gather information and solve problems	2.5	Use online environment for learning	2.1	
3.2	Apply audience analysis to designing and writing TC products	2.5	Use FrameMaker	2	

Rate	Ability to:	Rate	Ability to:	Rate	Ability to:
3.2	Write memos, letters, e-mails, and other practical TC products	2.45	Use visual elements to communicate persuasively		

Appendix 2. YEDA Technical Communication course structure

Table 5: YEDA Technical Communication course structure

Module	Description
1.Technical Writing	Teaches the fundamentals of documenting complex systems
	• Breaking down a hi-tech system into outline
	• Conceptualizing systems in terms of activity or parts to produce a well organized, useful document
	• Understanding audiences and how users read documentation
	• Structuring documents so that they can be used properly.
2. Marcom	Provides training in analyzing target markets, developing powerful messages, and turning the messages into successful copy
	• Principles of marketing
	• Positioning, branding
	• Understanding messages
	• Copywriting
	• Brochures
	• White papers
	• Press releases
	• Web copy
	• Facebook
	• Twitter

Module	Description
2. Marcom (cont'd)	• Blogging
3. Desktop Publishing	Provides the skills needed to use a wide range of software programs (Word, PowerPoint, RoboHelp, FrameMaker, Acrobat, Screen Capturing, Visio, Author-it, and others)
	• Page layout
	• Formatting
	• Flows
	• Conditional texts
	• Graphic drawings
	• Field codes
4.Technology	Teaches the key concepts behind today's hi-tech systems
	• Assembler code
	• Java code
	• Classes methods
	• C, C++
	• Documenting sets of instruction

(YEDA International Writing School 2012b)