International Master's Program in Telemedicine and E-health at University of Tromsø

Gunnar Hartvigsen, Johan Gustav Bellika

Department of Computer Science, University of Tromsø, Tromsø, Norway

Abstract

In autumn 2005, the University of Tromsø started a 2-year master of science in telemedicine and e-health. Students can choose between technology and health, and the program starts each fall. The program is developed and run in close collaboration between the University of Tromsø and the Norwegian Centre for Integrated Care and Telemedicine (NST). The idea behind the development and implementation of telemedicine is to move information instead of patients and reduce the growing burden on health care. Master's degree in Telemedicine and e-health provides a thorough introduction to medical technology, how health care is organized and how best to introduce telemedicine to provide better services to patients. The teaching language is English. Teaching is a mixture of lectures and group work. All students write a final thesis.

Keywords:

International master's program, telemedicine, e-health

Introduction

The development of telemedicine in North Norway started with the foundation of an office to the Norwegian Telecommunication Administration's research department in Tromsø in 1988. The task was among others to improve access to specialist healthcare to rural areas in North Norway through the use of telecommunication. The activity was done in close collaboration with among others medical doctors at the University Hospital of North Norway (UNN). Gradually, the activity grew into a separate department at UNN, which today is known as the Norwegian Centre for Integrated Care and Telemedicine (NST).

In 1997, the Department of Computer Science, University of Tromsø, established a research group in medical informatics and telemedicine. The Department has in this time initiated and / or been involved in several research projects in this area. Most of the projects have been carried out in collaboration with researchers at NST and UNN. Since 1997, more than 40 MSc students have worked on issues in medical informatics and telemedicine.

In 1999, a committee was appointed at the Faculty of Medicine. The committee was asked to answer whether it was doable and desired to establish a master's program in telemedicine at the university. The committee, chaired by professor Toralf Hasvold, answered "yes" to both questions. In 2005, the first international students were accepted in the International master's program in telemedicine and e-health. This paper presents the study program and discusses problems and challenges related to this program.

Materials and Methods

Among the background documents for the curriculum work was an earlier version of IMIA's "Recommendations of the International Medical Informatics Association (IMIA) on Education in Biomedical and Health Informatics" [1]. This document also provides an overview of major publications on competencies in biomedical and health informatics.

The MSc program in telemedicine and e-health

The Master's program in Telemedicine and e-health offers two different track – in technology and health [2]. The Faculty of Science and Technology is responsibility for the "Technology" track and the Faculty of Health Sciences is responsible for the "Health" track. The study program is monitored and administrated by an inter-faculty program board. The master's program is administrated by The Faculty of Health Sciences.

Objectives

The master's program's main objective is to provide healthcare professionals and technologists with further training in telemedicine and e-health, i.e., medical practice at a distance using communication technology [2]. In addition, the program deals with "Information and Communications Technology (ICT) processes and systems that support various health services, including those that patients can use directly." [2]. The "Health" track addresses "methodological and technological prerequisites and the associated social and organizational processes". In the "Technology" track, the students work with "various aspects in the construction of telemedicine and e-health systems".

Student profile

The "Health" track accepts "students with a bachelor's degree or the equivalent in medical/health sciences, for instance, medical doctors who have completed their education or graduates with other health-related degrees such as physiotherapy, nursing, pharmacy and radiography" [2]. The "Technology" track accepts "graduates with bachelor's degrees in computer sciences or the equivalent". Both Norwegian and international graduates in health-related disciplines and computer sciences are important target groups for the two study tracks [2].

Professional and occupational prospects

The public health service is a large and complex cooperative enterprise with increasing "need for collaboration, coordination and communication". We believe that candidates who understand both the healthcare and how technology can be used strategically to create new ways of working together will be attractive in a growing labor market that promotes technology in integrated healthcare [2]. The advantage of having the knowledge of the public health service also applies to graduates who will be responsible for design and development of telemedicine and e-health systems [2].

The master's program will qualify its graduates to [2]:

- "Promote and introduce telemedicine and e-health systems and services.

- Participate in the development of telemedicine and e-health systems and services.
- Apply telemedicine and e-health services in professional health work.
- Qualify graduates for researcher education and Ph.D. studies."

Learning Outcomes

The candidates should be able to [2]:

- "Describe the main types of telemedical applications in current use in the Norwegian health system as well as identify the primary actors.
- Understand how technology and e-health services can be exploited strategically to create new ways of working together.
- Contribute in the design, implementation and use of telemedicine and e-health systems.
- Promote and introduce telemedicine and e-health services and programs."
- Identify the conditions for successful implementation of telemedicine and e-health systems and services.
- "Apply telemedicine and e-health services in professional health work.
- The master's program will also qualify graduates for researcher education in telemedicine and e-health."

The health track

The candidates should be able to [2]:

- "Share first-hand experience regarding some telemedical applications.
- Identify potential gains, challenges and barriers related to the implementation of telemedicine and e-health in clinical practice through scientific-founded empirical work.
- Critically appraise scientific work on telemedicine and e-health.
- Design, carry through and write up a study relating to a topic within the field of telemedicine and e-health."

The technology track

The candidates should be able to [2]:

- "Contribute in the design, development and implementation of telemedicine and e-health systems and applications.
- Contribute in adaptation and maintenance of telemedicine and e-health systems and applications.
- Solve advanced problems in telemedicine and e-health experimentally through applying an engineering approach to problem solving.
- Evaluate the robustness of telemedicine and e-health services and projects."

Teaching methods

The master's program employs different teaching methods. Theories and science topics are investigated in lectures while the students are required to participate actively in group work and seminars. Teamwork includes practical problem solving, discussion of course materials and presentation of their findings in seminars [2].

The courses comprise a mixture of regular lectures and 1-2 days seminars where students must be present on campus. In addition, the students can solve online tasks via Fronter LMS

(Learning Management System). Students are required to attend and participate in practical exercises, group presentations, demonstrations and laboratory exercises [2]. "In addition to lectures and seminars, visits and excursions are organized" in order to let the students see how telemedicine and e-health systems are used in real settings [2].

Forms of evaluation

Different forms of evaluation are used. Some courses end with a final written and/or oral exam [2]. Other courses require a take-home exam where students must write an essay or solving problems at home [2]. These tasks include reviewing articles and essay writing. Most of the written tasks require electronic submission in Fronter.

Course plan

The 2-year master's program starts with one year of regular courses and ends with a one-year (60 ECTS) master thesis. Based on feedback from students and faculty members, the thesis in the technology track was extended from 30 ECTS to 60 ECTS. The argumentation was to allow more interaction with physicians and other health professionals. The figures 1 and 2 present the courses in the health and technology tracks, respectively.

1 A	TLM-3010 Telemedicine Applications	TLM-3040 Electronic Patient Records – theories, concepts and practice	INF-3792 Medical Informatics
1 S	HEL-3030 International and Environmental Health	TLM-3060 Patients and the public	TLM-3070 Quantitative methodology TLM-3080
2 A	TLM-3902 Master's Thesis in Telemedicine and E-health (60 ECTS)		
2 S			

Figure 1 - List of course related to teaching semester (1st and 2nd year autumn/spring) for the health track [2].

1 A	INF-3791 Telemedicine and e-health systems	INF-3792 Medical Informatics	INF-3200 Distributed systems fundamentals
1 S	Elective subject	HEL-3030 International and Environmental Health	INF-3795 Advanced telemedicine and e-health systems
2 A	INF-3997 Master's Thesis in Telemedicine and E-health (60 ECTS)		
2 S			

Figure 2 - List of course related to teaching semester (1st and 2nd year autumn/spring) for the health track [2].

Challenges

Starting a master's program in any field is not easy. The two most important elements are faculty members and students. Today, there are two full-time faculty members in each of the tracks, which is a very low number.

The program accepts up to 10 students each year in each of the two tracks. So far, there have been vacant seats every year. This despite of the fact that we have received more than 5 times as many applicants than places in recent years. Unfortunately, most of them are not qualified to enter the program or they do not have sufficient funds to enter the country.

As for the majority of study programs in Norway, there is no tuition to be paid for the two years master's program. (All students, both national and international, receive a tuition scholarship.) The main obstacle for those who come from countries outside the European Union is that they need a bank guarantee of approximately 25.000 EURO to be allowed to enter the country. (This is a guarantee for Norwegian immigration authorities that the student is self-supported during the stay in Norway.) Every year, 1-2 students have received a scholarship from the university. The scholarship is approximately 25.000 EURO, which is sufficient to be able to stay two years in Norway.

The telemedicine and e-health program can be classified as an inter-professional education (IPE) program. IPE has been defined as "occasions when two or more professions learn from and about each other to improve collaboration and the quality of care" [3]. As a multi-disciplinary program, the telemedicine and e-health program aims at teaching the students of the two fields to collaborate on developing future health services for the benefit of future patients. The increasing use of communication technology within the health service underpins the need for the education program. Also, the need for improved collaborations between the two fields is necessary as recent reports of a general tendency of dis-satisfaction among health personnel with the IT systems [4]. This tendency raises the need to improve both the IT tools and the collaborations skills of the professions. This tendency may also be met by including medical informatics, telemedicine and e-health topics in the education program of the health professions, as recommended by IMIA [1]. As other IPE programs, we face the traditional challenges, identified by others [5,6]. In particular building the capacity to offer new courses, use up-to-date education methods and tools and cover relevant and needed research areas.

Results

In 2005 the University of Tromsø started a two-year international Master's program in telemedicine and e-health. The program has two specializations within, respectively, technology and health. Every year, up to 20 students are accepted. Students come from all over the world. The motivation for starting this program was the tremendous efforts at the Norwegian Centre for Integrated Care and Telemedicine to spread telemedicine in Northern Norway, and later also internationally. With this in mind, University of Tromsø decided to help develop the subject in a more academic direction, while retaining the close links to the telemedicine community at NST and the rest of the University Hospital of North Norway.

Students attending the technology track work both experimentally and theoretically with systems in telemedicine and e-health. In addition to studying existing solutions, the students get experimental experience in designing what we think will be tomorrow's telemedicine and e-health systems. Many of the students contribute to the ongoing research in the field. Some

of them also write scholarly articles. In April 2013, for example, a second-year student traveled to Paris to present what she was doing in mobile games for children and adolescents with type 1 diabetes. During the summer of 2011, two of our students spent 3 months in Nice in France where they participated in IBM eXtreme Blue program together with three students from France. They developed an application for electronic disease surveillance, modeled after one of our research projects. The student group was among the best groups of students in the international competition.

Many of the student projects carried out in collaboration with researchers and developers at NST. Students sit in the locality of NST during the study. Most students also spend the last year of the NST premises where they are working on their thesis.

IT in healthcare is one of the fastest growing areas internationally. This is an independent economic sector. The need for expertise in this area is universal, as is knowledge. If an approach works in Norway, it also works in most other countries where the infrastructure is in place. In addition, it is a very exciting area. Most of our graduates are working in Norway. They are working with consulting, development and operation of health-related IT systems. Several have continued with doctoral studies in telemedicine and e-health. Some of our international students are working as advisors for their respective health authorities.

References

1. Mantas J, Ammenwerth E, Demiris G, Hasman A, Haux R, Hersh W, et al. Recommendations of the International Medical Informatics Association (IMIA) on Education in Biomedical and Health Informatics. First Revision. Methods Inf Med. 2010 Jan 7;49(2):105–20.

2. University of Tromsø. Master's Programme in Telemedicine and E-health. Health and Technology Fields of Study. Programme Description (Fall 2012). Department of Clinical Medicine, The Faculty of Health Sciences, University of Tromsø: Tromsø, Norway.; 2012.

3. CAIPE | Resources › Defining IPE [Internet]. CAIPE. [cited 2013 Jun 15]. Available from: http://www.caipe.org.uk/resources/defining-ipe/

4. Martikainen S, Viitanen J, Korpela M, Lääveri T. Physicians' experiences of participation in healthcare IT development in Finland: willing but not able. Int J Med Inform. 2012 Feb;81(2):98–113.

5. Liaskos J, Frigas A, Antypas K, Zikos D, Diomidous M, Mantas J. Promoting interprofessional education in health sector within the European Interprofessional Education Network. Int J Med Inform. 2009 Apr;78 Suppl 1:S43–47.

6. Gilbert JHV. Interprofessional education for collaborative, patient-centred practice. Nurs Leadersh (Tor Ont). 2005;18(2):32–6, 38.

Address for correspondence

Professor Gunnar Hartvigsen, Medical Informatics & Telemedicine group, Department of Computer Science, University of Tromsø
E-mail: gunnar.hartvigsen@uit.no