Six Years' Journey from Local Needs to a Health Informatics Degree Program – A Case Study

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Abstract

In 2004, Turku City Council nominated a work group to investigate the current state of health care technologies in the Turku region. The goal was to find out the actors in this field, to identify the local strengths in the Turku region, and to recognize future business and educational opportunities. Based on the needs identified in this survey, Turku University of Applied Sciences began the design of Health Informatics education
in autumn 2005. A steering group consisting of members from all higher education institutes in the region was nominated. The aim of the group was to determine the focus of the education and to position the program within the Turku University of Applied Sciences. In spring 2006, a number of interviews with the local industry partners was conducted to clarify the needs for future experts in Health Informatics. At the same time, the steering group had a series of meetings addressing the above mentioned issues. As a result of these interviews and meetings, a curriculum was designed in autumn 2006. In spring 2007, the first students applied for Information Technology studies with a specialization in Health Informatics, and began their studies in autumn 2007. In 2008, the first introductory course in Health Informatics was run /offered, and in autumn 2009 the first specialization studies will start. Based on the knowledge gathered so far, the authors are applying for an entire degree program in Health Informatics commencing in autumn 2010.
This paper describes the six years' journey from local needs to a complete degree program.

Introduction

In 2007 the students in Turku University of Applied Sciences (TUAS) had the first opportunity to apply for Information Technology studies with a Health Informatics specialization. This specialization was created based on the needs of the local industry and interest groups. Health Informatics in this context means ICT applications designed for and used in health care and social environment.
In 2004 Turku City Council nominated a work group to investigate the current state of health care technologies in the Turku region. The results of this investigations indicated that there was a clear need for educating IT specialists for employment in the health care industry. Based on extensive surveys conducted with local companies and educational institutes, the focus and placement for Health Informatics education was decided to be best fitted in the Department of Computer Science. Five new courses with a total of 38 ECTS credit units were developed to fulfill the educational needs found on the survey. These courses covered the following (main) topics:

- Health care processes
- Health care legislation
- Health care standards
- Information system integration
- Project management skills
- Process modeling skills
- Usability

Further work for defining the contents of the courses is constantly being carried out within the Innowell Network project with the intention to develop a complete degree program in the future.

he assignment

In 2004 the Deputy Mayor of Turku announced the following:
"There is a number of actors in the Turku area who develop and superimpose health care technologies in practice. There is a significant development potential and possibilities to get funding for future projects. Co-operation within this line of industry should be promoted but before that, there is a need for surveying the present situation. The survey should include:

- Description of notable present actors in health care field.
- Special expertise of the actors.
- Actors' joint vision for this line of industry and possibilities in South-western Finland.
- Assessment of willingness for co-operation between actors.
- Assessment of development potential."

The survey was conducted by the District Development Manager and the conclusions were presented to the City Council on 6.6.2005. All the topics mentioned in the assignment were covered. Here are some excerpts relating to field of education:

- Health care industry has a need for specialists with multi-disciplinary know-how in the business, ICT, and health care field.
- There is a real need for training such specialists at the present.
- Health care technology-oriented education should be started in the Turku region.

Development task

Based on the identified results, TUAS decided to begin the design of Health Informatics education. The design started in autumn 2005 when a steering group for the project was nominated. The group consisted of members from all higher education institutes in the region, namely, Turku School of Economics, Turku University, Faculty of Medicine, Åbo Akademi University, Faculty of Technology and TUAS with representatives from both schools of Health Care and Telecommunication and e-Business. The aim of the group was to decide on the focus of the education and to position the program within TUAS.
The first meeting for the steering group was held in March 2006 and the consensus was that further analysis was needed before any decisions about the Health Informatics education could be made. First of all, a competitor analysis should be conducted about other institutions offering similar education in Finland. Secondly, the needs of hospitals and health centers should be mapped, for example, what specialists they would need, if any. Thirdly, the needs of the local industry involved in health care technologies should be mapped as well.
At that time, Finland offered Health Technology studies in three separate institutions: Jyväskylä University of Applied Sciences, Oulu University of Applied Sciences and Savonia University of Applied Sciences. All three institutions mainly focused on health technology as shown in Table 1.

Table 1: Focus of Health Technology studies in Finland during the time of study

Jyväskylä UAS	**Savonia UAS**	**Oulu UAS**
- Production - Automation - Ergonomics - Usability	- Higher education for nurses - Data bases - R&D processes - Business studies	- Computer science - Health care environment - Human-technology interaction - General welfare studies

Based on this survey, there was geographically a clear need (Figure 1) for Health Informatics education in the Turku region. All the other institutions are located in either the central or northern parts of Finland. However, the majority of population and industries are located in the southern part. The survey also showed that only Oulu University of Applied Sciences is offering similar education that is being planned in Turku, that is, Computer Science Engineering education with a specialization in Health Informatics. Similarly, Jyväskylä offers engineering education but specializes in ergonomics, materials technology, automation and production. Savonia, however, offers post-graduate education for nurses in the Health Informatics field.

Figure 1: Locations of major cities in Finland.

According to the wishes of the steering group, a number of interviews were also made with representatives of hospitals and health centers in the Turku region. The aim here was to identify their needs and requirements for for future employees. Health care in South-western Finland is being mainly handled by two operators. First, Turku Municipal Health Care offers Turku residents basic health services which include preventive health care services, medical checks and treatment and rehabilitation services. The second major operator in the area is the Hospital District of Southwest Finland which offers specialized health care services. There are 24 health care centers, 1 university hospital, 3 district hospitals and 2 psychiatric hospitals in the district and the population base amounts to about 460 000. Both Turku Municipal Health Care and Hospital District of Southwest Finland have their own separate departments responsible for data administration. Interviews were carried out with representatives of both health operators in order to identify their needs for future employees. Health Informatics Engineering education should cover the following topics which emerged from these interviews:

- Standards relating to health care
  _HL-7
  _DICOM
- Databases
- Data security
  _Act for the status and rights for patients
  _Legislation for handling and processing personal data

All interviewees confirmed that there is a need for educating computer science engineers who understand the health care field and its processes.

There are several Health Care Information Technology companies in the Turku region. Most of these companies are not just active in the local area but internationally as well. The survey included 3 companies that either manufacture or deliver health care information systems or are closely related to them.

Table 2: Skills deemed important for Health Informatics engineers by local companies.

WM-Data	**TeliaSonera**	**Fujitsu**
- Project management skills - Process modeling skills - Fluent English must other language skills bonus bonus - Usability - Health care standards - Basics of programming	- Health care processes - Health care legislation - Understanding of the Health care field - Basic economics	- Health care processes - Information system integration - Data security and identification - Mobile solutions - Usability

WM-Data (nowadays it is part of Logica) is an international company that delivers hospital information systems to the 10 largest cities in Finland. It is also responsible for developing the next generation patient history system in Finland. Its Medical Director emphasized that there is a need for specialists who understand health care processes and needs there but have still a strong background in computer science. However, programming is often outsourced so programming itself is not as important as understanding the capabilities and limitations of it.

Telia/Sonera is a telecommunication operator which plays a very active role in developing and integrating new health care information systems for Turku Municipal Health Care. Its Director of Health Care stressed that health care engineer education should be based on three pillars:, computer science, economics and understanding health care processes and special needs. It is also important that the education is located in Turku because much of the industry is located there as well.

The third notable actor in Finland and internationally as well is Fujitsu who manufacture and deliver information systems to several hospital districts including the South-western Finland Hospital District. Incidentally, their health care department offices are located close to the University campus. According to its Health Care Development Manager, important topics in education are process orientation, multidisciplinary knowhow and usability.

In summary, all companies had a clear need for personnel that are familiar with the health care field and regulations but also have strong basic computer science skills.

Taking these findings into consideration, the steering group recommended that health technology education should be placed as a specialization in the Degree Program in Information Technology. This arrangement would best answer the needs of the local actors. The steering group also decided the first students with the possibility to choose Health Informatics as specialization would be accepted in autumn 2007 with specialization studies beginning in autumn 2009. According to this timetable, the first Information Technology engineers specializing in Health Informatics will graduate in spring 2011 to step into the job market.

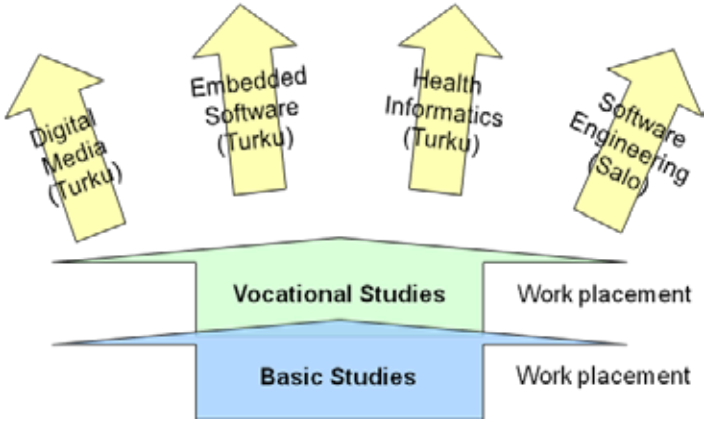
Curriculum

The Finnish higher education system contains two parallel sectors: universities and universities of applied sciences (or polytechnics). The universities focus on research and research-based education. They confer Bachelor's, Master's, Licentiate and Doctoral degrees. The universities of applied sciences are usually regional higher education institutions that provide instruction in subjects from several sectors, and which emphasize a connection with working life. The degrees they provide (Bachelor's and Master's degrees) are higher education degrees with a professional emphasis. (Ministry of Education Finland, 2009)

A Bachelor's degree in Engineering in a university of applied science requires 4 years of full-time study (240 ECTS credits). Studies are divided between basic and vocational studies. Basic Studies (86 ECTS) contain coaching in study skills, language and communication courses, and fundamentals of Science and Information Technology. Vocational Studies (86 ECTS) focus mainly on more advanced topics in Computer Science and its applications. In addition, courses in Industrial Economics and Entrepreneurship are provided. A significant part of the vocational studies is the advanced vocational module, i.e., the specialization topic. The degree contains also Free Choice Studies (15

ECTS), a Bachelor's Thesis (18 ECTS) and supporting Methodology Studies (5 ECTS), as well as an industrial Work placement (30 ECTS).
At the beginning of the third academic year, the vocational studies focus on an advanced topic, or a specialization topic. The students can select their specialization from three alternatives: Digital Media, Embedded Software and Health Informatics.

Figure 2: Curriculum structure and specializations in Information Technology.



Some of the needs that arose in the discussions are already met during the basic studies in Information Technology. Courses in languages, databases, programming and communication networks are part of basic studies with a total of 37 ECTS. The amount of specialization studies is 25 ECTS. The main topics for specialization were defined by the steering group. These were project management, processes in health care, data security, health care legislation and standards. Usability was deemed a topic that supports any specialization studies offered in Information Technology, so a new course on that was placed in the vocational studies. The same applies to Information Systems. Although they are optional, both of these courses are very highly recommended to all Health Informatics students.
The needs for economic skills are covered with the current course, Practice Enterprise (15 ECTS) which is part of vocational studies and again integrated as part of Health Informatics studies.
Lastly, a new introductory course to Health Informatics was designed. This is offered on the second year of studies and its purpose is to offer the students an insight into the field ofHealth Informatics and serve as a basis for making a decision on which specialization they want to choose. A similar introductory course is given on the other two specializations as well. Altogether five new courses were created to meet the requirements of the industry and the health care sector for Computer Science engineers with a Health Information specialization.

Table 3: Summary of new courses constructed/created for Health Informatics.

Introduction to Health Informatics, (3 ECTS)
This course introduces the students to the different areas of information technology and guides them into the advanced vocational studies and the selection of the vocational specialization. The students become acquainted with health informatics information system projects and different information systems and their life-cycle, architecture and design and with health informatics legislation.
A – Topics in Health Informatics, (15 ECTS)
This course gives the students a general understanding of how the social and health care field is structured and who its actors are. It also gives an insight into the processes in social and health care. The students will also get hands-on experience of the practical environment and the end-user viewpoint of the information systems. Other topics included on this course are social and health care service systems in Finland and laws and requirements related to social and health care.
B – Advanced Topics in Health Informatics, (10 ECTS)

This course will provide students with the knowledge needed in order to act as a representative of information technology in health informatics projects. Project work on various up-to-date topics will be carried out.
Usability and user interface design, (5 ECTS)
This course aims is to acquaint the students with usability, customer and user-based design and to teach how to apply these methods to design of user interfaces and special programs. The students will also learn to understand importance of usability tests and how apply then to R&D processes.
Information systems, design and implementation, (5 ECTS)
The students learn to define and specify information system requirements according to the needs of customers and end-users. The students also learn to understand database solution design, system architectures and integration and WWW-based information systems.

The current situation

At the time of writing, the first round of student selections for specialization studies have been made and 11 students have signed for Health Informatics studies. The second round will be made later in spring 2009 when all the second year studies have been completed. The current number of students choosing Health Informatics corresponds to approximately one third of all students.The ones who have chosen the specialization studies will commence their studies in autumn 2009 according to the original schedule.

Local heath care industry and interest groups are very interested in Health Informatics Engineering education and they have expressed willingness to collaborate with TUAS. This opens possibilities for joint projects where Health Informatics students can participate in the field environment and gain valuable experience. Projects also introduce the students to the job market and give them possibilities to make useful contacts. Local health care employers have also seen this as a good opportunity to preview possible future employees.

Based on the knowledge gathered so far, the authors are applying for an independent degree program in Health Informatics to begin in autumn 2010. The proposal has been approved by the university administration and is currently under consideration by the Ministry of Education. The decision about the program will be made during the summer of 2009. If decision is positive, work for new program will start immediately for defining the curriculum based on the present specialization. Regardless of whether the new program will be approved or not, work for improving Health Informatics education is being constantly carried out within the Innowell Network project by updating courses and seeking partners for various projects for students.

Discussion

This paper described the the development and the structure of the curriculum of the new specialization in Health Informatics. The needs of the local industry were described and how they were implemented in curriculum. According to recent discussions within the network created during this process, the need for Health Informatics engineers has not diminished but, on the contrary, it has increased.

The feedback from the first year computer science students also shows a growing interest in the Health Informatics specialization. Whether there will be an independent Degree Program for Health Informatics remains to be seen but the work started within this project seems to have come at the right time and place.

Acknowledgements

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