Teaching of Information Security in the "Health Care and Nursing" Postgraduate program

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Abstract. Informatics plays an increasing role in the area of health care services. Not only will the patient's satisfaction with the medical treatment depend on the cooperation and communication between the nurse and the doctor, but also on the nurse and her way of dealing with and usage of IT technology. Although having become a part of daily routines in the meantime, the question arises if nurses are aware of the importance of IT technology for their work duties. How many of the nurses will have probably ever thought about the importance and sensitivity of the data they daily use? Without doubt, computer-literacy among members of all professional groups within society has increased enormously in the last years. Nevertheless, especially the area of health care service demands some more specific knowledge and awareness by the concerned staff related to topics of possibilities, benefits, possible mistakes and theirs consequences, especially from the security point of view, including the sensitivity of the working area, as well as ethical issues. The aim of this paper is to present, the postgraduate program in general as well as the actual handling of providing lectures on information security for nurses. Furthermore, the paper will focus on (gained) experience, and the formative assessment of the postgraduate program.

1 Introduction

An essential part of every modern information technology (IT) environment is the issue of security. Security considerations include, fast and secure information processing, data gathering, decision support applications, data mining, and information generation either in the health care centers, pharmacies, hospitals or any other health care institutions. These considerations demand employing suitably educated personnel for activities where IT and information security (IS) are part of

everyday work and life. To cope with this situation, nurses have to be trained in a proper way [7], [14].

Taking into consideration the required knowledge from IT and IS, we are convinced that the proper way is to achieve an undergraduate or post graduate education where student nurses play an active role in the lecture phase. This participatory learning model increases the capability for students to use this knowledge when using IT systems in the workplace.   To reach these goals, we developed a postgraduate nursing curriculum within the frame of the EU Phare Tempus [14] project called NICE - Nursing Informatics and Computer Aided Education [1], [7] in which, as the name already reveals, informatics and IT as well as IS will be addressed and taught.

In the paper we will give a brief overview on the NICE curriculum. Besides this, we will concentrate on some details derived from the security lecture, which will be followed by experience which we acquired in the last years by teaching the mentioned lecture. Experience is very important for a further upgrading of the lectures, for the curriculum development and for keeping up with up-to-date lecture material accessible via webpage. The paper will be concluded by addressing teaching results and final remarks given in the conclusion.

2   The NICE curriculum

At the end of the 1990's (1996-1999), the NICE project was established with the aim to develop and introduce new short cycle degree courses from nursing informatics at the university colleges. The project partners came from Austria, France, Greece, Italy and Slovenia [1]. The team who developed the curriculum consisted of members of various professions like nurses, engineers, computer scientists, medical doctors and administrators. These participants have very different views, opinions and beliefs on nursing informatics in general and in particular on the content of the nursing informatics curriculum [4]. In Slovenia, this postgraduate program was the first one of his kind who integrated IT lectures to the curriculum for educating people for the health care and nursing domain. One of the top priority goals of the program was, besides integrating informatics and computer science knowledge to the program, the integration of experts from the mentioned fields to the lecturing of nurses and health care domain staff.

After discussing various approaches that had been used in education [5], [6] as well as talking about other system approaches [6], we agreed on the common definition of nursing informatics [2], [3] and teaching nursing informatics as follows [1]: Teaching nursing informatics is a process in which students obtain basic knowledge in the following areas:

- informatics and computer science,
- informatics in health care (medical informatics),
- informatics in care and nursery (nursing informatics),
- computer communications and security (internet),
- medical instrumentation and simulation supported by computers with the aim to support nursing care processes as well as making nursing work more visible and enjoyable.

Additionally the goals of the program are to provide and enable better health care for all. On this foundation the postgraduate nursing and health care informatics curriculum was developed and approved to by Slovenian authorities.

The program is, like all other study programs for postgraduate students at our university, offered as a part time study. Most of students are part time students (regular matriculation is also possible, but is not the normal case), working as nurses or keeping other similar positions. These students already have a background knowledge from the nursing area duties or closely related to it. Some of the students have a technical background in computer science and informatics and are working in health care institutions, pharmacies, hospitals and similar institutions. The program started in 2001 with one student. Currently the number of students in the program has reached 10-12 students starting every year. The postgraduate program can be finished within 1.5 year (3 semesters). During the program, two semesters are dedicated to attending classes (theories, practices, tools). The students will spend the last semester preparing their research and thesis. Within the two semesters of classes, students have to pass 18 exams.

The offered lectures of the program are divided into three modules: Nursing informatics, informatics in health care, and search for information in computer networks. In the following we will focus on the first module and give insight to the single lectures: "Information systems", "Telematics in health care", "Databases", "Intelligent Systems", "Ethics" and "Security of computerized data." Already the titles of lectures reveal the multidisciplinary content of the curriculum. Knowledge from nursing is combined with knowledge from the informatics and computer science and is added by electrical engineering cognition. The teachers of the individual lectures have high competence in their subject as they have achieved their expertise in this specific field of knowledge. Lectures like "Information Systems", "Databases", "Intelligent systems" and "Ethics and security for computerized data" are given either only by a lecturer from informatics and computer science or by lecturers from two or three areas who will then cooperate in the same lecture.

For each single lecture in the previously mentioned courses, teaching materials were produced, including a NICE book series [9] and PowerPoint presentations. Books published in the NICE series, cover all lectures and provide the basic knowledge required to finish the obligations of the program. Additionally, in response to the achieved feedback, the PowerPoint presentations and other electronic materials and tools [13] from lectures of the last years are available [7].

3   The security lecture

When developing the NICE curriculum, we followed the "Backward Curriculum Design Process" [8]. This process begins with desired outcomes and goals and goes back to learning objectives which are then divided into courses and modules. This approach was used also when developing single courses. The following section will provide details on the security lecture in the NICE program called "Ethics and security for computerized data" [9]. This lecture series is broken into 6 sessions:

Introduction and history: This part briefly introduces the importance of security in and for health care, gives some definitions and general historical

overview on the security including understanding information security, positions and roles.

Information Security: For successful information security, also some other topics of security have to be presented such as issues of security in computational systems, physical security (natural disasters, un-authorized access), users' security, technical security (data encryption, algorithmic systems, cryptography) and viruses, just to mention the most important topics.

Sensitive data: Sensitive data is data that should not be made public [12]. We are discussing which data are sensitive and what is their cause of being so sensitive. We are having a closer look at solutions of how to protect a database if only some pieces of data are sensitive. Furthermore, the role of data mining is pointed out.

Information Security in health care and medical systems: This part discusses the range of topics in which information security is used. Also available to the students are commercial and research projects and possible guidelines are presented [10].

Ethics: Special professional areas like medicine, health and pharmacies are closely related to the issue of ethics. Ethics is complex term and sometimes also confused with religion because many religions provide a framework in which they make ethical choices [9]. Besides giving a basic definition of the term, also the question of ethics versus relation, ethical principals and ethical reasoning are presented. Very important parts of the lecture are examples of ethical principles and case studies of ethics. Each case study is presented in detail and analyzed. Furthermore, alternative solutions or extensions are offered. A complementary topic is also the code of ethics as they are stated by IEEE, ACM and Computer Ethics Institute.

Practical work: Essential for students is the possibility of transferring their theoretical knowledge concerning information security to practical work and gaining practical experience with this issue. Instructors guide students to approach the topic of information security from their own field. The enterprise is defined by each student for his/her seminar work and information security is presented and developed. Results are presented and discussed with other students, the instructors and the lecturer. Final conclusions are done after having gained practical experience.

4   Experience

In general, educational assessment is the process of gathering, describing or quantifying information about the learning performance. The lecture being evaluated can range from the performance of students and instructors to the evaluation of lecture materials, courses and or the entire study program. Educational evaluation could be arranged during or after lectures and with different purposes. Generally speaking, assessment can be defined as the systematic process used to obtain information about study achievements [8].

After having provided a brief overview on the NICE nursing and health care postgraduate program and having presented the security lecture with some details, we would like to address some assessment results which were acquired during the last years. Most of them are obtained in informal discussions with students after

having concluded the exam of the Security lecture (formative evaluation). More formal assessment (summative evaluation) was not possible because the groups of participating students are very small and ranging between 5 and 12 students. Besides this, assessment is much more difficult if new teaching methods and experimenting are introduced.

One of the goals of the lectures is to prepare students to be actively involved into the developing process of information security, while they will have probably the role of domain (nursing, health care) expert consultant. Therefore they have to acquire knowledge and practice how to do this. Consequently, they have to select their own domain to develop information security. Very important is also that we put attention to the session about ethics and integrate it to the everyday work of the students (mostly nurses).

How do students tend to react when first being confronted with the issue of IS? There are no special requests for IT or IS by matriculation. So, they are mostly still quite unfamiliar with the topic (except those students with a non-nursing background or undergraduate study). They feel motivated to "reject" the lecture and to pass it as fast as possible, not paying attention to the importance of the topic and the knowledge they could actually gain.

After having experienced the first "shock" ("we are not able to do this"), they start gradually understanding the importance of information security and ethics. After having prepared the seminar work, they have developed a feeling for the importance of this particular lecture. This is maybe a surprising result as the students had already been working close to or in the selected domain before they had started the postgraduate program.

In the formative assessment, students explain their own story. We assist the student by providing formative questions (What is the biggest problem within information security in your domain? What is your opinion on the best method to solve your problem? Open questions, such as: What skills are lacking? What methods do you use to increase information security awareness?). The pedagogy of participatory learning is somewhat unfamiliar playing an active role in selecting and forming the content of their seminar work (they select the domain as well as a possible application for which the security/ethics needs to be developed) prepares the student to address unfamiliar problems when in the workplace.

In the summative evaluation, a secondary emphasis is used to assess students' achievement at the end of the lecture. The assessment data which was collected can also be used to provide feedback about lecture materials, the approach, and adjustment of the whole lecture, and gives response on the adequacy of the lecture in the presented program.

5   Conclusion

The main idea of this paper was to emphasize and prove the importance of both IS and IT in the nursing and health care educational programs – staff with this knowledge is more and more wanted. Actually, IS and IT are now part of every day life, starting with shopping experience up to working place conditions and visiting a doctor. Whenever things fail, are disliked, or experienced as being uncomfortable,

we are unsatisfied and complain either to the shop assistant or vendor or both or to our webmaster, IT engineer and also to the nurse or even the doctor. Quite often we blame the wrong person because the system is either not good or not working correctly. Sometimes the reason for dissatisfaction is due to the lack of knowledge by people who are using these systems. The NICE program was created to avoid this misunderstanding.   We can report that employers are reacting positive on first graduates [7].

    We have decided to implement the knowledge of IS to the nursing educational program, independent to the fact that for the majority of students this issue will be a new, unfamiliar domain. The presented curriculum provides the postgraduate students with the opportunity to compensate for the before mentioned lack of knowledge. By offering lectures in computer science and informatics, we are motivating our students also to play more active role in real projects at daily work using new IT and IS products for the mentioned domains. We are putting our graduates opposite the IT experts who have lack of health care and nursing knowledge and need much more additional work to come closer to mentioned areas as our students from opposite background.

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