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Multidisciplinary Education in Medical Informatics – A course for medical and informatics students

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Abstract

Design and implementation of healthcare information systems affect both computer scientists and health care professionals. In this paper we present our approach to integrate the management of information systems in the education of healthcare professionals and computer scientists alike. We designed a multidisciplinary course for medical and informatics students to provide them with practical experience concerning the design and implementation of medical information systems. This course was implemented in the curriculum of the University of Münster in 2009. The key element is a case study that is performed by small teams of medical and informatics students. A practical course on management of information systems can be useful for medical students who want to enhance their knowledge in information systems as well as for informatics students with particular interests in medicine.

Keywords:
Medical informatics, Health informatics, Education, Management information systems.

Introduction

Information technology has a strong impact on public health and medical information systems play a fundamental role in the everyday life of many health professionals. Physicians spend about 25 % of their daily clinical work on documentation tasks which become more and more supported by information systems [1]. The use of the Electronic Patient Record (EPR) is increasing and has the potential to improve the quality of care [2].

Therefore health care professionals and computer specialists need knowledge about the management of health care information systems [3]. Already in the year 2000 the International Medical Informatics Association (IMIA) published recommendations on education in Health and Medical Informatics emphasizing on the management of information systems [4].

In the current curriculum for medical students in Münster there is only one compulsory subject in the domain of medical informatics including the main topics of hospital information systems, electronic patient records, information acquisition as well as classification and coding systems. At least in Germany, education concerning the management of information systems is not mandatory for medical students. On the other hand, due to the lifecycle of medical IT systems healthcare professionals are confronted with specification and implementation of information systems.

Haux et al. described programs for medical informatics students as well as for health information management students with a focus on system analysis and project management [3]. This training might be useful for healthcare professionals too. For example to conduct realistic case studies regarding the design and implementation of information systems the expertise both from medicine and computer science is beneficial.

Healthcare professionals, in particular physicians, need skills and knowledge regarding information systems, not only as end-users, but also regarding requirement specification and evaluation. On the other hand, computer scientists need to understand processes in hospitals, medical documentation and physicians' workflows in order to design and implement adequate systems.

Former course evaluations by medical students showed that the teaching in subjects like medical informatics can be improved through practical oriented inputs [5, 6]. It also became evident that the need for health informatics training is increasing [7]. Therefore, our main objective was to design a multidisciplinary course with practical training for medical and informatics students. This course should be integrated in the current curriculum of both medicine and informatics.

Materials and Methods

The design of the new course concept is mainly influenced by three factors:
At first it is based on the standard evaluation of an existing course in informatics for medical students. We reviewed the evaluation of this course from winter term 2007/2008 to summer term 2009.

Secondly we used experiences from a pilot course on management of medical information systems which was introduced in the last year.

Thirdly we analyzed literature concerning medical informatics education with a focus on multidisciplinary courses.

Results

Evaluation of the current course in medical informatics

In the respective terms more than 400 medical students attended the course and evaluated education in medical informatics on a scale from 0 (very good) to 100 (very bad). Table 1 shows the results. The average score is between 38.9 and 56.3 while the median ranges from 32.0 to 53.5.

Table 1 – Evaluation of the course in medical informatics

Term	n	Avg	Mdn	Std Dev	Min	Max
2007/2008	129	39.5	34.0	25.4	2	99
2008	108	56.3	53.5	25.2	4	100
2008/2009	107	41.8	38.0	26.5	3	98
2009	113	38.9	32.0	26.1	1	100

Evaluation of the course in medical informatics from winter term 2007/2008 to summer term 2009 on a scale from 0 (very good) to 100 (very bad). n = Number of students, Avg = Average score, Med = Median score, StdDev = Standard deviation, Min = Minimum, Max = Maximum.

We also assessed the free text comments to explain the big range in the students' evaluations. On the one hand, students evaluated the course as "*one of the most important courses for the working life*" and "*good to gain insight into hospital information systems*", but on the other hand they missed the "*practical relevance*" and evaluated it as being "*abstract without practical examples*".

Therefore we decided to focus on practical tasks in the new course.

Experiences from a pilot course

In the summer term 2009 we conducted a pilot course for the management of information systems for medical students. We combined lectures with a practical part based on a case study.
In the case study the students have to analyze an existing tumor documentation process that should be described and modeled in order to specify requirements for a new system.
In the free text evaluation at the end of the course the students stated that the "*course was good, because it followed a central theme*" and that it was "*informative to work in small groups*".

Due to this positive feedback we decided that a case study should be a central part of our new course concept.

Literature analysis

In the literature regarding medical informatics education we identified a trend towards multidisciplinarity. The Committee on Interdisciplinary Research (IDR) of the National Academy of Science, the National Academy of Engineering and the Institute of Medicine analyzed "problems whose solutions are beyond the scope of a single discipline" [8]. The IDR provided also recommendations for students and postulated that "students should seek out interdisciplinary experiences […] that address societal problems and research experiences that span more than one traditional discipline" [8].
In 2008 van Bemmel added that this interdisciplinarity begins in the classroom [9]. Current research in medical informatics shows that interdisciplinarity should be a considerable part in medical education [10]. Also in the domain of clinical research informatics there is a strong need for cross-discipline education [11].

Regarding the practical relevance of such a course it is shown by Stang et al. that the use of examples which are close to reality helps students to understand the clinical relevance [12].

Besides the multidisciplinarity the concept of cooperative learning itself is an important aspect in teaching sciences and should therefore be utilized [13].

New concept for the multidisciplinary course

The main idea was to have mixed teams of informatics and medical students who work on realistic case studies and benefit from each other. Domain knowledge and IT skills should complement each other but also communication and collaboration should be fostered.

In addition to an existing curricular course for medical students the multidisciplinary course "Health Care Information Systems" was introduced for both medical and informatics students.

The course comprises lecture parts to introduce the theoretical background and practical parts in which students work on a case study with respect to an information systems project.

The main contents which will be described in the following are:

- Project management
- System analysis
- System selection
- System implementation
- Project conclusion

The course starts with a case study based on the following objective: "Hospital department X needs new software for their electronic cancer documentation".

The course design is shown in Figure 1. In the middle part the main contents of the course are listed. In each phase the tasks vary for informatics students (on the left) and medical students (on the right). Only the first and last tasks are the same. In the project management phase both groups have to create a project plan. In the system analysis phase medical students have to search for information about documentation needs and workflow which is then transferred into process models by informatics students. Medical students have to specify their requirements as prospective healthcare professionals during the system selection phase while the informatics students provide the functional specification. During system implementation informatics students should program and implement a system that can be evaluated by the potential users. Finally both groups complete the project report in the conclusion phase.

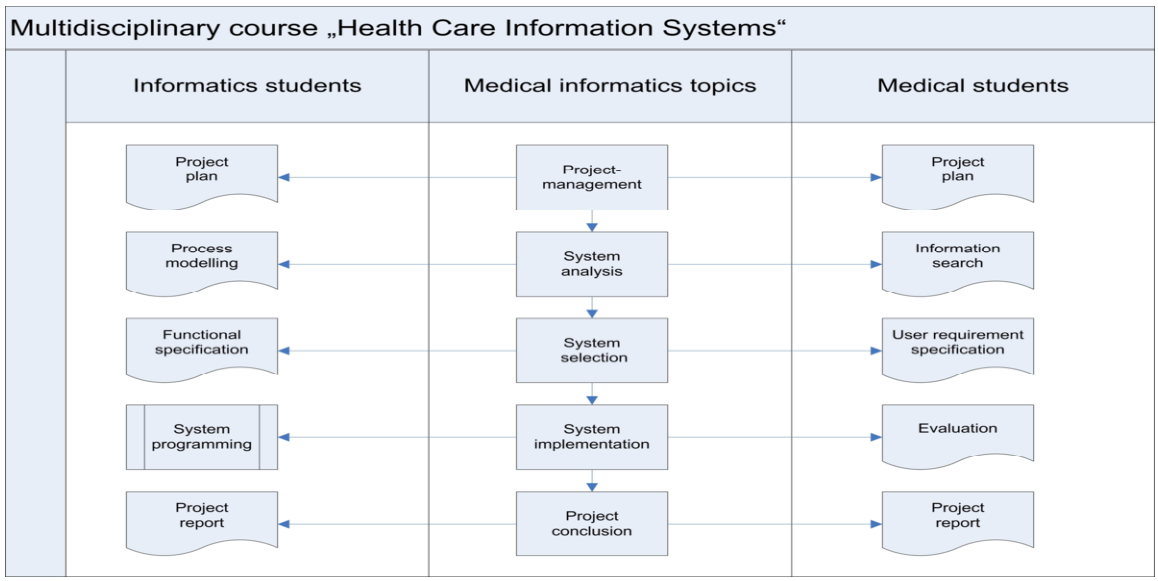

Figure 1-Multidisciplinary course contents.
The middle column shows the course contents. The external columns show the tasks of the informatics and medical students according to the single topics.

To avoid that poor contributions from one of the student groups affects the work of the other group we provided an individual feedback via Email, presented sample solutions according to the respective home-work and discussed the student solutions during classroom teaching.

Besides expert knowledge the students will also need to develop soft skills like communication abilities. Therefore the students work in small groups to enhance efficient conversation and teamwork. The course is integrated as an optional module in the curriculum of the medical students and as a compulsory elective module in the curriculum of the informatics students.

The course consists of 16 hours classroom teaching plus comprehensive project documentation and implementation tasks for the informatics students. In total there is a workload of 2 ETCS-Credits. The course is designed for 16 students per term (eight medical and eight informatics students).

Last term we started with 12 students (four medical and eight informatics students). A post course evaluation showed that the content and the integration of theory and practical tasks were in general good but there is still room for improvement. The overall rating was excellent.

Table 2 – Evaluation of the multidisciplinary course

	excellent	**good**	**fair**	**bad**
Course content	33 %	67 %	0 %	0 %
Integration of theory & praxis	33 %	59 %	8 %	0 %
Overall rating	87 %	17 %	0 %	0 %

Evaluation (in percent) of the multidisciplinary course from winter term 2009/2010 on a scale from 1 (excellent) to 4 (bad).

Discussion

With the course “Health Care Information Systems” informatics students gain insight into processes and documentation requirements of hospitals and can act as IT system providers while medical students learn about process description and modeling so that they can act as clients. Besides the domain knowledge students from both disciplines get experience in teamwork, presentations and communication which are important especially in cross-discipline projects. A critical aspect for establishing good communication is to create common theoretical foundations and a common terminology. The joined work on the case studies is designed to enhance communication between the two different domain groups.

Apart from the advantages for the students attending the course, also research in the domain of medical informatics will be fostered through the discussions between both domain

groups. As van Bemmel stated "interdisciplinary research can not be effective without interdisciplinary education" [9].
There are some discussions at what point in time in the curriculum a course in medical informatics should be placed and how such a course can be integrated in the education. Lungenau stated that after an introduction in the preclinical stage the problem-based-learning should be placed in the clinical part [13]. We agree with this and integrated the course as a compulsory elective module in the clinical stage to provide medical students with a possibility to extend their knowledge in medical informatics.

As a next step we plan to further extend the practical part by using videos - based on existing storyboards of clinical cases – in order to provide even more realistic clinical settings. Furthermore, we plan to complement the course by a seminar in which students can focus on specific topics from the course.

In addition further courses will be thoroughly evaluated by both student groups. Last year the University of Münster introduced the *Münster Audience Response System* (MARS) which is a system through that the students can use an electronic device to actively participate in lectures. We intend to use this technology to improve our multidisciplinary course.

Conclusion

Multidisciplinary education in healthcare information systems for medical and informatics students based on case studies is feasible and both disciplines can benefit from it.

Competing Interests

The authors declare that they have no competing interests.

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