

# Teaching Medical Informatics to Medical Students – What are the Challenges in a Model Curriculum?

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## Abstract

One of the aims of medical education is teaching the students not only theoretical knowledge but also to equip them with the necessary practical skills. In Germany, a revision of the federal law on medical education in 2002 had exactly this aim. In the following years, all around Germany, medical programs tried to reflect this change in paradigm and in 2005, a new model of teaching medicine was introduced at the Hannover Medical School. The topic of medical informatics was integrated in the third year of the model curriculum. Although medical informatics itself plays an important role in medical care, it soon became apparent that the opinion of students does not reflect this importance, rather, they do not really understand why they have to deal with this subject at all or they are under various misconceptions concerning the role of medical informatics in medicine.

Apparently, the conventional ways that had been in use in the past to teach medical informatics to medical students left too many questions unanswered. To alleviate this situation, we utilized the feedback given by the students – gathered in evaluations, but also voiced in live discussions as well as anonymous forums – to improve the way medical informatics is taught. In this paper, we first present a short appraisal of the situation, backed by the information gathered from the students, and then move on to give a more detailed view on the methods used to better convey the benefits of medical informatics in our classes. The new approach of teaching is also evaluated using standardized methods and the results are presented.

## Keywords

medical education, medical informatics, evaluation, curriculum, learning objectives

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## 1 Introduction

A common aim of medical education is educating students to become practically skilled, scientifically educated and (self-) reflecting physicians. In Germany, the federal law on medical education was revised in 2002 to meet this aim more appropriately. In many medical faculties, more emphasis was placed on the development of practical abilities and a better integration of preclinical and clinical aspects into new course concepts was started. In 2005, a new model curriculum was introduced at Hannover Medical School (MHH) [1].

The principle of HannibaL (=Hannover integrated adaptive practice-related learning concept) is a patient-centered, integrated training based on profound scientific knowledge. Although this approach may work well for clinical subjects, the real challenge for education in me-

dical informatics is to emphasize its practical relevance in modern medicine.

In HannibaL, the medical informatics classes are integrated into a module of three weeks duration during the third year of studies. The students receive 23 hours of lectures and tutorials in medical informatics. Other non-clinical subjects taught in this module include epidemiology and biometry.

All modules provided for human medicine are regularly evaluated by the central evaluation unit of the Hannover Medical School. The evaluation of the module for medical informatics received in the past made it apparent that a new approach concerning the didactical design and the contents was necessary. In the following paragraphs, we will describe the methods we employed for restructuring the module during the study year of 2008/09.

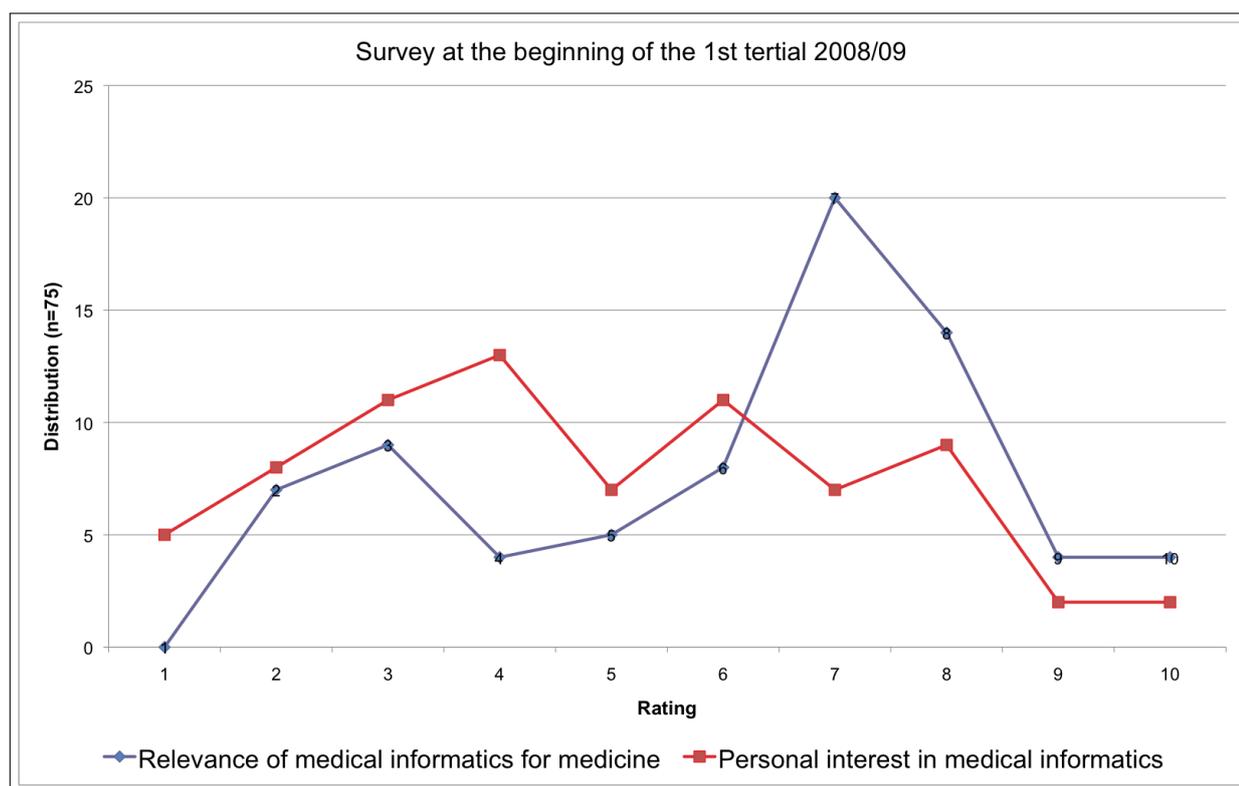


Figure 1: Survey at the beginning of the 1st tertial 2008/2009, n = 75.

## 2 Background

In the Hannover model curriculum each academic year is subdivided into three parts, so called tertials [2]. Thus, the same lessons have to be given three times each academic year to groups consisting of about 90 students. Our course covers the basics of medical informatics, i.e. clinical decision support systems, medical information systems, healthcare telematics, data privacy protection, health technologies, medical image processing and biosignal analysis as well as general aspects of using the internet in medicine.

At the MHH, all courses are evaluated after the corresponding final exam using a consistent scheme [3]. In addition to a summative grade, students evaluate in single categories teachers, content, learning material, organisation, exam and patient orientation of the course. Thus, the evaluation is also performed three times a year. A positive evaluation is not only of personal interest for the lecturers. It is also of importance concerning the acquisition of additional, internal funding from the university that is being distributed depending on the respective evaluation.

The evaluation of the module for medical informatics left much to be desired. Thus, it was necessary to reconsider the underlying concept and the orientation of the medical informatics course. Our starting hypothesis was that medical students are mostly unaware of the importance of medical informatics within modern medicine. They only

consider the course as an unpopular obligation with little or no relevance for their future profession.

Since patient orientation is one of the central points in HannibaL, starting in the academic year of 2008/09, a fictitious patient was introduced as a leading figure into all topics taught in the medical informatics classes, with the goal of better showing the significance of medical informatics in the various phases of patient care. This patient and how the methods of medical informatics facilitate the storage and evaluation of the various data acquired during his stay in a hospital became the central educational concept of our classes. For each of the basic topics in medical informatics, we tried to give practical examples for our virtual patient to make clear that medical informatics plays an important role in the whole process of patient care. Nevertheless, while it was not hard to provide practical examples concerning our “virtual patient” (who suffered from a shoulder dislocation) when talking about imaging modalities and image processing, in some cases, such as clinical decision support systems, it was hard to establish a relationship between the described case and the sub-specialty of medical informatics. Thus, our method of implementing a more patient oriented way of teaching did not always proceed smoothly.

By asking the students to complete further questionnaires in addition to the standard evaluations, we tried to get detailed information about the factors playing a role concerning the dislike many students harbour concerning the subject of medical informatics.

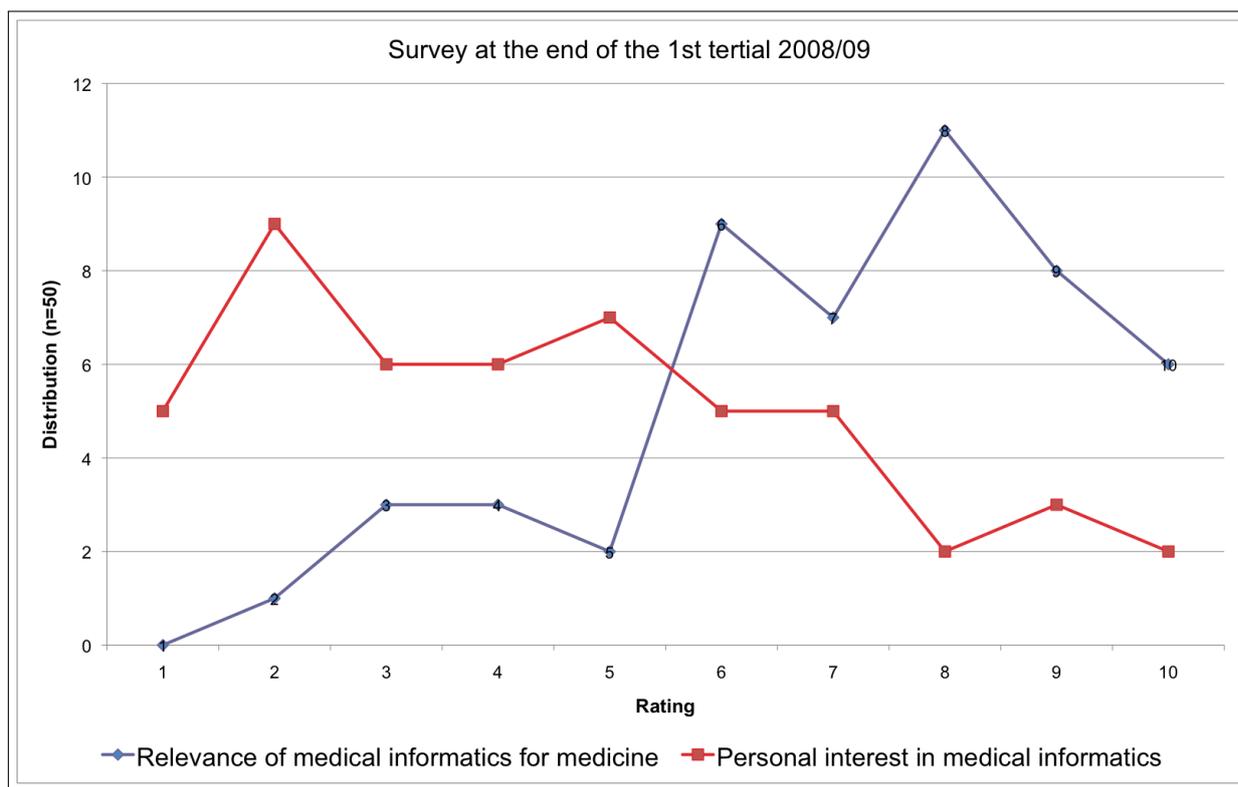


Figure 2: Survey at the end of the 1st tertial 2008/2009, n=50.

### 3 Methods

At the beginning and the end of each medical informatics course, the students were asked to complete a questionnaire that asked about the perceived importance of medical informatics within medicine as well as their personal interest in the topic of medical informatics.

Furthermore, in each tertial, four seminars with 20-25 participants each took place, where the role of medical informatics within medicine was discussed critically. For this purpose, an anonymous forum within ILIAS, the learning management system of the MHH, was used. During the seminar, the students were first asked to anonymously answer the questions. Afterwards, the various opinions expressed during the anonymous phase were jointly discussed. In each following tertial, we refined the questionnaire using insights of the previous cohorts.

In the following sections, based on the results of the standardized evaluations as well as our additional evaluations, we will describe the overall assessment of the medical students concerning medical informatics and the consequences we drew based on the results. This is mainly done based on the results of the 1st tertial.

Unfortunately, the response rate for the additional surveys at the end of the 2nd and 3rd tertial was not high enough to be able drawing significant conclusions from them.

### 4 Results

#### 4.1 Students' Perspectives on Medical Informatics

The results of the first survey in the 1st tertial of the academic year of 2008/2009 showed that there is a considerable mismatch between the estimation of the importance of medical informatics and the students' personal interest in medical informatics.

With a scale of 1 representing "irrelevant" to 10 representing "very relevant", the students were supposed to rate the perceived relevance of medical informatics within medicine. Again using a scale from 1 to 10, the students also had to indicate their personal interest in medical informatics with 1 representing "no interest" to 10 representing "high interest".

The mean of the importance of medical informatics is 6 pts. (sd=2.3), whereas the mean of the estimated personal interest was only 5 pts. (sd=2.4). The difference is best illustrated by a graphical illustration of the respective dispersion of all values (fig. 1). The importance curve is skewed left, the interest curve is slightly skewed right and has a flat kurtosis.

The survey at the end of the 1st tertial shows that the opinion of the students did not change for the better (fig. 2). In contrast, students' interest was even lower with a mean of 5 pts. (sd=2.5). The evaluation of the importance of medical informatics improved only slightly

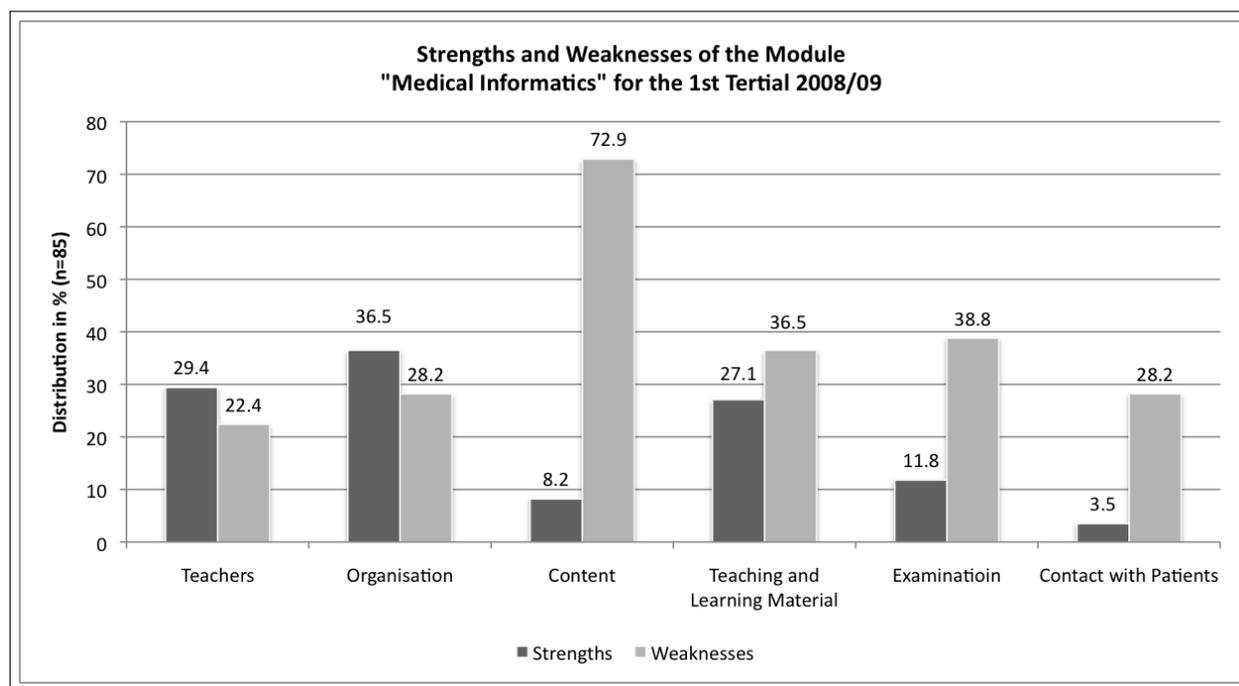


Figure 3: Standard evaluation 1st tertial 2008/2009.

(7 pts./sd=2.3). 50 students (50%) filled in the questionnaire.

To gain a better insight into why students think medical informatics is important for medicine but not important for themselves as medical students, we started a more detailed analysis of the entries given in the anonymous forum as well as of the comments the students voiced during the seminars.

## 4.2 Results from Discussing the Matter with the Students

Already in the 1st tertial, during the aforementioned discussions in the critical reflection part of the medical informatics seminar, it became apparent that many of the students are hardly interested in dealing with the principles and various issues of medical informatics. We collected their arguments for or against the integration of the subject into the medical curriculum.

Typical statements were: “Why do I have to learn all this now, the software will certainly have changed when I am finished”, “Why do I have to learn so many details, in practice all problems will be solved by experts anyway” or “Why do I have to learn things now that do not really help me in my current situation”.

Even though the students generally recognized medical informatics as relevant for medicine, they were not enthusiastic about its integration into the medical curriculum. We wanted to determine why and therefore adapted the questions posed to the students in the 2nd tertial.

Now, the students were also asked what skills in medical informatics they deem important for a physician.

It turned out that many medical students have a very narrow perspective: they hold the opinion that with regard to skills in medical informatics, physicians only have to be able to correctly operate the software necessary for medical care. Since software and its handling changes over time, for the majority of the students it does not make sense to already have to learn about current software in their 3rd year of studies since it will be years until they really have to work with the software; they also think that the software will look and work completely different until then.

We were surprised by these statements, since the goal of our classes in medical informatics was not to train the students in operating certain software products. Whenever a program was shown during the lectures or used during the seminars, it was only mentioned as an example to show basic principles. The focus rested on the general principles and methods of medical informatics. Apparently there was a discrepancy between the view of the teacher and the view of the students regarding the learning objectives of the class.

## 4.3 From Patient Orientation to Personal Learning Objectives

Our attempt to receive better evaluation scores through integrating a fictitious patient to underline the relevance of medical informatics for patient care did not serve to increase the personal interest of the students in

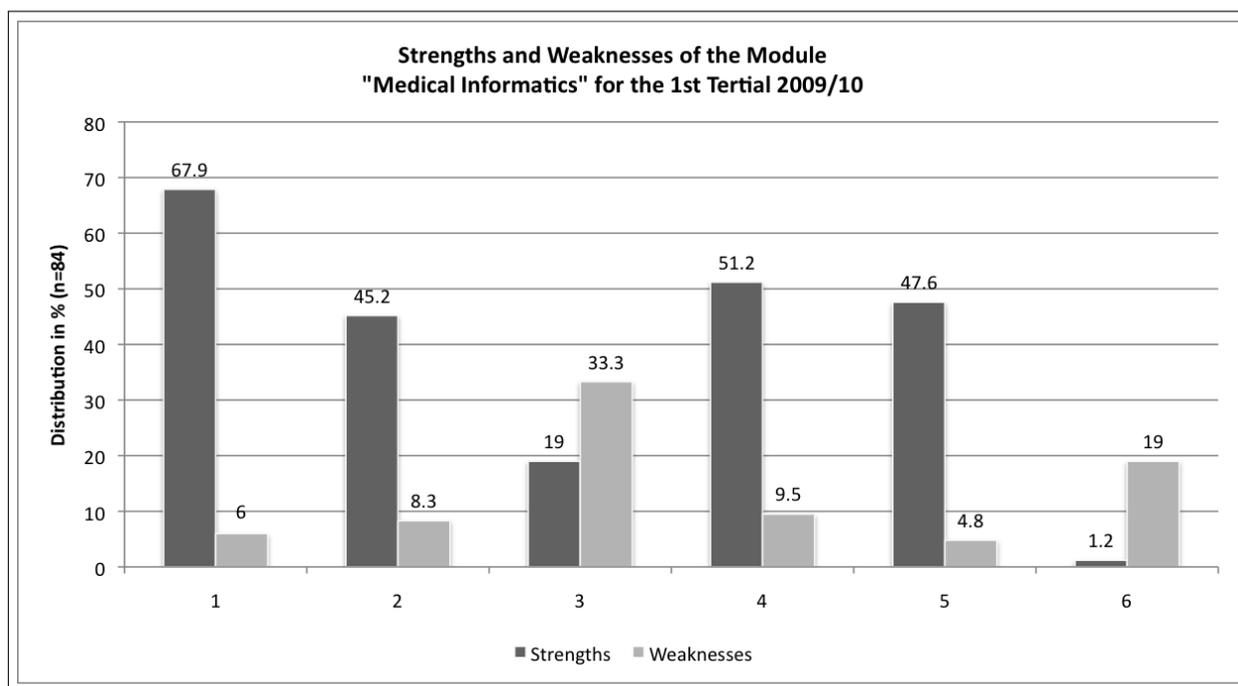


Figure 4: Standard evaluation for the 1st tertial of 2009/2010.

the subject. The course did not manage to alter student's points of view. Results of the standard evaluation for the same cohort documented the dissatisfaction (fig. 3). The students are supposed to evaluate the quality of the teaching staff, the content of the classes, the provided materials, the patient contact and the final exam as well as the organizational aspects. In addition, there is an overall evaluation of each module using the grading system also employed by German high schools that is based on 15 points representing exceptional results and 0 points representing a failing grade.

Despite our efforts to put an emphasis on showing the importance of medical informatics in medicine, at the end of the 1st tertial, the overall assessment still left much to be desired with 6 points. Of the participating students, 79.9% rated the contents of the module as a weakness of the module. Only the lecturers as well as the organizational aspects of the module received positive evaluations.

The sobering results of the evaluation as well as the statements the students made during the critical reflection seminars made us once again rethink our didactical concept. A new concept was worked out. Therefore, each lecturer reflected the students' perspectives based on the analysis of their accounts.

Thus, the educational concept of our medical informatics course was revised and learning objectives for each subtopic were defined. The learning objectives were supposed to give the students a binding concept of the competencies they were expected to acquire and how these skills already could be helpful in their present training. In this

way, the students were shown the practical relevance of the presented lectures. The goal was to give them a distinct idea about the impact and importance of medical informatics in all phases of medical education. Therefore, at the beginning of the tertial, a comprehensive introduction to the course was given. Each topic was presented by one of the lecturers. During this introduction, each lecturer gave a personal account of what he or she expected the students to learn, including some basic examples to pique the personal interest of the students. Thus, the various topics of medical informatics became tangible – something the students could better understand and apply.

It turned out that the new concepts of the class and especially the presentation of the learning objectives lead to a significant increase in the standard evaluation results in the next study year (fig. 4). Apart from the assessment of the learning contents themselves and the integration of patients in the syllabus, the other evaluated aspects were all seen as strengths of the module. Also, the overall assessment rose to 10 points and was thus much better than in the previous tertial.

The trend of the standard evaluation in 2009/10 was continued subsequently. Currently the results level off around 9 points. In the opinion of the students, the strong points of the module continue to be the lecturers, the organizational aspects, the learning materials as well as the written exam.

## 5 Conclusions

In publications about the skills medical students are supposed to acquire in medical informatics, there is a focus

on various topics of epidemiology and biometrics and even within the medical informatics community; “pure” medical informatics is not really seen as an interesting topic [4, 5, 6, 7]. In addition to the scientific perspective on medical informatics, we put the emphasis on a competency-based approach as described by Manta et al. [8]. Aside from describing the learning outcomes, it also seems important to implement the learning objectives as individual learning goals for the students. Of course, clearly defined learning objectives are important in all educational settings. Nevertheless, a clear definition of the learning goals becomes even more important when considering the education in medical informatics. The description of the learning objectives at the beginning of the course was one of the factors leading to better evaluation results.

Still, the evaluations and the discussions in the seminar showed that some students did not at all fathom why they had to gain deeper insights into medical informatics. They acknowledge that the topic contributes essentially to the medical field. Yet, it seems to be a domain that is reserved to experts from outside who provide their knowledge to physicians and hospitals. Related to their education, many students reduce medical informatics to the proper use of software. It is therefore important to broaden this perspective.

Starting in the academic year of 2009/10, the evaluation results finally became satisfactory, although the exceptional evaluation results of the 1st tertial deteriorated a bit in the following tertial and finally levelled off at an average of 9 points. One of the remaining problems is that since attendance is during the lectures is not mandatory, many students refrain from participating. One of the main contributing factors is probably the time demands that are placed on the students. Medical informatics still remains a seemingly superfluous subject to many students. To firmly establish medical informatics as an important part of medical studies, it would be helpful to better integrate its various aspects with clinical subjects: methods of digital image processing could be combined with radiology, the functions of clinical information sys-

tems could be explained as soon as the students start the clinical part of their education and diagnosis supporting systems might better be introduced while the students are taught diagnostic methods.

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