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Medical Informatics Education in Bosnia and Herzegovina

Abstract: Medical informatics, as a separate medical discipline, is quickly developing in our country, both in Bosnia and Herzegovina. In our country, medical informatics has been a separate subject for the last ten years with regard to Medical curriculum at the biomedical faculties in Bosnia and Herzegovina. This is in accordance with the project of education related to the Bologna declaration and the project EURO MEDICINA. Last year, the Chair of Medical Informatics of the Medical Faculty in Sarajevo celebrated ten years of its existence.

The research was performed using a separate questionnaire patterning data with defined characteristics for the quality assessment of the performed course. The total attitude of the assessed students shows dominant satisfaction with the majority of the parameters that are important for the assessment of the quality and the tuition contents which were evaluated through use of the questionnaire. Education in the field of medical informatics is based on the concept which is used in developed countries, according to the recommendations of the working groups of the European and international association of medical informatics. Theoretical and practical teaching and training performance as a whole is performed by use of the computer equipment, and the final knowledge check of the students is also performed using the Data Base Management System MSAccess specifically designed to cover full teaching and training material by using question sets in the data base which encircled nearly 1500 question combinations. In this paper, the author presents ten years of experience of medical informatics education at biomedical faculties in Bosnia and Herzegovina.

1. Introduction

Medical Informatics, as an obligatory subject, was introduced to the biomedical faculties in Sarajevo (medical, dental and pharmaceutical as well as the High medical school) in 1992 and 1993. The Chair of Medical Informatics of the Sarajevo University was established in August 1992. The education process is organized according to the newly adopted plan and program by the Scientific Council of the Medical Faculty, and it considers 15 hours of theoretical and 15 hours of practical training in the computers room [1,2]. The plan and program of the faculty are made in accordance with the project of Euro medicine for six

years studies on biomedical faculties of south-eastern Europe, and in accordance with the recommendations which have been proposed by working groups of EFMI and IMIA. The same curriculum also existed at the dental faculty with 15+15 teaching hours. It also existed at the Higher Medical School with 30+30 hours of education. By adopting the rules of the Medical Faculty in Sarajevo plan and program of medical informatics, education was also expanded starting from this year to 15+30 hours of practical and theoretical training for the sixth year of study –and it happened exactly 10 years after the establishment of the Chair of Medical Informatics at the Faculty of Medicine [3,4].

That means that the training process will be divided in two parts this school year: Basics of medical informatics in the second semester of studies and applicative medical informatics in the 12th semester of study. For both modules the exams and teaching process have been adopted. Examination and organization of practical and theoretical education are thoroughly explained in the following pages.

We also organized the teaching process for the post-graduate studies of Medical Informatics into 15+15 hours of training. After the practical training and theoretical lectures, students are obliged to complete the semester work and the final theoretical

exam. Similar education plans and programs are also set up at the chair of medical informatics in Tuzla, Mostar and Banja Luka, taking into consideration that the basic text book is written by two authors I.Mašić and Z.Ridanović as 'Medical Informatics', book 1 and 2.

Education in the field of medical informatics is also organized by organizing scientific and professional meetings under the supervision of the Medical Informatics association founded in 1988, which also organized the first congress of Medical Informatics in B&H in 1999 in Sarajevo. Also, significant education results are achieved by publishing articles with the topics relating to the application of computer science in medicine "Acta Medica Informatica". Acta Medica Informatica is currently celebrating 10 years of existence. Currently in Bosnia and Herzegovina there are about 100 researchers and professionals who are contributing to Medical Informatics and few of them are specialized for the particular segment of health statistics, as for example doctors of medicine, dentists, pharmacy masters, health statisticians, economists, electrical and mechanical engineers and others [5,6,7]. One of them is also the project "Introduction of tele-distance learning in medical curriculum" which was approved by the Federal Ministry of Education in Sarajevo, and the project itself will be applied at the Medical Faculty of Sarajevo University.

2. Lectures

In the last few years, a number of hours have been adopted. Duration is now two hours of theoretical and 3 hours of practical education. In the theoretical part of training, the following methodological units have been thought out:

1. Introduction to medical informatics which considers the terms and definitions of medical informatics, subjects, goals and tasks in this discipline. We also give a short description of the historical development of medical informatics.
2. The second lesson is related to data definition and information, classification and the value of medical information.
3. The third lesson refers to systems and communication, system analysis, the basics of cybernetics, communication and the theory of information, as also Internet.
4. The fourth lesson considers methods of data manipulation. Students are taught different methods of data processing and data manipulation
5. The fifth lesson refers to the basics of medical documentation.
6. The sixth lesson refers to the most important classification systems: Systems of classification of medical services, international classification of sicknesses, injuries and the causes of the death, international classifications of diseases, injuries and death causes, anatomical, therapeutic and chemical classifications of medications, similar groups, other classification systems etc.
7. The seventh lesson considers the structure and the organization of medical databases and the architecture of medical data bases.
8. The eighth lesson considers explanations of the basic terms of hardware and software, in which we give the most basic information about hardware and software support which is used in medical practice.
9. The ninth lesson refers to models, modeling and computer simulation.
10. The tenth unit considers all areas of the medical decision making processes, different levels of decision making, problems in the common group decision making process for doctors and for patients.
11. The eleventh lesson refers to computer support in the medical decision making process. Artificial intelligence and expert systems are presented.
12. The twelfth methodology unit refers to the system of biomedical scientific and professional information and considers primary, secondary and tertiary publications, bibliographic data processing and expert systems in the system of the biomedical professional and scientific information.
13. The thirteenth methodology unit considers use in the process of education and research including education programs for teaching, simulation and multimedia, as well as the methods of distance learning.
14. The 14th methodology unit considers information technologies in the field of medicine and health care protection: diagnostics methods such as data processing and analysis of biophysical signals, computer electrocardiography, analysis and processing of medical pictures, ultrasound systems, computerized tomography, nuclear magnetic resonance, as well as modern methodology units which refer to insurance and quality control of work in health protection.
15. The 15th methodology unit covers health information systems applied in health protection and family medicine of medical information systems.

3. Practical Training of the Students

Students have practical computer training for a period of 7 weeks. We first provide a very short introduction to the architecture of computer systems, MS DOS, Windows 95/98/2000/XP with all their characteristics and instructions, which are most frequently in use. So students are familiarized

with the style of delivery of contents on the computer, work with documents, installation of software and hardware, ways of making work on the computer faster, ways we can fix windows, as well as ways we can set up the computer desktop are all taught.

Students have training in Excel, Word etc. The fourth week refers to work on medical application software, examples of expert systems, their working principles and ways of the application of software in practice QMR-Quick medical reference. Part of the practical training is used for the training in use of the database Access. We also mention Fox Pro. We give students different possibilities for the program. We provide instruction on the creation of small databases, making different data-bases as well as on exchange relationships between tables and conducting data exchange with other programs. We especially give instruction with regard to Microsoft Access.

The fifth week of practical training will be used for talking about the basic instructions for the preparation, collection, data processing and data analysis of medical information for daily medical practice. We also gave the example of one local information system-ISPZZ, its structure and data organization.

This database model was tested in the Health Station of the Medical Faculty in which the students were doing the practical training. Also the students were familiarized with the databases about the survey on the health of the inhabitants – those were models of the informatization of the CINDI project for survey on the incidences and prevalence of the wide range diseases of Sarajevo inhabitants, project assessment of the satisfaction of PZZ users, the project of drug use analysis and the family reasons for the use of drugs.

Students are also theoretically introduced to ISPMZ, CINDI, HFA (Health for All project), Medical expert

systems, experts, QMR-Quick medical reference, HEPAT, MEPSS and ILIAD.

The sixth week of training is oriented towards familiarization of the students with the Internet. This is performed in collaboration with the Electrical Engineering Faculty where there are Internet connections with about 12 working stations. The students are familiarized with the use of the Internet, as well as ways of research of the medical databases and Internet medical records data provision.

For the exercises of this week, students are introduced to basic information about the Internet, about www, about how to surf, about addresses on the Internet and what else is necessary in order to be familiarized with the web. The most frequently used database for medical records search on the Internet was MEDLINE.

In the seventh week, students are given their semester projects and they have the exams. The semester project entails making one data carrier according to the will of the student himself.

4. Final Exam

The examination on the subject of Medical Informatics is performed in two parts: practical knowledge examination and exam of the theory of the application of computer science in medicine for the students of the Medical Faculty. Practical check-up of the knowledge will be based on checking knowledge of the MS-DOS computer operating system, WINDOWS 95/98, Microsoft Word, Microsoft Excel and Microsoft Access operating systems and the use of the Internet. The final exam is thereby composed of four parts: data entry from medical data carriers into the database, marks from semester work, oral part of the semester work and examination of

practical knowledge of computer use. Two questions covering the theoretical part of the exam (essays) and theoretical examination will be posed. These questions will be posed by using an Exams Database specially designed for the purposes of the theoretical examination. This database holds about 1500 questions in the field of medical informatics.

The software environment in which the database is established for the theoretical part of the exam considers the contents that students are trained for in Sarajevo.

Material learned in the subject of Medical Informatics is an excellent basis on which students of medical informatics are basing their knowledge for their future studies. As such, medical informatics as the faculty module is extremely complex to be simply represented by the responsible teachers.

Software for the exam is designed in order to facilitate the process of examination of the students. Assistants or professors enter different combinations of questions for all the subjects that are presented during the lecturing process. Different sets of questions are automatically generated for each separate student, according to his ID number. Although for the perfect understanding of the prompted questions it is necessary to have prior knowledge of pre-clinical and clinical knowledge, it is also necessary to have perfect theoretical background knowledge of the theory of the subject of medical informatics.

This MS Access database application allows the student to view the results of the examination without waiting too much. It also helps the professor to expand the domain (set) of the questions for the exam.

Each student registers with his own registration number on the form,

presses a button, and a set of 50 questions is prompted out with three yes/no questions. Students have 45 minutes to answer the yes/no questions. The mark is given based on the combined percentage. The grade range of passing marks is from 80% to 100%. The mark is given taking into consideration the necessary score for passing the exam. Marks are 6,7,8,9 and 10.

The passing range is from 51% to 100%, and the following criterion is established:

- for mark 6 we need the percentage more or equal to 50% and less than or equal to 60%.
- for mark (appraisal) 7 we need to have the percentage greater or equal 61% and less or to equal 70%;

- for mark 8 it is necessary that the percentage be greater or equal to 71% and lesser than or equal to 80%;
- for mark 9 we need the percentage to be greater or equal to 81% and less than or equal to 90%;
- for mark 10 it is necessary to have the percentage greater or equal to 91% and less or equal to 100%;

The questions are selected by the professor or his assistant who is preparing the set of examination questions. The database is prepared so the professor can enter questions. It is possible to enter an undetermined number of questions.

The questions are selected by the professor or his assistant who prepares a different set of questions for each student. The data base is prepared so

the professor can enter questions for each student separately according to their ID number. The database is prepared such that an unlimited number of questions can be entered. At the beginning of the application, each user is confronted with 4 command buttons that determine the purpose of this application:

1. The form for the student registration
2. Medical Informatics examination
3. Form for printing of the examination results
4. Form for entering new questions

After the selection of the button for the new student registration, the form for the new student registration is opened. Additional information with regard to further steps for student registration and the basic steps that the

Student ID	Pitanje	Odgovori
37	Zaokružite tačne tvrdnje	Baza heksadecimalnog brojnog sistema je 8; 0,35E5 je notacija za 0,35*1000000 BCD kod koristi ukupno 7 bitova pri čemu je kod podjeljen na bit pariteta, 2 zonska bita i 4 numericka bita;
97	Zaokružite tačne tvrdnje	Rijeci se u racunarskoj terminologiji sastoje od bajta; 1Kbyte=1024 bajta ROM je vrsta memorije sa koje se može citati i u koju je moguće upisivati podatke;
97	Zaokružite tačne tvrdnje	EPROM memoriju je moguće reprogramirati pomoću električnih signala; EAPROM je moguće reprogramirati pomoću električnih signala; Kompakt diskovi pripadaju kategoriji ROM memorija;

POČETNO VRJEME: 11.7.2003 10:34:39

KRAJNJE VRJEME: 11:19:39

SPASI UNOS

STAMPANJE ISPITNIH PITANJA

FORMA ZA STAMPANJE REZULTATA ISPITA

UPUTSTVO ZA UPOTREBU FORME ZA ISPITNA PITANJA:
PROCITAJTE PITANJE I STAVITE KVAKICU PRITISKOM NA MIŠA AKO MISLITE DA JE TVRDNJA ISPRAVNA. NA KRAJU PRITISNITE DUGME SPASI UNOS A ZATIM STOP DUGME.

Fig. 1. Screen window of exam questions.

student is supposed to do in order to get his exam questions is given.

1. During the input of the student ID number in the field Student ID it is necessary first to press the number which is placed in the lower left corner of the screen, which is actually the number of the RECORD.
2. Date has to be entered in the format day/month/year;
3. Index number, year of study and the student name in the fields designed for them;
4. Press the button with the exam questions;

When students register their data in the form for the student registration, and after pressing the button "Exam questions", the form with 50 examination questions appears. Questions are uniquely selected and are composed of 50x3 yes/no questions. The answer is acknowledged when the check mark is pressed. The starting and ending time is located in the lower left hand corner of the screen. When the time for the exam is up, the student needs to press the command button "SAVE THE ENTRY", and press the "STOP" button.

It is possible to enter new questions in the database, to delete the existing questions, and also to modify already entered questions. This is presented on the picture above. After all, the most useful advantage of this examination database is the automatically calculated score of the exam. This can be printed on the click of a button.

5. Quality Assessment of Medical Informatics Education

Each year students give their own opinion about the work of the professor, his assistants and other relevant opinions about the lecturing, training and examination processes. This is called quality assessment of the work of the chair of medical informatics. The results of the examination serve as the measurement parameters of working quality.

Results of the questionnaire are processed with the help of the computer database designed in DBMSMS Access. Reports on the results of education go to the chief of the chair of medical informatics at the end of each school year.

6. Conclusion

Education in the last ten years using experiences from other countries in which the field is developed and the recommendations in curriculum from medical informatics are given by the working groups of the European Federation of Medical Informatics (EFMI) and International Medical Informatics Association (IMIA). The up-to-now organization of instruction and the continuing innovation of the educational process from the Medical informatics chairs and their collaborators insured the high rating at the Medical faculty of the University of Sarajevo and also outside our country. The satisfaction of our undergraduate and postgraduate

students with contents and organization of the teaching process up to now is indisputable and proven.

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