Medical Informatics as Academic and Scientific Discipline in Bosnia and Herzegovina – Twenty-five Years of Experiences from Faculty of Medicine, University of Sarajevo

Izet Masic

Faculty of medicine, University of Sarajevo, Sarajevo, Bosnia and Herzegovina

Corresponding author: Prof Izet Masic, MD, PhD, FACMI, FEFMI, MIAHSI. E-mail: imasic@lol.ba

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1. INTRODUCTION

This year is anniversary of 25 years from establishing the first Cathedra of Medical informatics at Bosnia and Herzegovinian universities (Figures 1, 2, 3). From long time this exam was one of basic in biomedical curricula, but during last 5 years it was changed and modified at different school years regarding modifying all curricula at Faculty of medicine within Bologna model of education, followed proposals some groups of university and faculty managers. This year's (2016/2017) Medical Informatics was listened to at IV semester and XI semester of school years for students who studied in Bosnian language and at IV semester for students who studied in English language.

In October of the year 1992 the first Cathedra for Medical Informatics was established at Faculty of medicine, University of Sarajevo. Cathedra staff at the time comprised of the following: Asst. Professor Izet Masic, Chief of Cathedra and teaching assistants - Zoran Ridjanovic, MD and engineer Safet Jakupovic, and associates Amra Redzepovic and Ljubomir Kravec (1-5). Cathedras for Medical informatics at medical faculties in Tuzla, Banja Luka, Foca and Mostar were established later – from 1994-1996.

There are five medical faculties in Bosnia and Herzegovina (Sarajevo, established in 1946; Tuzla, established in 1976; Banja Luka, established in 1986; Foca, established in 1994; and Mostar, established in 1997). At all the faculties, since 1992 and later, cathedras for medical informatics were established and/or introduced as independent subjects: medical informatics or health informatics, bioinformatics, etc. In prin-

ciple, 60-70% of the curriculum are the same, or very similar; the only difference is that the chiefs of some cathedras are medical doctors and of others are professors, engineers, mathematicians or economists with the title of MSc or PhD in this area. Most of those cathedras have web sites where students can check the number of hours and content to be taught (2-6).

In past years the curricula of Medical informatics at universities in Bosnia and Herzegovina (B&H) were modified and harmonized (Table 1), but the basic one was the Program of Sarajevo cathedra for Medical informatics. In last 10 school academic years Medical informatics curricula consists of theoretical and practical parts: 30 + 45 (Sarajevo); 60 + 90 (Tuzla); 30 + 30 (Banja Luka); 30 + 30 (Foca) and 30 + 30 (Mostar).

Year by year subjects and contents of medical informatics education were improved, followed by assessment of student's opinion about quality of teaching model, contents of theoretical and practical lectures and finally proposals of the way of providing medical informatics exams (orally, by test, electronic exams, etc.) by Bologna model of education (11-20).

2. HEALTH INFORMATICS IN MEDICAL EDUCATION - HISTORICAL BACKGROUND

The need for additional education of health professionals was realised after the first application of electronic data manipulation. For physicians in primary health care and in clinics, in order to perform their duties in a high quality manner, must have been up to date with the latest accomplishments in medicine

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Faculty	Name of the subject	Type of subject
Faculty of Medicine Sarajevo	Medical Informatics	elective
Faculty of Medicine Tuzla	Informatics with medical statistic	compulsory
Faculty of Medicine Mostar	Scientific methodology and medical informatics	compulsory
Faculty of Medicine Banja Luka	Medical statistics and informatics	compulsory
Faculty of Medicine Foca	Medical statistics and informatics	compulsory

Table 1. Status of Medical Informatics exams at Faculties of medicine, at Universities in Bosnia and Herzegovina in 2017

and health. Since the 60's the development of information technologies has had a quantitative and qualitative growth especially in diagnostics and therapy, and health workers had to follow that. Great role in this field had IMIA – International Medical Informatics Association and EFMI – European Federation for Medical Informatics. Working groups of IMIA and EFMI recommended and defined concepts and methodologies of education for medical informatics on three levels (6-10).

First, informatics education which should provide general knowledge to users and data analysis on the place of their generation, and on all places of collecting data in health system (physicians of all specializations, nurses and paramedical staff).

Second level, informatics education of this level is in regard to medical staff which was directly involved in collection, manipulation, analysis and interpretation of health data. This kind of education was expanded with skills, knowledge and practical applications which are necessary for personnel on this level.

The third level is basically a very wide and highly specialized education for experts in the health sector who would like to be professionally involved in this kind of work.

In B&H there has never been an accepted proposal for introducing subspecialization from medical informatics, in spite of the fact that authors of this paper put a lot of effort and energy into making it official. It is a fact that at some universities in European countries there are separate faculties or universities for graduates with the title of engineers of health informatics ((3-6).

Openly speaking in undergraduate education until 1992 when medical informatics was introduced as an independent subject at the Faculty of medicine, University of Sarajevo just some lectures were taught; those were methodological units in that time very important for health practice (medical documentary with two teaching hours and health information systems also two teaching hours) under the subject of Social medicine and organization of health care and Professor Izet Mašić. From 1979. on Postgraduate education at the Medical Faculty, University of Sarajevo there were subject Health informatics led by the pioneer of health informatics in ex-Yugoslavia Prof Gjuro Dezelic, PhD using concept, content and methodology at the Medical Faculty, University of Zagreb (3, 4, 6, 7).

After spending 6 months on education at Department of Medical Statistics and Informatics at London School of Hygiene and Tropical Medicine (LSHTM) in London in 1982, Izet Masic took over the leader position and with the help of Professor Gjuro Dezelic and Professor Arif Smajkic he

launched a separate course for students of postgraduate study at Faculty of medicine in Sarajevo named as "Informatics and Economics in Health Care System" for a total duration of 30 hours. Numbers of postgraduate students became MSc and PhD in this subject, and some of them became professors and assistants in B&H universities and abroad.

Since 1992 at the Medical Faculty, University of Sarajevo there have been Cathedra for Medical Informatics. The content of education is 30 hours of theoretical and 45 hours of practical education for students of the Medical Faculty, 15+15 hours for students of Faculty of Dental medicine and 30+30 hours for students of College of Nursing. From 2002 the subject is split into two parts: Basics of medical informatics with funding of 15+15 hours in the second semester of studies and Applicative medical informatics with funding of 15+45 hours in the eleventh semester. The final exam is due after the 11th semester. Curriculum, teaching materials, application for the exam, the exam itself and checking of results are possible at the web sites www.unsamedinfo.org, and www.imasic.org.

Also, since 2002 at Cathedra for Medical informatics the project "Distance learning in biomedicine" was included as obligatory model of medical informatics education, and few articles were published in domestic and international indexed journals, visible on PubMed, PubMed Central and Scopus databases (15-26). This model of education allows students to use an electronic way of learning and to pass their exams in this subject. This method of education is now official method at almost all universities in Bosnia and Herzegovina.

In total, education from Medical informatics gained till now approximately 5000 students. At postgraduate students of the Faculty of medicine, University of Sarajevo there are subject Medical Informatics with funding of 15+15 hours and this type of education enabled over 1000 medical doctors all medical specializations (6-10).

3. THE PROGRESS OF MEDICAL INFORMATICS DURING THE BOSNIAN WAR (1992-1995)

In December 1992 in Sarajevo, scientific conference was held, organized by the Society for Medical Informatics of RB&H. Topic was the "Nomenclature and classification systems in health services". During the Conference 11 papers had been presented from eight different entities (12). In August 1993 in Sarajevo, another symposium on medical informatics was held, and this time organized by the Society for Medical Informatics of B&H in order to, according to professor Izet Masic. At the event titled Appendix to the history of cultural and educational development of B&H have been presented a total of 39 papers from 22 institutions (12).

In December 1994, a symposium named "Health Information Systems" was held, with the theme of possibilities of development of health information system in B&H (3, 4, 7, 12), without which, as in the prologue states professor Masic, "could not imagine a functioning health care system today. In fact, modern information systems in healthcare are the main mechanism shaping the health care system, his rationalization, increase efficiency, economy and self-regeneration." Counselling is tasked to provide an overview of modern concepts of individual sub-systems of health care information systems and to present the current level of potential and pros-

Figure 1. Some documents about establishing Medical informatics cathedra and staff, and cover pages of the Medical informatics book and Almanah

pects of development of these systems in our communities (12).

4. MEDICAL EDUCATION AND THE ROLE OF MEDICAL INFORMATICS

The argument that medical informatics should be central feature of the medical curriculum rests on the following premise: “To support health care, life-long learning, education, research and management, medical students should be able, at the time of graduation, to utilize biomedical information for: formulating problems; arriving at strategies for solutions; collecting, critiquing and analyzing information; taking action based on findings; and communicating and documenting these processes and the results.” (1).

Medical education is a life-long or career-long process beginning with medical school. Support of life-long learning with information technology requires more than computer literacy. In short successful medical school graduate should be able to demonstrate knowledge of information resources and tools available to support life-long learning; retrieve information; filter, evaluate and reconcile information; and to exhibit good information habits – attitudes that support the effective use of information technologies (1).

In year 2002 at Cathedra of Medical informatics of Medical faculty in Sarajevo conducted first tele-exam in the history of education in Bosnia and Herzegovina between Podgorica (Montenegro) and Sarajevo (Bosnia and Herzegovina).

In October 2003, University of Sarajevo began with Distance learning education, opening University Distance Learning Centre at University of Sarajevo (UTIC – University Tele-informatics Centre). Opening the University Distance Learning Centre, as coordination body and leader in all activities in connection to Distance learning, has provided opportunity for development and growth of this kind of life-long education (10, 11, 14, 15).

In the period March - April 2006, 491 students from Medical faculty, Dentist faculty, Pharmacology faculty and Nursing College, University of Sarajevo, were interviewed. In this study authors were keen to know computer literacy of the students and its influence on quality of medical education

and further work of young physicians. At the time, out of 491 interviewed students, 235 did not have the opportunity to use the computer, 186 did not know, 49 students had opportunity but never used it, 19 used it rare and 2 students used faculty computers almost every day. It was very sad that students did not have opportunity to use computers commonly however, it was promising that almost 60% of student used IT to develop knowledge and improve education. Another discouraging result was that 70% of student about to graduate did not feel comfortable to work without help in family medicine units.

Based on the results of the survey main conclusions were:

- Reform of education system must be performed as soon as possible in accordance with needs and possibilities;
- Assure continuous quality of education (internal and external evaluation);
- Determine golden standards in education, what is a minimum of what graduate should have in terms of knowledge and skills;
- Adjust medical curriculums with countries in the region and in EU;
- Teachers and educators must be evaluated regularly;
- Student must be involved in all reform processes;
- Enlarge volume and content of the practical education;
- In accordance with available funds improve work of libraries and better equip classrooms.

These facts for us were basis as recommendations and proposals how to improve theoretical and practical concept and model, also topics, for medical informatics education in the future.

5. INFLUENCE OF BOLOGNA MODEL EDUCATION IN DEVELOPMENT OF MEDICAL INFORMATICS AT SARAJEVO MEDICAL FACULTY

Bosnia and Herzegovina signed the Bologna Declaration on 18 September 2003, and in the light of this new approach to university education, and the process of joining The European Union experts for Bologna model of education gave us to realize following aims: to determine the current level of knowledge among medical students at the Medical Fac-

ulty of the University of Sarajevo, to determine the level of knowledge among medical students before their enrolment at the faculty, and to find out students opinion on their needs for further education. They have remained dedicated to these aims (6).

Curriculum of the subject covers the following areas:

- Introduction to the Medical informatics, architecture of personal computers: their components and operating principles, biomedical signals, systems software and application software.
- Application software and usage-ready software packages used in medical data processing: MS WORD, ACCES, EXCEL, SPSS, as well the usage of other databases in statistical processing and the display of research results in healthcare.
- Qualitative and quantitative variables in medical research, means of creating data-carriers and data entry in the databases. Statistical processing of the entered data, by the usage of computer packages.
- Usage of the Internet in biomedicine, usage of biomedical databases in exploration of biomedical literature; clinical decision support systems and mobile clinical decision support systems.
- Means of preparation and display of textual form of the processed data, and preparation of the presentation with the same content. Demonstrating and practicing the creation of certain physical findings with the most important informational communication technologies (ICT) in healthcare. Creation of data-carriers for their storage in the modules of local information systems in healthcare.

Even today, the justification of implementing Medical informatics as an elective subject in medical schools remains uncertain. The polemics still persists on the importance of the subject, which remains by side in comparison to preclinical, extensive subjects. This cut is meant to draw attention to the need of attending and listening to Medical informatics in modern educational process, regardless of the fact that we are living in the modern world, which is constantly keeping us in a close vicinity to the information technologies, without which a modern-day life would have been unimaginable. (2, 3). In order to become familiar with the subjective attitude of the students in the University of Sarajevo's Medical Faculty, on the importance of this subject in their total medical knowledge and future work, we had conducted a survey, containing the relevant questions.

6. USE AND KNOWLEDGE ON THE INFORMATION TECHNOLOGIES IN MEDICAL EDUCATION - BOSNIAN AND HERZEGOVINIAN EXPERIENCE

Let us present some of our results of provided research about knowledge and attitudes of the medical students about ICT in medical studies. The aim was to analyze the use of IT in the prism of two systems, the old system and the Bologna system (15–26). Answers from questionnaires from total of 459 students (2012/13–2015/16 generation) were analyzed. During the academic year 2013/2014, Faculty of Medicine, University of Sarajevo it was conducted an observational, analytical study (15–16) The study included 154 students of the final year of study, 85 of those studying at the Bologna pro-

Figure 2. Decision for including ICT in Medical informatics projects

cess, and 69 of them attending the old system of education. The survey was conducted voluntarily by anonymous questionnaire consisting of 27 questions, divided into five categories, which are collecting facts about student's: sex, age, year of entry, computer skills, possessing the same, the use of the Internet, the method of obtaining currently knowledge and recommendations of students in order to improve their IT training. Students have self-evaluated their knowledge from 1–4 grades, where 1 is the lowest and 4 the highest review. Included in the group of the 154 students covered by this investigation 44.8% of them studied under the old system and 55.2% studied at Bologna process. Apparent differences in computer usage between the students of the two educational systems had been noted. All respondents confirmed that they own a computer and there is a possibility of using it at the college. The study showed a better understanding and application of user applications and tools by students of the Bologna process. The average score of students of the old system of knowledge of computer components is 2.73, 3.55 using of Word, Excel 2.3, 3.56 Power Point, Internet 3.5, knowledge of basic computer concepts 2.4, and overall knowledge 3.00. The average score of students in Bologna system of education of knowledge of computer components is 3.07, the use of Word 3.69, 2.53 Excel, Power Point, 3.68, 3.78, and Internet knowledge of basic IT concepts 2.68, and 3.24 overall knowledge. About 92% of students of the old system and 98% of students of the Bologna system use computer in everyday work (only 36% of old system and 47% of the Bologna system are using "faculties" computers). The computer is used for entertainment, education, information (via Internet) and for communication (e-mail, chat, and social networks) (68.5% of the old system and 84% of students of the Bologna system have chosen all 4 offered answers). MS Word and MS Power

Point are significantly more used compared to the use of MS Excel in both systems ($p < 0.05$). The knowledge necessary to use their computers student of both systems have acquired through individual work. Students feel that they need to improve knowledge of the treatment of sub-base (76% of students of the old system and 62% of students of the Bologna system). Having analyzed the generation of 2015/16, 84.5% of students of the Bologna system and 75% of students of the old system used smartphones or tablets. The purpose of using a smartphone is, in most cases for accessing the social networks. 77.4% of smartphone users of the Bologna system, or 73.3% of the users of the old system have installed an application from the medical field (15, 16, 22).

In February of 2017 the surveyed second-year medical students had been processed. The point was being held on the questions regarding their amount of computer usage in their work, the most common purpose of computer usage, their subjective evaluation of knowledge they possessed in information technologies usage, the fields in education they wished to expand their knowledge in, as well as their total satisfaction with the teaching quality of the staff (senior assistant, assistant professor, professor) in the subject Medical informatics. During the academic year of 2016/17, on the University of Sarajevo's Medical Faculty, a survey had been conducted, and it included 146 second-year students, who anonymously answered 27 questions divided into 5 categories. These five categories contained questions on the general info (age, sex), frequency and purpose of computer usage, means of acquiring the knowledge in computer usage, evaluation of the current capabilities in the computer usage, and questions on the possible improvements of education on the subject of Medical informatics. 66% of respondents are female. Regarding the computer usage in their work, 70% of the students use the computer in their work, 28% uses computers occasionally, and only 2% of the students do not use computers in their work. 43% of the students use computers for acquiring information, 31% for education, 13% use them for fun and 13% for communication. The least knowledge students possess in using the MS Excel, where 19% stated they knew next to nothing, and only 11% of the respondents believe to know almost everything. The majority of the students believed to know almost everything when it comes to using the Internet (74%). 58% of the respondents believe their knowledge of Microsoft Office Word to be excellent and are able to use all of its functions. Regarding the familiarity with the terms file, database, operation system, programming and software, the majority of the respondents is partly familiar, 38%. 24% of the respondents believe their familiarity with the terms to be excellent. Regarding the knowledge and usage of Microsoft Office PowerPoint program, 59% of the respondents believe to know and use it excellently. 70% of the respondents believe their knowledge of working with databases should be improved, in order to be ready for work in the primary healthcare. Regarding the teaching process evaluation on Cathedra for medical informatics, majority of the students finds it satisfying, 47%, while 19% of the respondents find it to be excellent.

Even though the processed students belong to the modern generation, which is in touch with the various hardware and software solutions on a daily basis, this survey shows that

the subject of Medical informatics should be inevitable in early years of medical education since, even today, the great number of students lacks adequate knowledge of basic software packages manipulation.

The fact is that the teaching process in this subject can be improved, and infrastructure (hardware and software) must be strengthened in order to improve the teaching process quality. Students must be provided with the adequate knowledge in database manipulation and processing, since 80% them will surely work in primary healthcare, where this knowledge is essential. It is necessary to set up firm foundations, and in later years, to additionally educate students in data processing, statistical software solutions, and to prepare them for the professional, as well as the academical work.

The conclusion was that the education in software solutions that are connected to databases processing, must be imperative in reform of the teaching process. IT can only improve the teaching process; the organization of the education system in most eminent universities is undeniably linked to information technologies.

7. MEDICAL INFORMATICS APPLICATION IN MEDICAL EDUCATION - E-LEARNING AS NEW METHOD OF MEDICAL EDUCATION

For the need of e-health, telemedicine, tele-education and distance learning there are various technologies and communication systems from standard telephone lines to the system of transmission digitalized signals with modem, optical fiber, satellite links, wireless technologies, etc. Tele-education represents health education on distance, using Information Communication Technologies (ICT), as well as continuous education of a health system beneficiaries and use of electronic libraries, data bases or electronic data with data bases of knowledge (2, 10).

The traditional static concept of medical education should be changed into the dynamic. A passive doctor who is to be compelled to education becomes a creative doctor focused on a problem he/she wants to solve in practice (*self-directed*). At the same time, medicine incorporates its part of electronic revolution. Expansive development of biomedical sciences put each doctor in a situation to get information on latest medical achievements with delay and apply a relatively out-of-date technique in treatment - meaning, he/she makes mistakes (2, 11).

We have recently been witnesses of an impressive progress of information and telecommunication technologies. The use of computers in medicine allows permanent data storage, data transfer from one work station to another, data searching and processing, data availability at any moment, monitoring the patient's condition during time etc. can significantly improve medical profession. Nowadays, medicine is one of the most intensive users of all types of information and telecommunication technologies. Fast and reliable data storage and transfer (text, images, sound etc.) ensures significant relief and improvement in almost all medical procedures. Moreover, data transfer to places remote from medical centres can be of invaluable use, especially in emergencies (2, 14).

Information technologies are becoming a tool today without which further education of both medical students and doctors is not possible, since the quantity of information

and the need for their fast search have become possible only by using these technologies. Today it can be freely claimed that a bad doctor is the one who does not use information technologies, because he/she does not know facts which might mean a lot to his/her patients in time.

Thanks to the growth of educational technologies and the Internet, the number of online resources available to educators has dramatically increased. Within medical education, repositories or digital libraries have been established to manage access to e-learning materials. Although few at this time, such repositories offer a vision of expanded access to a large number of high-quality, peer-reviewed, sharable e-learning materials.

Examples include the Association of American Medical Colleges' (AAMC's) MedEdPortal, a repository for curriculum and assessment materials organized around core competencies in medical education and populated with up-to-date, peer-reviewed teaching and assessment material. The End of Life/Palliative Education Resource Centre is a free-access repository of digital content for health profession educators involved in palliative care education (2, 14).

The Health Education Assets Library (HEAL) provides high-quality digital materials for health sciences educators and promotes the preservation and exchange of useful educational assets such as individual graphic, video, or audio elements, while respecting ownership and privacy. HEAL has begun a peer-review process for all e-learning materials submitted to the library.

The Multimedia Educational Resource for Learning and Online Teaching (MERLOT) is designed primarily for faculty and students of higher education (2). The service collects links to online learning materials, along with annotations such as users' reviews and assignments. MERLOT contains a growing science and technology section that includes health care education e-learning materials.

The International Virtual Medical School (IVIMEDs) is an international organization whose mission is to set new standards for e-learning in medical education through a partnership of medical schools and institutions, using a blended-learning approach. IVIMEDs hosts a repository for use by its member medical schools. Most of the materials in this repository are free to use, although some materials have clearly defined conditions for use.

Tele-education and distance learning in Bosnia and Herzegovina has made a great progress (11, 14). Possibilities of introduction of distance learning in medical curriculum are the title of project which has been realizing at Department of Medical Informatics, Medical Faculty since year 2002. The Project was approved by Federal and Cantonal ministries of science and education. The purpose of this project was to support improvement educational process at biomedical faculties using contemporary methods, methodologies and information technologies in accordance with strategy and objectives given by Bologna declaration. The pilot project realized during five years, the theoretical and practical parts of the subject Medical Informatics are adapted to modern concepts of education using world trends of distance learning. One group of students from the Medical Faculty was involved in this project, which was finalized by electronic registration of an exam and electronic testing on 20 June 2005, in public

in the Physiological amphitheatre of the Medical faculty in Sarajevo. (11, 14, 24, 25, 26). The Cathedra of medical informatics and the Cathedra of Family medicine at the Medical Faculty of the University of Sarajevo started to use web based education as a common way of medical students teaching. Lecture contents are presented in a virtual classroom. In this "classroom", learning materials, power point lecture presentations as well as practice exercises with step-by-step instructions, are easily accessible to students. Moreover, on this web site, students will be able to find subject relating literature as well as the English version of the presentations. Satisfaction with this method of education within the students is good, but not yet suitable for most of medical disciplines at biomedical faculties in Bosnia and Herzegovina.

Platform of the course for distance learning was established in collaboration with University tele-information Centre (UTIC). UTIC, established as part of University of Sarajevo and first ISP in Bosnia and Herzegovina in 1996. It is a scientific-organizational unit of the University of Sarajevo for improvement of scientific-research work (11, 14). UTIC's objectives are among many to develop an integration of of informatics computer technologies in education, to create flexible infrastructure which will enable e-Learning to be accessible to all student at the University of Sarajevo, improvement of digital literacy of academic population, development of top educational content which could be integrated in the actual European process of e-learning revolution. With their help centre for distance learning "LUCIS CENTRUM" was created (11).

On UTIC web site, students enrolled at Medical Faculty, are able to learn from distance about Medical Informatics subject. Besides the learning material it is possible to upload and download the following: practical and seminar works, links, plan and program, quiz, schedule examination results.

The website was tested for the first time during the symposium "Tele-education in biomedicine", at the Cathedra for Medical Informatics, Medical Faculty, University of Sarajevo in the year of 2002 (11, 14). Leader of this activity was electro-engineer Safet Jakupovic, UTIC manager. By this occasion it was held tele-lecturing in duration of 90 minutes. It was start of the project "Learning from distance in biomedicine". Izet Masic was leader of that project at Medical faculty in Sarajevo, and the project was financed by funds of the cantonal Ministry of Science and Education and the Federal Ministry of Science and Education. Experiences from this project were presented at number of world and European scientific events and published in a few articles (16-21, 24, 26).

8. HEALTH INFORMATICS IN MEDICAL EDUCATION – BENEFITS IN THE FUTURE

Information technologies (i.e. ITs) have the capacity, more than any other medium, to facilitate student learning and problem solving, in addition to many other benefits, which include (2):

E – LEARNING, which encompasses all forms of electronically supported learning, such as web-based learning, learning with computers, virtual classrooms and digital collaboration?

INTERACTIVE CLASSROOMS that allow students to actively work with the dynamic content, rather than pas-

sively listening to the teachers. They provide students not only with the dynamic study and work environment, but with a word rich in resources, while simultaneously being adjustable to the various learning and teaching styles. They include equipment such as: interactive panels and pens, cameras, multimedia projectors, wireless electronic board, devices for student answers ("clickers"), electronic notebooks for joint learning, as well as numerous other pieces of interactive hardware.

COMPUTER SUPPORTED INDEPENDENT STUDY PROGRAM OF BASIC MEDICAL SCIENCES, which should allow students to independently progress through the curriculum, based on their level of knowledge and competence.

DISTANCE LEARNING, which is commonly being used as the synonym for "Web-based learning", but has its own context and definition: "Distance learning is planned learning that takes place at the remote site of teachers, and as a result requires special techniques, curriculum design, special instructional techniques, special methods of communication, as well as special organizational and administrative arrangement(s)" (Moore and Kearsley, 1966). Forms of distance education include: individual participation, teleconference, tele-seminar(s), web conferencing, electronic classrooms, etc.

WEB-BASED LEARNING is characterized by the separation of teachers and students (no longer in the process of teaching face to face), the existence of educational organizations (as opposed to self-education or private tutoring), use of Web technology for presentation and distribution of educational content, providing two-way communication over the Internet, so that students can communicate with each other, with teachers and faculties' administration. Since the 1990s, it has become an important branch of educational technologies.

VIRTUAL CLASSROOM, a form of computer based education, where the teacher communicates with students through video-conferencing, internet or e-mail.

INTERACTIVE DISTANCE LEARNING, where students solve tasks by choosing one or more correct answers. Answers are then displayed after pressing the "submit" button. Students are provided with the correct answers, as well as the explanations to why certain answers are wrong.

9. INSTEAD CONCLUSION - PAST ACCOMPLISHMENTS IN THE FIELD OF MEDICAL INFORMATICS IN BOSNIA AND HERZEGOVINA

In 2017, the health informatics profession in Bosnia and Herzegovina celebrated five jubilees:

- Forty years on from the introduction of the first automatic manipulation of data. In Sarajevo 1977, under the supervision of Fuad Secerbegovic, MD, Chief of the Department for Health Statistics, Republic Institute for Public Health BiH in, the company - "Energo-invest" Ltd. carried out the first analysis of summary and periodic health data reports about the network, capacities and performance of the healthcare service in Bosnia and Herzegovina.

- Thirty years on from the establishment of the Society for Medical Informatics BiH. In October 1987, the above named Society was established by a group of enthusiasts and pioneers of health informatics in BiH (Izet Masic, Irfan Zulic, Arif Agovic, Marijan Dover, Mladen Novak, Zoran Kontic and others).
- Thirty years on from the establishment of the Scientific and Professional Journal of the Society for Medical Informatics of Bosnia and Herzegovina "Acta Informatica Medica" (www.actainformmed.org). From the year 2008 articles published in Acta Inform Med are indexed in PubMed, PubMed Central, Scopus and 20 other on-line databases.
- Twenty five years on from the establishment of the first Cathedra for Medical Informatics on Biomedical Faculties in Bosnia and Herzegovina.
- Fifteen years on from the introduction of the method of "Distance learning" in medical curriculum.

All five of the mentioned activities in the area of health informatics had special importance and gave appropriate contributions to the development of health informatics in Bosnia And Herzegovina. The Society for Medical Informatics of Bosnia and Herzegovina gathered the most eminent experts, mostly medical doctors with various specialties. BiH Society became a member of European Federation of Medical Informatics – EFMI during the war in 1994, and in the same year, a member of the International Medical Informatics Association – IMIA. In 2009 the Society for Medical Informatics of Bosnia and Herzegovina were given the opportunity to organize the 22nd European Congress of Medical Informatics in Sarajevo announced as "the best ever MIE". At Sarajevo Conference participated more than 420 experts of Medical informatics from more of 40 countries from over all the word. Also, pioneer of Medical informatics in Bosnia and Herzegovina, and one of pioneers of Medical informatics in countries of SouthEastern Europe, professor Izet Masic, in 2016 was elected as Honorary Fellow of European Federation for Medical Informatics and Fellow of American College of Medical Informatics, and in 2017 he was elected as inaugural member of International Academy for Health Sciences Informatics. It was award for everything what he has done in the past for development of Medical informatics in Bosnia and Herzegovina and Europe as academic and scientific biomedical discipline.

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