E-LEARNING A VÝZNAM PŘEDÁVÁNÍ INFORMACE STUDENTŮM A PACIENTŮM V MNOHOJAZYČNÉM PROSTŘEDÍ (CZE)

E-LEARNING AND THE IMPACT OF INFORMATION DELIVERY TO STUDENTS AND PATIENTS IN MULTILINGUAL SETTING (ENG)

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Abstrakt

Internet hraje velmi důležitou roli ve výukových programech a v šíření poznatků. Ukážeme několik příkladů jak využít Internet a Web 2.0 e-learningové nástroje v postgraduálním doktorském a celoživotním vzdělávání. V lékařství a zdravotnictví jsou tři hlavní oblasti, kde byly použity e-learningové nástroje: při vzdělávání lékařů, v translačním výzkumu a ve zdravotnické osvětě. Ukážeme některé e-learningové nástroje jako interaktivní knihy, interaktivní programy a systém pro hodnocení znalostí ExaMe na příkladech z oblasti zubního lékařství. Představíme rovněž problém přenosu znalostí v různých jazycích při použití internetového časopisu European Journal for Biomedical Informatics.

Klíčová slova: e-learning, znalosti, hodnocení, šíření

Abstract

Particularly important in educational programmes and knowledge dissemination is the role of the Internet. We show several approaches how to use Internet and Web 2.0 based e-learning tools in doctoral and lifelong education. Within the fields of health and medicine there are three main areas, where the e-learning approach has been applied: medical training, research translation and health literacy. We show some e-learning tools, especially interactive books, interactive programs and system ExaMe, using examples from the field of dentistry. We also concern with problem of transferring

knowledge in different languages using Internet based European Journal for Biomedical Informatics.

Key words: e-learning, knowledge, evaluation, dissemination

Introduction

Educational programmes in the area that we nowadays refer to as biomedical informatics cover topics from the field of medical informatics, healthcare informatics and bioinformatics. The conceptual roots of such programmes lead back more than thirty years and the programmes are well established in many countries. The leading role in promoting activities concerning education in biomedical informatics has been given by the International Medical Informatics Association (IMIA) at MEDINFO congresses, special topics conferences and activities of the IMIA working group on Health and Medical Informatics Education. This working group initiated the development of the first IMIA Recommendations on Education in Health and Medical Informatics [1] translated till now into Spanish, Chinese, Italian, Turkish, Czech, and Japanese languages. These recommendations were updated and the second version published in [2]. Let us mention at least the IMIA conference on medical informatics education held in Prague 1990. It brought together participants from 18 countries and the „Knowledge, Information and Medical Education“ proceedings [3] contained more than 60 selected contributions and covered the role of informatics in the medical curriculum and experiences existing in many medical faculties all over the world. During the 58th World Health Assembly held in Geneva in May 2005, the Ministers of Health of the 192 member states of the United Nations approved the so called *e*Health Resolution [4] that officially recognizes the added value of the information and communication technologies for health purposes. *e*Health technologies opened the doorway to a new type of medical services where healthcare professionals are able to utilize them fully for prevention and management of diseases, lifelong learning and communication with colleagues and patients. Moreover, education and use of *e*Health technologies can help to change a passive attitude of patients against their diseases towards a proactive attitude of informed citizens for managing their own health.

Particularly important in educational programmes and knowledge dissemination is the role of the Internet and mainly – from the beginning of the 21st century – the 2nd generation of web services known as Web 2.0. Thanks to rising availability of the Internet and opening of the World Wide Web as a publication, sharing and collaboration platform to wide masses of learners, we have witnessed a shift of e-learning towards so called *e-learning 2.0*, see e.g. [5]. Within the fields of health and medicine there are three main areas, where the e-learning 2.0 approach has been applied:

Medical training: Web 2.0 tools and services have been used in undergraduate medical education, as well as lifelong professional education in medicine (continuing medical education, CME). One of many examples is database of clinical cases and images, ClinicalCases.org, which is running on blogging software. A lot of useful teaching material is available through wiki software.

Research translation: Web 2.0 tools and services have been employed for improvement of scientific medical information resources, as well as for development of new information sources for professionals in health care and medicine. Dissemination of new information facilitated by viral effect, which is produced by social networks, is indispensable for effective translation of research findings into clinical practice and into the process of lifelong learning of professionals. There are a lot of applications offered by traditional information providers, reputable institutions, as well as new “start-ups”. For example The Cochrane Collaboration offers podcasts and Twitter messages on latest systematic reviews. It also communicates about its activities and events on Facebook. Most of medical information sources provide RSS feeds, some of them are accompanied by blogs. Number of social networks around medical databases rises.

Health literacy: Improvement of health literacy of people has positive impact on prevention of diseases and supports active role of health care consumers in keeping their health and making decisions about their treatments (i.e. shared medical decision-making). Web 2.0 applications have been harnessed in construction of laymen-oriented health and medical information resources, which enable people to be well informed and to make informed decisions. There are educational portals providing podcasts, RSS feeds, blogs and/or connections to social networks (e.g. GetHealthyHarlem.org).

New approaches and e-learning tools, applied to the doctoral programme in biomedical informatics running at Charles University in Prague and to lifelong education, are introduced and discussed. The studies are given in Czech and English languages. Full-time courses in doctoral studies in the field of biomedical informatics last for four years as a minimum. A full-time doctorand has the status of a student of Charles University in Prague with all the respective juridical and social consequences. The requirements for successful completion of the study are:

to pass the state doctoral examination in chosen field,

to defend a thesis, compiled on the basis of own published papers.

The graduates are awarded the academic degree "doctor" (abbreviated as Ph.D. after the name).

Education and Training in Biomedical Informatics in Doctoral and Lifelong Education

Education and training in biomedical informatics at Charles University in Prague have been developed in cooperation with the Academy of Sciences of the Czech Republic. Its roots are coming from the knowledge gathered in several European projects and knowledge available from national and international contacts with universities, research organizations and the working groups concerned with education and training in the International Medical Informatics Association (IMIA) and the European Federation for Medical Informatics (EFMI). Further we introduce selected e-learning tools used in biomedical informatics courses and we stress the multilingual approaches for knowledge dissemination.

EuroMISE Courses

Several biomedical informatics courses for doctoral programmes and lifelong education are given by teachers of the EuroMISE Center, the join workplace of Charles University and the Academy of Sciences of the Czech Republic. The EuroMISE Center (European Center for Medical Informatics, Statistics and Epidemiology) was established in 1994 in frame of the European project with acronym EuroMISE. The project focused on education in the methodology field of healthcare [6], namely on education in medical informatics, statistics and epidemiology. EuroMISE courses developed in the project were given in English to participants from Central and Eastern European countries in the period of 1994-1998 and more than 120 certificates were passed in the Charles University Aula Magna for successful completions of the courses to participants from these countries. Further teaching materials in English were developed in frame of the project IT EDUCTRA (Information Technologies in Education and Training) with versions in German, French, Spanish, and Czech languages [7]. The European projects, textbooks on biomedical informatics education, e.g. [8], [9] and experience with education of biomedical informatics on different levels gathered from relevant literature and conferences, e.g. [10], [11] influenced the nowadays shape of biomedical informatics courses. In the period of 1998-2009 there were 558 participants in different courses for lifelong education and doctoral programmes. 501 of participants completed the courses successfully. Further we summarize the teaching approaches and e-learning tools supporting the biomedical informatics education.

E-learning Tools

E-learning tools can support lifelong education and doctoral programmes in biomedicine. E-learning, understood as the use of information and communication technology to support and enhance learning practices, has, no

doubt, a great impact on learning processes. The main reason for use of e-learning tools is related to flexibility in time and place, limitations of cost and possibility to use e-learning tools by students in their own place and time. We use both, the general e-learning tools available on the Internet and the e-learning tools developed at the EuroMISE Center as it follows:

interactive electronic books,

audio presentations of the lectures and videofilms,

system Bayes,

system TECOM,

system ExaMe.

Interactive electronic books

Based on the knowledge gathered from European projects the EuroMISE Center has started to develop two editions named “Biomedical Informatics” and “Biomedical Statistics” of books in the Czech language. The books are published by the Carolinum Printing House of Charles University in Prague and some of them are available in pdf formats for registered users on http://www.euromise.org/education/textbooks.html . Interactive versions of the books are available only for teachers and students in the courses. Till now three books have been issued in *Biomedical Statistics* edition and four books in the *Biomedical Informatics* edition. The knowledge in these books can be evaluated using the system ExaMe described further.

Audio presentations of lectures and videofilms

Audio presentations of lectures given in five courses with different biomedical informatics topics were developed. Participants of the courses receive relevant lectures for their course on DVD as the material for self-study. The biomedical informatics courses are also enriched by videofilms. For example the videofilm on electronic health record can show an e-health application running at the University Hospital in Motol presenting the lifelong voice controlled dental cross based on structured electronic health record [12]. Other videofilms show interoperabilitiy issues on transfer of data between the hospital information system in Caslav and an ambulance or information and organizational features of kiosks working at out-patient cardiology clinics in Caslav or at policlinics in Prague.

System BAYES

The system *BAYES* helps to explain the Bayesian approach to the design of research studies in health sciences. The central idea of the Bayesian method is

the use of study data to update the state of knowledge about a quantity of interest. In study design, the Bayesian approach explicitly incorporates expressions for the loss resulting from an incorrect decision at the end of the study. The software tool demonstrates the Bayesian approach by generating numeric examples and thus helps students to understand the basic principles of the method including sensitivity and specificity of a test, prevalence of a disease, the ROC curve, etc.

System TECOM

The *TECOM* system supports teaching of medical decision-making. It utilizes data obtained in the process of treating patients and collected in the database. Students are asked to decide the correct diagnosis of a patient from the database. Students have to choose appropriate questions and from their answers they have to give their subjective probabilities of various diagnoses. The diagnosis with the highest subjective probability is considered as the final decision. The results are evaluated by the traditional error rate technique (percentage of false and correct decisions) and by a prediction coefficient, which measures quality of decision-making processes. The *TECOM* system can help clinicians to reveal more explicitly their decision-making competencies and enhance their medical knowledge from cases and correct decision stored in the database. The use of the *TECOM* system for decision-making in cardiology is demonstrated through the database of real cases diagnosed at the Municipal hospital in Caslav.

System ExaMe

Since 1998 the ExaMe system for evaluation of a targeted knowledge has been developing [13]. The idea of the system is based on *generalized multiple-choice questions*, with no prior restrictions on the number of given answers. The only restriction is that at least one answer is correct and at least one wrong. This new idea has led to new concepts of standardization of test results and also to new research problems in statistics. Evaluation by the ExaMe system is performed using fixed or automated tests. A *fixed test* is appropriate for evaluation of a group of students in a computer classroom connected to the Internet. An *automated* test is appropriate for self-evaluation on remote places. Students can pass evaluations by automated tests by themselves and the final results of the tests are displayed immediately. The displayed results give also explanation to students why some answers were not correct. The ubiquity of the Internet and its World Wide Web applications made it possible to realize the new educational goals in an innovative and creative way.

Experience from biomedical informatics courses running in the last years confirmed great advantages of this *e*-learning tool for students, e.g.

- easy availability 24 hours daily, because the ExaMe system is an Internet application and the only interface between the ExaME system and its user is the web browser,
- evaluation of knowledge by self-study using Automated tests of the ExaME system with attached explanation of wrong answers. The automated test and attached explanations of wrong answers in the ExaME system lead to deeper understanding of course materials,
- access of students to all results of their tests evaluated by Automatic tests during the course duration as well as for teachers and course organizers,
- easy administration of a course, the possibility to follow results of students not only during the course but also during their self-study,
- possibility to adjust difficulty and evaluation of a test to a purpose of the course and consider different target groups of students in the course.

Web 2.0-based e-learning tools

We have been developing several Web 2.0-based tools suitable for e-learning at the EuroMISE Center. We cover all three areas of applications as they are described in the previous text. Firstly, we provide information on scientific medical information resources and evidence-based medicine, suitable for both undergraduate and lifelong medical education. Secondly, we have been developing system supporting translation of scientific knowledge into clinical practice, and thirdly, we provide information aimed at improving healthy decisions of people.

Blogs

We have been building up four educational sources, both in Czech and English, based on weblog software Blogger. Three of them are password protected, intended for medical students, doctors, and medical information specialists. The fourth, open blog, is aimed at provision of health related information to laymen. We appreciate flexibility and ubiquity of Blogger system (if an Internet connection is available), so that a teacher can easily update the content when necessary and users can browse it conveniently, without time and place limitations.

CLI*NEWS*

CLI*NEWS* stands for Clinical Evidence News. It is an application based on principles of evidence-based medicine and Web 2.0. The application is framed as an online RSS reader and a database of chosen types of articles from the medical database MEDLINE/PubMed. Tracked documents are randomized controlled trials, systematic reviews with meta-analysis, and clinical practice guidelines. Records are filled in twice daily and they comprise bibliographic data, most of them with abstracts, further they include links to full texts of articles and to related articles in the database MEDLINE/PubMed. The articles are sorted in accordance with MeSH terms. Relative frequencies of MeSH terms assigned to the articles are visualized as a tag cloud. Below the entries, there is possible to put comments and to rate the articles using a 5-star scale. The application is linked to web services providing social bookmarks, including tools for storing and sharing scientific publications like Connotea, CiteULike and Bibsonomy. Beta version of CLI*NEWS* is presently available at http://neo.euromise.cz/clinews.

European Journal for Biomedical Informatics

The European Journal of Biomedical Informatics (EJBI) is reacting on the great European need to share the information in the multilingual and multicultural European area. EJBI (www.ejbi.eu) opens for the field of biomedical informatics a new model of electronic publishing. EJBI is publishing accepted peer-reviewed papers in English and other European languages simultaneously. This opens new possibilities for faster transfer of scientific-research pieces of knowledge of many European countries to a large international community of biomedical researchers, physicians, other health personnel and citizens. Moreover, the journal enables to make results of scientific-research work and practical experiences of foreign specialists accessible to wider health public in a more comprehensible way in each European country and contributes to unification of applied scientific terminology. The aim of the journal is to reach the high scientific level and to show the best practices of biomedical informatics applications to wide readership.

Conclusions

Internet and Web 2.0 based e-learning tools are quickly changing the traditional way of education, training and knowledge dissemination. There are many data and knowledge sources and increasing possibilities for their use in education and training mainly in English language. Multimedia linked to clinical cases can be stored in digital educational libraries [16]. However, the use of these sources in national languages is also very important. We describe the

current courses in biomedical informatics held in Czech and English languages and we are showing the knowledge transfer in other European languages than English using the European Journal for Biomedical Informatics.

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