

European Project For Education In Osteosynthesis For Surgical Management Of Fractures For Orthopaedic Surgeons And Biomedical Engineers

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Abstract

With the new developments in biomedical engineering and information and communications technology raised the needs of training on modern aspects of computer assisted surgery and new surgical techniques and implant models. In this paper, a European project on transfer of innovative approach and courses for training of medicine professionals (residents, surgeons) and engineers involved in implants development and manufacturing and disseminating the new approaches to diagnosis (image processing and analysis) and in orthopaedic surgery is presented.

Keywords: higher education, orthopaedic surgeons, biomechanical engineering.

INTRODUCTION

The European eHealth strategy is to continuous and sufficient education of healthcare specialists on information and communication technologies (ICT) usage and to building working telemedical applications etc. "The expansion of the knowledge base is accompanied by an unprecedented speed in transformation of frontier scientific inventions into practical use and products.... As probably the most promising of the frontier technologies, life sciences and biotechnology can provide a major contribution to achieving the European Community's Lisbon Summit's objective of becoming a leading knowledge-based economy" [1]. The European Council reconfirmed the strategic goal for the European countries to become the most competitive and dynamic knowledge-based economies in the world and enforced the accelerated development of Information society and ICTs. The implementation of e-Health is an important component of the information society and was acknowledged as one of the main priorities in the European development plans. Agenda for new skills and jobs [2] states: "By 2020, in the health sector a shortage of about 1 million professionals - and up to 2 million if ancillary healthcare professions are taken into account is estimated, i.e., 15% of the care needed in the EU." The importance of lifelong learning in the health sector was stressed in the Europe 2020 strategy [3]: "Improving access to lifelong learning and expanding occupations such as those emerging from 'sustainable growth' policies and 'white' jobs (medicine sector)".

So, there is a need of new environments for predictive, individualised, evidence based, more effective and safer healthcare and the physicians and the other staffs in health sector need to be trained to work with them.

In this paper, a European project on transfer of innovative approach and courses for training and disseminating modern aspects of diagnosis (image processing and analysis) and in orthopaedic surgery is presented.

Why was this project designed?

Osteoporosis is the most common cause of fractures, due to bone mass reduction and increased bone fragility. A significant increase of fracture cases is expected in the coming years as a result of population aging and increased life expectancy. In 2000 3,8 million fractures were registered in Europe due to osteoporosis. Associated public health expenditure was 32 billion euro and this expense is estimated to reach 77 billion in 2050. The incidence of lower limb fractures in traffic accidents is widely documented: in Europe, 4.5% of the individuals suffering from a car accident have a fractured femur. This translates to 90000 cases a year, of which 75% require surgical treatment. In 2008 fixation devices were used in approximately 420000 surgeries in Europe, associated with costs of more than 4,8 billion euro. A significant portion of these costs (15%, 720 million euro) depends on re-interventions that are necessary to address failures of surgical techniques, usually caused by errors in the diagnosis of the fracture, in the selection of implants or preoperative planning. The increasing demand coupled with the large number of failures of surgeries has caused the following problems in the field of Orthopaedic Surgery and Traumatology:

- increased pressure by patients and patient organizations to improve quality and prevent errors;
- continuous introduction of new surgical techniques and implant models, many of them being not well known to surgeons;
- need of better trained professionals able to address the growing demand in the field.

To respond effectively to these increasingly stringent demands it is essential that surgeons, biomedical engineers and residents can count on one hand on the latest knowledge in the art of biomechanics and application of implants and on another hand to upgrade their education with the objective to refine and adapt surgical techniques.

Other European projects aimed at training e-skills in the healthcare sector

The PEDITOP project (www.peditop.com) was aimed at developing a pilot format for a comprehensive on-line education and training system, with the relevant interactive facilities, and exploiting continuous feedback from paediatric professionals. By concentrating on on-line delivery and interactivity, there was full potential for continuous update. Along with the development of teaching materials, the project is concerned with the creation and integration of appropriate software and platform for on-line education in this field. The continuation of this project was MEDITOP-EU - International Virtual Classroom for Health Care Professionals [4] (http://leonardo.ec.europa.eu/pdb/detail_en_2000.cfm?Numero=6170002&Annee=2006).

Other two projects "Improvement of the Quality, Effectiveness and Efficiency of Healthcare Services" and "Vocational education and training for quality of life through e-healthcare & well-being" (http://leonardo.ec.europa.eu/pdb/detail_en_2000.cfm?Numero=6177443&Annee=2006) [5] target healthcare managers and administrators, healthcare and social health personnel, doctors who want to master management in healthcare. They were aimed at collaborative quality function deployment of the Virtual HealthCare Quality Centre; development of VET modules on: "e-Healthcare Organisation and System management" and "Healthcare Economy", and one module for training of general public, "Quality of Life and Well-Being".

EU EBM Unity – European Union Evidence Based Medicine Unity (http://leonardo.ec.europa.eu/pdb/detail_en_2000.cfm?Numero=5162349&Annee=2005) [6] tended to improve transparency, efficiency of practice and health outcomes across the European Union (EU) Healthcare sector through the promotion and pilot of a EU qualification in Evidence Based Medicine (EBM) for medical practitioners. A core EBM curriculum that is integrated into clinical practice- combining work based and classroom/home training will be developed. The project aimed to establish a pan-European assessment of current medical training (at Foundation level 2) and the already described European Qualification, which addresses training experience and accreditation issues for one of the potentially highly mobile employee groups in the EU.

This project was followed by "Evidenced Based Medicine: Training the trainers across the healthcare sector" (<http://www.adam-europe.eu/adam/project/view.htm?prj=4450>) [7] which product is a complete e-learning package. E-learning sessions were designed to allow learning in the workplace during short breaks within clinical activities, with the option to interrupt and restart learning flexibly. The learning objectives and outcomes were to help participants learn how to identify their trainees' knowledge gaps related to current clinical practice and to use these

to initiate EBM teaching. Each module includes an e-learning course that outlined the basic prerequisite EBM competencies to be acquired by participants. The clinical setting is described taking into account the variation in practice between different healthcare systems. Practical advice is provided on facilitating teaching of the various EBM steps with videos demonstrating EBM teaching in action.

PROJECT DESCRIPTION

The consortium consists of orthopaedic surgeons, experts in biomechanics, experts in educational technology and e-learning materials development, institutions providing continuing education for professionals in mechanical engineering and in orthopaedics.

The new courses allow medical students and residents to update and expand their knowledge of the biomechanics of fractures and fixation techniques, and engineering students to acquire knowledge that will result in improved design implants.

Objectives

This project is aimed at adapting and integrating innovative training courses and results from previous Leonardo da Vinci project into continuing VET of medicine professionals (residents, surgeons) and professionals involved in implants development and manufacturing to respond to the needs defined above.

To this overall aim, the project will work toward achieving the following specific objectives:

- Identifying and analysing the needs of biomedical labour market, of biomedical engineers, orthopaedic surgeons, managers, residents in the sector.

This objective addresses the priority of making VET more responsive to labour market needs for “white” jobs and of training of healthcare professionals. In Bulgaria there is no formal education of biomedical engineers either education in biomechanics for orthopaedic residents and surgeons.

- - Selecting and analysing the e-learning innovative content to meet these needs and upgrade the content with the new developments in the sector.

This objective addresses the need of training new skills for the “white jobs” and for improving access to lifelong learning, to help people move to high-value added sectors as the medicine sector and the biomedical engineering services for the sector.

- - Adapting, upgrading and implementing the Osteoform e-learning materials to the legal framework, training system, and language in Bulgaria and Greece and to the needs of target groups in all partner countries.

Each country has its own regulations, training practices and certification rules and this objective addresses the specific needs in the target country for the transfer of innovation. At the same time, the European collaboration will help to share experiences and best practices in osteosynthesis and can help the EU to harmonize the training of professionals and to progress towards some qualification standards.

Target users

Target groups, which will benefit directly from the outputs/products and activities of the project, are the physicians – specialists in orthopaedics, anaesthetists, surgeons, teachers and students in medicine, medical managers and the doctors from remote regions particularly. They all need courses for continuous (lifelong) training on the use of ICT for their specific purposes, e.g. systems targeting specific clinical needs such as prediction of diseases, early diagnosis, disease quantification, surgery planning, treatment and training.

With the new developments in biomedical engineering and information and communications technology raised the needs of training on modern aspects of computer assisted surgery in the public health care sector. In particular, new developments in applications ranging from image processing to robotics lead to new approaches to diagnosis (image processing and analysis) and minimally invasive surgery (arthroscopy).

The students in biomechanical engineering and their teachers are also target group in this project. They need courses providing knowledge about the subject of the devices they are developing. They can not assist at real surgeries, so the virtual courses will correspond to their needs.

Potential users are physicians in all specialities, medical managers, students in medical high school (colleges) who need to be prepared to use and work in the eHealth environment. They could benefit from the results of this project which courses in orthopaedics will serve as a pilot for developing an improved system of learning using the approach of performance support systems. The experiences gained and the lessons learnt within the project would be useful for the ICT experts developing eHealth systems, e.g. the Bulgarian National Health Information Foundation.

OSTEOform system

The OSTEOform represents an e-learning platform with training courses specialized in the field of bone fractures and osteosynthesis, as well as permanent access to practical modules that allow trainees to improve their knowledge. This initiative is focused on long bones fracture, and their diagnosis and treatment, including implants used in their restoration. OSTEOform also supports a database of anonymous cases that is continuously updated with pre-surgical and postsurgical patient information.

The system offers:

- Specialized training courses:
- A database of anonymized clinical cases.
- A virtual community of skilled professionals (discussion boards, chats, faqs, blogs, etc).
- Usage of the simulation services with generic implants.
- A tool to practice bone fracture analysis

Within the OrthoBioMed project we transfer in Bulgaria and Greece the integrated in OSTEOform materials from the best in the field European centres, offering trainees the opportunity to gain knowledge on the subject of osteosynthesis from very different points of view such as the clinical and biomechanical.

Work in progress

Within the project, we have identified and analysed the specific requirements of orthopaedists, surgeons, medical staff with regard to the stage of development of eHealth systems in each partner country. Based on the requirement analysis, orthopaedics specialists have determined the training content and have developed the presentation scenarios of the training courses with regard to the development of evidence-based medicine.

All partners transferred their knowledge, text-based learning materials, case studies in a telematic environment for continuing education of surgeons, residents and engineers in osteosynthesis. It was based on the knowledge and results of activities carried out by the consortium members. Among them:

- Generation of teaching materials for courses taught in doctoral and MSc programmes in osteosynthesis of biomechanics;
- Books biomechanics of bone fracture and repair techniques;
- A database of clinical fractures. It can be used as a training tool of diagnosis, the trainee may use the Internet through the analysis of practical cases based on real clinical cases, and this will result in better training of surgeons with reduced learning time and less need for face clinical sessions;
- Created finite element models of long bones and major osteosynthesis implants. These models can provide the mechanical behaviour of the implant, once implanted in a patient. The educational materials improve the understanding of the mechanisms that underlie the osteosynthesis techniques, helping surgeons in selecting the most suitable implant for each clinical case and engineers in the design process and improving existing products.

The theoretical modules have been adapted for the needs of end users in Bulgaria and Greece, while the practical modules (which include simulation models adapted for teaching application and the database of real clinical cases) will allow the implementation of training foreground. By using real clinical cases and biomechanical simulation

models in the case studies, the trainee will understand better the case and the visual presentation will reinforce the theoretical basis.

From January 2015 started the pilot test of the system with 22 trainees from the participating countries, residents, doctors, engineers. It ended in March 2015 and some improvements of the system shown to be necessary during the test, have been done. The last six months of the project are devoted to the implementation of the system – field trial with larger audience from all target groups.

The expected added value of this project is in the improved quality and attractiveness of the continuing professional education in the target countries by transferring existing innovations to new geographic environments and across the sectors of medicine and engineering, through working with transnational partners.

Evaluation

The purpose of the evaluation within the project is to serve decision making but its main goal is to help core developers and the new users in the improvement of the product and development process. It is more oriented to the end users, i.e. to obtain feedback to help developers to improve the products and services as well as to optimise the development process through early diagnosis of defects, to reveal of unforeseen circumstances in the learning environment, to insure better communication in the development team, to measure whether training objectives and trainees' needs have been achieved and that results could be used for decisions about the implementation and dissemination of the products and for new training modules development.

Expert reviews and design walkthrough in the early stages of materials design and prototypes production provided information and corresponding feedback to developers for ensuring the quality of content and usability aspects of prototypes, and to validate the efficiency of chosen methods and media as early as possible.

To meet the users' needs a prototyping approach was used in the environment and course adaptation/upgrade and a large audience is being involved in the pilot tests. The representatives of the decision-makers are being invited to all project meeting and in the pilot test. Trainees were involved in the evaluation process when the first versions of prototypes were ready. Interviews and questionnaires to gather data on learners' attitudes and opinions will be used.

It was very difficult for the doctors to work with the software, so every medical institution has been working with a partner institution in engineering or in information technology.

Quality assessment is based on a careful procedure of self-evaluation by the institutions involved in the project followed by external evaluation by peers. The external peers test whether the self-evaluation has been done carefully. They will report their own conclusions and recommendations.

EXPLOITATION, follow-up

After the pilot test and the final improvement of the environment and the courses, they will be incorporated in the regular training practices of the partner institution from universities and hospitals. To be used in the day-to-day practice in these institutions, the courses will be updated every 12 months correspondingly to the rate of technology development in orthopaedic surgery and new implants technologies.

The Web-based training materials will be implemented in the regular courses in the medical schools at the Medical Universities of Thessalia and Plovdiv and in Technical University of Sofia and in the lifelong training activities of practicing physicians in the hospitals.

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