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MANAGEMENT OF ON LINE LEARNING PLATFORMS IN MEDICAL EDUCATION

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Abstract

Learning on the Internet by the "e learning" method, fundamentally changed the way by which doctors can get information and be involved in educational activities designed to ensure their continuous medical education. The present paper wishes to offer a general overview of Web-based learning in Medical Education based on the research, results and experience gained by an international partnership in 2 LDV projects and one in development Erasmus + KA2 project. The challenge of our projects was to offer innovative courses for medical professionals by a flexible, attractive and focused e-learning training pathway based on online courses and real case studies. The target group addressed was formed by medical professionals that improved their competencies in Ultrasound within project e-EDUMED, and Human Movement Analysis, Orthopaedic and Rehabilitation issues in projects ORTHO e-man and COR-skills. The innovation of the projects consisted in the development of online courses by the use of a new methodology (Problem Based Learning) and a virtual environment with open Source technology (Open Source online Platform). Innovation was added by Multimedia Lessons in HTML and flash format, virtual classes, a visual Authoring Tool and Keyword-guided Clinical Case search tool. Measuring the satisfaction of the trainees our conclusions showed that e-learning platform and technologies didn't mean to substitute the practice but to strongly enhance the skills and knowledge of medical professionals to be better prepared to practice, allowing them to tailor their experiences to meet their personal learning objectives.

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Keywords: On line education; medical education; on-line platform .

1. Introduction

The need for new methods for education in medicine is set by the Lisbon goals and by the EU Health Policy Forum. Several policies of the World Health Organization, the Directorate-General for Education and Culture of the European Commission, together with the national strategy for higher education and the strategies of the Medical Universities underline the great importance of integration of

clinical sciences from both aspects of theory and practice that would help facilitation of transition from learning to work. These priorities are directly linked to the priority of development of web based education. Implementation of problem-based learning and e-Learning are important part of the recommendations (Karle H, 2000; World Federation For Medical Education, 2015).

These recommendations are taking place in a framework in which there is a serious need of complementarity between vocational training and higher education. The EU Comission Comunicate on Rethinking Education (2012) undelines that increasing only basic skills is not enough to promote employability and vocational education must react to the demand for advanced vocational skills as requested by the labor market. In the same idea Swanwick (2008) reporter that there is a growing number of reports that draw attention to the need of adjustment of the offer in medical education to labour market needs. More, Koh J.& Dubrowski A. (2016) underlined that despite the well known fact that lifelong learning is an essential trait expected of every medical doctor. many physicians are not engaging in lifelong learning, due to different reasons, among which the lack of time is essential.

Unfortunatelly, medical education is considered by many as one of the most conservative education providers in terms of methods used. Training by e-Learning platforms, though appreciated for the offered advantages (low cost and flexibility) is rather a secondary option for representatives of training providers and employers.

 By reviewing the last decade literature on e-learning. Chumley-Jones et al (2002) showed that there are few repositories or digital libraries that offer access to e-Learning materials. More recent studies showed that in the last years a higher number of software systems were developed, with a move into a more student-centered model, a focus on implementing reusable software platforms for specific learning contexts, and analysis of online activity to track and predict outcomes (Taveira-Gomes et al, 2016).

Another important aspect is that medical interventions are not equally received and with the same benefits by all patients. Sinclair et al (2015) reported that standard procedures are not all the time effective, as each patient has its own particularities, so there is an urge need to adapt medical procedures by patient focused interventions. In this context a flexible training offer by developing an online learning community to provide the resources and digital materials in medical education and to support the development of e learning courses in EU level is a challenge and a real necessity.

The present paper wishes to offer a general overview of Web-based learning in Medical Education based on the research, results and experience gained by an international partnership in 2 LDV pilot developed projects and one in development Erasmus + project. E-EDUMED project adressed to medical professionals aiming to improve their knowledge in ultrasound (doctors and nurses) meanwhile ORTHO e-man and COR-skills are designed to medical professionals in orthopaedics and rehabilitation, aiming to stimulate resident learning by new approaches, as the development of an innovative e-training method which is able to offer a database with case studies directly linked to the challenges in the work place and an advanced training curriculum based on new demands on labor market as computational gait analysis.

 Challenge was therefore to offer an attractive methodology (Problem Based Learning), a flexible and innovative virtual environment with open Source technology (Open Source online Platform) and above all offer quality of content, real case studies, attractive videos as well as virtual spaces where discuss simultaneously problematic cases faced in medical experience. Our Pedagogical models have successful met the medicine learning needs exploiting the synergy of virtual Problem-based Learning,

peer to peer, and self-direct learning approaches to promote the achievement of practical skills by the use of different types of e-learning platforms like Claroline and Moodle.

2. Methodology

In designing the platform for our medical online courses we carried on a market research in order to identify the most suitable platforms for the delivery of distance learning, in particular through Internet. It was decided that Claroline will be the environment for the e-learning platform in project e-EDUMED, meanwhile we used Moodle for ORTHO e man and COR-skills.

This platforms are distributed under the GPL license which is the standard licence for Open source software. There are no fees to pay for installing it on a WEB server to provide professional E-Learning courses through Internet. The online students have found both platforms very easy to navigate and use.

For all projects the e-training environment was multilingual and the presentation tier was adapted to include additional data provided by different medical investigations as medical imaging (ultrasound, MRI, CT), video files of motion analysis, graphs of forces, muscle and joint reactions, numerical data, contact pressure diagrams, etc). By this we intended to develop a repository of training material as a database of clinical case studies that can be used by the trainees to develop basic skils and also advanced vocational skills that would permit patient focused interventions. The trainee must choose the right surgical protocol or adapt the standard rehabilitation protocol based on the particularities of the case study (patient-focused interventions).

The e-learning platform and technologies permit the learners to personalise their learning by giving control on the pace of learning and optimizing the instructional approach. By using case study approaches similar to those encounter at the work place the learning activities are meaningful and relevant to learners.

The following issues were taken into consideration:

E – course. As the name suggest, this area provided students with extensive learning materials and the PBL environment where users and facilitators will run their PBL sessions. Teachers and tutors can access as course manager in order to develop learning contents and tutor students as described in the following pages in details. All the learning and communication tools are accessible from the home page of the course and there is a course description showing all about the general presentation of the course such as a description, targets, topic list, help desk contacts, staff involved, learning tools. Course managers can insert and edit the different parts of the course description while students can only look at (read only) what is displayed on the screen.

Case Studies. Our goal was to offer a fair number of real case studies that can be used by the trainees to identify a health problem, diagnose the problem and propose the appropriate action or treatment for each pathology.

Case studies were in the form of full reports on patients in orthopedic/rehabilitation department (medical history, clinical signs, paraclinical evaluations), associated with one or more visual content objects (i.e. 2D, 3D images as acquisition outputs of Magnetic Resonance Imaging, Tomography, plantar pressure graphs and video), starting with preoperative radiological images, description of surgery, and the outcome of the procedure (postoperative and further follow-up X-rays, MRIs, physical findings, contact

pressure pattern of the patient gait). The system provides a feedback by showing students the correct diagnosis and how to arrive at it with minimal cost.

The workflow for each case was structured as follows: detection of lesion/annomaly -> propose a diagnostic -> medical assessment -> propose a treatment (surgical, rehabilitation) ->re-evaluation.

In including the case studies within the e-learning platform we used a plug-in that consists of 3 parts: plug-in-core, Authoring Tool and Display Tool.

The Authoring Tool was developed within ORTHO-eman project as innovative approach. It creates a XML description of the whole course and it is used by the Display Tool to reconstruct the course and present it to the trainees. It offers simple tools that permit the trainee to draw geometric figures (rectangles, ellipses, polygons) to mark the region of interest. These tools allow the trainee to select a point in the image or designate an area by a simple mouse click. This can be done to indicate the zones of abnormal high or low pressures, to identify the centre of pressure, the highest impulse area, the contact percentage, foot axis or foot angles. Also the Authoring Tool has also some standard image processing tools such as tools that allow changing of brightness, contrast, etc. Specific tools as angle calculation and cross-hair tool were added. The cross hair tool permit to draw a horizontal and a vertical line on the graph image that form a crosshair-like object. The aim is to target a desired point on the graph and to estimate it's values for x and y axes.

Some case studies recorded the pressures exerted on a patient's feet during roll-off (gait analysis). As measurement is recorded in motion we included some basic movie player controls such as Play/Pause/Stop functionalities and Rewind that allows the trainee to better analyse the gait and to indentify the abnormal patterns.

The trainer takes ownership of maintaining a case study with the ability to update it online with timely or relevant information. Students as part of the curriculum are required to view individual profiles, brainstorm ideas proposed within them, evaluate key discussion points and draw conclusions from those discussions.

Agenda. The agenda allows teachers or tutors or course mangers to insert important course deadlines together with a title of the event or activity to be carried out, a description of the event or activity to be carried out. The event or activity list is displayed from the most recent (decreasing order by date). The student can also see the agenda in a different way from 'My Calendar' in the menu just below the logo of the E-Learning platform. Here the visualization is like a calendar with the event or activity titles and, all the description is displayed by clicking on the respective title.

Library . This tool provides a comprehensive mechanism for organising files and links that a teacher can choose to make available to students. It is possible to create various directories, and to have directories within directories in order to enable the grouping of files. This area has been conceptualized for storing all types of resources that do not have to be tracked by the system.

Project work. The assignment tool is a publication area for students. Teachers can create one or several project works, where students will be able to publish their work. Teachers will then give feedback on their works and assess students directly on-line.

The assignment is a valid tool to assess students in a qualitative way while quizzes to be provided within the learning paths are closed questions i.e. their goal is to make a quantitative evaluation of students' learning progress.

Depending on the peculiar didactic strategies, teachers can ask students to provide project works by writing online in an appropriate text box and / or upload a document which has been prepared offline previously.

Forum. The forum is a classic asynchronous communication tool. The Forum was set up to encourage communication among users, teachers and tutors and providing the opportunity to post ideas, opinions, and information on the course in an organized manner.

It is important to mention that a forum could be used as a strong tool for collaborative learning. For example, if a student doesn't understand a particular course topic, he or she can open a new thread asking for clarifications. Probably, other students more familiar with the topic will be able to give a satisfactory explanation.

Moreover a user's group, who participates to a given PBL session, can open a new thread to discuss about the issues that the case study is presenting and what kind of materials are more likely to be studied to try to find a correct and complete solution to the case study proposed by its facilitator.

Quizzes. The E-Learning platform has built in utilities to allow teachers to make in an easy way quizzes. Teachers have different available options to implement (depending on the didactic strategy) when they create a quiz such as number of allowed attempts, random questions, and show results or not after the quiz, maximum time allowed.

Each participant has tailored the learning pathway according to its job profile, work experience, competencies, and skills. Each one has chosen how much time he needs to spend for each module, the order of delivery and the number of quiz attempts.

There is a system of tracking the trainees activity on the platform in consulting the teaching materials (course statistics) showing the number of acesses, number of downloads.

3. Results

3.1. The Ultrasound training package

This package was delivered for medical doctors and consisted of interactive US courses included into e-EDUMED e-learning platform. The package was divided into subsequent 3 modules and is available in EN, RO, BG (fig.1). For this package we provided the curriculum/syllabus, schedule of courses and educational materials (WWW-based). The selected approach is based on a modular architecture focused on three levels (power point presentation, level text, image level). Within each module, different type and number of learning objects that can be considered as elementary bulks of learning. Three types are included: Multimedia lessons, Video lessons and Quizzes

Content is structured in the best way to build gradual competences. For each module we developed packages containing a section with anatomical bases, ultrasound images and videos, a system of evaluation and self-esteem of the results (fig.2). For 6 topics we had developed multimedia lessons.

Competence self-evaluation system based on quizzes and case studies are also available. All the materials are free to download.

The total of developed materials are presented in Table 1.

Table 1. The content of the ultrasound training package

Anatomy- nr. pages	US-nr.pages	PPT- nr. slides	Multimedia lessons- nr.	Virtual classes- nr.	Quizzes- nr	Size	
161	471	606	6	10	150	1	KB

3.2. The Nurse training package

Nurse training was developed as an on-line course; PPT presentation, with voice as well as animation, video and multimedia elements were available. The module was developed as PBL with case studies of videos. Discussion were coordinated via Virtual Classroom of the E-Edumed project by the trained nurses.

The package was divided into subsequent 3 modules and is available in EN, RO, BG, HU. The programme is designed to give nurses additional education in order to prepare them for advanced nursing practice and to respond to the actual demands in health care for the provision of primary health care to individuals, families but also to communities.

For this modules we provided the curriculum/syllabus, schedule of courses and educational materials (WWW-based). The total of developed materials are presented in Table 2.

Table 2. The content of the nurse training package

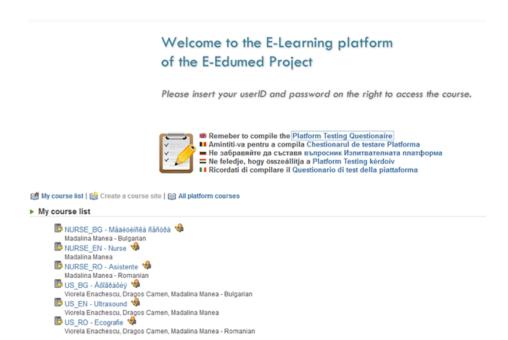| Text- nr.pg	Multimedia lessons –nr.	PPT- s - nr.slides	Multimedia lessons-nr	Virtual classes- nr	Quizzes- nr	Size
126	6	335	4	10	80	50 MB

Fig. 1. Structure of the ultrasound training module

Fig. 2. Types of learning objects for the ultrasound training module

3.3. The case studies

The case studies were developed in the ORTHO e-man project and COR-skills project and refer to clinical and imagistic evaluation of the patient and clinical gait analysis. Analysis was carried on before and after surgery and/or rehabilitation. The trainees can use platform specifications that allow comparison of recorded date before and after medical procedures. In Figure 3 is shown an example of case study development.

Fig. 3. An example of a case study development – clinical analysis

These features were proposed by us as innovation and were included into ORTHO-eman interactive e-learning platform for identifying medical imaging obtained by digital evaluations or measurements by Footsan pressure plate.

The COR-skills project which is under development will improve and enhance the case studies with patient centered intervention and correspondent cases for rehabilitation after orthopaedic surgery.

3.4. e-platform assessment

Our e-learning courses were followed by over 200 medical professionals from different European countries. Based on the information gathered from target group regarding e-platform assessment the quality of the overall e-platform was seen as high to very high by all members of project consortium. To "poor" or "average poor" grades, specific improvement was provided.

The quality of the various features of the e-platform (content and topics of modules, courses, virtual classes etc.) was seen as high to very high by more than 70% of respondents. To "average" or "poor" grades, specific improvement was provided.

4. Discussions

In continuous professional training and obtaining CME credits, on line training is a reliable and superior alternative to classic courses that require accommodation, time, etc. and can be used fully in the development of courses EMC credited, offering a perfect option for continuing professional development and formal education in the possibilities offered for review and updating knowledge, sharing information and brainstorming. By implementation of our projects we have learned several lessons, depicted in the following aspects.

4.1 Pozitive aspects

1.   Great interest for our modules.

At the time the project ended there were almost 170 000 visitors. We explained this by the following aspects:

-    In all participant countries medical professionals have to attend training courses and make refresh courses. They are usually organised in traditional face to face events and they could be quite expensive considering either the time or money spent. According to this, e-learning methodology and reduction of expenses have represented a consistent added value.

-    Ultrasound and Nurse Courses represent a "new" offer for the medical context

-    Ultrasound for a medical doctor already specialised in a medical field, need to be deepen with many images (3D if possible), case studies, high quality of content, group discussions and practical information. Information Technology is a flexible and powerful tool able to make the difference.

-    The quality of materials - the course provided recent and systematized, specific information, in a didactic approach; the use of multimedia coupled with the tracking of effectiveness: possibility of accessing material at any time and from any location;

-    A complex multichannel dissemination.

-    The structure of the WEB site. In development of our web site we took into consideration that only websites which provide new information are re-visited, so we updated the project website regularly. More we aimed to offer information and external links beyond the limited project scope,as follows

-    offering a gateway for information on European e-learning medical training programmes-section Heatlth e-learning in Europe presents a database of the most interesting projects in the field of e-learning in different health topics, developed with the European Comission support in the last 10 years, selected and recommended by the project partners, with links to project websites

- developing the section open resources contain links to useful article, books, educational software, database of links promoting e-learning, and database with institutions involved in Internet-based learning, selected and recommended by the e-Edumed partnership.

2. Participants have demonstrated to have successfully acquired the concepts and knowledge of learning pathways. Test scores for those who attained the final test were between 120-200. Only 2 trainees failed the test.

3. The trainees that had filled the satisfaction questionnaire published in the Platform, rated the course quite satisfactory, and add some comments in order to improve the next learning ventures.

4.2 Negative aspects and limitations

1. Not all the registered specialists that followed the modules apllied for final testing (the rate was 66%). We tried to explain this by the following aspects:

-E-learning is in fact not diffused in medical field for main subjects that usually include practical competencies. It is mainly used for theoretical topics such as protocols, guidelines, cross topics (security, new laws, and emergency protocols).

-In fact, Medical Doctors are quite sceptical that distance learning could improve their practice. They have studied many years and they work every day for many hours in hospital thus what they really need is to refresh key concepts, learn breaking through practices or treatments or equipment as well as be aware of specific case they have never met.

-Ultrasound and Nurse Courses represent a "new" offer for the medical context thus the process needs some time to be assimilated

-Some participants were interested only in refreshing their knowledge and not in certification or were students, so no accreditation was available. For this reason we had developed (as added value) an US e-book and atlas, available on the project web site.

2. Low level of ICT skills for medical doctors/ trainees (in accesing the platform, participation to virtual classroom, participation to forums) and little experience in elaboration of multimedia lessons by trainers. The Attendees have been requested a deep assistance in particular to properly access the platform and make the final test. Also we expected a greater dimension in sharing of information between students on the forum, opportunity of brainstorming, access to trainers' opinion and Second Opinion to an integrated imaging database.

3. *Fragility* of virtual classroom- internet speed, decreasing of speed with the nr. of visitors

4. Vulnerabilities of projects web sites. Even if we implemented a complex procedure for registration, that uses completion of a non-standard registration form and completion of a special field "capcha", we observed that, in time, many spam users registrated. Significant is the fact that the number of registrated users that really used the e-learning platform was over 200, the registration index went over 3000. We found it very difficult to select and filter the users. In one way the project wanted to support all interested persons in our educational modules, whatever part of the Europe they are. On the other part it is impossible at that point to ask for documents showing the professional level, as some of them were interested only in e-book or atlas, and the number being too great.

5. Conclusions

All participants have been benefited from the e-learning medical courses coping with their learning needs. It has been evaluated an interesting experience considering the methodology, e-learning achievements and collaborative learning successful experience.

Despite of the fact that e-learning in medicine is even now not fully exploited and known, the courses were appreciated by all target groups. Wishes to receive more information about other medial projects have been demonstrated by all participants.

Even if there is an evident need for e-Learning solutions, the wide implementation of e-Learning requires more then just development of technological platforms. Changes in the institutional vision, management, and organisation, as well in the attitudes and practices of administrative and teaching staff, are also required.

Our final conclusion is that integration of e-Learning into Medical Education is a process at its very beginning and requires a lot of work to be done. In our view, to overcome the above problems, a regulatory system has to be approved to stimulate, develop and use e-Learning content at all educational levels; good practices need to be disseminated; open-source software and e-Learning environments with English and national language interfaces should be popularised; joint research concerning the technological and didactical issues of e-Learning have to be conducted on a larger scale; and more universities should offer Master's programmes in e-Learning education.

Providing informations about e-Learning and its benefits, encouraging and initiating the Training of the Trainers (medical and academic staff); encouraging the training of the learners; increased dissemination on all levels (hospitals, universities, professional organisations, decision makers) could make a difference.

Acknowledgements

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