Challenges in developing and implementing a blended learning approach in Medical Physics Experts course: An example for the Anthropomorphic Phantoms module

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Abstract: The paper presents the blended learning approach used in one of the modules from the EUTEMPE-RX course dedicated to the Medical Physics Expert. The course is under development within the FP7 EUTEMPE-RX project that aims to provide a model-training scheme that allows the medical physicist in diagnostic and interventional radiology to reach the high level of knowledge, skills and competence. The course will involve 12 modules developed at EQF level 8, with radiation safety and diagnostic effectiveness being prevalent subjects. Blended learning approach will be used throughout the modules. Each one will combine face-to-face classroom and online methods to varying degrees, theoretical, computer-based activities and practical sessions depending on the discipline.

Key words: Medical Physics Expert, EUTEMPE-RX course, blended learning, Sekoia platform.

INTRODUCTION

The Medical Physics Expert (MPE) is defined by the Council Directive 97/43/Euratom as "an expert in radiation physics or radiation technology applied to exposure, within the scope of this Directive, whose training and competence to act is recognized by the competent authorities; and who, as appropriate, acts or gives advice on patient dosimetry, on the development and use of complex techniques and equipment, on optimization, on quality assurance, including quality control, and on other matters relating to radiation protection, concerning exposure within the scope of this Directive [1].

According to this definition and the MPEs mission statement, it is expected that MPEs bring new knowledge and expertise from the physical sciences into the health sector, so that, among other things, it may be able to better and independently judge how best to deploy its resources imaginatively and safely in this important area. However, recent developments in the field of medical imaging have shown difficulties encountered in some EU Member States regarding the availability of really adequately trained and qualified MPEs to address the needs of medical procedures applying ionising radiation [1].

The main objective of the EUTEMPE-RX project is to provide a model training scheme that allows the medical physicist in Diagnostic and Interventional Radiology (D&IR) to reach a high level of knowledge, skills and competences, described in [1]. For this purpose, the partners within the EUTEMPE-RX project will develop modules dedicated for the MPE training and education. Courses will be designed using a blended learning scheme. As part of this scheme, e-learning education and teaching sessions will be developed. This will, in particular, help support medical physicists that cannot be released from their duties for long periods, especially those with childcare responsibilities [2].

The aim of this paper is to present and disseminate the approach in performing blended learning within the EUTEMPE-RX course and to demonstrate it for the particular case of one of the modules.

THE EUTEMPE-RX PROJECT IN SHORT

The EUTEMPE-RX project - European Training and Education for Medical Physics Experts in Radiology - is an EU FP7 project within the Euratom Fission Training Schemes in 'Nuclear Fission, Safety and Radiation Protection' financed by the Commission of the European Communities [3]. The main objectives of the EUTEMPE-RX project are to:

- create a network of excellent teaching centres for medical physics in D&IR and

to prepare courses at EQF[4] level 8;

- set up a multi-campus Educational and Training platform (for course material, online teaching activities, etc.);

- get the course either accredited or serve as a model in as many Member states as possible.

The EUTEMPE-RX project will develop a training course with 12 modules at EQF level 8, with radiation safety and diagnostic effectiveness being prevalent subjects. Courses titles can be found at the web page of the project (http://www.eutempe-rx.eu/).

REQUIREMENTS FOR EACH EUTEMPE-RX MODULE

A standard course module will consists of:

- a clearly defined topic, a practical challenge to be solved and learning outcomes of skills-knowledge-competences to be achieved in line with the key activities as formulated in the 'Guidelines for the MPE project' [1]

- both theoretical and practical training sessions;

- state-of-the-art literature review of the topic;

- translation of exciting fields of expertise to the reality of the hospital and the nuclear safety aspects of patients and personnel;

- use of demonstration software and proper software tools;

- evaluation method and evaluation moment to introduce the learners in the research domain they represent;

- collection of educational material on the different topics.

THE PLATFORM

The Media and Learning Center of the KULEUVEN is responsible for the technical development and implementation of the education and online training platform of the EUTEMPE-RX. Choosing the right platform in such a course is a challenging task – teachers are from different universities, hospitals, and research centres; therefore they use divers approaches and partially implemented module content. For the EUTEMPE-RX course, the Sekoia platform will be exploited [4]. In this platform, every Sekoia module is structured like a book. Pages can be added easily as well as they can be grouped into chapters. The modules are created through the Course Builder facility that provides both teachers and educational staff with a powerful and intuitive tool to create amazing blended and online courses either from scratch or from existing course documents, web lectures and presentations.

DEVELOPMENT OF THE ANTHROPOMORPHIC PHANTOMS MODULE

The Biomedical Engineering team at the Department of Electronic Engineering and Microelectronics at the Technical University of Varna is responsible for the preparation and organisation of one of the modules: **Anthropomorphic Phantoms**. In order to achieve the learning objectives of this module, blended learning will be used: face-to-face and online presentations, readings and discussions. A screen shot of the online material for this module is shown in figure 1. As can be seen, the first page lists the "syllabus" or "the learning goals". This is actually valid for every Sekoia module.

Online and face-to-face teaching and learning activities are summarised in the table. The online phase may be performed at any desirable time of the participants, and therefore they would not need to take time off their clinical duties. The face-to-face component will include a period of 1 week, organized in a mixed format that includes lectures, computer-based exercises, visits to hospital for experimental work and

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[4] European Parliament and Council (2008) Recommendation 2008/C 111/01 on the establishment of the European Qualifications Framework for Lifelong Learning

discussion sessions. Learner assessment will consist of a work project on a case study from D&IR, combined with a short written exam. The work project will be given to the learners combined in groups of 2 to 3 people, at the beginning of the face-to-face phase. It will be carried out throughout the face-to-face duration and will conclude with a short presentation.
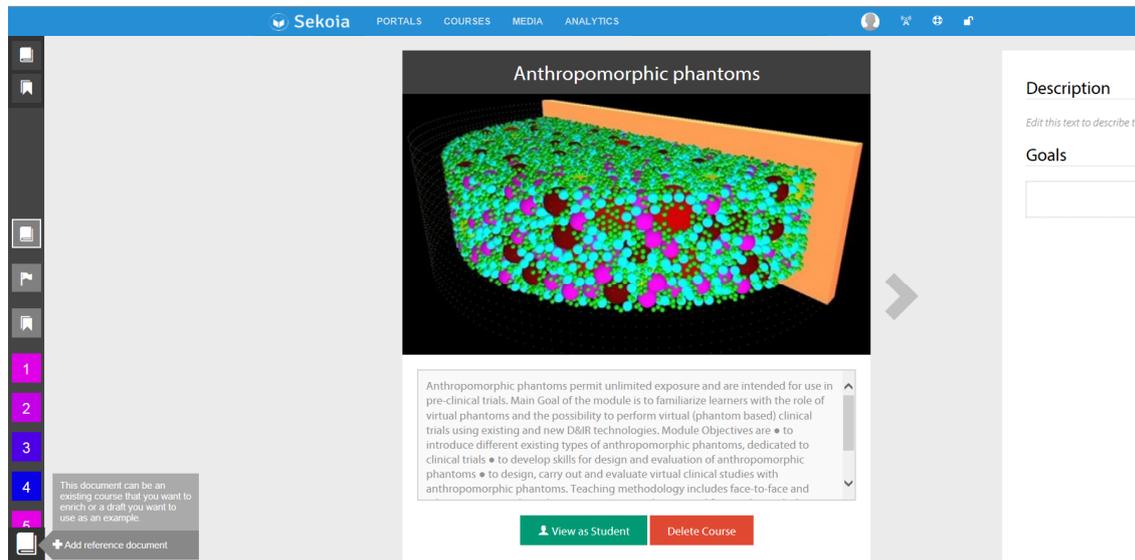

Figure 1: A screen shot from the online e-learning Sekoia platform depicting the course *Anthropomorphic Phantoms* under development.

Table: Online and face-to-face teaching and learning activities for the Anthropomorphic Phantoms module

Topic (briefly)	On-line	Face to face
Introduction to anthropomorphic phantoms	Short overview Review Articles PPT, interactive images	Day 1:Lectures, demonstrations
Design and composition of anthropomorphic phantoms	Short overview Review Articles PPT, Interactive demos in HTML5 Recorded lectures	Day 1: Lectures, tutorials Classroom work
Software tools used in x-ray imaging research	Brief description and links	Day 1: Lectures, tutorials Classroom work
Hands on implementation of computational anthropomorphic phantoms	Demos of software applications to be used; Tutorials	Day 2: Lectures, tutorials Classroom work
Application of anthropomorphic phantoms	Short overview Review Articles PPT with examples, Recorded practicals	Day 3-5: Lectures, tutorials Classroom work Practical work at Hospital
Computational Anthropomorphic Phantoms as Prototypes of Physical Objects	Short overview Review Articles Demos, Recorded practicals	Day 6: Lectures, tutorials Classroom work

An example of presentation of material related to the applications of anthropomorphic phantoms in optimising the parameters of an existing imaging modality is shown in figure 2. The information is given as a PPT and by using an interactive image. Specifically, the interactive figure presents a computational phantom of the female breast and forms part of the classification description. The presented example allows the user to get familiar with the phantom and discover its parts through interactive exploration.

(a)   (b)

Figure 2: Screen shots from the online e-learning Sekoia platform depicting
(a) the methodology for creation of software breast models
and (b) Interactive figure integrated into multi-section media tool

Although the general idea of exploiting the advantages of the different teaching methods exists, how to better do that is a challenging question. In our module we rely on preliminary self-preparation using online materials, including Sekoia book, downloadable artwork PDFs, Power point presentations, recorded videos and screen captures, etc. Web-based tele-meetings are planned to potentially consult or advise the learners before running the face-to-face session. The face-to-face session remains the main part of the module but it will be greatly facilitated by the e-learning completed before. Scientists from other universities, developing other modules for the course intend to blend the different teaching approaches in an opposite way – first performing a face-to-face consultation and then providing the content using online materials, presentations and any other e-learning facilities.

CONCLUSIONS AND FUTURE WORK

We believe that the practical application of the EUTEMPE-RX course will contribute for the raising the quality not only of the education but also of the research and development in the field of medical physics. We believe also that the blended teaching and learning is the profitable approach. However, only the time can confirm that. The first module from the pilot course is already scheduled for February, 2015 while the Anthropomorphic Phantoms will be delivered at the beginning of September 2015.

ACKNOWLEDGEMENTS

REFERENCES

[1] European Commission Radiation Protection Report 174, "Guidelines on Medical Physics Experts", 2014

[2] EUTEMPE□RX, an EC supported FP7 project for the Training and Education of Medical Physics Experts in Radiology (invited lecture), RPM 2014, Varna Bulgaria.

[3] EUTEMPE-RX: European Training and Education for Medical Physics Experts in Radiology, in FP7 Fission-2013-5.1.1: EURATOM Fission Training Schemes (EFTS) in 'Nuclear Fission, Safety and Radiation Protection' , Project Number: 60529801.08.2013 - 31.07.2016

[4] http://www.sekoialearn.com/

The paper has been reviewed.