IOMP PROFESSIONAL AND EDUCATIONAL ACTIVITIES

PILOT IMPLEMENTATION OF EMERALD TRAINING MODULES IN BRAZIL

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Abstract— **A research cooperation program was established between the Institute of Physics of the University of São Paulo and the King´s College of London to conduct the translation to Portuguese language, adaptation and update of the X-Ray Diagnostic Radiology training module of the Emerald Program (www.emerald2.eu/cd/Emerald2/). The Emerald Program teaching material in X-Ray Diagnostic Radiology is divided in ten topics covering the basics of Diagnostic Radiology, Quality Control and Radiation Protection. The referred work, besides the translation of the texts into Portuguese, comprised the review of the previously produced material. During the review process, it was decided to update some of the training tasks and add more information related to current topics, such as digital X-ray imaging modalities, multi-slice computed tomography and tomosynthesis. These new additions will also be available in English. The translated or written texts have been submitted to a cross-reviewing process by the co-authors in order to standardize the language. Moreover, national radiological protection recommendations were included to assist the users of the teaching material with the Brazilian rules of radiation safety and quality control in X-ray medical applications. Part of the material was submitted to a validation and also to a practical assessment process by means of a critical analysis by experts in Medical Physics education during a workshop held in São Paulo in March 2014. Finally, a pilot implementation has been organized in order to do the last adjustments before making the material available to other users in Portuguese language. Further assessment and feedback procedures were planned in both London and São Paulo, aiming to evaluate and disseminate the final product.**

Keywords— **Emerald project, education and training, Medical Physics, Portuguese language.**

II. INTRODUCTION

The Leonardo EU project for European Medical Radiation Learning Development (EMERALD) [1], a Consortium of Universities and Hospitals from many countries, developed three training modules in medical radiation physics (X-ray Diagnostic Radiology, Nuclear Medicine and Radiotherapy). These modules were prepared in an attempt to support more widely the worldwide initiatives of education and training in Medical Physics (MP).

Each Training Module encompasses the physics and engineering of the topic, leading to competencies based on the UK IPEM Training scheme and on the recommendations of the European Federation of Organizations for Medical Physics (EFOMP) and the UK Institute of Physics and Engineering in Medicine (IPEM) Training Scheme [2]. The modules are for the training of graduated university students in MP or related disciplines, their tutors, as well as other Hospital employees.

The Emerald Program teaching material in Diagnostic radiology is divided in ten topics: General Principles of Radiation Protection, General Principles of Diagnostic Radiology Quality Control, X-ray Dosimetry and Patient Dosimetry, Radiological Image Parameters, X-ray Tube and Generator, Radiographic Equipment, X-ray Films/screen and Laboratory, Fluoroscopic Equipment, Digital Image and CT Equipment, and Basics of Shielding in Diagnostic Radiology. A very important part of Emerald are Training Timetables (syllabus) with indicative time necessary for acquiring certain professional competencies during a training period of approximately 4 months.

The present work describes a research cooperation program established between the Institute of Physics of the University of São Paulo (IFUSP) and the King´s College of London (KCL), with the participation of the Physics Department of the Catholic University of São Paulo. This research program conducted the translation, adaptation and update of the X-Ray Diagnostic Radiology training module of the Emerald Program [3]. This material written in Portuguese was named Emerald-BR.

Part of the motivation for investing in the adaptation of the original Emerald training modules to Brazilian (and Latin America) needs is based on the growing number of young physicists starting in Medical Physics area each year, and the low offer of organized training programs in the country [4,5]. This work presents the status of this project, which aims to contribute, firstly, but not only, with Brazil and Portuguese language countries, by the production of online resources for teaching and training in MP, based on the Emerald modules.

III. METHODOLOGY

The referred cooperation program between IFUSP and KCL, started by the translation of the original texts into Portuguese, after which comprised the review of the produced teaching material. The translation included the latest updates of Emerald materials including training tasks on CR, DR and Spiral CT. During the review process, it was decided to update some of the training tasks and to add more information related to current topics such as multi-slice computed tomography and digital tomosynthesis. These new additions will also be available in English in the near future.

The translated and written texts have been submitted to a cross-reviewing process by the co-authors and other contributors in order to standardize the language. National radiological protection recommendations were included to assist the users of the teaching material with the Brazilian rules of radiation safety and quality control in X-ray medical applications. At least 120 person-hour was expended for concluding these tasks in 8 months of work.

After the conclusion of the translations and previous reviewing process, the project staff organized a workshop during March 10-11, 2014, in São Paulo, for presenting the preliminary teaching material and sharing the information regarding the Emerald Project to professionals involved in education in Medical Physics (Fig.1). During this workshop, the project team presented the history and previous implementations of the Emerald program in other countries as well as the general concepts introduced by the Leonardo EU project. It was also presented the status of the translated material and the development of the Emerald-BR project. Additionally, a test-session was guided, including practical assessment by the participants of part of the material. For this purpose group of simulated experimental activities was introduced providing hands-on approach to the translated material and its application.

Fig. 1 Participants of the Workshop for diffusion of the Emerald-BR project in São Paulo.

IV. RESULTS

Most of the modules have been translated with adaptations and a grammatical and conceptual reviewing process was conducted. The translation was helped also by the Multilingual Medical Physics Dictionary EMITEL. One of the co-authors applied a language and vocabulary harmonization. In addition, the newer parts to be added to the training material are in pre-production. In the current version, the teaching material has 243 pages, 30 figures and 51 tables.

The material was submitted to a validation and to a practical assessment process by means of a critical analysis of part of the tasks by experts in Medical Physics education during the Workshop. Participants of the workshop (n=20). These included MP teachers from Universities (29%) and coordinators of training programs in hospitals (50%). The distribution of these professionals is presented in Fig 2. These participants came from the three most populated regions of the country (Fig. 3).

For the hands-on activity, the participants were distributed in six groups of 3-4 physicists pre-arranged by the organizers. The selection has taken into account the variety of professional experiences, the geographical origin, and gender. Each group received one sub-chapter of the translated material with basic informations regarding one area of diagnostic radiology.

Three groups received material, which simulated data from quality control, including images and forms for the evaluation of spatial resolution and contrast resolution of a digital and an analogic fluoroscopy equipment. The other three groups worked on the evaluation of data from Quality Control of X-ray tube and generator. Furthermore, all groups received an additional task guide to help to optimize the execution of the activities.

The opinion of the participants regarding the quality of the produced material was accessed by the use of forms including Likert scale type survey and open questions, which were filled by the participants after the last activity

(hands-on) of the workshop. The questions included in the forms were based on a previous scheme developed for the evaluation of the e-Learning material of EMERALD and EMIT [2]. These queries were designed to investigate the view of the potential trainers regarding the adequacy of the developed learning material. Table 1 presents the questions included in the forms. Questions 1 to 4 were evaluated by a score level from 1 to 4 (1 - very good; 2 – good; 3 – acceptable; and 4 – inadequate). Questions 5 and 6 were commented and reported by the participants.

Question 1 referred to the clarity of the objectives of the training task performed by the participant during the hands on section. As many of the participants are training experts, there were also questioned regarding the adequacy of the time, in days, suggested for completion of the proposed tasks. - 67% of the participants stated that the time proposed for concluding the tasks are adequate.

Question 2 focused to the appropriateness of the sequence of steps within the performed tasks evaluated by the participants, considering the material they have access during the hands on activity during the workshop and the information presented by the lecturers in the workshop. In this case, 54% of the participants considered that the sequence of training steps within the assessed tasks was "very-good", and 47% considered it as "good". Based on this result some editing will be applied to the proposed sequence of steps within the training task.

Table 1 – Questions distributed for the participants

	Questions
1	Are the objectives clear? Based on your experience, do you think that such objectives could be reached in the proposed period?
2	Do you consider the sequence of proposed tasks in the module appropriated?
3	Is the content conceptually and technically correct and in sufficient amount in the module?
4	Do you think that the trainee would be prepared in a sufficient level to:
	(a) To be familiar with the terminology and concepts regarding this task ?
	(b) To conduct the tasks WITH some assistance ?
	(c) To conduct the tasks WITHOUT assistance ?
5	How this material could be used in your institution?
6	What are your suggestions for improving this training program?

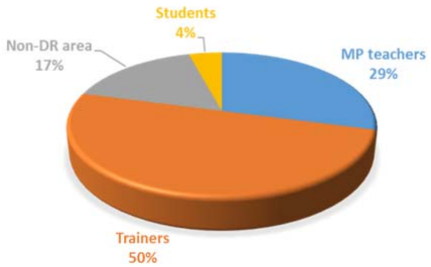

Fig 2. The four main groups of participants of the workshop were: trainers (50%), medical Physics teachers (29%), participants which main activity is not diagnostic radiology (17%), and students (4%).

The third question addressed the assessment by the participants of the conceptual and technical adequacy of the training steps within the assessed tasks during the hands on activity of the workshop. Half of the participants received the module 5.4 - Assessment of X-ray Generator kVp and Timer Parameters, and the other half the module 8.1 – Fluoroscopic Equipment. The questions in the forms they received addressed regarding the amount of information included in the modulus using the proposed Likert scale. The results showed that 67% of the participants considered it "good", and 27% considered it "very good". Thirteen percent of the evaluators considered the material only "acceptable". Consequently, the organizers of the Emerald-Br planned a specific review of these points.

Finally, question 4 reflects the opinion of the participant on how would be the level of a trainee that had used the material in two aspects: (a) familiarity with the terminology and concepts of the task; (b) and (c) ability to conduct the tasks with assistance (question 4b) or alone (question 4c). This group of tasks was intentionally proposed in order to evaluate if the participants had understood that the main use of the Emerald-BR material is as a support training reference, and that it was not intended to be a self-learning material for a pure e-Learning or distance-teaching scheme for Medical Physics. In other words, the constant support of the trainer is essential for the success of the trainee learning – what is the original objective of Emerald. The answer of the participants reflected exactly the expectations as shown in the last rows of the Table 2.

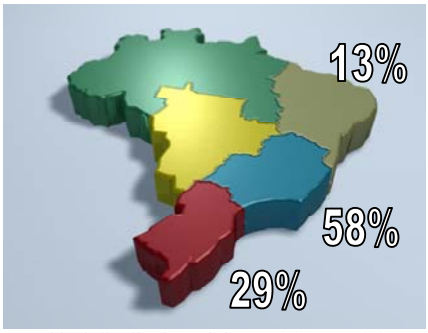

Fig 3. Geographical distribution of the participants of the workshop in the regional areas of the country. According to the distribution 58% work professionally at southeast region, 29% at south region and 13% at northeast region. There were no participants from regions north and central.

Table 2 – Evaluation of the answers from the participants of the workshop regarding the questions 1 to 4 (Table 1). The meaning of the Likert scores are: 1 - very good; 2 – good; 3 – acceptable; and 4 – inadequate

	Likert Score			
Questions	**1**	**2**	**3**	**4**
1	10 (67%)	4 (27%)	1 (7%)	0
2	8 (54%)	6 (40%)	1 (6%)	0

3		3 (20%)	10 (67%)	2 (13%)	0
4	**a**	5 (33%)	6 (40%)	4 (27%)	0
	b	10 (67%)	4 (27%)	1 (7%)	0
	c	0	0	5 (33%)	10 (67%)

The two final questions were open. The participants had a defined space for expose his or her feelings about the adequacy of the Emerald-BR material to be used in training programs in their own institutions (question 5) and to include suggestions for improving the training program (question 6).

More than 80% of the participants presented their intention in using the material in their institutions for training young graduated medical physicists. Some of them, also cited the possibility of using the material as support for last-year under-graduate students, especially in practical aspects of the Medical Physics in Diagnostic Radiology (laboratory classes), and also for helping continuous education programs of experienced Medical Physicists and as additional studying material in Residence programs.

The suggestions collected as answers to question 6 reflected a very broad range of aspects. Some of them reflected the need of reviewing the material in terms of the adequacy of the terminology in Portuguese, in particular the terms in statistics of experimental data. Other point that was cited by some participants was the need of the implementation of training programs for the trainers. The convenience of introducing hyperlinks to EMITEL e-Encyclopaedia was also commented.

V. CONCLUSIONS

Emitel has been developed as a sequence of stand-alone training tasks in order to permit its adaptation to various existing national requirements and protocols. Its original e-Learning form, facilitated by the EMITEL Multilingual Dictionary, helps its international distribution and implementation in various MP training programmes. With this on mind, the authors advise the colleagues who would implement the material to collect information from active leads of education and training in the country in order to adapt more closely Emerald to the local regulations, culture and knowledge.

The development of Emerald-BR material is still a work in progress and some adaptations are been conducted after the feedback of the participants of the workshop. A final review process and the inclusion of links with EMITEL Multilingual Dictionary will be implemented until the middle of 2014.

Additionally, a formal consultation was done to the institutions which have trainers as participants at the workshop regarding their interest in taking part of a pilot implementation of the program. Five Universities and one company and one hospital how offer training programs declared available to participating of this pilot-implementation. It will be starting in the second semester of 2014.

As a final comment to those who intend to implement the Emerald project in their regions, we advise that, as for other educational activities, to hear the educational staff involved in the task of preparing medical physicists is essential for a good assessment of the material and methods and for the adaptation to local culture and knowledge.

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