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Development of educational image databases and e-books for medical physics training

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EMERALD plus EMIT International Consortia[1]

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Abstract

Medical physics education and training requires the use of extensive imaging material and specific explanations. These requirements provide an excellent background for application of e-Learning. The EU projects Consortia EMERALD and EMIT developed five volumes of such materials, now used in 65 countries. EMERALD developed e-Learning materials in three areas of medical physics (X-ray diagnostic radiology, nuclear medicine and radiotherapy). EMIT developed e-Learning materials in two further areas: ultrasound and magnetic resonance imaging. This paper describes the development of these e-Learning materials (consisting of e-books and educational image databases). The e-books include tasks helping studying of various equipment and methods. The text of these PDF e-books is hyperlinked with respective images. The e-books are used through the readers' own Internet browser. Each Image Database (IDB) includes a browser, which displays hundreds of images of equipment, block diagrams and graphs, image quality examples, artefacts, etc. Both the e-books and IDB are engraved on five separate CD-ROMs. Demo of these materials can be taken from www.emerald2.net.

Keywords: e-Learning; Medical physics training; Medical physics education

1. Introduction

The development of education in medical physics and medical engineering underwent rapid growth in the decades after the 1960's, particularly in the postgraduate sphere. A large number of M.Sc. programmes were established across the world, but particularly in Europe [2,3,5,13,20], America and Canada [14,24,25].

A number of surveys conducted by the International Organisation for Medical Physics (IOMP), the European Federation of Organisations of Medical Physics (EFOMP) and the EU project TEMPERE [19,30] addressed the development of education and training in the profession. The EFOMP Policy Statement No. 2 (1984) "Medical Physics Education and Training: The present European Level and Recommendations for its Future Development" presented the first information in Europe gathered from 19 countries, suggested ideas for structuring educational courses and encouraged the establishment of national training centres [18,21].

The first international conference to specifically address the problems and goals of medical physics and engineering education was organised in Budapest in 1994. The delegates at this conference exchanged expertise on education, which was summed up in the book "Medical Radiation Physics—a European Perspective" [29]. This book triggered the establishment of series of new educational courses in Eastern Europe and other countries. Many of these courses were established as EU-supported international projects. Some of

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these courses are at the University of Patras, Greece [26], at the Inter-University Medical Physics Centre in Plovdiv, Bulgaria [32], in Iashi, Romania [6], in Estonia, Latvia and Lithuania [8,15] and elsewhere.

Despite the well-established position of educational provision in medical engineering and medical physics, there is a natural tension between the elements of education and training [1] and the development of formal structured training is a very recent development. The lack of structured training is somewhat paradoxical, since in engineering in general the structured approach to training has been well established in many countries for several decades. The recognition amongst the engineering profession that structured training was a necessary sequel to education was largely a reflection that engineering is a wealth generating activity, and therefore its workforce need to become skilled as quickly and economically as possible. In medical physics, on the other hand although there are unquestionably issues of public safety, there is little or no wealth-generating imperative. As a result, structured training in medical physics is less developed and still viewed as inappropriate by some colleagues.

Finniston reported to the UK Government in 1980 on what he called the "formation" of professional engineers. This process was one in which education, training and continuing professional development was integrated into a continuum. The need for structured training for medical engineering and the requirement for accrediting centres, where training could be carried out, was pioneered by the UK Biological Engineering Society (BES) in the late 1970's and early 1980's. The BES also became the first body within the international community to facilitate the professional registration of medical engineers through what was then the Council of Engineering Institutions [28]. This national move was also paralleled by moves at an international level within the International Federation for Medical and Biological Engineering (IFMBE) to establish international agreement on the minimum acceptable standards for practice as a clinical engineer [27].

Later the UK Institute of Physics and Engineering in Medicine (IPEM), incorporating both the Biological Engineering Society and the Hospital Physicists' Association, developed a short guidance for the education and training of medical engineers and physicists. The first booklet on this subject (published in 1993) incorporated a short list of competencies, which must be met in order to satisfy requirements for corporate membership of IPEM. Since 1993 this training scheme booklet has been regularly updated and published by the IPEM, providing a starting point for a programme of training [17]. IPEM accredits both postgraduate M.Sc. courses and training centres, leaving the training centres a great deal of freedom to interpret what is needed to achieve a satisfactory training programme. A recent development in the UK has been the introduction of a statutory register for those practising professionally as Clinical Scientists (including medical physicists and medical/clinical engineers). This register is maintained under the Health Professions Council who is ultimately responsible for the initial and continuing competence assessment of all clinical scientists. The former task is presently delegated to the Association of Clinical Scientists.

An independent study conducted on behalf of the UK's National Health Service evaluated the adequacy of training across all scientific support services, from medical physics to microbiology [12]. This survey found that there were widely differing success levels in standards of training and highlighted areas of perceived deficiency. Chief among these related to medical physics and medical engineering was the lack of adequate planning and organisation (63% of respondents found this a significant or very significant barrier to training). It was also noted by 73% of respondents that not having a clear idea of what was required to meet competencies significantly or very significantly affected the quality of their training.

In Europe training related to ionising radiation used in medical procedures was a very important requirement in the EEC Directive 84/466/Euratom, which introduced the concept of Qualified Expert in Radiophysics. Later, EU Directive 97/43/Euratom replaced 84/466/Euratom and used the term "Medical Physics Expert". This Directive stated that ". . .member states shall ensure . . . adequate theoretical and practical training . . ." [7]. Both these Directives were specifically addressed in the EFOMP Policy Statements No. 3 "Radiation Protection of the patient in Europe: The Training of the Medical Physicist as a Qualified Expert in Radiophysics" and No. 9 "Radiation Protection of the Patient in Europe: The Training of the Medical Physics Expert in Radiation Physics or Radiation technology" [9,18,21].

This paper describes part of the methodology and e-Learning concepts applied by the EU pilot projects EMERALD and EMIT to develop the first structured training programme in medical physics.

2. e-Training project development

Following the 1994 Conference in Budapest, medical physicists from several EU Universities and Hospitals took part in an original pilot project under the EC Leonardo da Vinci programme that targeted the use of ionising radiation in medicine and was in accord with the requirements of the EURATOM Directives 84/466 and (later) 97/43. The project (developed in Department Medical Engineering and Physics at King's College London and King's College Hospital) had the acronym EMERALD, standing for "European Medical Radiation Learning Development". EMERALD brought together a Consortium of Universities and Hospitals in the UK, Sweden, Italy and Portugal, and the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste. The objectives of the project were to produce training curricula and e-Learning materials to facilitate core training for medical physicists in three areas (modules): physics of X-ray diagnostic radiology, nuclear medicine and radiotherapy. As the project developed (under the name EMERALD, Internet