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EFOMP project on the role of biomedical physics in the education of healthcare professionals

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The policy statements describing the role of the medical physicist (and engineer) published by organizations representing medical physics (and engineering) in Europe include the responsibility of providing a contribution to the education of healthcare professionals (physicians and paramedical professions). As a consequence, medical physicists and engineers provide educational services in most Faculties of Medicine / Health Science in Europe. In 2005, the EFOMP council took the decision to set up a Special Interest Group to develop the role of the medical physics educator in such faculties and to work with other healthcare professional groups to produce updated European curricula for them. The effort of the group would provide a base for the progress of the role, its relevance to contemporary healthcare professional education and provide input for future EFOMP policy documents regarding this important aspect of the role of the medical physicist. The present communication will present the group, summarise its latest research and indicate future research directions.

Key words: biomedical physics education, medical education, academic role development, curriculum development.

Definitions used in this work

Biomedical physics (BMP): the use of physics concepts, theories and methods for the greater understanding and development of clinical practice and experimental medicine. This is a wider definition than clinical medical physics and would include physics based aspects of life science research which would have a future impact on clinical practice (e.g., microscopy, nanodevices, spectrometry). At a more mundane level the term is also used in this paper to allow for the fact that most departments in Europe within medical / health science faculties are called either 'medical physics' or 'biophysics' or some combination of both terms. Most basic science departments within faculties of medicine / health science are now being grouped under the generic term 'biomedical sciences'. Many biomedical physics departments today are of necessity multi-disciplinary and include physicists, engineers, mathematicians and sometimes chemists and physicians. By 'biomedical physics department' we include any entity whether in a faculty of medicine/health science or otherwise (e.g., department of physics in a faculty of science, hospital based medical physics department) providing such services.

Curriculum development model: a strategy by which curriculum development can be approached comprehensively and systematically.

Faculty of Medicine/Health Science (FMHS): A university-based organizational entity which includes the education of healthcare professionals as one of the principal components of its mission statement.

Healthcare professions (HCP): Physicians and paramedical professions. 'Paramedical professions' are defined as 'All types of professions related to medicine, e.g. personnel in the fields of nursing, midwifery, sanitation, dental hygiene, physiotherapy, laboratory medicine, therapeutic exercise, radiography' (European Observatory on Health Systems and Policies, http://www.euro.who.int/observatory/Glossary/TopPage?phrase=P).

Higher education: refers to institutions which provide programmes at Bachelor or higher level as defined by the European Higher Education Area (http://www.eua.be/index.php?id=65)

Role development model: role development is an umbrella term for the making, elaboration, redefinition, modification and expansion of a role; a role development model is a strategic plan that would take a role from its present state to a desired enhanced future state.

Introduction

This article presents a new curricular research project initiated by EFOMP aimed at developing the role of biomedical physicists (BMP) in the education of the non-physics healthcare professions (HCP). This aspect of the physicist's role is becoming progressively more important owing to the rapid increase in the number and sophistication of medical devices used by these professions. As medical device education has not kept pace with the rapid increase in technology there has been an increase in the under-utilization of these devices and the number of instances of improper use. In 2005, the EFOMP council took the decision to set up a Special Interest Group (SIG) to develop this aspect of the role of the medical physicist and enhance its relevance to modern medical and healthcare professional education. The present communication introduces the group, presents a background to the project, summarizes a literature review regarding the role recently authored by the group and indicates future research directions. The literature review draws mainly on information from western Europe because this is where the majority of published articles originate. However as the work develops we will also be reporting the situation in eastern Europe. The full version of the literature review has been submitted for publication in Physica Medica – European Journal of Medical Physics, which is the official journal of the EFOMP.

The group

The members of the SIG 'Biomedical Physics Education for the Healthcare Professions' are presented above as the list of authors of the present article. The members represent biomedical physicists from the various regions of the EU and a judicious mix of physicists who are working or have worked in either academic and / or hospital based departments. This ensures a pan-European perspective, representation of the various categories of stakeholders from within the profession and the right balance between theory and practice. It is envisaged that at a later stage representatives of the medical and healthcare professions would also be involved in the project.

Background to the project

A scrutiny of the medical and healthcare professional literature provides relatively few references on the educational role of the biomedical physicist in Faculties of Medicine / Health Science (FMHS). Current curricular content varies tremendously across Europe. Even for a single profession such as that of physician content ranges from general physics to physical biochemistry, biomolecular and cellular biophysics, physiological physics, the effects of physical agents on the human organism and medical devices. From the personal experience of the members of the group there are various causes for this variability. Remits presented to BMP educators by HCP programme leaders are sometimes quite vague as the latter are often unsure on what the learning requirements of their students are. Choice of curriculum content is often subjective with BMP educators simply choosing learning objectives based on those areas of their expertise that in their opinion are most relevant to the particular HCP. Research-based curriculum development and international networking on the issues are lacking. This ad-hoc approach to curriculum development may lead to learning objectives that are far removed from the everyday practicalities in the exercise of the HCP, hence leading to a low level of satisfaction and motivation on the part of the students. There are also indications that the BMP academic is not perceived by the various HCP to have a clear, valuable and easily identifiable role with respect to the education of their students – an issue which if not addressed with urgency by the profession could lead to a reduction of curriculum time devoted to BMP in the various HCP curricula. At the same time, the gradual construction of the European Higher Education Area (often referred to as the ‘Bologna’ process) is encouraging institutions involved in higher education to take a critical look at their curricula and ensure that the latter are more in agreement with the present and future learning needs of the professions. BMP educators cannot play a significant role in this process unless they have a clear updated role mission statement, are in possession of research based role and curriculum development models to guide their work, and increase the degree of harmonization of their activities at the European level.

Summary of the literature review regarding the role

Almost all articles found in the literature focus on the role within programmes for physicians, diagnostic radiographers / radiation therapists and the postgraduate medical specializations of radiology, radiotherapy, interventional radiology and cardiology.

There are very few articles regarding the physics component of medical curricula even though it is a component of many medical programmes. The only work that has been described in detail is that of J. K. Robertson, teaching at the Queen's University Faculty of Medicine, Canada in the years 1909-1951. The pedagogical approach of this educator demonstrates the remarkable vision of some early educators. At that time the medical curriculum was very linearly structured with strict separation of basic and applied science. Robertson challenged this system and produced a very successful course which combined physics principles with clinical applications in a single unit. “Robertson's success in this endeavor was based largely on two factors: his sympathetic understanding of the needs of medical students and his innovative combination of basic and applied science in one course – factors that are as important to medical teaching today as they were 50 years ago” [18]. However it seems that this initial flash of educational initiative was not followed up by the international biomedical physics community. Moreover, there have been indications that the absence of systematic research and publication has resulted sometimes in unsatisfactory learning with a high theory-practice gap [21]. In 2001, an interesting attempt to introduce problem-based-learning based teaching to medical students by a team of physicists, a biochemist and medical doctors was reported [16]. In 2005, EFOMP published a radiation protection syllabus for medical undergraduates [11]. Some authors have appealed for a widening of content to include topics such as biosignal measurement and processing [20]. In 2005, a survey of the physics component of European undergraduate medical curricula led to the following results: (a) in general a compulsory physics contribution is included in the pre-clinical stage with further optional units in the clinical years (b) there is wide variation in the compulsory pre-clinical curriculum time devoted for physics, ranging from 0 to 90 hours (c) in some countries the physics component is a national legal requirement whilst in others not (d) there is wide variation in curriculum content – in some countries legal instruments specify detailed content whilst in others these provide only general direction (e) delivery is still mainly presentation based though in some countries practicals are mandated by law (f) there is a lack of systematic, research-based curriculum development (g) most departments have not yet reacted to developments such as competence-based curricula and problem-based learning [8]. In a subsequent paper the same authors developed a biomedical physics learning outcome competence inventory for undergraduate medical education in Europe [9].

Physics has been included in the curriculum for diagnostic radiographers since the beginning of formal radiography education. However, the first research-based inventory of physics competences for diagnostic radiography education in Europe was only published recently [6]. Physicists have always been involved in international initiatives (EC, ICRP, IAEA) for the development of resources for radiation protection education. These have always included reference to radiographers [15]. Physicists are presently involved in an International Commission for Radiation Protection (www.icrp.org) group working on a document entitled 'Radiation protection training for diagnostic and interventional procedures' to be published in 2009 (Vano E., personal communication, Feb. 2008). Therapeutic radiology is an area in which physicists and other healthcare professions have worked together to produce European curricula including one for radiation therapists [10].

Physics has always been a component of the curriculum of the postgraduate medical specializations of radiology and radiotherapy [2, 3, 12, 14]. It has been argued that it is the superior knowledge that radiologists have of physics that gives them an advantage over other clinicians who attempt to read medical images. Others have argued that owing to the pressures on radiologists' learning time only physics knowledge that is derived from the clinical practice should be taught. This was countered by the argument that it is more important to use the time available to build firm broad conceptual foundations as concepts that were not seen as relevant at the time of learning could become so at a later date. A more recent debate involved a discussion on whether the rapid increase in the number of imaging modalities implies that the physics taught to radiologists would need to be expanded and become more quantitative. The arguments in favour of the proposition tended to be statements on the lines that more technology requires more physics. Arguments against the proposition were that there is simply no available curriculum time and that medical students do not tend to be mathematically inclined [1, 13, 17, 23]. It is the view of the SIG that, although, a more quantitative approach is of course not suitable for all learners it is highly desirable and it is up to the individual educators to show the way to those who do have the necessary aptitude. Some recent experiences in the teaching of the practical aspects of radiation protection to interventional radiologists and cardiologists have been well received by clinicians [22, 24-26].

Conclusion

Although there are indications of increasing interest [4, 5, 7, 19] the literature indicates that the precise role of the biomedical physics educator in Faculties of Medicine / Health Science has never been studied in a systematic manner. The Special Interest Group therefore will address the following research objectives: (a) carry out a comprehensive Strengths-Weaknesses-Opportunities-Threats (SWOT) based Europe-wide position audit for the role, including curricular challenges within higher and healthcare professional education (b) propose a strategic role development model for the perusal of role holders which would ensure the future well-being of the role (c) propose a curriculum development model which would be structured enough for systematic curriculum development yet generic enough to be applicable to all the medical / healthcare professions and easily modifiable to national and local needs.

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