

## **An Initial Set of Exploratory Case Studies Regarding the Role of the Biomedical Physics-Engineering Educator as Practiced in Health Science Faculties in Europe**

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### **Abstract**

*The role of biomedical physics-engineering (BMPE) educator in faculties of health science has historically not been well defined with the result that its status within such faculties has sometimes been questioned. It is therefore important that the role be thoroughly researched and good practices identified so that the presence of the role within such faculties be properly justified. This paper reports briefly the results of an initial set of exploratory case studies regarding the role as practiced in universities from three European states having diverse health science faculty and higher educational structures, namely the Czech Republic, the Republic of Ireland and the Netherlands. Data was collected from university web-sites, published documents, curricular materials and textbooks. This data was supplemented when necessary with semi-structured interviews and direct observation during on-site visits.*

### **Introduction**

This set of case studies forms part of a project which aims to produce a clear role definition and role development model for the perusal of BMPE educators in faculties of health science [1]. The aim of the initial phase of the project is to describe the role as presently practiced in Europe and assemble elements of good practice.

### **1 Research Design**

The philosophical perspective of the project as a whole is pragmatic, the research approach qualitative. The research strategy in the initial phase of the project consists of a qualitative cross-sectional Europe-wide survey consisting of a series of case studies of BMPE entities (which in practice range from large departments to individuals). A preliminary exploratory survey was carried out via an analysis of health science faculty web-pages across Europe and a purposive sample of countries and universities chosen. Criteria of choice of countries included level of BMPE educator activity within health faculties, geographical position, range of health professions serviced, higher education structure and level of participation in European initiatives. In general universities within capitals were chosen as these provided the best data for the aims of the project. Other institutions

outside the capitals were also included when new themes were indicated. Data was collected from web-sites, published documents, curricular materials and textbooks with the help of a purposely designed thematic checklist. The checklist was expanded and improved recursively as new themes emerged. This data was supplemented when necessary with semi-structured interviews and direct observation during on-site visits. The interviews were also necessary to provide an element of the social-constructivist and advocative perspectives which are essential in role development research. This paper reports on the results from the initial three case studies which were very exploratory in nature.

### **2 The Czech Republic**

The Instit. of Biophysics and Informatics of the First Faculty of Medicine, Charles Univ., Prague provides 6 ECTS to 1<sup>st</sup> year medical-dental programmes which include work on biomolecular and physiological physics, bioeffects of physical agents, medical devices and BMPE practicals. Two optional single ECTS credits on radiation based therapeutic medical devices ('Clinical Radiobiology') in the 3<sup>rd</sup> year and other miscellaneous medical devices ('Biophysical Methods in Medicine') in the 4<sup>th</sup> year are also offered. Two 'Biophysics for Physiotherapy' ECTS credits (one theoretical, one practical) are provided to 1<sup>st</sup> year Physiotherapy. These are mostly an abridged version of the medical-dental units with some added material on physiotherapy devices. Biomechanics-kinesiology are absent as these are serviced by the Instit. of Physiology and Department of Rehabilitation Medicine. The instit. itself organises a degree programme in Healthcare Technology which focuses heavily on medical devices. There is no servicing in the degrees of Nursing and Occupational Therapy ('ergotherapy') an issue which may need to be addressed in the future. Good practices include a student laboratory dedicated uniquely to BMPE practicals and multimedia presentations. Members of the department have also published a textbook to be used during practicals. Textbook analysis indicates an emphasis on accuracy and precision in measurement and a wise choice of experiments relevant to healthcare. The number of devices that health professionals need to use is increasing

rapidly. Therefore a more professional attitude towards device use is essential. The degree in Healthcare Technology indicates that the institute has a correct vision regarding future developments in healthcare.

The Department of Biophysics and Physical Chemistry of the Faculty of Pharmacy, Charles University (Hradec Kralove campus) provides units to programmes in Pharmacy and Biomedical Laboratory Analysis. These involve lectures and practicals with an emphasis on measurement. The Instit. of Medical Engineering and Biophysics, Faculty of Health and Social Care, University of South Bohemia is heavily involved in a programme for Radiological Assistants (Radiography-Radiotherapy combined) with commendable emphasis on imaging devices, radiation protection and quality control. The Dept. of Biophysics, Faculty of Medicine, Palacky University, Olomouc offers medical device courses for specific professions including Nursing and Dentistry.

### 3 The Republic of Ireland

Both University College Dublin and Trinity College Dublin have Faculties of Health Science but neither have a department of BMPE. However each health profession independently hires BMPE educators. At UCD there is a part-time BMPE educator teaching basic radiography physics and medical radiation protection in the School of Diagnostic Imaging. Some lecturing units in the curriculum of this profession would greatly benefit from the employment of a full-timer as radiography is very BMPE intensive. There is one full-timer in the School of Physiotherapy who teaches biomechanics-kinesiology and associated measurement devices. There seems to be little input by BMPE educators in the 'Applied Physics and Physiotherapy' units which means that a good opportunity for inter-professional collaboration is lost. The medical course has adopted the systems approach and some 'Biological Physics' (basic physiological physics) is included in the 1<sup>st</sup> year curriculum under 'Systems I – Normal Human Biology'. In the case of TCD some part-time BMPE staff form part of the Department of Clinical Medicine and there are two full-timers within the School of Therapeutic Radiography with a heavy commitment in teaching imaging and radiotherapy physics, radiation protection and radiotherapy planning. There is an excellent student computer lab with radiotherapy software on each terminal. Non-applied physics is also taught by the departments of Physics of the Faculties of Science as a foundation level course for most healthcare courses at both universities as the entry qualifications are such that students can gain entry even if they have a poor knowledge of physics.

### 4 The Netherlands

Higher education in the Netherlands is delivered at two types of universities, that is, the traditional *Universiteit*

and the Universities of Professional Education. Medicine, Dentistry and Pharmacy are found in the traditional universities, whilst all other health professions in the Universities of Professional Education. The Department of Clinical Physics and Informatics within the Faculty of Medicine of the Vrije Universiteit in Amsterdam provides theoretical and practical components within a few study-blocks of the systems-based medical curriculum (medical imaging, microscope optics and the human visual system). There is also some BMPE education in the dentistry curriculum. There is no biomedical BMPE department at Fontys University of Health Professional Education (Eindhoven). However a full-time BMPE educator delivers an excellent medical radiation protection course including practicals within the Medical Imaging and Radiotherapy programme. The radiation protection part of the curriculum is specified by law which means it is protected against arbitrary curricular change. There is a BMPE component also in the Physiotherapy programme.

### 5 Discussion and conclusions

The presence of BMPEs *within* faculties of health science as opposed to outside-servicing from mainstream physics or engineering departments has resulted in a much reduced theory-practice gap in learning objectives. The Czech Republic model in which BMPE educators are organized within a single department servicing the various health professions ensures an element of collegiality and cross-fertilisation of ideas between BMPEs as well as the possibility of courses for multi-professional groups. It is vitally important however that mechanisms for regular contact with academics from the other health professions be set up to maintain relevancy. In particular BMPE curricula should be designed by multi-professional teams. In the case of both the Republic of Ireland and the Netherlands the separate development of the health professions within separate profession-specific university entities has led to a fragmentation of the role and isolated BMPE educators with little say in faculty affairs. Each BMPE is producing very good work in his own sphere, however inter-BMPE interaction is lost. On the other hand there might be the advantage of a higher level of interaction with the particular serviced health profession.

### References

- [1] CARUANA, CJ. The Role of the Medical Physics Educator in a Faculty of Health Sciences. *GIREP Conference 2002 Physics in new fields and modern applications.*