



ELECTROMAGNETIC BIOSIGNALS AND ELECTROMAGNETIC RADIATION IN ELECTRONIC EDUCATION OF MEDICAL BIOPHYSICS - A PEDAGOGIC PROJECT.

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Abstract

The aim of the presented pedagogic project is to prepare multimedia materials in form of e-learning courses. The target groups will be students of medicine and biomedical physics. The prepared lectures will allow better understanding of topics concerning bioelectromagnetism to overcome the lack of time during normal planned classes. The individual study will be accompanied by didactic tests with automatic evaluation to monitor and to verify the students' knowledge. All multimedia materials will appear also in a printed version and always in Slovak as well as in English language.

Key words: medical biophysics, e-learning, bioelectromagnetism

Introduction

Without physical background, it is not possible to understand correctly many functions of the human organism, neither diagnostic methods in medicine based on physical principles, nor functioning of devices, what may lead to decreased diagnostic efficiency as well as to patient impairment. If the doctors and the medical personnel intend to approach their work responsibly,



they have to understand these problems and not to consider them as an enemy.

We try to contribute to this problem solution within the frame of the project KEGA 004UK-4/2011 in cooperation with Faculty of Mathematics, Physics and Informatics CU in Bratislava and Faculty of Medicine UPJŠ in Košice. This paper offers short information about the project.

Background of the project

The knowledge level of contemporary students on the subjects based on natural science is markedly lower as it was several years ago. This is probably the consequence of the changed way of teaching at basic and comprehensive schools. The lack of knowledge is unfavourably manifested mainly in exact science subjects, which cannot be mugged up. Subjects as Mathematics, Physics or Informatics require to use logical thinking, not only mechanical repeating of topics. Next reason is the continuously decreasing ability of students to trace the lectures online and make adequate notes from them.

Nowadays, there is an enormous increase of new information. It is not possible to remember all of them. Therefore, the student has to know how to sort them and how to work with them. This can not be managed without logical and creative approach.

The university education in Physics can not supply for any type of education at lower stages. This all is the more demanding the less is the number of Physics lessons compared to the other subjects based on natural sciences as Chemistry (three times more classes) or Biology (one and half times more classes). For example, Physics (more exactly Biophysics and Medical Biophysics) at Medical Faculty of Comenius University in Bratislava is taught in average two times less than at comparable medical faculties in the Slovak Republic. In Bratislava, there is neither an acceptance test involving Physics nor a preparatory course as is in Biology or Chemistry. And this happens in spite of the fact that the best assumption for a successful passing of medical study is mastering Mathematics and Physics. The knowledge neither in Biology nor in Chemistry is in any relationship with the successful getting through the study.

On one side, we have good experience with students who have not had any Physics at their secondary school, but were able to master the physical topics within a relatively short time period if a good study material was available. On the other side, we have experience with graduates who were not able to work successfully because of lack of knowledge in Physics and



Mathematics and they needed additional tutorage after starting in their positions at medical clinics.

The lack of classes can be recompensed only in form of individual study. The existing university textbooks on Physics and Biophysics are not always suitable for this purpose as they are more or less of encyclopaedic character, for example [1 - 3]. They presume that the student governs the high school physical principles. Furthermore, this problem can not be solved by any "formula collection", for example [4], as the formulas can not be appropriately applied without understanding the problems what is then more or less demonstrated during examination. Students need new possibilities to gather the required knowledge in a suitable and effective way without recompensing the high-school subject matter. This can be done, for example, by individual studying of those parts, in which the student feels the largest gaps without the need of browsing an amount of printed textbooks and/or multimedia materials, which does not exist at all, which are not in Slovak or which are not open to students of other universities.

Furthermore, the majority of available materials comprising bioelectromagnetism are oriented mainly technically and not medically. Some texts that are planned to be used were already partially prepared in English language and published in textbooks [5; 6].

Aim of the project

The aim of this project is to prepare multimedia materials enabling deeper understanding of topics, which cannot be explained in detail during current lessons because of lack of time. Individual topics in form of interactive lectures are planned to be completed with didactic tests and automatic evaluation. In the first stage, we cover the physical basis of bioelectromagnetism, transport processes, thermodynamics of living systems, biophysics of excitation processes, biological signals as the basis of diagnostic methods in medicine, essentials of biomedical electronics, passive electric and magnetic properties of cells, tissues and organs, electromagnetic spectrum, its basic characteristics and corresponding spectroscopic and tomographic methods, influence of non-ionising electromagnetic radiation on organism, safety and protection of health during registration of electric and magnetic biosignals. All materials are prepared in both Slovak and English language to ensure the uniform education content in both languages. All topics will be accompanied with didactic tests with automatic evaluation [7; 8].



Students preferring to study in a textbook form or those without access to Internet will be supplied with printed versions, which will be prepared simultaneously to the multimedia materials.

The chosen topics belong to the most difficult for understanding. They combine physical knowledge with essentials of Biology, Chemistry, and Electronics, and represent an important background for next disciplines, as well as all diagnostic methods, which cannot be applied without modern technology.

Preliminary results

The Slovak version of the chosen topics published earlier in English language [5; 6] is under preparation together with the test questions. The printed version is planned to appear till the end of the next year. Besides, several lectures in form of PowerPoint presentations have been published on the MEFANET portal of the Faculty of Medicine CU in Bratislava (<http://portal.fmed.uniba.sk/>), all in both languages.

Conclusion

Our project has been prepared to help the students in acquiring knowledge in Medical Biophysics and to fulfil their demands to get the study materials in advance in electronic form and to have the possibility to prepare for classes. Monitoring of their knowledge and test evaluation according to different topics will allow us to use the feedback information for planning and improvement of teaching. We assume that this will lead to a platform for a long lasting exploitation of e-learning courses and didactic tests.

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