Preclinical training – closer to clinical practice

Stefan Krustev

This paper is related to *the need to direct preclinical training according to medical specialties to clinical practice. In this context, in line with global standards for medical education, special attention is paid to the study of basic biomedical sciences. Based on these general formulations of modern medical education, we present some of the results of the experimental implementation of the project-oriented training in Biophysics for the majors Medicine and Dental Medicine.*

Key words: *preclinical training, clinical practice, biophysics, project-oriented training, experimental implementation*

INTRODUCTION

The accusation that fundamental sciences in the preclinical medical education are not taught with the required clinical orientation, and clinical sciences have insufficient practical orientation, is traditional. It is emphasized that during the course of training a bridge should be thrown between preclinical and clinical courses and to overcome negative attitude and indifference of students to preclinical studies, to teach students to seek, find and analyze information from various sources, to develop and form clinical thinking, to acquire the much needed skills of professional communication, esteem and self-esteem and teamwork from the very beginning of the medical training.

Nowadays, integration and multidisciplinary approach should orient students to clinical thinking based on the established personal base of theoretical knowledge, where the instructor to appear in the role of moderator which is the basic idea of contemporary interactive methods of teaching (problem-based training; evidence-based teaching; project-based training, etc.), whereas, this training should be as close as possible to the actual professional activities, and the main objective of the training process should be provoking a desire for learning, creating an attitude to independent learning throughout life, in accordance with the strategy of the European Union [1]. As stated in the global medical education standards of the World Federation for Medical Education (WFME) [2], training in medical specialties in the field of basic biomedical sciences should pay particular attention to the contribution and importance of fundamental concepts and methods in close conjunction with their application in clinical science. In this sense, it is necessary to emphasize on the need students to build and develop creative thinking and understanding of the fundamental nature of biomedical sciences and their clinical application, to prepare students in a manner that will enable them to deal with future avalanche-like development of medical scientific knowledge and new technologies [2].

PRESENTATION

Based on these general formulations related to the objectives of modern medical education, in view of studying Biophysics in the Department of Physics and Biophysics, in 2013/2014 academic year the first experimental implementation of project-oriented training in Biophysics was laid down. Within this experiment, from the very beginning of the term, students of Medicine and Dental Medicine were given the opportunity throughout their training to develop a micro-project entitled Biophysics – Clinical Application, where to detect and trace biophysical fundamentals and methods of testing in the origination, diagnosis and/or treatment of various diseases. The name micro-project was motivated by the desire to emphasize on the fact that the development of this project is not related to involvement of significant time and effort on the part of already busy enough students in these majors.

To boost teamwork abilities, students were given the opportunity and were encouraged to work in small teams (up to 3 students), without excluding the possibility for independent development of a project. Indicative limitations to the volume, in which the

team should present its work on the respective projects, were set out. Topics of potential projects were put on discussion and consulted in advance, in some cases repeatedly, with the professor conducting the lectures. Each team had to present the results from its work on the project in the form of multimedia presentation on public defense before the course students and the professor, conducting the lectures.

While working in team on the development of such a project, students pass through all stages of a serious scientific research, prepare themselves to make a literature review, to collect and analyze scientific evidence, to discuss the results of various studies, to critically examine the various sources of information on the given topic and improve their competences.

In this case, the need of appropriate incentives and reporting the results of students' work and diligence put in the project is natural. For the purpose, a scoring system already established in the department (1998) that covers the whole work during the term (the student's theoretical knowledge and practical work) plus the results of the examination was used [3]. It should be noted that as a result of the introduction of this 100-point system for checking and evaluating students' knowledge, their interest and motivation for systematic work and the satisfaction of the objectivity of the grade for the achieved knowledge, raised. Here is the place to note the information and diagnostic importance of this approach, providing opportunity for studying and quantifying the results of the introduction of new forms of work in the process of training [3].

As far as the developed project is presented in the form of multimedia presentation at public defense it was reasonably decided that in case of successful defense the grade of the project may be recognized for taking an oral examination. During the public defense, all students from the team were asked questions (including by the audience) on the topic of the project, and adequate answers were expected showing depth knowledge on the relevant issues and ability to understand the specific biophysical principles and concepts applicable to corresponding clinical applications. Upon successful defense, students who received the maximum grade were exempted from oral examination after successfully passed written exam. Students who have successfully defended their project but having grades lower than the maximum, had the right to keep this result for the oral examination and if willing to ask for additional questions in order to improve their performance.

It should be noted that while the introduction of the project-based training required much more extensive reform [4] and [5], in this case we prefer to use the expression project-oriented training.

In the course of the experiment, surprisingly large number of projects on topic *Biophysics – Clinical Application*s was developed. This is probably due both to the provoked interest and to the incentives created by reporting the work done on the project and the final result of the examination in Biophysics. There were a total of 61 projects developed and defended publicly, of which 45 were of medical students and 16 of dental students, as the teams included a total of 158 students (117 medical and 41 dental students). It can be noted that the different number of developed projects according to fields roughly corresponds to the ratio between the students of both majors and represents approximately half of the students in the course, giving a good benchmark.

It should be noted the considerable interest provoked by the possibility to develop a project in teams, the formation of a team and the orientation to a specific topic of the project. During the discussions with the professor conducting the lectures an essential part of the topics originally selected by the students (around 30%) were rejected as inappropriate or were proposed to be re-defined mostly due to insufficient focus on biophysical concepts and principles or vice versa – insufficiently justified from a clinical point of view.

There were projects discussing a wide range of issues related to biophysical concepts and principles and their clinical application. The following may be mentioned as examples: Quantum Dots, Effects of Laser Radiation on Biological Tissues and Its

Application in Ophthalmology, Electrophoresis in Sports Injuries and Diseases, Electrochemotherapy, Photosensibilisation of Subcellular Structures, General Controlled Hyperthermia, Biocybernetic Model of Immune Response in Tumor Development Processes, Study of the Effects of Laser Radiation on the Oral Cavity in Dental Practice, Electrical Stimulation for Fractures, etc.

Eventually, a total of 216 students majoring Medicine sat for the examination, of them 117 have developed and successfully defended a project. It is noteworthy that 86 of these 117 students (73,5%) have successfully passed the colloquium on the first part of the lecture material, at that there were fears that after the successful defense of the project, they would underestimate their preparation for taking the written exam on the second part. These fears proved to be unfounded. The analysis showed that the average results shown by these students on the second part of the study material is 25,9 out of a maximum of 30 points, while students who have not developed projects showed an average result of 18,1 points, i.e. students who have developed a project have 43% higher results.

It should also be noted that students who have received the maximum number of points (30) at the written examination on the second part are 25 (29,1%) of all students who have successfully passed the colloquium and developed a project. This shows a really high level of motivation. In comparison, only 12 students (12,1%) of all students who have preferred to sit an oral exam and have not prepared a project, showed the maximum result of 30 points at the written examination on the second part, which is approximately two and a half times less as a relative share.

CONCLUSION

Summing up, we can state that as a final result, students who have developed a project, completed the examination in Biophysics with an average result of 83,1 points out of the maximum 100 points, while those, who have not developed a project showed an average result of 70,3 points. The so established 18% growth in the success rate of students who have been involved in the experiment and have developed a project on *Biophysics – Clinical Applications*, gives ground to consider this experiment successful.

The results of students majoring Dental Medicine are similar, but because of their relatively small number they would not have the necessary statistical significance. At the same time, it would not be appropriate to generalize the results for the two majors, because they study Biophysics according to different curricula with different number of classes.

It is essential to note the significant growth in the interest and involvement of students in *Biophysics – Clinical Applications* project. Thus, during the summer term of 2014/2015, the projects developed under the direction of assistant professors and presented in the department in the form of posters are a total of 156 for both Medicine and Dental Medicine majors. The best of them were subsequently presented as multimedia presentations. It can be assumed that with the existing number of students, such a massive involvement is close to the “point of saturation”, and as a reserve we should be looking at improving the quality of the projects developed. The development of the so planned experiment is still to be followed over time and the results obtained are to be evaluated based on the 100-point system [3] for evaluation and checking the knowledge of students.

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CONTACTS:
Assoc. Prof. Stefan Krustev, PhD; Department of Physics and Biophysics, Medical University—Varna, tel. +359 052 677257, e-mail: krustev@mu-varna.bg

Докладът е рецензиран.