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EFFICACY OF TEACHING MEDICAL STUDENTS BY PROBLEM-BASED LEARNING METHOD

O. K. Koloskova[1], T. M. Bilous[1], G. A. Bilyk[1], S. S. Kaliyeva[2], V. P. Riklefs[2], G. Z. Abakassova[2], A. Z. Muratova[2]

1 - Higher State Educational Establishment of Ukraine "Bukovinian State Medical University", Chernivtsi, Ukraine
2 - Karaganda State Medical University, Karaganda, Kazakhstan

Tetiana Bilous - PhD, Associate Professor, Department of Paediatrics and Children Infectious Diseases, Higher State Educational Establishment of Ukraine "Bukovinian State Medical University", Chernivtsi, Ukraine, Teatralna sq., 2, Chernivtsi, 58002, Ukraine,+380502213516, bilous.tetiana@bsmu.edu.ua

Abstract

To determine and analyze the evaluate efficacy of teaching senior students of medical faculties at Universities in terms of avoiding medical errors in pediatrics. Students studied according to problem based learning method while learning the subject "Pediatrics" within the framework of ERASMUS+ TAME project. Therefore, students were distributed into three groups: students, who learnt pediatrics by branch case method, students, who studied by problem-based learning method and linear cases method in particular and students, who studied by the traditional classical scheme of teaching pediatrics. The compiled questionnaire consisted of questions including: questions the subject of cases, tangent questions, they were

not included into cases and control questions. The analysis of questionnaire of students showed that the best result (in percent of right answers) was seen in I group; its representatives studied by branch cases (42,0% Ukrainian and 43,2% Kazakhstan). The lowest percentage of right answers (37,6%) was determined in the control III group (41,9% in Kazakhstan), and the results of the group with linear cases was 40,6% of right answers (36,5% in Kazakhstan). Thus, problem-based learning considerably stimulates motivation of students to learning and promotes better efficacy of the whole educational process. Students who study according to problem-based learning method as compared to those who study according to the traditional methods demonstrate better results by the number of right answers given to tests.

Keywords: problem-based learning, virtual patient; pediatrics; medical errors.

Introduction. Considering continuous improvement and increase of requirements in the field of training highly qualified professionals in medicine who completely meet the needs of contemporary time and are able to give aid according to standards based on the latest achievements of medical science and practice, the problem of improving the quality of education at higher medical educational establishments has become especially acute. Contemporary requirements call for training specialists on a new qualitative level under conditions of snowballing information flow which is transient and constantly renewing. Considering this fact classical methods of teaching traditionally applied at higher schools often appear to be insufficiently effective. They do not completely conform to modern tendencies and demands. Limited possibilities of traditional approaches to teaching students who have to learn mechanically a lot of material during the first three years of their studies, poor interrelations with practical clinical medicine studied at senior years, induced searching alternative pedagogical methods at higher medical educational establishments. In addition, new educational strategies and styles are recognized a powerful factor varying teaching, making a creative atmosphere in students' groups, improves motivation to learning and quality of education. To overcome a passive role of students during practical classes, their complete dependence on the teacher in educational process, to get over contraindications and disintegration of theoretical and clinical subjects, to stimulate student motivation to self-education, as far back as in the 60-ies of the XX century a group of scientists headed by Howard Barrows at the Medical School of McMaster University (Ontario, Canada) introduced educational tactics of problem-based learning (PBL) in medical education (Barrows, 1986; Barrows et al., 1980) having possessed a new content. This method had been known since

1944 as interconnection between doing, thinking and learning.

Problem-based learning (PBL) is now considered as a certain idea, pedagogical strategy, special style of getting knowledge, due to which it becomes possible to learn the issue comprehensively with deep, active, durable contextual mastering material from real life situations with maximal use of evidentially substantiated world information resources. Problem-based learning is teaching-learning method based on unsupervised solution of specified and real problems by learners as a motivation stimulus to active of acquiring knowledge. Problem-based learning is personality-oriented pedagogical method motivating students to active learning of the subject by means of active acquiring experience in solution various issues to be discussed (Banu et al., 2014; Wood, 2003).

PBL method differs from others by its stimulation of a student's motivation to active learning, constructivism, and a central position of students in educational process. An important key element of PBL method is the fact that a clinical task suggested for learners activates their independent acquiring knowledge essential for its solution, forming skills and abilities of students to find and apply their knowledge in available information resources that can be used in real practical situations. Moreover, students learn to identify and analyze issues, organize their activity in the direction of searching information, correlate the knowledge in different subjects obtained at junior years, assess the information obtained, work in a team, and train their qualities of a leader (Masek et al., 2010; Neville, 2009).

Nowadays there are many variants that can be classified as PBL, and directed design, case method, role game, modeling in particular (McKeachie, 2010), as well as learning on the base of a project. There are different PBL models: original Barrows conception of "pure PBL", hybrid PBL model, and traditional model with the elements of solving problems:

1) SBL (Subject-Based Learning) – a traditional technology of lecturing the material with practical classes in clinic;

2) "Flipped" class – students study at home using paper and on-line resources, do certain tasks during practical classes with the purpose to consolidate the material;

3) TBL (Team-Based Learning) – training in small groups. Students prepare outside the class and cooperate with group mates to solve the tasks;

4) MOOC (massive open online course) – on-line resources available for everyone assuming an open access to Internet and a number of participants;

5) ScBL (Scenario-Based Learning) – case-scenario method, authentic cases from real situations with consolidation of specific skills and knowledge.

Nowadays a great number of classical PBL models are adapted to different new

programs in various subjects, and preformed hybrid PBL models are implemented into curricula (Potu, 2013). It is explained by peculiarities of methodological approaches of PBL that are easily adapted to different curriculum structures, and enable to achieve a certain goal with solution a specific problem.

According to the data of modern scientific literature (Savin-Baden, 2000) PBL model should be adapted correspondingly to five objectives:

1) PBL to achieve epistemic competence. Knowledge is more or less proportional, but students are expected to be competent in using their knowledge and moving in the direction of problem solving.

2) PBL to optimize professional actions. Knowledge is assessed by practical use and productivity, and problem scenario is based on real application in clinical situation in particular.

3) PBL for interdisciplinary understanding. Knowledge is obtained through "know-how" and "know-what", as well as problem-based scenario is overcoming gaps between these two directions.

4) PBL for trans-disciplinary learning. The knowledge assumes understanding borders between disciplines, and the problem-based scenario is presented in an open format to move forward.

5) PBL for critical discussions. Knowledge is obtained by a contingent contextually and structured inside of multi-dimensional problem scenarios suggesting multi-dimensional solutions.

The latter position as a purpose of teaching by PBL method forms the basis within the framework of EACEA ERASMUS+ project. Since October 2015 the teaching staff of the Department of Pediatrics and Children Infectious Diseases, Higher State Educational Establishment of Ukraine "Bukovinian State Medical University" (BSMU), has joined the project. Apart from BSMU 9 higher educational institutions from 7 countries of the world are the members of the TAME (Training Against Medical Error) project №561583-EPP-1-2015-1-KZ-EPPKA2-CBHE-JP (2015-2944/001-001), based on teaching students by PBL method. The project is coordinated by Karaganda State Medical University (Kazakhstan), and its members are: St. George London University (Great Britain), Caroline Institute (Sweden), Masaryk University (Czech Republic), the Aristotle University of Thessaloniki (Greece), Zaporizhzhia State Medical University (Ukraine), Astana Medical University (Kazakhstan), Hanoi Medical University (Vietnam), Huey University of Medicine and Pharmacy (Vietnam).

The problem to avoid medical errors was and has been rather acute in different times.

In the USA in particular, as a cause of lethal outcome medial errors occupy the third position after cardiologic and oncological causes (Makary et al., 2016). The main strategic purpose of the project is to achieve avoidance of medical errors in medical practice, and while giving medical aid to children in particular. Its tactic purposes are the following:

1. To develop the methods of teaching based on virtual patients enabling future doctor to avoid the most common medical errors in diagnostics and treatment.

2. To ensure exchange of knowledge and experience between institutions which used effective methods of training future pediatricians; to promote development of pediatrician branch in every institution.

3. To apply accumulated experience in experimental study with the purpose to create similar resources in different medical fields of every institution.

4. To use inter-regional electron nets (ePBLnet, MEFANET etc.) of medical education with the aim of creation, mutual use and share the resources directed to prevention or decrease of medical errors.

Moreover, participants of the project want to motivate student for self-realization and development, mastering skills of team work that further will reduce the risk of wrongdoing and making wrong decisions in their practical work.

Methodologically training of students was oriented on the following main positions:

1. A complicated and/or original clinical issue occupies a central position in the created cases (clinical cases on virtual patients), requiring knowledge and skills obtained by the students at previous courses and departments.

2. In the process of teaching a teacher (tutor) is not a source of knowledge but plays a passive role of an observer, and students take the main initiative and bear responsibility for the process of learning.

3. Considering different personal features of students' group we use individual approach to every student in the process of problem solving.

4. Free access to information recourses enables in short time to ensure multi-disciplinary approach to problem solving and review lost knowledge.

5. Working in groups of 8 participants students learn the principles of team work in problem solving, acquire qualities of a leader, skills to maintain one's position and ability to recognize own errors in presence of other participants.

6. The results of training are assessed by a teacher (tutor), as well as self-assessment and assessment by other group-mates is encouraged.

Objective: to evaluate efficacy of teaching senior students of medical faculties at

Higher State Educational Establishment of Ukraine "Bukovinian State Medical University" and Karaganda State Medical University (Kazakhstan) in terms of avoiding medical errors in pediatrics (within the international grant project TAME) by means of a comparative analysis of the mastered knowledge by the results of the standard questionnaire of respondents who studied according to problem based learning and traditional methods of training in pediatrics.

Materials and methods. 64 six-year students of the Medical Faculty №2 studied at the Department of Pediatrics and Children Infectious Diseases, Higher State Educational Establishment of Ukraine "Bukovinian State Medical University" (BSMU) according to problem based learning method while learning the subject “Pediatrics, Children Infections” during Module 5 within the framework of ERASMUS+ EACEA project Training Against Medical Error (TAME) №561583-EPP-1-2015-1-KZ-EPPKA2-CBHE-JP (2015-2944/001-001). The classes were organized during 6 weeks twice a week per 3 hours. The groups included 8 participants. Branch and linear cases were used for the classes. At Karaganda State Medical University – KSMU (Kazakhstan) classes were organized in congruence groups of 5-year students (graduates). The groups were similar, topics of the classes were identical, and the same variants of PBL were used.

The whole methodological support for organization of classes according to problem-based learning method in the form of 6 cases within the framework of the project was provided by St. George London University (Great Britain). These cases were used to organize classes both in the form of branch and linear variants. Branch cases included virtual patients; every part of information about them was distributed into certain steps while examining a clinical case. Students who studied according to this variant of problem-based learning method were able to choose a certain way to problem solving selecting different variants of examinations, treatment of a patients etc., and further they faced the results of their solutions.

At the same time, students who studied according to linear cases (virtual patients) did not have such a possibility to choose or directions to consider clinical scenario, that is, they studied according to the simplified model of the case when additional ways to solve a clinical situations were lacking, and a certain step had been already made by the tutor instead.

The subject area of cases included the following: congenital heart defects, buttered child syndrome (BCS), acute laryngotracheitis, neonatal sepsis, celiac disease, intestinal invagination. It should be noted that these methodological materials were adapted according to the requirements of the current therapeutic protocols by the University specialists in Ukraine and Kazakhstan respectively.

To assess the efficacy of problem-based learning method including branch and linear

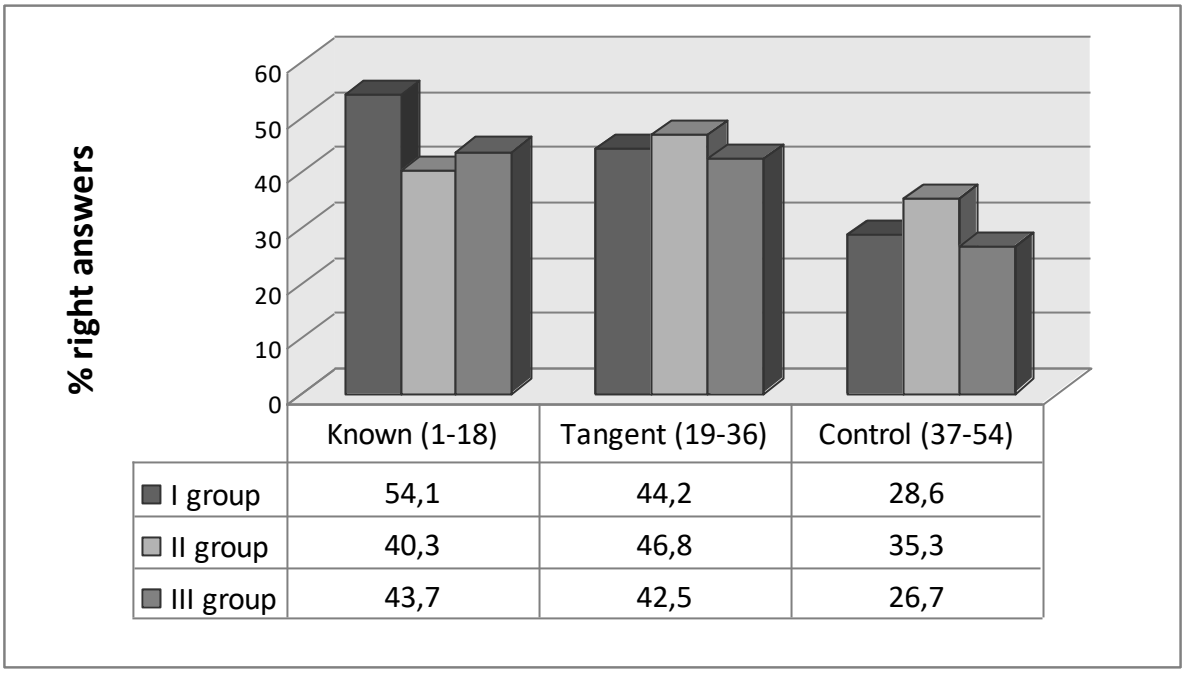
variants in the cases used the students at Higher State Educational Establishment of Ukraine "Bukovinian State Medical University" and Karaganda State Medical University (Kazakhstan) were surveyed: 64 students who studied by PBL method and 29 students who studied by traditional methods according to the standard questionnaire in Ukraine; in Kazakhstan those respondents were 64 and 32 respectively.

A comparative analysis of the obtained answers in Ukraine and Kazakhstan was made depending on the methods applied for teaching pediatrics. Therefore, students were distributed into three groups: the first (I) group included students (32 in Ukraine and 32 in Kazakhstan), who learnt pediatrics by branch case method, the second (II) group – 64 (32 and 32 respectively) students, who studied by problem-based learning method and linear cases method in particular, the third (III) group – 61 (29 and 32 respectively) students, who studied by the traditional classical scheme of teaching pediatrics. This group was the control one for the previous two.

The compiled questionnaire consisted of 54 questions including: (1) questions from 1 to 18 concerning the subject of cases, similar questions were in cases (students who studied according to PBL method were supposed to be better aware of answers to the questions); (2) questions 19-36 – tangent, they were not included into cases, although they could be discussed with a tutor or learnt independently while studying according to PBL method; (3) questions 37-54 – control, their content was not found in cases and was not discussed during classes.

Results and discussion. The analysis of questionnaire of Ukrainian students showed that the best result (in percent of right answers) was seen in I group; its representatives studied by branch cases (42,0%). The lowest percentage of right answers (37,6%) was determined in the control III group, and the results of the group with linear cases was 40,6% of right answers. The results of students from Kazakhstan were practically similar, although they were a little better than those of Ukrainian respondents except the group of graduates who studied according to traditional system of teaching pediatrics. Thus, the results of branch cases were 43,2% of right answers, the group of linear cases – 41,9% and III group (traditional methods of teaching) – 36,5% of right answers.

Fig. 1 presents comparative results of testing Ukrainian students by separate groups of tests and tasks (familiar, tangent, control) in percentage of right answers.



Note: I group – branch cases; II group – linear cases; III group – traditional method of teaching in pediatrics

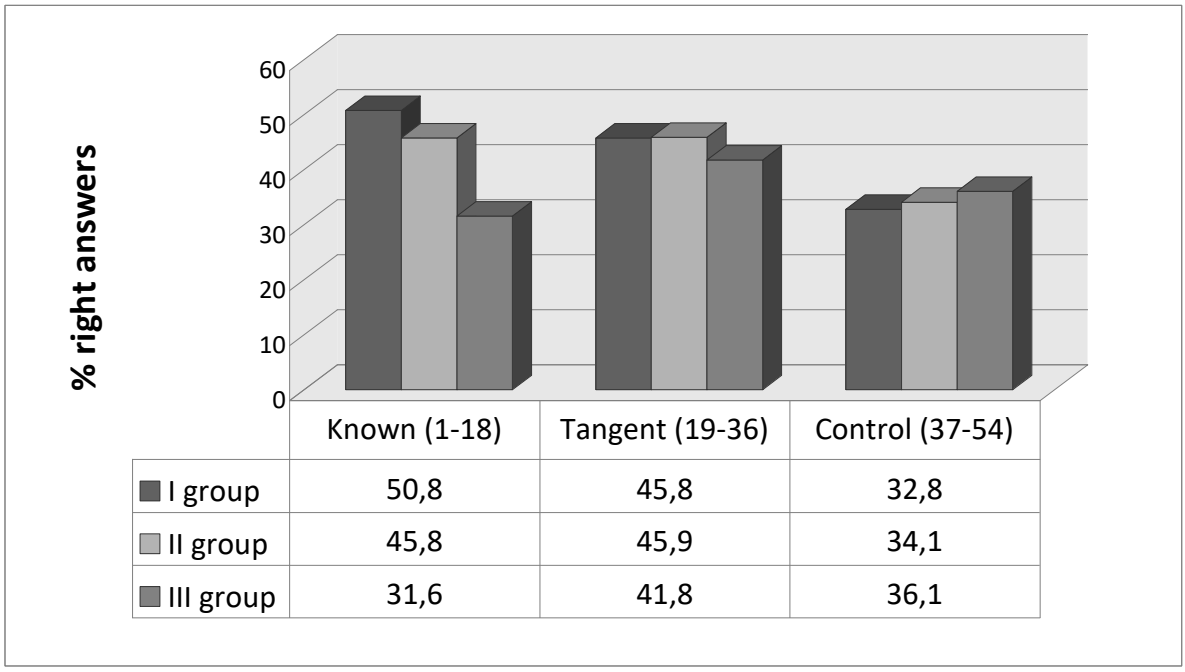
Fig. 1. Results of the questionnaire of BSMU students

Therefore, the representatives of I and III groups gave the best answers to known questions, and students who studied by linear cases – to tangent tasks to the topic of the class.

Fig. 2 presents similar results of teaching pediatrics for the students in Kazakhstan. Thus, the tendencies in BSMU and KSMU were similar in the group of students who studied by the branch cases. At the same time, the representatives of III group were better in tangent tests, and the group with linear cases was the worst in solving the review questions (control).

It should be noted that odds ratio to solve all the questions correctly was identical both for Ukrainian and Kazakh students, and was 2,3 in I group as compared to III group of respondents. At the same time, an attributive risk to give a wrong answer to unknown questions as compared to the already known tasks by Ukrainian students in I group was 1,3 with odds ratio 2,1. Practically similar results concerning the possibility to give wrong answers to unknown questions were found among Kazakh students who studied by the branch cases, - the attributive risk was 1,3, with odds ratio 2,0. Odds ratio to give wrong answers to review questions among Ukrainian students who studied by the linear cases was 2,7 with attributive risk 1,7, which was indicative of a less efficacy of this educational technology as compared to the classes by the cases containing mistakes (branch cases). Similar indices of the risk to give wrong answers to the review questions as compared to the known tasks were

found among Kazakh students who studied according to linear cases: odds ratio was 2,3, attributive risk – 1,6.



	Known (1-18)	Tangent (19-36)	Control (37-54)
I group	50,8	45,8	32,8
II group	45,8	45,9	34,1
III group	31,6	41,8	36,1

Note: I group – branch cases; II group – linear cases; III group – traditional method of teaching in pediatrics

Fig. 2. Results of the questionnaire of KSMU students

Conclusions:

1. Problem-based learning considerably stimulates motivation of students to learning and promotes better efficacy of the whole educational process.

2. Students who study according to problem-based learning method as compared to those who study according to the traditional methods demonstrate better results by the number of right answers given to tests.

3. Teaching pediatrics according to branch cases appears to be more effective as compared to the classes organized according to linear cases, which is evidenced by better results of answers given to the questions and less risk to fail (2,7 against 2,1 among Ukrainian students and 2,3 against 2,0 Kazakh students).

Informed consent was obtained from all individual participants included in the study.

Compliance with ethical standards.

Conflict of interest. The authors declare that they have no conflicts of interest.

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