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Abstract

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ESTIMATION OF PBL TECHNOLOGY BY MEDICAL STUDENTS DEPENDING ON THEIR LEARNING STYLE

The article presents the results of an empirical study in which a search was made for the correlation between learning styles of students and their attitude to two types of learning: traditional for Medical institutions of Ukraine and problem-based learning (PBL). This study was conducted among second-year students of Medical Institute of Sumy State University by using questionnaires. For comparative estimation of learning systems, authors developed special questionnaire that estimates psycho-emotional comfort, organization of learning process, student's role in the learning process, students' vision of the teacher's role, and the choice of the teaching system as optimal. Students of different learning styles ("activists", "theorists", "reflectors", and mixed styles) have been established to perceive different teaching methods (traditional versus PBL) differently. Reflectors and Activists (as leading learning styles, 45.1 % and 19.6 %, respectively) give more positive estimation of learning process organization in PBL system compared to traditional system than Theorists (11.8 % of students). In general, students of all learning styles appreciated PBL as an additional educational innovation that improves the practical component of higher medical education based on traditional approaches to teaching. This can be explained by the fact that organization of PBL lessons meets the demands of all learning styles. The possibility to introduce 50 % of PBL study lessons into the curriculum of students' training in Medical Institute has been supported by the majority of students.

Keywords: problem-based learning, learning styles, higher medical education.

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Резюме

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ОЦІНЮВАННЯ ТЕХНОЛОГІЇ PBL СТУДЕНТАМИ-МЕДИКАМИ ЗАЛЕЖНО ВІД ЇХНЬОГО СТИЛЮ НАВЧАННЯ

У статті представлені результати емпіричного дослідження, в якому був проведений пошук кореляції між стилями навчання студентів і їх ставленням до двох типів навчання – традиційного для медичних освітніх закладів України і проблемного навчання (PBL). Дане дослідження було проведено серед студентів-другокурсників Медичного інституту Сумського державного університету за допомогою анкетування. Встановлено, що студенти різних стилів навчання («активісти», «теоретики», «мислителі») сприймають різні методики навчання (традиційне на противагу PBL) по-різному. В цілому, студенти всіх стилів навчання оцінювали PBL як додаткову освітню інновацію, яка покращує практичну складову вищої меди-

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чної освіти, що базується на традиційних підходах до навчання.

Ключові слова: проблемне навчання, стилі навчання, вища медична освіта.

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ОЦЕНКА ТЕХНОЛОГИИ PBL СТУДЕНТАМИ-МЕДИКАМИ В ЗАВИСИМОСТИ ОТ ИХ СТИЛЯ ОБУЧЕНИЯ

В статье представлены результаты эмпирического исследования, в котором был проведён поиск корреляции между стилями обучения студентов и их отношением к двум типам обучения – традиционному для медицинских образовательных учреждений Украины и проблемному обучению (PBL). Данное исследование было проведено среди студентов-второкурсников Медицинского института Сумского государственного университета с помощью анкетирования. Установлено, что студенты разных стилей обучения («активисты», «теоретики», «мыслители») воспринимают разные методики обучения (традиционное в противовес PBL) по-разному. В целом, студенты всех стилей обучения оценивали PBL как дополнительную образовательную инновацию, которая улучшает практическую составляющую высшего медицинского образования, основанного на традиционных подходах к обучению.

Ключевые слова: проблемное обучение, стили обучения, высшее медицинское образование.

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Introduction

Modern society development provides for the use of efficient instruments to improve all sectors of human life. According to our point of view, this concerns education, the primary goal of which is to solve problems on supplying of highly qualified personnel that can sustain and accelerate progressive tendencies. Ukraine, that has taken the road of the European course of development, sharply experience the need for effective placement of personnel in politics, economy, education, medicine, etc.

Scientific, methodological, and organizational changes, which have recently taken place in the system of higher medical education in Ukraine, are caused by the necessity to reform doctors' training according to the level of that in the developed countries. The usage of modern teaching technologies and techniques together with preservation of long standing positive experience of teaching in higher medical educational institutions in this country, allows improving the quality of educational services considerably. Search for innovative teaching technologies becomes possible due to participation of higher educational institutions in international projects and programmes, which create conditions for use of experience of leading European universities.

Problem based learning (PBL) is well-known all around the world as an efficient method that has been actively used for more than 50 years in many countries to train specialists in various spheres of public life [1]. Due to European Union assistance and support of the implementation of modern technologies in teaching programmes of Eastern Europe universities in the last few years, PBL technology became an available pedagogical innovation for Ukrainian medical higher educational establishments. As for Medical Institute of Sumy State University (SSU) (Ukraine, Sumy), the participation in implementation of the educational project Tempus "Introduction of innovative teaching strategies in medical education and the development of the international network of national training centers" allowed joining in the international experience of PBL use in the course of doctors'-to-be training.

This project participation provided for creation of conditions required for PBL integration into Medical Institute curricula during three semesters involving two groups of students starting with the second year of studying. PBL approach integration was done by introduction of lessons based on standard clinic situations (cases), which made up 25 % of curriculum for the second-year students. Cases used were thoroughly developed, approved

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for usage at lessons with PBL and successfully tested at St. George University (Great Britain) during last 5–10 years.

Implementation of PBL methodology for teaching subjects of medical profile and the research of students' perception of the new pedagogical approach have proved the necessity of comparative analysis of a traditional learning system and PBL taking into account students' individual preferences. A point of view that an optimal use of any pedagogical innovation (including PBL) requires allowing for individual individual psychological features is not a new one [2]. Preliminary studies demonstrated that learning with the use of PBL is a complex process, which must take place with due account for various factors that ensure its effective implementation [3].

A comparative analysis of medical students' work at PBL study lessons and traditional study lessons at SSU proved the necessity of more detailed consideration of the possibility to taking into account individual student's learning style with further usage of these data in an implementation of this pedagogical practice innovation. As repeatedly emphasized, a learning style is a dominant approach that determines efficient mastering the information [4]. This fact is maintained by the existence of a great number of methods that allow determining individual preferences of certain learning style for an efficient professional development.

At present, a designation of an effective PBL method use is a relevant issue for Higher Medical School of Ukraine. We think that professional implementation of a method, which is totally new for this country and is not supported by pedagogical traditions of a secondary school, is possible under condition of allowance for different factors, especially for a medical student's learning style. Our point of view is explained by the fact that it is learning style consideration that will allow effective using all benefits of PBL strategy in separate students' groups with proper tendencies in perception and processing of information.

The aim of our research is to analyze students' work during the first year of PBL technology integration into Medical Institute of SSU curriculum and the estimation of their attitude to the pedagogical innovation taking into account a learning style that can allow finding forms and approaches for the implementation of this pedagogical technology into the teaching process.

Materials and Methods

In order to study the pedagogical experience of PBL implementation, an empirical research was used that is based on continuous observation and questionnaire survey in 4 groups of second-year students (51 persons) that studied in accordance with the experimental curriculum, which provided for integration of PBL lessons into the traditional system of doctors training in Medical Institute of SSU.

In PBL study lessons, students learnt 35 clinic situations (cases) that were kindly provided by St George University (Great Britain) according to Tempus terms. After studying of each case, students discussed results of their work, expressed their point of view as to the case content and organization of teaching process during the preparation for the lesson, share personal impressions with other students about their teamwork and its efficiency. Moreover, tutors organized lectures-conferences every semester where students, who study in accordance with the experimental programme, could estimate student's and teacher's role in PBL system and share on their vision of such the role. The key forms of information presentation were students' oral and stand reports. The results of the discussions were recorded by tutors that allowed paying attention to aspects of comparative analysis of these two pedagogical strategies that are important for students.

The integral estimation of efficiency of PBL integration into the teaching process was formed during the 3rd and 4th semesters of two academic years (2014/2015 and 2015/2016) by means of monitoring of students' work in PBL study lessons, which was performed by tutors.

Students' poll by using of two questionnaires was carried out in this research. The first form used at the beginning of the implementation of PBL pedagogical innovation was based on the Learning Styles Questionnaire (LSQ), which was proposed by P. Honey and A. Mumford for estimation of individual peculiarities and preferences in choosing forms and methods of professional learning [5].

The second students' poll was carried out after cases study at the end of the first year and was based on the questionnaire "The Comparative Estimation of Learning Systems – CELS" (Table 1). CELS questionnaire was developed by the authors of this article with due account taken of earlier established key aspects of students' estimation of two pedagogical approaches (PBL and traditional learning).

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Table 1 – The Questionnaire of the Comparative Estimation of Learning System (CELS)

	Characteristic indicator for estimation	***Score on a 5-point scale***	
		Traditional learning	PBL
I.	**Psycho-emotional comfort**		
1	Interest to the process		
2	Environment comfort		
3	Absence of emotional suspense		
4	Absence of pressure from people around you		
5	Satisfaction of the result		
6	Awareness of the own success and intellectual capability		
7	Absence of fear to make a mistake		
II.	**Organization of learning process**		
8	Working rhythm during a lesson (taking into account the time required for solving problems)		
9	Informational fullness (scope of obtained and processed information)		
10	Dynamics of the learning process and diversity of solved problems		
11	Practical orientation of the tasks		
12	Exactingness to the final result		
13	Methodical base of preparation for lessons		
14	Scope of solved tasks		
15	Keep up an interest to the educational process during the lesson		
16	Novelty of lesson form and content		
III.	**Student's role in the learning process**		
17	Possibility for self-expression and taking the initiative		
18	Development of team skills		
19	Development of communicative skills		
20	Development of creative thinking		
21	Interest in the process		
22	Activation of thinking		
23	Depth of received knowledge		
24	Systematic nature of received knowledge		
25	Practical use of obtained knowledge		
26	Survival potential of obtained knowledge		
27	Awareness of the necessity of obtained information		
28	Motivation for preparation for lessons		
IV.	**Teacher's role in the learning process**		
		Necessity (without double estimation)	**Tradition-al learning**	**PBL**
29	Directing and organizing role			
30	Role as a source of new information			
31	Encouragement for learning			
32	Exactingness for learning			
33	Supervisory role			
V.	**Psycho-emotional aspect of student-teacher relationship**		
34	In the "student-student" system		
35	In the "student-teacher" system		
Total			
VI.	**Answer the question: "Which learning system in Medical Institute would you prefer?"**		
Traditional system			
PBL			
Integration of PBL into traditional system (_____ %)			
Give reasons for your answer:			

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The main goal of creation of the second questionnaire was psychological and pedagogical estimation of students' readiness to consider PBL as an efficient innovation that can be integrated into the traditional system or be an independent methodological basis for specialists' training in Higher Medical Institutions in Ukraine. The CELS questionnaire consists of five blocks, each having characteristic indicators that were chosen as basic estimation criteria for learning system. Students scored learning systems on a 5-point scale, where 5 is the maximum point that characterizes the most positive result. For the majority of students such scale is simple, traditional and well-understandable for result estimation. The respondents were offered to estimate both a traditional and innovative PBL system according to different criteria. The first set of questions estimates psycho-emotional comfort, the second one estimates organization of learning process, the third – student's role in the learning process. In the 4th bloc of questions, students could express their own vision of the teacher's role based upon existing needs in leaning ("the necessity"). Estimation of "the necessity" (without double estimation) was ranged from 1 to 5, where the maximum point denoted the highest priority. Total result of all characteristic indicators in the first 5 blocks of questions was obtained by summation of points for each pedagogical strategy. The last 6th bloc of questions provided the choice of the teaching system that is optimal for students who learn subjects of the medical profile. Moreover, the respondents were offered to explain their personal point of view in this bloc.

Statistical analysis was carried out by Van der Waerden's non-parametric criterion according to G. Lakin [6].

Results and discussion. For more detailed analysis of the prospects of PBL implementation in Higher Medical schools in Ukraine, authors' research provided: 1) determination of individual tendencies to learning among students; 2) analysis of estimation of learning systems (traditional and PBL) after the experience of the first year of implementation of PBL lessons; 3) search for association between learning style and personal attitude to pedagogical approaches to the organization of learning process (traditional and PBL).

The well-known fact is that functioning of any pedagogical approach to learning is guaranteed by existence and cooperation of two sides: a teacher, who teaches, and a student, who studies. In comparison to traditional learning process, a teacher in PBL works in such conditions, when the focus is shifted from assimilation of considerable body of information within one subject to a multidisciplinary approach to studying the material, which is based on a certain clinical situation. Moreover, a student must be directed and motivated to an individual search for problem solution, taking into account the necessity of an efficient work of the whole student's group.

Learning, which is based on the solving problems, is recognized as an efficient tool for assimilation of information and its transformation into certain actions [7]. Organization of PBL study lessons uses elements of "forward-looking learning" that is based on stimulation and development of mental activity directed at an individual knowledge acquisition under conditions of responsibility for the process during team work at a problem. Hence, on the contrary to the traditional learning system, a teacher in PBL is no longer a carrier and a transmitter of some new information. A "navigation" work of a teacher comes to the foreground; this work is aimed at enhancement of students' motivation for thorough acquisition of knowledge that can ensure specialist's competitiveness in his future career.

Adoption of any new educational technology should take into account abilities and interests of those, who are interested in getting educational services. Students, who study according to the traditional system, are accustomed to it through secondary school. They fully understand that a teacher must present the information and create conditions for its assimilation and maximal "survival". Under the conditions of a unified system of learning, students' individual psycho-emotional features and preferences can't fully be taken into account. The necessity of students' adaptation to pedagogical system, which is traditionally proposed in higher educational establishments, is seen as a result of non-alternative approach to the choice of a way of knowledge acquisition.

Nowadays, when regulation of information flow comes to the foreground, the development of pedagogical science provides for search of new non-traditional approaches to learning and their efficient use. According to our point of view, designing, approbation, implementation and development of PBL method should be seen as one of the modern tendencies of progressive methodological approaches to experts' training.

It should be noted, that under conditions of domination of traditional approaches to teaching in a certain cultural environment, when the participants of the pedagogical process know and agree with "game rules", the implementation of pedagogical innova-

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tions must pass certain stages to prove its viability. European Union grant support of PBL experimental approbation in Ukraine is a true step for such PBL implementation into the system of Ukrainian doctors' training in compliance with the European educational standards.

Due to framework agreement on the international grant project Tempus, Medical Institute of Sumy State University got a unique chance to be one of the participants of methodologically considered, well-planned, thoroughly elaborated pedagogical experiment on PBL integration into the syllabus of doctors' training on the specialty "General Medicine". One year experience of project tasks fulfillment allowed teachers to get invaluable professional experience, to learn and to analyse the procedure of PBL method implementation under real conditions of Ukrainian higher medical education. Due to the research, it became possible to draw the first conclusions as to prospects of active introduction of the innovation into the educational process.

It is well-known that thorough analysis of the innovation procedure is not enough for the implementation of new methodological approaches into education process. We think that prognostication of perception of new pedagogical approaches by students and efficient use of such approaches in studying are important key priorities during implementation of innovative technologies.

Inclusion of PBL lessons with case studies into Medical Institute curriculum, the basis of which is traditional education, gave the possibility to study correlation between students' perception of two pedagogical methods and their inclination to a certain learning style. We share the point of view that an efficient measuring tool of any research, aimed at studying people's points of view on various phenomena, is a poll [4]. That's why to estimate personal features of information perception and processing, the LSQ survey was carried out at the beginning of the academic year among second-year students who were chosen at random for the experimental programme with integration of PBL lessons. In spite of the great amount of authoritative approaches to learning style estimation, a questionnaire, that is based on the Kolb's concept [8] interpreted by P. Honey and A. Mumford (LSQ questionnaire) [5], is the most popular one in the sphere of specialists' professional training, since it takes into account real dispositions of a person [5; 9; 10]. Moreover, the bibliography analysis of LQS usage has proved, that influence of the learning style on students' results is a relevant issue and is considered to be dynamic characteristics that changes in accordance with existing circumstances [11].

The results of our LSQ questionnaire correspond to literature data in percentage distribution of learning styles among group of junior students (51 persons). We revealed two leading learning styles: Reflectors (23 persons, or 45.1 %) and Activists (10 persons, or 19.6 %). Tendency to other two styles was observed among smaller number of students: Theorists – 6 persons, or 11.8 %, and Pragmatists – 2 persons, or 3.9 %. A small percentage of students didn't have any distinct learning style and was categorized to mixed styles ("Reflectors + Activists"–4 persons, "Reflectors + Theorists" – 3 persons, and other types, total of 19.6 %). As a rule, junior students choose an introvert strategy in learning that is characterized by observation and analysis. That's why, from our point of view, Reflectors-students were dominant in this sample of respondents (45.1 %). It is known that professional motivation of senior students gradually grows and they become show a tendency to implement ideas and theoretical hypotheses into practice. This fact was proved in our research – second-year students, who prefer Pragmatists learning style, were shown to constitute a small group (3.9 %). According to the number of respondents in Activists, Reflectors, Theorists and Pragmatists groups, the analysis of correlation between learning style and the estimation of advantages of a learning system became possible only for the first three mentioned groups.

Attitude of students with different learning styles to traditional education and PBL was evaluated by using a Learning System Estimation Questionnaire – LSEQ (Table 2).

Table 2 represents students' responses from section VI of CELS, where they gave proof of their point of view regarding the possibility of integration of a new pedagogical approach into the traditional system of learning. It is known that the student's point of view allows increasing the objectivity of estimation organization and efficiency of learning process as well as taking into account all positive and negative aspects [12]. During estimation of positive sides of PBL learning, respondents emphasized on more comfortable atmosphere at case study lessons (Table 2, for PBL: items 5, 8–10, 13–15). We believe the advantage of PBL system in this context can be explained by the authoritarian type of organization of traditional lessons, where a teacher is the person who always has the last word. In CELS, students pointed out the absence of a certain freedom during traditional study lessons (Table 2, for traditional learning: item 13).

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Table 2 – Positive and negative aspects of learning in two learning systems from students points of view (according to grounds of their personal opinion on the PBL integration in section VI of CELS)

Traditional System		***PBL***	
Positive aspects			
1	Traditional system gives sound basic medical knowledge / gives wide base of theoretical knowledge	1	PBL allows to use obtained theoretical knowledge according to practical situation, "it is interesting to use obtained knowledge"
2	Traditional system has wider choice of subjects, which enrich with knowledge	2	PBL stimulates to learn theory
3	Traditional system creates conditions for more deliberated and professional approach to practice learning	3	PBL gives skills to combine knowledge from different subjects
4	Estimation system stimulates leaning	4	PBL develops thinking, teaches logical thinking
5	Traditional system is more informative, controlling and demanding	5	More interesting learning of subjects
6	Traditional system has more effective control of knowledge and its quality	6	PBL makes forms of learning more diverse
7	Traditional system has better developed method of information presentation	7	PBL is closer to life
8	Traditional system is more oriented at the final result of knowledge obtaining	8	PBL makes lessons more interesting, facilitates retention of knowledge in memory
9	Traditional system allows thorough learning of each subject separately	9	PBL gives more space for thinking and thoughts expression
		10	PBL gives more possibility for self-expression
		11	PBL makes possible to study the issue at different angles
		12	Learning occurs at more comfortable emotional environment
		13	Absence of fear of making a mistake; a mistake has no negative consequences
		14	PBL forms skills of team work
		15	Mutual friendly relationship with a teacher, less emotional stress
		16	PBL is an interesting experience of familiarization with the world system of higher medical education
		17	It's interesting to feel themselves as good diagnosticians at junior courses
		18	PBL gives skills to get answer in the presence of minimal information and knowledge
		19	PBL allows systematize obtained theoretical knowledge better
Negative aspects			
10	Theory is more distanced from practice	20	Motivation to learning, based on case studies only, is weak
11	Absence of understanding for what purposes the theoretical material that is studied could be necessary	21	Less volume of studied information
12	Students study subjects that are not directly related to future profession	22	Requirements for getting solid theoretical knowledge are less
13	Traditional system limits possibilities to use freedom in communication and activity	23	PBL doesn't correspond to realities of students' attitude to learning
		24	It is difficult to study because of lack of basic medical and biological notions
		25	Student's freedom in learning and small teacher's control influence knowledge quality negatively
		26	PBL may be useful at senior courses, when students have certain base knowledge
		27	PBL can't be used as an independent system because of sociocultural and educational traditions in Ukraine
Traditional system gives solid theoretical knowledge, PBL allows to use it efficiently according to certain clinical situations. Conclusion: "A skillful combination can give a better result".			

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The results of the survey (average points) are given in Table 3; students that belong to categories Pragmatists, Reflectors + Activists, Reflectors + Theorists and other combinations were excluded because of their small number. The difference in obtained data as to PBL system and traditional learning was estimated according to Van der Waerden's non-parametric criterion (detailed calculations are not given).

Table 3 – Comparing of traditional system of learning (TSL) and PBL system by students of different categories

Reflectors			Activists			Theorists		
TSL	**PBL**	***p***	**TSL**	**PBL**	***p***	**TSL**	**PBL**	***p***
Estimation of psycho-emotional comfort								
24.0	31.4	< 0.01	20.5	30.6	< 0.01	24.3	31.8	< 0.05
Estimation of organization of learning process								
30.7	38.7	< 0.01	31.0	37.5	< 0.01	33.2	38.5	< 0.05
Estimation of the student's role								
43.3	52.2	< 0.01	41.1	49.5	< 0.01	44.3	51.5	< 0.05
Estimation of the teacher's role								
19.0	19.5	> 0.05	20.5	18.2	> 0.05	21.3	19.7	> 0.05
Estimation of psycho-emotional aspect of individual relationships between teachers and students								
7.5	9.1	< 0.01	7.4	9.6	< 0.01	6.8	8.5	> 0.05
Estimation of traditional and PBL learning systems according to total scoring								
124.5	150.9	< 0.01	120.5	145.4	< 0.01	129.9	150.0	> 0.05

Table 3 demonstrates that students of three learning styles (Reflectors, Activists, and Theorists) prefer the PBL system from the point of view of psycho-emotional comfort. The respondents estimated positively the emotional component of PBL study lessons that is justified not only by the total positive estimation in section I of CELS (psycho-emotional comfort). Statistical calculation of general estimation of psycho-emotional comfort at PBL and traditional lessons showed that Reflectors and Activists prefer the innovative approach (difference is statistically significant even at 1 % degree of certainty) in comparison to Theorists (difference is significant only at 5 % degree of certainty). We think that this fact can be explained by some peculiarities of Theorists' approach to learning. Students who work in groups at PBL lessons have to express their thoughts and share impressions but it is not a subjective necessity for Theorists' style; they, on the contrary, have tendency to contradict such a necessity.

All categories of students estimated positively the organization of teaching process at PBL lessons compared to traditional system. We haven't found any significant differences among Reflectors, Activists and Theorists. From our point of view, this can be explained by the fact that organization of PBL lessons meets the demands of all learning styles. For Reflectors, it is the time that is necessary for analysis, thinkings, and estimation. For Activists, there is the possibility to share their impressions (without any restrictions), to get experience in a new activity. Well-structured PBL lessons and the possibility to present theoretical grounding of some clinical cases make this new pedagogical approach interesting for students, who belong to Theorist learning style. Moreover, all student categories pointed out that practical approach of case-oriented study lessons influence positively on their learning. It is maintained by the comparative analysis of students' points of view on traditional and PBL systems, as given in Table 2 (for PBL: items 1, 17, 19; for traditional system: items 10–12).

A detailed statistical analyses showed that Reflectors and Activists give more positive estimation of learning process organization in PBL system compared to traditional system (difference is statistically significant even at 1 % degree of certainty) than Theorists ($0.01 < p < 0.05$). We believe that it can be explained by the fact that Theorists, when

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make hypotheses and assumptions, feel themselves more sure if they have a solid theoretical knowledge base. Organization of PBL tutorial sessions is done in such a way that students can start analyzing a clinical situation without certain theoretical knowledge. Lack of information is a motivating factor that stimulates each student to set oneself the task of finding the ways of problem solving that is possible only after study of theory. Students who are used to the traditional vector in studying "from theory to practice" may feel discomfort when incomprehensible practical issues become "motivators" for learning the theoretical material. Such conclusion is based on students' points of view in section VI, CELS (Table 2, for traditional system: items 1–0; for PBL: items 20–22, 24–26).

Moreover, for the majority of Ukrainian students, a traditional strong motivation stimulus to study is the system of control and knowledge estimation. Students pointed out that interest to learning can't be the dominant factor that can guarantee high knowledge quality (Table 2, for traditional system: items 4–6; for PBL: items 20, 23, 25, 27).

During the analysis of comparative estimation of PBL and traditional system in section CELS "Student in the learning process" (Table 3) for Reflectors, Activists and Theorists, similar regularities were revealed as in the previous sections ("Psycho-emotional comfort" and "Learning process organization"). High estimation of the innovative system by respondents of all styles of learning is explained by the fact that students are under conditions at PBL study lessons, which are close to modern tendencies in the society. They have more possibility for the expression of their personal point of view that, in created environment, has no "breaks" for creativity and searching for correct answers in far parts of one's mind. Students are more sure of demonstrating their individuality. This fact was constantly pointed out by tutors, who could analyse students' behaviour at traditional and PBL lessons. Students, who were outsiders at traditional study lessons, were very active at PBL sessions and impressed with their ability for analytical thinking and quick search for solutions.

Table 3 illustrates the fact, that all students, especially Activists and Theorists, estimate highly a teacher's role in the traditional system.

The analysis of rating in items 29–33 of CELS ("A teacher in the learning process"), which was done by students to express their own need in teacher's functions ("necessity"), demonstrated some differences for three learning styles. Thus, 77 % of Reflectors-respondents consider a teacher, in the first place, as "a source of new information". The second important function of a teacher for this students' learning style is considered to be "directing and organizing role" – 50 % of respondents expressed this point of view. In contrast to reflectors, 60 % of Activists put "directing and organizing role" of a teacher at the first place. They consider a teacher's role as "the source of new information" is important but secondary – 50 % of respondents put this function at the second place. For 50 % of Theorists, a teacher's role as "the source of new information" was important in teaching process.

We believe the obtained results prove the existence of stereotypes in relationship "teacher-student" and the requirements to a teacher from the part of students, that are conditioned by domination of traditional educational system starting in the secondary school. It is the traditional organization of the teaching process that impedes students' perception of a new teacher's role, proposed by PBL. Students are used to be passive in learning and consider themselves as those, who must be taught. They think the teacher exists for giving information and creating such conditions for knowledge control that force them to study. From our point of view, only methodological changes in traditional system with the introduction of many elements of problems may stimulate students to active learning and shift them from the position "I am taught" into the position "I learn". Only then a student will be able to estimate an organizing and directing role of a teacher's as well as his skills to induce new information search and to give reasons for learning.

Table 3 also demonstrates high estimation by Reflectors and Activists of psycho-emotional relations between students and teachers at PBL lessons. We believe that PBL gives the possibility for mentioned learning styles to develop rapport and to hear other points of view, feel cooperation and unity in a team, get kind teachers. As for Theorists, the difference in estimation of relations in systems "student-student" and "student-teacher" for PBL and traditional system was similar but statistically doubtful ($p > 0.05$) because of small number of students in this category.

The overall estimation of two learning systems according to all CELS items demonstrated the advantage of PBL for such learning styles as Reflectors and Activists – an innovative system wins ($p < 0.01$). For Theorists, such advantage is not apparent due their small number ($p > 0.05$).

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In CELS questionnaire, students also answered the question "Which learning system in Medical Institute would you prefer?" with such options as "traditional system", "PBL" and "PBL integration into the traditional system" (writing possible percentage of integration). An average percentage of PBL integration into traditional system was approximately the same among Reflectors (50.9 %), Theorists (50.0 %) and Activists (49.0 %); the difference between them in all pairwise comparison according to Van der Waerden's criterion was not statistically significant ($p > 0.05$), which can be explained by large spread in values in each category and a small number of students in each group.

The obtained results demonstrate general positive estimation of a new innovative system by students of all three learning styles after a year of experience in an experimental programme in Medical Institute. Students consider PBL integration into the traditional teaching system as a real possibility to improve practical focus of medical education and to join world experience of introduction of modern progressive pedagogical technologies.

Conclusions

The experimental programme of PBL integration into the curriculum of SSU Medical Institute, which is based on the classical principles of traditional training of medical students, has proved the necessity to introduce innovative pedagogical technologies that are professionally oriented. Students who participated in this programme took new pedagogical approach positively and could estimate all benefits and drawbacks of PBL technology. The possibility to introduce 50 % of PBL study lessons into the curriculum of students' training in Medical Institute has been supported by the majority of students.

Search for association between students' learning style and tendency in choosing traditional or PBL system hasn't revealed a reliable result that could be used for making unified recommendations as to organization of teaching process according to students' preferences. Nevertheless, we can claim that Reflectors and Activists welcomed this pedagogical innovation.

In general, students in experimental groups that belong to Reflectors, Activists, and Theorists learning styles, pointed out PBL system as an additional tool for implementation of theoretical knowledge, which was gained at traditional study lessons, for solving practical clinical tasks. We attribute the obtained results with peculiarities of socio-cultural environment and traditions of education system organization in Ukraine, which start in the secondary school.

The experimental programme, which was introduced in SSU due to the European Tempus project, allows improving considerably the technology of medical students' training in Ukraine in accordance with modern tendencies and requirements in higher education.

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