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CREATIVITY AS AN ESSENTIAL ASPECT IN MEDICAL EDUCATION

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Abstract. The article deals with the issues of developing students' creative skills at medical educational institutions. Intensification of students' creative potential occurs through the formation of thinking, research and communication skills, ability to interact with information means and technologies. Second-year students of General Medicine Faculty were involved in the experiment at Danylo Halytsky Lviv National Medical University in Ukraine. Experimental and control groups included 172 students in each one. We singled out two groups: a control group – training based on the available basic course "Professional English in Medicine" and an experimental group – training based on a combination of two courses: the basic course "Professional English in Medicine" and the elective course "Special Medical Terminology". Homogeneity of the control and experimental groups was checked using Student's *t*-test. Testing 0-hypothesis showed no significant differences between samples for the reliability level 0.05 (5% probability). At the first stage of the experimental study, students' performance was considered at the beginning of the experiment in the control and experimental groups. Students were divided into three levels: high (82–100 points), medium (64–81 points) and low (50–63 points). Certainty of differences between groups was tested using Pearson's chi-squared test (χ^2), according to which the critical value was = 5.991, and the corresponding empirical value = 0.414. Thus, any differences between the results of the control and experimental groups are random variations with a probability of less than 5%, and, therefore, the samples are homogeneous by the research indicator. Verification of reliability of the obtained results in improving the level of creativity in students was checked by Pearson's chi-squared test (χ^2), according to which the critical value equaled 5.991 and the corresponding empirical value = 6.11. Thus, any differences between the results of the control and experimental groups are with a probability of less than 5% and based on the result of introduction of an active pedagogical factor into the educational process, and, therefore, the difference between the control and experimental groups is expected for the studied indicator. To define creative abilities, we used Joy Paul Guilford's parameters and factors for interpreting variations in creativity: sensitivity to problems; flexibility and fluency; originality; synthesis, analysis; reorganizing or redefining; complexity and evaluation; to determine verbal aspect of students' creativity, we applied the techniques suggested by Walther Moede and Sarnoff A. Mednick. All students performed significant improvement in the ability to

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generate a lot of ideas; they also showed a steady increase in such forms of creativity as sensitivity to problems, flexibility and fluency. Slight increase was noticed in reorganizing or redefining, complexity and evaluation. The students' ability to solve problems by realization of relevant analytical and synthetic operations must be taken into consideration while developing creativity and creative communication of medical students.

Keywords: communication, creativity, independence, medical education, self-development, students.

Introduction

In Ukraine, current social processes require a new quality of higher professional education: promotion of the compulsory European dimensions in medical education, particularly with regards to the curriculum development of creativity as educational policy, interinstitutional cooperation, mobility schemes and integrated programs of study, global trends in training and creativity research. In conditions of the military and political crisis, the reform of higher education in Ukraine was adopted and elaborated based on the requirements of the Law of Ukraine "On Higher Education" dated 1 July, 2014, No. 1556–VII.

Nowadays, educational process at higher medical institutions is associated with contemporary requirements of Ukrainian society and reforms. Every civilized country cares about creative potential of society in general and of each individual in particular. The attention to the development of creative ability of any individual is constantly strengthening and many educators still pose important questions about how to move 21st century education forward: "Four Cs (critical thinking, communication, collaboration, creativity)" (National Education Association, 2010).

Creativity, innovation, collaboration and problem solving are essential personal and professional skills for future doctors of the 21st century. Thus, we have to define medical students' potential in developing creativity. The role of creativity in education is described as "a capacity for significant imaginative achievement" (Craft et al., 2008), and diverse applications of creativity within education continue to foster myriad investigations pertinent to creative and critical thinking in learners (Runco & Jaeger, 2012). Creativity components include knowledge, intellectual ability, preferred thinking style, personality traits, motivation, and environment. We should not forget that "creativity can be defined as production of an idea or product that is innovative and meaningful. There is a vital role for creativity studies in making the most of our self-awareness, and furthering our human possibility" (Lafferty, 2004, p. 43). It is obvious to support the idea that creativity is also often thought to be connected with personal development to such a degree that it is considered both a positive and necessary part of the human experience (Richards, 2007).

In the last decades, creativity has become a field of investigation for many scholars as Thompson (2017), Zha et al. (2006). Agars and Kaufman (2005) defined four ways of creativity: person, place, process, and product. In the workplace, as in any applied context, these "four P's" are inextricably linked. Runco and Jaeger (2012) suggested that creativity requires both originality and effectiveness. Shaheen (2010) recommended to make creativity a part of an educational agenda. In particular, researchers classified skills for developing creativity (Sydorchuk et al., 2016; Cropley, 2000; Furnham, 1999; Hoidn & Kärkkäinen, 2014; Shin

et al., 2006). The scholars applied creativity strategies in the context of the sociocultural approach (Kim, 2005; Lafferty, 2004, p. 43; Sligh et al., 2005; Sternberg, 1985). Researchers described the features of creativity (Kaufman, 2009; Preckel et al., 2006). The investigators outlined types of creativity strategies (Irvin, 1996; Ku et al., 2002; Rankin & Brown, 2016).

It is worth mentioning that the process of forming creativity in students is largely connected with a teacher, how he/she organizes teaching process, which methods and means he/she uses, what tasks he/she offers to students, and whether or not the a teacher himself/herself is a creative personality. As a scientist noted that "only a personality can educate a personality, a character can form a character" (Ushynskyi, 2004). Thus, the presence of teacher's pedagogical talent is significant as well as a continuing process of improving knowledge, perfecting skills and competencies, forming values and attitudes (Mukan et al., 2019).

We also suggest that success of study and training at higher medical institutions depends on a teacher, her/his scientific and theoretical knowledge (interdisciplinary approach), pedagogical skills, business, cultural and moral qualities. They must also have skills of creative teaching using creative tools and techniques. Creative environment for both teachers and students also plays a significant role (Moran, 2010; Jordan Starko, 2013). The teacher must cultivate effective classroom discourse based on real professional situations or open-ended questions, responding flexibly to students' creative answers to promote thinking, problem-solving skills and profound problem understanding.

Ukrainian teachers support the statement that creativity draws on both spontaneous thought, originating from the default mode network, and on sustained cognitive control over those thoughts originating from a separate brain network (Beaty et al., 2015). Unfortunately, there is a lack of methods for systematic assessment of skills as critical thinking or creative thinking.

In our opinion, integrating updated pedagogical methodology with creative techniques and interprofessionalism is a valuable approach for fostering students' creativity and generating research skills. It is also compulsory to orient knowledge into the development of students' systematic and logical viewpoint, scientific and theoretical beliefs, moral qualities, and active life position (Wiley & Jarosz, 2012).

It is necessary to mark that intensification of future doctor's creative potential is performed through the formation of creative thinking, research skills, ability to interact with the information means, put and solve different tasks according to specific activities that may help in the formation and development of independence and cognitive research activities in the process of personal, specially organized student's educational activities (Runco & Jaeger, 2012). Nevertheless, up-to-date training experience is not focused on the demands of contemporary society as: "we are currently preparing students for jobs that do not yet exist, to use technologies that have not yet been invented, and to solve problems that we don't even know are problems yet" (Darling-Hammond, 2008, p. 2).

Shaheen (2010) stated that for many developing countries, creativity remains neglected, whereas in developed countries, educational philosophy and goals rely on student's enhancement of creativity and self-actualization. Consequently, we define creativity as both a talent and a skill that can be developed as an independent activity, which is closely connected with intellect, curiosity and analytical thinking.

At this investigation stage, the goal is to analyze pedagogical approaches to formation of students' creative skills at higher medical educational institutions and to determine students' creativity at Danylo Halytsky Lviv National Medical University (DHLNMU).

The objectives of the article are to prove the validity of the parameters of students' creativity; to process medical studens' academic achievements in the control and experimental groups; to define correlation between creativity and independence; to form the verbal aspect of creative activity.

Theoretical research methods were used in the process of investigation (analysis and synthesis to study the problem; systematization – to shape complex characteristics of developing creativity; generalization – to draw the conclusions). Descriptive and comparative methods were applied to differentiate the parameters of creativity; analytical method was used to obtain versatile information about theoretical and practical issues of developing creativity; statistical method was used to compare and verify data received. The homogeneity of the control and experimental groups was tested using Student's *t*-test. The significance of differences between the results in the control and experimental groups was checked using Pearson's chi-squared test (χ^2). For calculations, construction of tables and *Microsoft Excel* software was used, which allowed to perform calculations quickly, visualize the results using charts and graphs. Critical values were determined using tables taking into account a specified number of the respondents and a probability of 95%.

1. Research design

1.1. Participants

Second year students of General Medicine Faculty (GMF) at DHLNMU, 2018–2019 academic year, 48 groups from Master of Medicine program (qualification "Doctor", specialty 222 Medicine, knowledge branch 22 Health Care) were involved in the investigation. Quality of higher education at DHLNMU is provided according to the "Strategy, Policy, and Procedures of Education Quality provision at Danylo Halytsky Lviv National Medical University", elaborated based on the requirements of the Law of Ukraine "On Higher Education" dated 1 July, 2014, No. 1556–VII. Students had one class of "Professional English in Medicine" per week for 1.5 years as a basic course and an elective course, respectively. The students were informed about the experiment and gave their agreement for participation and processing of academic performance. Students could refuse to participate at any stage of the experiment without any academic consequences. The procedure of the research was approved by the external experts from Lviv Polytechnic, Ukraine, Department of Foreign Languages. The experts ensured that the investigation was performed with valid tests in proper conditions and confirmed reliability of the obtained results according to the rules of academic integrity.

At the beginning of the academic year, students were given creative assignments (creative mental synthesis task), for example, choosing a news story that has piqued their interest. Students had to write a report on the news story; write a dialogue in which a journalist interviews a doctor involved in the story; answer a question like, "What could have gone differently?", thus, prompting them to use conditionals, for example. The second task

was to read an email and write an appropriate reply, like a complaint about a bad service experience or an inquiry. Another way to get the students engaged in the assignment was to ask them to come up with some ideas for a creative assignment on their own and share them with the class.

The sphere of demonstrating students' creative activity involves understanding and mastering relevant material, using additional educational and scientific information. The scope of creative reasoning demonstration encompasses educational, scientific and tutorial processes. Therefore, individual work should be included in all forms of the educational process.

1.2. Procedures

In the process of experimental research we substantiated the choice of groups of the students participating in the formative stage of the experiment. Based on the data, the composition of the experimental and control groups was determined as 172 students in each group. This indicator made it possible to ensure reliability and validity of the experimental work. For comparison, we singled out two groups: a control group – training based on an the available basic course "Professional English in Medicine" and an experimental group – training based on a combination of two courses: basic course "Professional English" and elective course "Special Medical Terminology".

The task of the formative experiment was to establish the efficacy of suggested courses. During the formative part of the experimental study, various tests were fulfilled in order to obtain the investigated parameters. To achieve the goal, teachers of English use a rather broad arsenal of methodological techniques and those aimed at developing creative thinking and creativity especially in medical students. The most usable one is "What's Your Rating?" (to evaluate the proposed situation (*e.g.*, innovative methods of treatment of any disease) by comparing it with the traditional one adopted in medical practice. Another technology can be *Priority Ladder* (to mark objects or phenomena to prioritize). Students are encouraged to identify the priorities in the process of treatment, for example, and place them at appropriate levels. The technology *Human Bias Graph* is worth mentioning (to identify possible bias against proposed statements and evaluating a position). Students are informed about their positions in the proposed problematic situations (making a diagnosis, gathering complaints) and show their agreement or disagreement with certain statements in the scheme. The advanced technology is *Milestones* (to determine a sequence of actions in the process of solving a particular problematic situation). To do this, students build a plan for solving the problem systematically, justifying the chosen sequence. As researchers stated that "modern methods in combination with traditional ones help teachers achieve better results and obtain high-quality education" (Isayeva et al., 2020) in developing creativity.

The final part of the research was conducted in 1.5 years of study. To investigate the verbal aspect of creative activity, we applied the technique of assessing creative abilities by Moede. This technique involves giving four related words to learners. Their task is to write quickly as many phrases as possible, so that each one contains all these words. This task investigates creative imagination, quick thinking, and diversity of using active vocabulary.

Each of the sets of four words below can be linked to one another. All the words are related to medical matters. What are the missing words? Write them in the centre of the charts as shown in Figure 1.

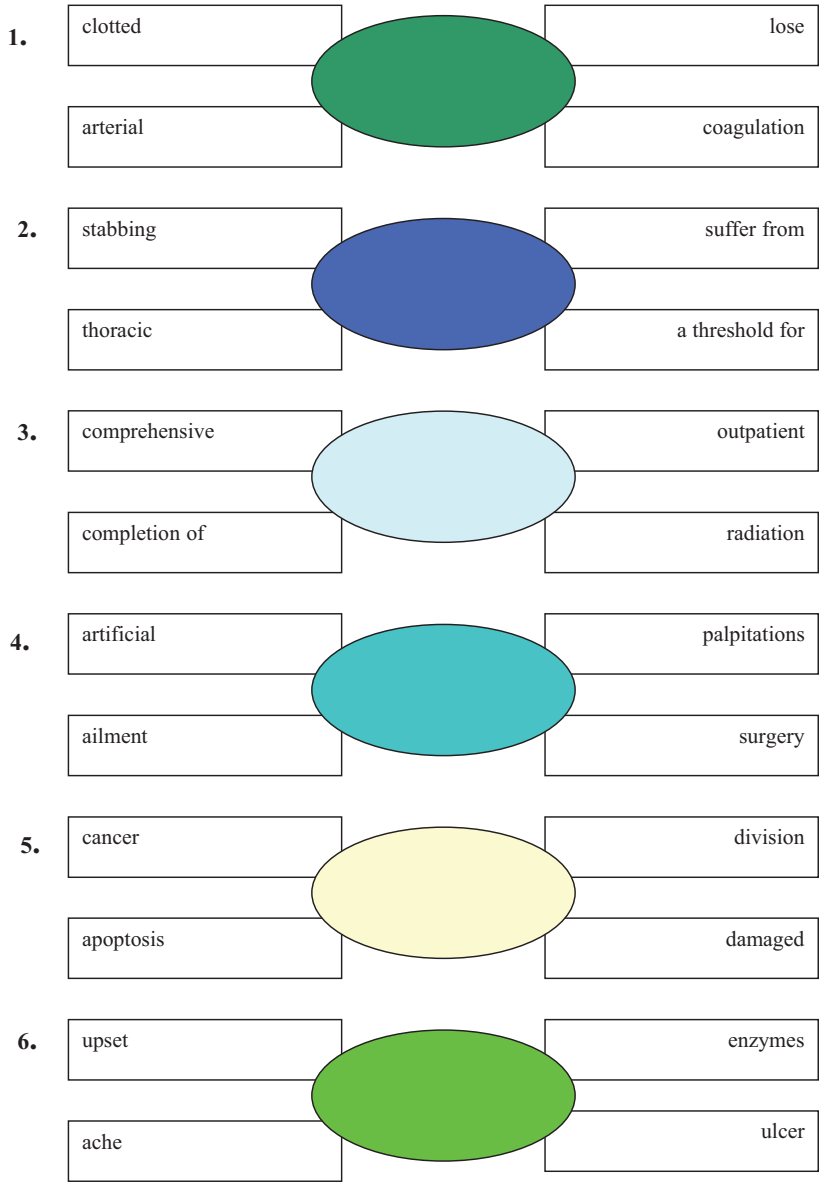

Figure 1. A chart related to medical matters. Keys: 1) blood, 2) pain, 3) treatment, 4) heart, 5) cell, 6) stomach (source: created by authors)

Mednick's technique is a combination of 20 sets of words, each containing three. The task implies choosing one more word so that it can be combined with each of the three suggested words (to make combination). The suggested words can be changed grammatically.

A mind map is a way of organizing vocabulary to show connections between words. This mind map is based on the word "heart" as shown in Figure 2. Design a mind map for one of the following: 1) health; 2) hospital; 3) patient. An example with a word "heart" is given below:

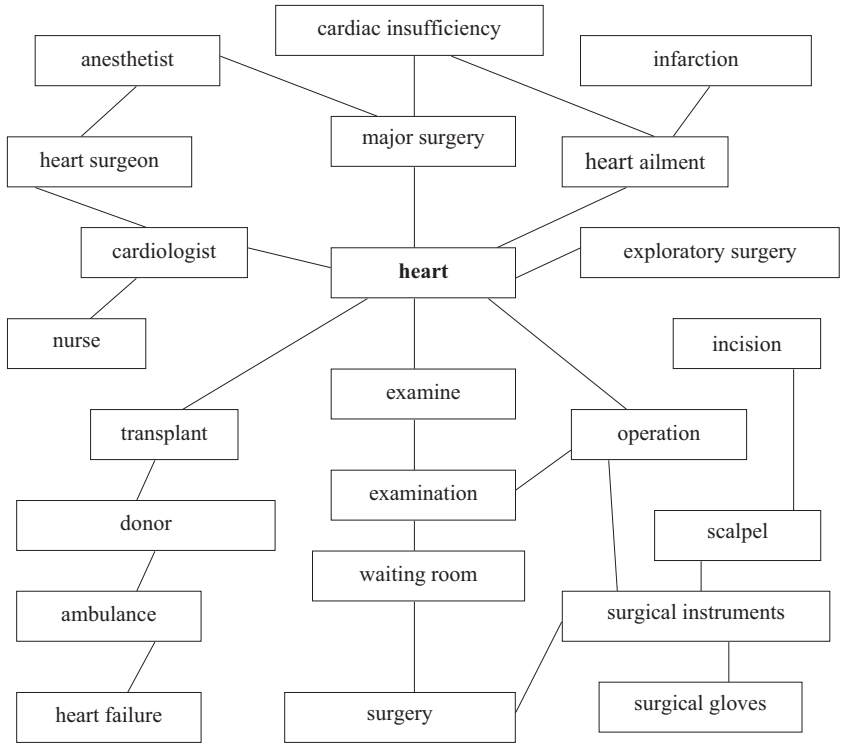

Figure 2. A sample of a mind map with the word "heart" (source: created by authors)

This technique enables students to demonstrate the creative aspect in communication. This method helps mark structural components of communicative creativity as productivity, verbal originality, and unique character.

2. Research results

Homogeneity of the control and experimental groups was checked using Student's *t*-test. Testing the null hypothesis showed no significant differences between samples for the level of reliability 0.05 (5% probability). At the first stage of the experimental study, students' performance was considered at the beginning of the experiment in the control and experimental groups. The results of the study are shown in Table 1. Students were divided into three levels: high (82–100 points), medium (64–81 points) and low (50–63 points).

Table 1. Distribution of learning outcomes of students in control and experimental groups (source: created by authors)

	Level	High				Medium				Low	
	Points	90–100		82–89		74–81		64–73		50–63	
	Students	number	%	number	%	number	%	number	%	number	%
Experimental group	172	**15**	8.6	**26**	15.1	**64**	37.2	**30**	17.4	**37**	21.7
Control group	172	**19**	11.1	**20**	11.8	**32**	18.6	**59**	34.3	**42**	24.2

Certainty of differences between groups was tested using Pearson's chi-squared test (χ^2), according to which the critical value equaled 5.991, and the corresponding empirical value = 0.414. Thus, any differences between the results of the control and experimental groups are random variations with a probability of less than 5%, and, therefore, the samples are homogeneous by the research indicator.

The experimental study was conducted to determine the dynamics of the creativity levels. The results of the experiment showed an increase in the number of students with a high level of creativity in the experimental group compared to the control (Table 2): 31.3% in the experimental group and 19.7% in the control group. It is worth noting that a decrease in the number of students with a low level of creativity in the experimental group is 21.7%, while in the control group – 25.1%.

Table 2. Formation of creativity (source: created by authors)

The level of creativity formation	Experimental group, % (individuals)	Control group, % (individuals)
High	31.3 (54)	19.7 (34)
Medium	47.0 (81)	55.2 (95)
Low	21.7 (37)	25.1 (43)

Verification of reliability of the obtained results was checked by Pearson's chi-squared test (χ^2), according to which the critical value was 5.991, and the corresponding empirical value = 6.11. Thus, any differences between the results of the control and experimental groups are with a probability of less than 5% and based on the result of the introduction of an active pedagogical factor into the educational process, and, therefore, the difference between the control and experimental groups is expected for the studied indicator.

Verification of the reliability of the obtained results was checked by Pearson's chi-squared test (χ^2), according to which the critical value was = 5.991, and the corresponding empirical value = 19.52. Thus, with a probability of less than 5%, any differences between the results of the control and experimental groups are the results of the introduction of an active pedagogical factor into the educational process, and, therefore, the difference between the control and experimental groups is natural for the studied indicator.

As creativity cannot be measured mathematically, we used Guilford's parameters and considered creativity as a form of problem solving and distinguished between two types of cognitive operations: divergent production and convergent production. Divergent production is a broad search used in open problems to generate logical answers or alternatives, whereas convergent production is focused on the search that leads to the generation of a specific logical imperative for a problem, in which a particular answer is required. Guilford (2017) defined divergent production process as more relevant to successful creative thinking. It means that creativity can be revealed by testing.

Creativity as a complex quality is characterized by the following features: awareness, independence, reflectivity, purposefulness, coherence, accountability and self-organization. It functions at various levels: operational, objective, reflexive, personal and communicative (Guilford, 1950). To enhance a creative component in the educational process, it is necessary to use psychological and pedagogical methods of activating thinking and heuristic activities of students, such as brainstorming, synectics, method of focal objects, method of morphological analysis, control questions, applications of theory, connection, definitions, experimental clutter, contradictions, criticisms, updates, recodifications and others.

According to scientific opinions, creativity is closely connected with intellect. The structure of Intellect theory comprises up to 180 different intellectual abilities organized into three dimensions for accurate description: operations, content, and products. To define creativity, we used Guilford's parameters and factors for interpreting variations in creativity: 1) sensitivity to problems – to reveal and formulate problems; 2) flexibility and fluency – to produce various thoughts; 3) originality – to respond to stimuli in an unusual way; 4) synthesizing and analyzing – to generate ideas; 5) reorganizing or redefining – to improve a targeted object, adding certain details; 6) complexity and evaluation – to solve problems by realization of relevant analytical and synthetic operations.

The aim of this task is to diagnose levels of creativity according to Guilford's parameters which are essential for doctors' career. However, this strategy requires specific conditions and schemes of implementation.

Evaluating creativity of the students, involved in the research, we concluded that students' quantitative results before and after the experiment differed in meaning (Table 3). The level of students' creative skills was assessed before and after the course. Creativity was defined using standard tests, which correlate with a person's abilities (various componential factors as originality/novelty, usefulness/appropriateness, fluency, *etc.*) of a wide range of tasks and contexts.

The task included four parts for each parameter (25 grades maximum per part), in total 100 points. We calculated the statistical data in percentages of how many students coped with the parts of the task with grades over 20 according to a 100 grading scale as a total excellent grade.

Overall, it is clear that the first group of students showed the highest results in all forms of creativity at the beginning of the course. The most significant form was their flexibility and fluency and the weakest one was complexity and evaluation. But after the course this index increased in 18%, which proves that the students gained the ability to solve problems by realization of relevant analytical and synthetic operations as well as the ability to respond

Table 3. Comparison of academic performance results (source: created by authors)

Parameter	I group High		II group Medium		III group Low	
	Before the course	After the course	Before the course	After the course	Before the course	After the course
Sensitivity to problems	80%	89%	64%	74%	52%	56%
Flexibility and fluency	86%	94%	72%	84%	64%	68%
Originality	72%	91%	75%	82%	58%	82%
Synthesizing and analyzing	70%	82%	65%	79%	54%	79%
Reorganizing or redefining	72%	84%	64%	72%	50%	52%
Complexity and evaluation	65%	83%	56%	64%	52%	52%

to stimuli in an unusual way, which rose from 72% to 91%. Other parameters of creativity were improved and increased in the range of 10%.

Regarding the second group of students, the most noteworthy result is observed in such form of creativity as synthesizing and analyzing, the index rose from 65% to 79%. It proves that for these students it was easier to generate a lot of ideas than to respond to stimuli in an unusual way where an index was the lowest, 7%. Moreover, they showed rather good improvement in sensitivity to problems and flexibility, where their indices increased within 10%. Although, there were some differences in parameters, this group of students demonstrated the most stable development after the course.

The most unexpected results were observed in the third group of students whose initial data of academic performance results were the lowest ones. After the course, their ability to respond to stimuli in an unusual way and the ability to generate a lot of ideas were improved by 24% and 25%, respectively. However, they showed a steady increase by 4% in such forms of creativity as sensitivity to problems, flexibility and fluency. Slight increase in 2% was noticed in reorganizing or redefining, complexity and evaluation. The students could not develop their abilities to add certain details to a targeted object and to solve problems by realization of relevant analytical and synthetic operations.

In general, all students demonstrated significant improvement in the ability to generate a lot of ideas. Nevertheless, some indices were different and must be taken into consideration while developing creativity and creative communication of medical students.

Students of the first group comprehended the material, could solve required assignments, since they have well developed critical and logical reasoning, can work individually, collect, synthesize and analyze information, specify the key ideas in certain assignments. The students have the ability of demonstrating creativity including critical thinking and verbal creativity. Students of the second group properly comprehended new material, but could not point out the key issues or give priorities in a set task. They work individually, however, have difficulties synthesizing and analyzing information. The students need teacher's assistance to direct them in the appropriate way. Students of the third group were also taught by the same technique, however, they found it difficult to perform tasks, the majority of students

did not do home assignments, since a lot of time and effort was needed and they could not understand the tasks due to poor knowledge of English. The students could not distribute their time and work at home on their own. During classes, they cannot work without teachers' help either.

Discussion

Humanities provide medical students with alternative ways of thinking – "brainstorming", analyzing personal beliefs and values and summarizing the obtained knowledge or experience about diseases, patients and the world. Sociocultural skills include student's ability to use acquired and well-structured knowledge in accordance with the situation of communication: a complex of organizational values, processes, conventions and practices which encourage future doctors to improve skills, performance and competence. Moreover, effective teaching is supplemented by personal knowledge, trials and errors, reflection in practice, and conversations with colleagues. They should cope with the ability to grasp efficient practical experience, to identify and analyze current problems using professional critical thinking, *etc.*

Teachers should be able to manage the educational process as their main activity. Organizing creative independent learning (methodological support, forms of control) is even more time-consuming to make critical well-informed decisions than regulation of teachers' activities specified in the documents. Thus, teachers should be able to ask and answer questions, provide hints and explanations, monitor students' understanding, provide appropriate feedback, and keep track of what has been covered in the learning process of humanitarian disciplines (Isayeva, 2014). Accordingly, we can conclude that the formation and development of a creative personality requires introduction of new didactic and methodological tools that help to model the educational process based on the defined and specified goal.

Formation of future doctor's creativity, according to Guilford's parameters, requires the development of mental actions (judgement, inferences), operations (analysis, synthesis, comparison, generalization, classification and intuition), which develop students' professional thinking – critical thinking competence – creative critical thinking. Critical thinking and creativity are strongly linked. Students require explicit support to develop breadth and depth of their thinking and to take intellectual risks. This attention to reasoning helps students to build self-awareness and their capacities for reflection. Forming critical and creative thinking capability is an essential element of developing successful, confident and innovative future doctors.

Students also obtain a wide range of possibilities to develop their thoughts based on information, conscious perception of own intellectual activity and of others. Thus, the development of creativity involves the formation of students' ability to analyze learning information from the standpoint of the logic and personal approach in order to use the results obtained in both standard and non-standard situations and problems, as well as the ability to ask original questions, find arguments, and make independent decisions.

A researcher notes that efficacy of medical students' creative self-realization during the study process depends on the creation and comprehension of the following organizational and pedagogical conditions (Pysklynets, 2010):

- Formation of intellectual and creative atmosphere in the class, favorable for creative process and situations, which gives rise to students' creative activity and develops their creative capabilities;
- Establishment of friendly relations between a teacher and students in the process of common creative activities in solving complex creative tasks;
- Consideration of concernment, medical students' individual interests in the process of creative and search activities;
- Development of students' imaginative thinking that leads to independent choice of directions, forms and methods of activity;
- Intensification of students' motivation for creative self-expression.

Nevertheless, students' creative self-realization, according to the scientist's statement (Pysklynets, 2010), depends on creative tasks, the main role of which is to develop students' initiative and independence, the ability to apply the theory in solving theoretical and practical issues, to impose the taste for research. They can be calculated, qualitative or experimental. Using the methods of creativity organization during classes, it is necessary to implement the following types of creative tasks as: prediction, optimization, review task**s** with incorrectly represented information, research tasks, logical, communicative and creative, management assignment, problem solving tasks, tasks aimed at acquiring new ways of activity. To develop creativity, it is essential to use problematic situations, for example, different ways of solutions to medical issues, various approaches in disease treatment, *etc*.

The process of solving any problematical situation involves several steps: goal setting, choosing appropriate means and forms of achieving it. It should be noted that problematic situations at the initial stage of learning are given to students partially: a teacher only sets the goal, which requires students' intellectual activity. This active, independent mental activity will result in positive mental development of students.

In our opinion, the internal contradictions of professional creative self-improvement of medical students are:

1) a student is both an object and a subject in the process of forming professional creative abilities, because accumulation of individual knowledge, practical skills, improvement of intellectual and moral strength is directed at own personality, and, to some moment, a personality is a sole user of his/her work;
2) student's desire to get acquainted with professional innovations and insufficient social pedagogical provision of this process.

The first contradiction can be overcome by correcting educational curricula on the subjects investigated and under the conditions of effective organization of tutorial process.

The solution to the second controversy implies the improvement at the level of professional and creative culture, which is achieved through the increased volume and growth of the quality of independent educational and scientific research of medical students, organization of conferences, sessions, round tables, plenary and thematic sessions with involvement of medical students at university.

To our understanding, fostering creativity by adapting new teaching methods and creating safe educational environment could, consequently, support overall improved performance at university, while preparing medical students to be innovative in life and future career.

We suggest that creativity is linked to the efficacy of the following life skills as critical thinking, problem identification and communication. Communication skills are integral to learning, which applies and fosters the development of effective speaking and active listening abilities being significant for medical students. The complexity of communication has increased with information technology and new media technology. Modern pedagogy is considered an effective tool to enhance communication skills. Therefore, communication skills are conducive to employability and instrumental to various levels of work relations. Communication can be defined as: sharing thoughts, ideas; asking questions; finding solutions; exploring different points of view; models of communication: written, verbal, non-verbal; communicating clearly, *etc.*

Group dynamics, team building, emotional intelligence and cooperative decision-making are the main features in developing communication skills. Communication skills should be elaborated through group discussion, oral presentations, and analysis of innovations in media using cognitive ability, operational activity, and personal traits. Future doctors have to develop their skills in research, group or teamwork and oral presentations based on Guilford's parameters.

We suppose that teaching should use both different forms and verbal expressions to explore techniques and methods for creativity and creation; students should be given a chance to assess their communication skills by working with production and interpretation, and by examining how specific forms of aesthetic expression are used to communicate. Teaching should also give students the opportunity to enhance understanding of communication through analysis, reflection and discussion about interpretation, which are essential for developing creativity.

Confirming our opinion, creativity is related to both innovative divergent thinking and communication that can lead to creation and innovation. It is essential to develop interdisciplinary explanation regarding the role of communication for medical students. The analysis of scientific pedagogical literature suggests that "independence" is interpreted primarily as the activity approach and is determined as the main didactic value. Independence as an essential notion should be nurtured in early childhood and should be emphasized and developed before creativity. Therefore, it is necessary to teach every medical student to think independently and creatively, to analyze and synthesize, to act in unusual situations and solve a variety of problems related to urgent conditions, severe cases or accidents, to build and generate new ideas and apply knowledge into new contexts. Students need to apply their knowledge in unfamiliar and evolving circumstances. For this, they will need a broad range of skills, including cognitive and meta-cognitive skills (*e.g.* critical thinking, creative thinking, learning to learn and self-regulation); social and emotional skills (*e.g.* empathy, self-efficacy and collaboration); practical and physical skills (*e.g.* using new information and communication technology devices).

Based on own experience, we have revealed the factors that contribute to the development of students' creative cognitive independence at higher medical educational institutions:

- Natural and biological data of personality – individuality, learning abilities, intelligence, imagination, fancy, character traits;
- Social conditions – interdependence of reorganizations in society and in educational domain;

– Pre-university training – preparedness for further education, readiness for profession, adaptive capacity;
– Medical and pedagogical system of higher educational institution – diagnostics, contents, methods and techniques of work, types of activities, control and self-control.

Teachers know that problems arise in the process of study and formation of students' independence, the solution to which is possible via self-improvement: how to create, along with obtaining a formal education, the environment that promotes self-education; how to study according to one's interests using a variety of sources independently.

Therefore, we suggest that the use of students' creative works provides optimal independence, curiosity, imagination in solving cognitive tasks, a high level of mental development of students' creative thinking and contributes to an improved quality of their knowledge. The level of creative independence is determined by the components: incentive (motivations of cognitive intellectual activity), informative (reference knowledge) and technical (forms and methods) which are responsible for generating imaginative thoughts and facilitating creative action of future doctors.

Thus, independent work can be classified due to guiding principles, namely according to time and control form:

– Short-term, completed directly in the class or at the moment of preparation for classes with current or intermediate control;
– Long-term, connected with independent search, high activity level of students, requiring more continued preparation (*e.g.* project activity) using intermediate and final control. These components should be combined during class interaction as independence which is as important as creativity.

According to own experience, we suggest that many students are not able to work independently. Thus, most students do not possess enough skills to organize independent work, some of them are not able to plan their time, and there are those who do not know how to make this division. It is also complicated for students to follow cognitive control, to keep self-regulation and emotion regulation, memory suppression, personal understanding, *etc.* Nevertheless, hours for self-study are constantly increasing at medical universities. It is necessary to form readiness for independence and creativity in future medical specialists while being a student. Independent thinking and creative attitude and interest in the future profession and orientation are also significant to achieve good results in it.

Conclusions and implications

To enhance a creative component in the educational process, it is necessary to use psychological and pedagogical methods of activating reasoning and heuristic activities of students, such as brainstorming, synectics, method of focal objects, method of morphological analysis, control questions, applications of theory, connection, definitions, experimental clutter, contradictions, criticisms, updates, recodifications, *etc.*

Various methodological techniques were applied in teaching students to develop their creative abilities in the process of two courses: basic course "Professional English in Medicine" and elective course "Special Medical Terminology" at DHLNMU. The technologies *Priority Ladder* and *Milestones* were the most effective. Creative aspect in communication helps

mark structural components of communicative creativity as productivity, verbal originality and unique character in students.

To define creative abilities and compare academic performance results, we used Guilford's parameters; to determine the verbal aspect of students' creativity, we applied the techniques suggested by Moede and Mednick.

Based on our research, we revealed that communication is an important constituent of students' creativity and defined the correlation between creativity and independence. The development of students' creativity is characterized by several stages: personal (traits of character, intellectual abilities, logical reasoning, creative thinking, creative self-expression); professional (aesthetic communication, professional independence, lifelong professional development, professional experience, being innovative and positively motivated, being highly conscientious and resourceful); social (learning environment, climate setting, collaborative partnership between colleagues and society, physical factors, cognitive dimensions, motivational aspects).

While developing creative assignments for students, teachers must take their intellect and abilities into consideration. Students with developed critical and logical reasoning can work individually, collect, synthesize and analyze information, specify key ideas in certain assignments. Such students are able to demonstrate creativity including critical thinking and verbal creativity. Students, properly comprehending new material but unable to point out the key issues or give priorities in a set task, can develop their creativity skills performing assignments aimed at responding to stimuli in an unusual way and generating a lot of ideas on a certain issue. Definitely, a well-designed set of exercises, focused on the development of flexibility, fluency, originality, elaboration and problem sensitivity, foster medical students' creativity. More attention shoud be paid to complexity and evaluation as the components of creativity, since students have to gain skills of problem solving by realizing relevant analytical and synthetic operations.

Thus, our suggested methodology works properly and is suitable for training medical students not only in the process of teaching professional English. The methodology is considered as the technique used for developing creative personalities.

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