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## **ECONOMICS**

### **BENCHMARKING IN THE SYSTEM OF REGIONAL DEVELOPMENT STRATEGY**

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**Annotation.** *The development of effective strategic decisions on the territorial development today requires new approaches and tools of strategic management. It is the benchmarking tools related to the search and implementation of best management practices in regional governance regarding territorial development that make it possible to solve problems more effectively and set development priorities. Achieving a high standard of living and sustainable regional development are the most important priorities of the community. The tools of benchmarking in the activities of united territorial communities, where the active community adopts experience and gained practice, and sometimes financial assistance from international institutions in order to implement their projects, are of particular relevance. Benchmarking is a tool for improving best activities and practices using the best experience in a specific field. The main aim of the study is to highlight the methodological principles of benchmarking in the analysis and formation of strategic directions of regions and to find a methodological tool that would identify the model-region as an example of best practice in a particular area of territorial strategic development.*

*The study was based on the use of: method of comparison, generalization - to clarify and formalize the essence of the concept, correlation and regression analysis - to build multifactor regression models, to determine the model-territory for basic comparisons of different territories on key indicators, territory clusterization; graphoanalytical method - to provide clarity of the material and schematic representation of a number of theoretical and practical provisions of the study. Methods of computer processing, analysis and display of information using Microsoft Excel, STATISTICA were used for complex analysis. The information base includes statistical materials of the State Statistics Service of Ukraine, official publications of international organizations, expert assessments of rating agencies, monographs, basic scientific research of domestic and foreign authors, materials of scientific conferences, domestic and foreign publications, electronic Internet resources, etc.*

**Keywords:** *strategizing, regional development, leadership potential of the region, benchmarking.*

**Introduction.** *At the present stage of market transformation of Ukraine's economy, one of the main factors in the stability of the achieved positive socio-economic trends*

in the country is to ensure sustainable economic growth and development of the social sphere. The significant role of development given to the study of modern successful practices should be recognized among the ways to strengthen the economy. The very mastery of benchmarking technologies and their productive use is an integral prerequisite for the development of business entities.

The key feature of benchmarking is its creative nature, focus on best practices with further use in its own practice. This allows to reach the level of best practices, in particular, in the territorial strategic development, and to exceed it. This feature of benchmarking becomes extremely relevant when the economic situation is developing very slowly, and additionally, the impact of pandemics increases the unpredictability of events. That is why the further development of the theoretical provisions of benchmarking, as well as its adaptation to domestic realities is an extremely necessary, relevant and timely practice.

**Material and methods of research.** In the management system of the entity, the benchmarking tool acts as a strategic focus on the best achievements through the comparison of activity results and methods of work with the standard. It covers the processes of technology research, organization of production and marketing, management and marketing methods at the model-object to identify innovative experiences and their implementation in a particular research object. In order to understand the possibilities of using such a tool in the formation of strategic directions of regional development, it is important to understand the possibilities and benefits of benchmarking methodology. Analytical review of foreign literature sources [2, 6, 7, 8, 13, 18, 20-23] revealed the presence of theoretical principles and practical experience of effective using of benchmarking in businesses belonging to different industries. The main attention is paid to the classification and characteristics of certain types of benchmarking, the methodology of studying the model, the principles of organization and use of its results in practice. Domestic theory covers issues that reveal the historical stages of development and importance of benchmarking, justify the reasons and motives for its attribution to the level of management and marketing [3, 5, 14].

Based on generalized practice and theory, benchmarking is the process of finding a standard or model cost-effective competitor to compare with one's own and adopt his best practices [14]. Taking into account these definitions, the object can be not only a business entity - an enterprise, but also a particular region or local community. Of course, certain characteristics of such an object of study will differ from the enterprise. But it is worth noting that today the use of benchmarking in business management practices gives management the opportunity to continuously systematically search for best practices and implement them that lead businesses to a more perfect form. Positive experience in the using of benchmarking in PJSC "Obolon", PC "Farmak", Sandora and others prove that it is an effective tool for determining the position of an entity compared to other entities similar in size and / or sphere of activity, subjects.

**Results and their analysis.** The study of the peculiarities of the formation of modern areas of territorial development in Ukraine has revealed that as one of such areas, regional scholars and public administration experts highlight the need to introduce such a process

as strategizing in Ukraine. The classic understanding of strategizing is associated with the development of a strategy for a particular region. But the systemic nature of the strategy and the experience of international practices in focusing on not only internal capabilities, but also taking into account geopolitical external influences. Infrastructures that go beyond the country and require a new type of strategic infrastructure management - all this has a decisive impact on all processes and significant decisions in the country. In this context, strategizing the development of a certain territory - it is advisable to understand it as the method of multidimensional (multi-focus) self-management of territorial development, taking into account long-term strategies of various external strategic players and in contrast to that developing and implementing their strategies.

Nowadays, the state monitoring of strategizing practice in Ukraine shows that most communities do not have much demand for the development and implementation of quality strategizing models. Often such a request is stimulated from outside. European strategizing practices are disseminated with the help of international technical assistance programs (eg "U-LEAD with Europe", "Decentralization brings better results and efficiency: DOBRE", etc.). But despite the availability of sufficient methodological tools to build effective and efficient strategic and project management systems, most rural communities still do not have not only quality development strategies, but also a public demand for quality strategizing. The same applies to socio-economic development programs, which are often inconsistent with each other, without a clear prioritization of projects in them and clear and measurable indicators of their implementation. Collaborating communities are not always aware of the place of planned development strategies in the system of strategic planning and changes in the community management system that need to be implemented to make these strategies an integral part of decision-making mechanisms. Therefore, it is easy to see that the expected results of many strategies developed in 2015 and completed in 2020, most likely, will not be achieved. And as the results of communication with residents of different communities show, few people know about the existence of such documents in general, and those who do, do not consider them effective tools in ensuring community development [9]. Why territories are so ambivalent about best practices of strategizing? Experts call the objective factors related to the human resources of the newly created local governments, the lack of practice and culture of strategizing and project management.

The conducted researches of processes of strategizing of territorial development allow to allocate the key stages differing in limits of key results:

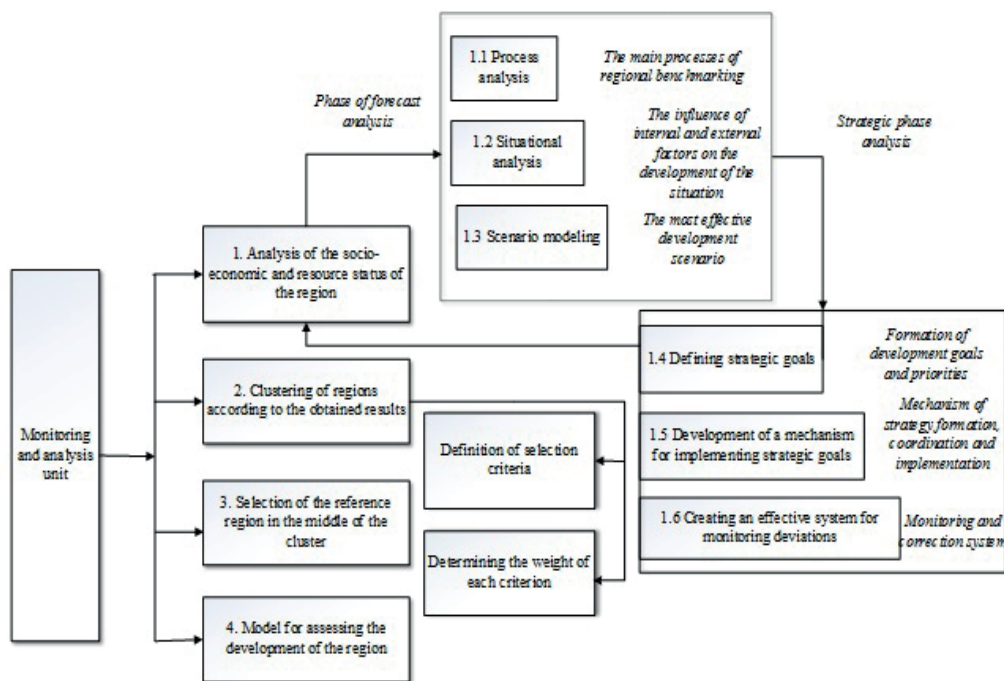
- strategic analysis, which involves the implementation of stages and work focused on analyzing the current situation and determining the most effective strategic scenario for the regional development;

- goal-setting, which includes stages and work aimed at further detailing and concretization of the chosen strategy of socio-economic development of the region: definition of goals, priorities, specific plans, implementation mechanisms (Fig. 1).

The study of strategizing methodology, which is mostly based on a systematic and program-targeted approach allows us to conclude about the methodological unresolved

issue of taking into account variables that affect the generalized function of territorial development.

This definition of variables and their impact on the efficiency of administrative structures is a major achievement of the situational approach, which has become a logical continuation of systems theory. The situational approach most fully reflects the problems that arise in management; it is universal and, in fact, contains the basic methods associated with management decisions contained in other approaches. Solving the problems of situational analysis of territorial development is related to the expediency of including the stage of comparative analysis of territories on the basis of a system of relevant criteria in the procedures of spatial economic research.



**Fig. 1. Strategizing the socio-economic territorial development**

*\* Created by the authors on the basis [15]*

The method of spatial benchmarking can be cited as a tool that most fully satisfies the position defined above. This tool is based on the original concept of benchmarking, developed for the level of primary economic entities with the subsequent transformation of key concepts and methodological foundations in the direction of spatial research.

When using benchmarking tools at the territorial level, it is advisable to clarify such key concepts that are used in the implementation of the procedure, as the territory under analysis and the model-territory. The territory (community, region) under analysis is the territory for which the results of the procedure provide the formation of recommendations



to improve the parameters of the problem area of research.

The model-territory ("best practice territory") is a territory that is characterized by improved studied indicators (subject area) compared to the given territory.

Research of methodical bases of benchmarking has given the chance to formalize stages of carrying out the benchmarking research of territorial development (pic.2) [12, 17, 19].

In the presented model, the choice of the model-territory is a key module of the benchmarking research procedure. However, the choice of the model-territory is complicated by the objectively existing problem of compatibility of territories due to the disproportions of the spatial development of regional systems.

Thus, to solve the stated problem, the system of criteria for selecting the model-region is offered. This system consists of four groups of indicators:

- 1) indicators that reflect the current state and functioning of spatial systems, which are closely interrelated with specific historical features of their origin and development;
- 2) the level of provision of the territory with capital resources as traditional factors of economic growth of the studied territories, per one employee in the economy;
- 3) final indicators of the functioning of regional systems per employee in the economy
- 4) leadership potential of the territory, as a specific integrated indicator of the level of social, human and managerial potential.

Let us pay attention to the fourth group of indicators. When highlighting this group, it should be noted that understanding leadership is the key point. Society's need for leaders determines the scientific interest in understanding the concept of "leader" and "leadership". The results of research in this area are covered in a number of publications [9-11]. The task of effective strategizing requires the implementation of a range of new functions (business processes) at the level of management of a particular region. Such functions include the ability to analyze the macro environment, the ability to identify current needs, the requirements of stakeholders, the ability to put forward and generate innovative ideas in the field of new services, and others.

Execution of these functions is possible only if they are provided with the necessary resources: technical, technological, personnel, information, financial, etc. Because the resources that a certain region has are always limited, so, they can be distributed among the above-mentioned functions in such a way as to achieve the maximum possible systemic effect.

Thus, in an unstable environment, the maximum capacity of the region will be determined not by the maximum amount of GDP, but by the ability of regional leaders to anticipate potential changes in the external environment and willingness to respond flexibly to them. For this purpose, the term "potential" is used in the references. The importance of focusing on the leadership potential of a particular territory today is obvious to the development of any business entity. The study of the problem of leadership development leads to the conclusion that some researchers consider this problem from the standpoint that human resource development is one of the components of the leader's competencies,

from other positions leadership is the driving force of human resources development. The conducted researches of the authors allowed to allocate indicators of identifiers of leadership potential of a certain territory. As a subsystem of indicators of leadership potential, the indicators, which could be characteristics of health, intellectual level, potential for intellectual development, and human development potential, were chosen.

Let's return to the study of benchmarking of territories. As the key indicator is leadership potential, the clusterization procedure and the consistent selection of the model-region were used to determine the region's rating on the leadership potential. The main criteria for selecting the model-region are:

- similarity of regions in terms of territory area (territory area and share of dominant economic activities in the overall structure of gross domestic income as an indicator of the scale of spatial segments and their territorial specialization);
- proximity in terms of sectoral specialization (indicators of the volume of fixed assets per 1 employee in the economy as a resource of regional development, taking into account the norms of accumulation of physical and human capital related to the dynamics of attracting and intensity of labor and capital resources in specific point in time);
- proximity in terms of GDP per capita in the economy and the average annual value of fixed assets per employee in the economy.

Table 1

**Indicators of development of regions of Ukraine in 2020 (fragment)**

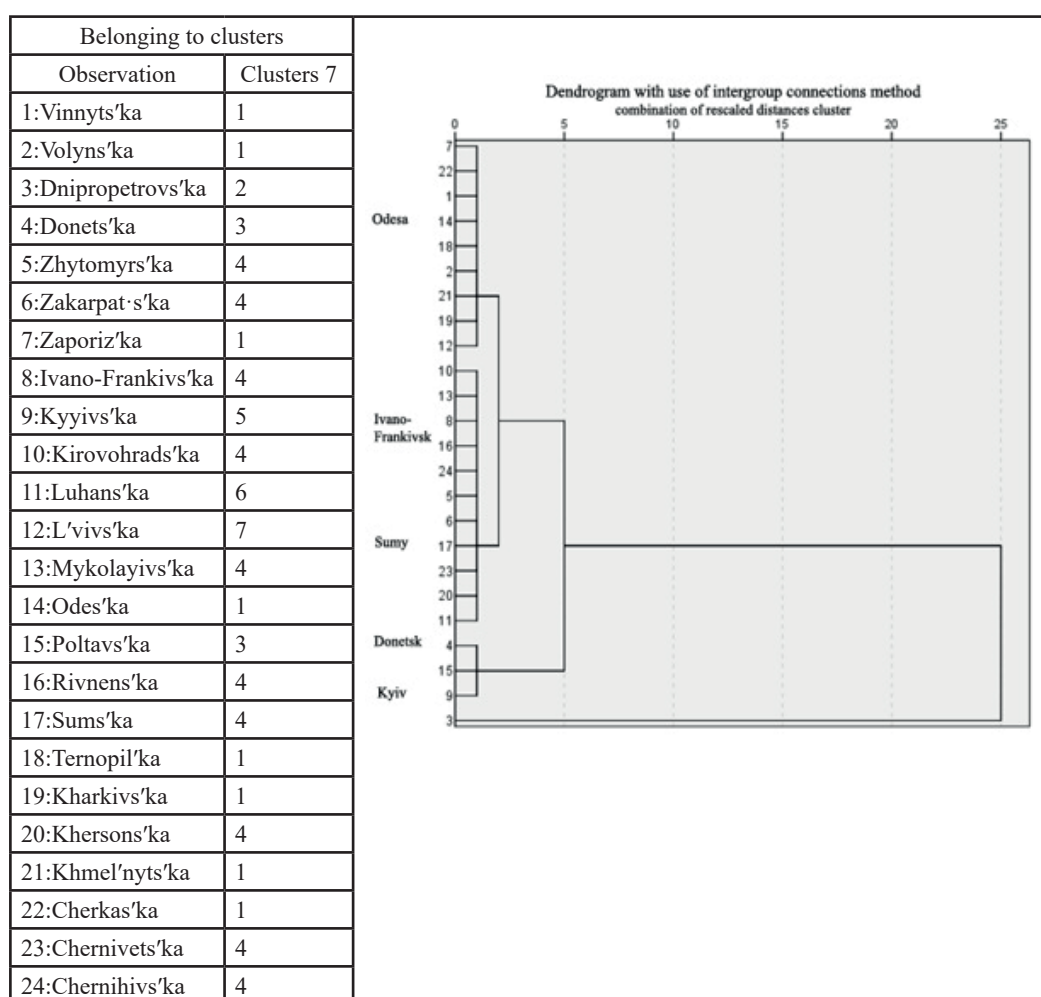
Region	NPEAB, un.	NEIAB, un.	NSAB, %	NIP, %	PRS, un.	GRPS, mil. UAH	GRPE, tho. UAH	CIS, tho. UAH	CIE, tho. UAH	CSRD, tho. UAH
Zhytomyr	75,9	0,03	4,64	66,2	1,48	2,86	0,15	172,76	8,89	0,05
Transcarpathian	84,2	0,02	3,85	59,0	3,69	4,80	0,11	198,73	4,53	0,14
Ivano-Frankivsk	67,0	0,02	5,64	85,7	3,02	6,24	0,14	248,25	5,51	0,07
Kirovohrad	69,3	0,03	3,10	66,3	1,22	2,97	0,17	223,75	12,73	0,06
Luhansk	182,1	0,03	5,64	15,4	2,43	1,51	0,11	76,92	5,76	0,11
Mykolayiv	89,9	0,03	6,02	68,4	2,02	3,76	0,17	243,30	10,86	0,43
Poltava	71,0	0,03	6,32	56,1	1,64	6,52	0,28	560,66	24,31	0,07
Rivne	61,1	0,02	5,63	76,0	1,63	3,36	0,13	157,70	5,92	0,03
Kherson	81,9	0,04	4,91	55,7	1,45	2,18	0,12	127,09	7,17	0,14
Chernivtsi	99,2	0,04	6,10	63,8	5,34	5,15	0,10	185,37	3,44	0,24
Chernihiv	67,4	0,03	3,63	75,8	1,03	2,45	0,16	165,82	10,85	0,10

\* Calculated by the authors according to the data [16]

We propose to determine the model-region and the rating of regions in the cluster, according to methodological techniques, which are based on the use of certain groups of indicators that are the main indicators of the level of regional development. To assess the regional development, the following indicators were used in the study: gross regional

product per 1 sq. km (GRPS), gross regional product per 1 employee (GRPE), capital investment per 1 sq. km (CIS), capital investment per 1 employee (CIE), the cost of scientific research and development per 1 employee (CSR), the number of Private Entrepreneurs per 1 able-bodied person (NPEAB), the number of educational institutions per 1 able-bodied person (NEIAB), the share of students in the total working population (NSAB), the share of ill people in the total population (NIP), the number of Private Entrepreneurs per 1 sq. km (PRS) (Table 1).

The formation of clusters according to the level of regional development and indicators of leadership potential was carried out using IBM SPSS Statistics 22 (hierarchical cluster analysis) (fig. 2).



**Fig. 2 Belonging to clusters - dendrogram with the use of the intergroup relations method**

*\* Calculated by the authors according to the data [16]*

Cluster analysis is used in order to structure and segment into homogeneous sets according to the selected criteria of the regions of Ukraine. Due to the small number of observations, the method of hierarchical cluster analysis was chosen. The mechanism for combining into clusters is as follows. Initially, each observation forms a separate individual cluster. Two individual clusters are then searched for and combined. The process continues until a certain number of clusters remain. The distance between clusters is calculated for quantitative variables by the Euclidean distance square method. When choosing a clustering method, the Ward's method was used, and standardization of values was previously done. According to the results of comparisons, a dendrogram was formed (fig. 2).

According to the results of calculations, 4 clusters were formed. The first cluster included 9 regions, the second included 11, the third - 3, the fourth - 1. To determine the model-region, the second cluster was chosen. The list of regions included in this cluster is presented in Table 2. The model value for each indicator is the region with the maximum value. The rating assessment was done using the Euclidean distance method.

Table 2

**The results of a comprehensive rating assessment of the development of regions depending on the leadership potential in the cluster**

Region	Indexes										Indicator of comprehensive assessment	Rating
	NPEAB, un.	NEIAB, un.	NSAB, %	NIP, %	PRS, un.	GRPS, mil. UAH	GRPE, tho. UAH	CIS, tho. UAH	CIE, tho. UAH	CSRD, tho. UAH		
Zhytomyr	0,42	0,75	0,73	0,77	0,28	0,44	0,52	0,31	0,37	0,11	1,81	7
Transcarpathian	0,46	0,60	0,61	0,69	0,69	0,74	0,39	0,35	0,19	0,32	1,67	5
Ivano-Frankivsk	0,37	0,58	0,89	1,00	0,57	0,96	0,49	0,44	0,23	0,16	1,63	4
Kirovohrad	0,38	0,78	0,49	0,77	0,23	0,46	0,60	0,40	0,52	0,14	1,77	6
Luhansk	1,00	0,81	0,89	0,18	0,46	0,23	0,40	0,14	0,24	0,26	1,96	11
Mykolayiv	0,49	0,70	0,95	0,80	0,38	0,58	0,59	0,43	0,45	1,00	1,32	1
Poltava	0,39	0,65	1,00	0,65	0,31	1,00	1,00	1,00	1,00	0,16	1,34	2
Rivne	0,34	0,54	0,89	0,89	0,31	0,52	0,45	0,28	0,24	0,08	1,91	10
Kherson	0,45	1,00	0,78	0,65	0,27	0,33	0,43	0,23	0,29	0,33	1,82	8
Chernivtsi	0,54	0,88	0,97	0,74	1,00	0,79	0,34	0,33	0,14	0,56	1,46	3
Chernihiv	0,37	0,69	0,58	0,88	0,19	0,38	0,57	0,30	0,45	0,22	1,82	9
Standard (maximum values)	182,16	0,04	6,32	85,75	5,34	6,52	0,28	560,66	24,31	0,43	-	-

\* Calculated by the authors according to the data [16]

Thus, Mykolaiv region was defined as the model-region in a cluster. Thus, we have a region where the ratio between the main indicators of the scale of the region

and leadership potential is the best ratio. That means, sufficient leadership potential for development has been formed in this region. Benchmarking of territories involves conducting the following research - it is determining the magnitude of the impact of leadership potential on the regional development by correlation and regression analysis. However, continuous, accurate monitoring observations are needed to obtain operational data about the region.

**Conclusions.** Thus, benchmarking is an alternative method of strategizing, with the use of which the task of regional development can be determined taking into account reasonable criteria and indicators. The application of benchmarking in the management system allows us to systematically find and evaluate all the benefits of the best experience of the model-territory and create opportunities for their use in one's own region.

Thus, improving the strategizing of regions considering system-forming factors and the need for flexible response to modern challenges is the most effective lever to influence socio-economic processes. Therefore, the main scientific task today is the development of methodological principles of situational analysis, as well as creating conditions for their implementation.

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## THEORETICAL AND PRACTICAL ASPECTS OF SECURITY-ORIENTED TRANSPARENT ACTIVITY OF THE ENTERPRISE

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**Annotation.** *The article examines the essence of the concept of "transparency" and identifies its main elements and qualitative characteristics. It is established that the transparent activity of the enterprise, is the coverage in the public domain of reliable information and explanations on the objective view of the financial and non-financial performance of the enterprise.*

*This article analyzes the current trends in the development of transparent activities in Ukraine. The results of the analysis show that the highest level of transparency is inherent in the companies of the principal departments (so-called head offices), the financial sector, electricity supply, telecommunications and transport. It has also been found that state-owned enterprises increase the transparency of their activities every year. This situation is related to the reform of corporate governance of state-owned enterprises in Ukraine.*

*The final part of the article identified the main benefits of transparency for enterprises for all participants, both at the micro and macro levels. Along with this, the emphasis had placed on the main shortcomings of this phenomenon. In order to implement a security-oriented approach, it was justified to establish the limits of transparency, the implementation of which will realize new opportunities and avoid risks and ensure a positive impact on the level of financial and economic security of the enterprise.*

**Keywords:** *transparency, enterprise, transparency index, benefits, disadvantages, financial and economic security.*

In recent years, the concept of transparency has been actively implemented in the public and private sectors. The main reason for such changes is the transition of economic relations to the level of digitalization. In such conditions, the openness of information on business organization, innovation and corporate social responsibility is a criterion for the quality of management of enterprises, which determines their investment attractiveness



and growth of market value.

At the same time, not only new opportunities but also threats open up for the company. This highlights the problem of studying the impact of transparency on the results of the enterprise. This issue requires the development and implementation of modern security-oriented approaches in the activities of enterprises with the prospect of strengthening financial positions in the short and long term based on the principles of transparency.

There are quite a several scientific approaches to defining the essence of the concept of "transparency". This term can be considered both in the general context and at the level of different economic entities (Vynnychenko N., Miroshnychenko O., Cherkay O., 2020). It should be noted that the term "transparency" is quite common and has its origins in different languages. Thus, in particular, from the English language "transparency" is translated as "transparent", but it is generally accepted that the only origin of the concept is from Latin, where "transparere" is translated as "something transparent and clear" (Nalyvaiko L., Romanov M., 2016).

The concept of transparency combines several qualitative characteristics of the business and the information that the company provides to stakeholders: it is credibility, clarity, content, and relevance. For most domestic scientists (Khalina V., Sirovatsky O., 2020, Krasnokutska N., Kruhlova O., Kozub V., Martiskova P., 2019, Bilotska I., 2020) the meaning of the concept of transparency is associated with access to information on social, economic, political, environmental and other processes. In addition, foreign scholars see transparency as a social phenomenon, as a state of awareness (availability of complete, sufficient and reliable knowledge) about a particular activity (its objects or results), which would allow any stakeholder to have a full idea of it (ESG Transparency Index of Ukrainian Companies, 2020). That is, the transparency of the company is information transparency or publicity, publicity of the environment and information that the company provides to stakeholders in an open, complete, timely and understandable form for rational decisions.

Summarizing the existing interpretations, we can conclude that transparency at the enterprise level is a reliable and unbiased presentation of information about the activities of the entity. Accordingly, the transparent activity of the enterprise means the coverage in the public domain of reliable information and explanations of the objective view of the financial and non-financial performance of the enterprise (Bogutska L., 2017).

The general characteristics of the concept of transparency are presented in Figure 1. Accordingly, by adhering to the criteria of transparency and highlighting relevant information for all interested users, the company will have several competitive advantages that will strengthen its financial position of the company.

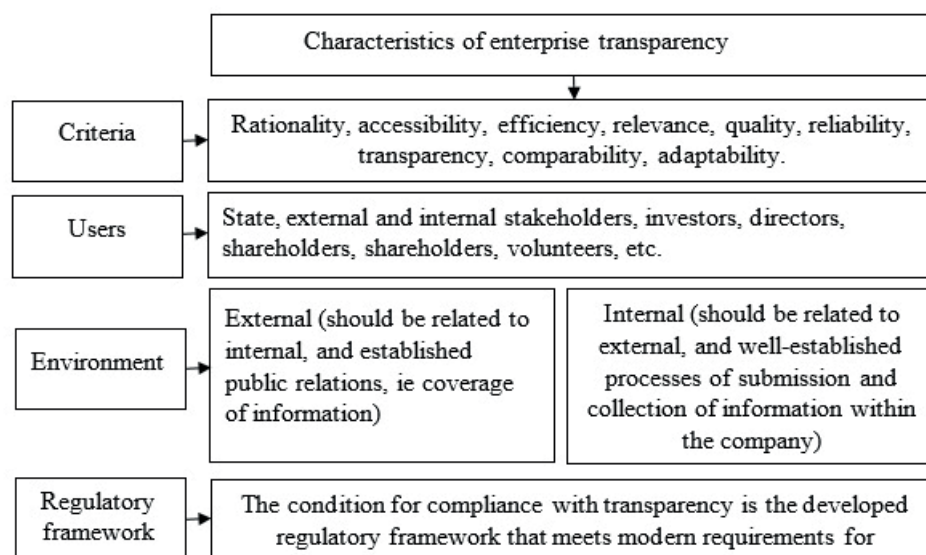
Therefore, by implementing the principles of transparency, the company can count on the following benefits and additional opportunities:

1. Attracting talented staff. It is the transparency of business processes that is a valuable asset in the eyes of creative employees when choosing an employer.
2. Building trust. Many customers equate transparency in business with the morale

of the company. In 2016, research by consulting firm Label Insight for Roi Study showed that 94% of consumers prefer brands that adhere to the transparency of production processes (Driving Long-Term Trust and Loyalty Through Transparency, 2016).

3. Increasing labour productivity. The effectiveness of the company's employees depends on the completeness of the information and the scope of delegated powers.

4. Strengthening business responsibility. By making data available, company executives demonstrate a willingness to report on every step of the company. A study by Label Insight showed that consumers are willing to pay more for products made by "transparent" companies (Driving Long-Term Trust and Loyalty Through Transparency, 2016).



**Fig. 1. Characteristics of enterprise transparency**

*\* Source: compiled by the author on the basis of (Vynnychenko N., Miroshnychenko O., Cherkay O., 2020, Khalina V., Sirovatsky O., 2020)*

Transparency provides the ability to forecast economic activity at a higher "quality" level and is a significant "intangible asset" that increases the market value of the enterprise by creating additional value for the entity. That is why transparency is also a qualitative characteristic of companies, which is assessed primarily through the level of coverage of information, both financial and non-financial. Accordingly, transparency includes a set of disclosure decisions, the main purpose of which is to create a complete and accurate picture of all aspects of the enterprise. Therefore, selective transparency is impossible under such conditions.

The main elements of financial and non-financial information disclosure about the company include the following areas: financial, legal, administrative, technological,

social, personnel, environmental and corporate (Table 1).

Table 1

**The main elements of enterprise transparency**

Element of transparency	The essence of the element of transparency
Financial transparency	Relevance, reliability, completeness, clarity and accessibility of financial statements.
Legal transparency	The openness of information on the establishment of the enterprise, its owners, the state of corporate governance, relationships with customers, employees, government agencies, and data on court decisions.
Administrative transparency	The openness of documents on management bodies at the enterprise, openness of the decision-making process.
Technological transparency	Notices on the use of certain technologies in the production (provision of services), information on the receipt of raw materials, and major partners.
Social transparency	Information on development programs for employees of the enterprise, implementation of social projects, there are clear principles of activity based on social responsibility.
Personnel transparency	Clear regulation of work by cultivating the unity of the structure of formalized requirements and norms, building a system of disciplinary measures that determine the level of responsibility, and employee involvement in decision-making.
Environmental transparency	Demonstration to the society of intentions and their realization concerning the observance of ecological norms and standards.
Corporate transparency	Openness and clarity of the code of ethics, cultural norms and rules of conduct within the company.

\* Source: Compiled by the author based on (Bilotska I., 2020, Surovtseva I., 2016, Khalina V., Sirovatsky O., 2020)

Emphasis should be placed on the relationship between transparency and the value of information. As you know, the activities of any enterprise are directly related to the concept of "information"; and transparency itself is determined by the company's direct ability to present freely available information that is needed by other stakeholders. Accordingly, the information goes through the stages of output, processing, and transmission. As information becomes an economic resource, it becomes valuable (Vynnychenko N., Miroshnychenko O., Cherkay O., 2020).

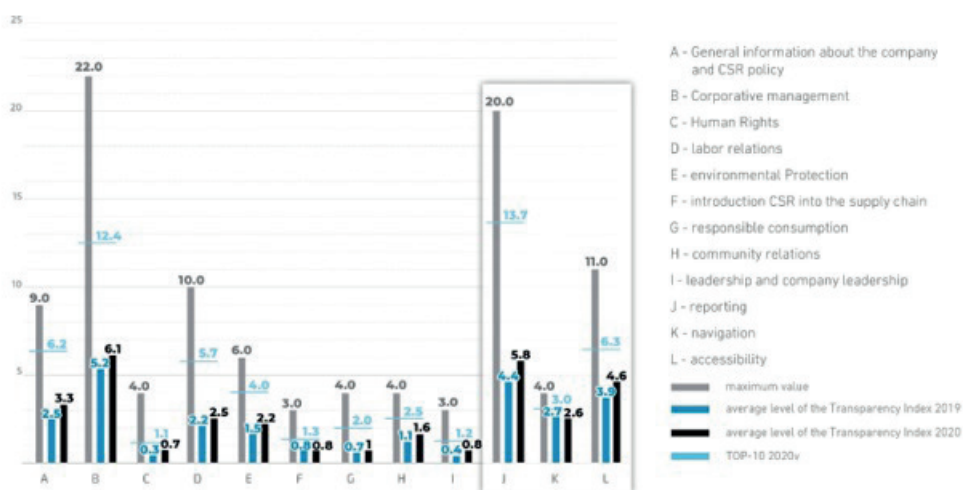
The main indicator of the level of enterprises' transparency in Ukraine is the ESG Transparency Index of Ukrainian Companies calculated by the Professional Association of Corporate Governance (PACU) and the Center for Corporate Social Responsibility with the support of the Center for International Private Entrepreneurship (CIPE). These organizations assessed public information for 2020 on the ESG factors of Ukrainian companies that were among the 50 largest taxpayers, as well as companies that voluntarily participated in such an assessment. The index assesses the openness of Ukrainian companies by ESG factors (social, environmental and managerial).

In our opinion, an integrated ESG strategy helps companies set goals and measure the

impact of each factor, as ESG factors are the three key criteria for assessing a company's sustainability for sustainable investment. Companies are increasingly aligning their business strategies and social goals with the Sustainable Development Goals by adopting their ESG strategies.

According to the results of the study, it was determined that the disclosure of information by Ukrainian companies in 2020 averaged 32%, which is 6.5 percentage points more compared to 2019. This shows that more and more Ukrainian companies are striving for transparency. After all, in modern conditions, the company's performance is evidenced not only by financial indicators but also by ESG indicators, which characterize the company's achievements in the field of environmental, social and management goals. It was found that the average level of transparency of Ukrainian companies according to these indicators is: 26.4% in social aspects; 36.6% - in environmental; 27.7% - in corporate governance. Also, it is worth noting that 23 out of 56 companies have a level of ESG disclosure above average, and the level of transparency of the top 10 companies reaches over 60%.

Most of the participants in the ESG Transparency 2020 Index disclose information on general company information, environmental protection and community relations. For a more detailed study of this issue, we will analyze the average level of information disclosure by categories of the ESG Transparency Index 2019-2020 (see Figure 2).



**Fig. 2. Average level of information disclosure by categories of the ESG Transparency Index 2019-2020 in Ukraine (ESG Transparency Index of Ukrainian Companies 2020)**

Analyzing this chart, we can say that the TOP-10 companies in almost all criteria have twice as high, and for such an indicator as "Reporting" - almost 2.5 times. As can be seen from the above figure, in 2020 the openness of information increased in all categories and most of all in such criteria as "Human Rights" (increased 2.3 times)

and "Leadership and Company Leadership" (increased 2 times). Also, the disclosure of information by individual components shows that the highest level of disclosure has such components as "Navigation" and "Accessibility". So in general we can say that the level of transparency of Ukrainian companies, in all categories, tends to increase.

Also, it can be argued that among the companies that have demonstrated the highest level of transparency are companies with head offices (so-called head offices), finance, electricity, telecommunications and transport, with an average level of transparency of 59.2%, 48.6 %, 42.3%, 41.6% and 36.4%, respectively (Table 2).

Table 2

**The level of transparency of companies by type of activity**

Activity	The level of transparency of companies of a certain type of activity, %
Activities of main departments (head offices)	59,2
Provision of financial services	48,6
Supply of electricity, gas, steam and air conditioning.	42,3
Telecommunications	41,6
Transport, warehousing, postal and courier deliveries	36,4
Beverage production	31,7
Wholesale trade, except for motor vehicles and motorcycles	27,3
Mining of metal ores	25,7
Extraction of crude oil and natural gas	24,2
Manufacture of tobacco products	21,2
IT	19,5

\* Source: Compiled by the author based on (ESG Transparency Index of Ukrainian Companies 2020).

To analyze the most transparent enterprises, consider the TOP-10 companies according to the Transparency Index in 2020. Thus, the leaders of the ESG Transparency Index were such companies as PJSC VF Ukraine, JSB UKRGASBANK, DTEK Group, JSC First Ukrainian International Bank, FE Coca-Cola Beverages Ukraine Limited, SE NNEGC Energoatom, PJSC Ukrhydroenergo, JSC Ukrainian Railways, MHP and NJSC Naftogaz of Ukraine. It is worth noting that the positions of companies in the Index are quite tight and the difference is sometimes 0.5%, which indicates a sufficient openness of all ten companies. Also, we see that 5 companies in the top 10 are private and 5 are public. This shows that both the public and private sectors are striving to work more transparently.

As a result of the study, we found that state-owned enterprises increase the transparency of their activities every year. If in 2017 the level of transparency of public and private enterprises was almost the same and amounted to 24% and 23.3%, respectively, then in 2020 this figure is much higher and is 39.4% for state-owned

companies and 28.4% for private. In our opinion, this situation is related to the reform of corporate governance of state-owned enterprises in Ukraine.

We also want to emphasize and give some examples of what companies publish on corporate sites. Thus, 35 companies posted information about the company's mission, vision and values on the site; 33 companies have posted Codes of Ethics on their websites; 26 companies posted corporate and social responsibility (CSR) strategies or CSR goals on their websites; 19 companies posted the Company's Strategy on their websites; 11 companies have committed to the Sustainable Development Goals; 48 companies provided information on governing bodies and their staff; 29 companies posted anti-corruption programs on corporate websites; 27 companies provided information on ownership structure; 30 companies posted information on channels of reporting on violations of business conduct and possible corruption; Eleven companies disclosed policies on salaries, bonuses and remuneration of members of the Supervisory Board and management in non-financial statements.

Thus, this analysis shows that companies are becoming more transparent, and businesses are changing and improving their standards. The purpose of the business is transformed from making a profit to providing value to customers, employees, suppliers and partners. Companies and investors see this as a competitive advantage for the company. More and more investors are seeking to fund organizations and products that support and promote sustainability and transparency, and the leaders of these companies are working to be proactive in addressing key aspects of sustainable development.

It will be quite a positive trend if more and more companies become on the list of this rating every year, and the ESG Transparency Index itself will also grow. We believe that not understanding these requirements is a thing of the past. Instead, integrating ESG into business opens up new opportunities for companies, including financial, reputational and managerial. The company's transparency enhances its reputation and improves its financial performance.

In the process of transparent activity, economic entities that are interested in cooperation, as well as relevant bodies of corporate and state control interact with the enterprise. Thus, the main relationships between entities include the relationship between owners and employees, cooperation between the firm and partners, especially financial and investment; customer relationships; relations with the state and the public.

It has been established that open business is a condition for investment attractiveness. Also, research shows that the main benefits of transparency for the company are attracting talented staff, building trust, increasing productivity, increasing business responsibility, strengthening the competitive position and ensuring financial security.

That is why, if the company manages to attract investment and implement new projects due to its openness, then transparency itself is a significant driver of economic growth. However, openness in a market economy is controversial. To study such contradictions, it is necessary to highlight in more detail both the advantages and disadvantages of this phenomenon.

Transparency primarily helps to determine the market value of the company, and

its public assessment of the market. And not only to potential investors or competitors but also to financial analysts, and audit companies. Thus, on the part of audit firms, transparency will allow them to perform full-fledged work to increase business efficiency and reveal the most important and deepest issues to those who are interested in a detailed understanding of business operations. Transparency helps the auditor give advice and guidance to the business owner to maximize its value.

On the part of the rating agency and investors, transparency is the most important component of the company's investment attractiveness. In other words, transparency means openness of the company, and willingness to work effectively for each shareholder, investor or partner; it is an indicator of the presence of strategic goals and a business set to work seriously and for a long time.

For the state, transparency will ensure a transparent tax policy for enterprises, help reduce the shadow sector and increase budget revenues, increase foreign investment, and ensure the implementation of sustainable development goals, which will be manifested in the introduction of socially responsible business. It is undeniable that in general all components of financial security of the state (tax, investment, debt, currency, monetary) will have a positive impact on the transparent activities of enterprises.

Transparency will also have a positive effect on increasing consumer confidence in the company's products, which will expand the market. Thus, disclosure of shareholders, maximum transparency of financial documents, information on all major transactions, independent audit and evaluation, and publication of non-financial information significantly increase confidence in companies.

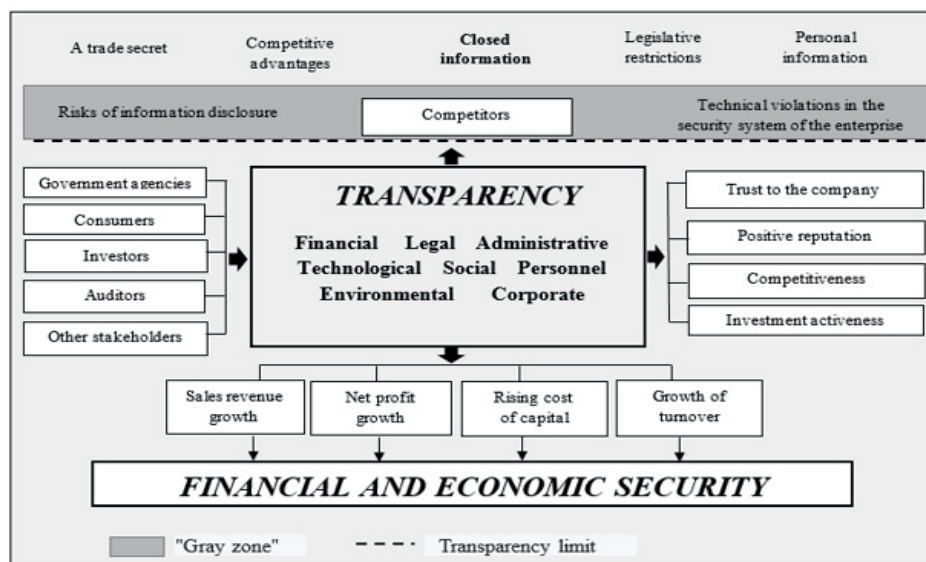
Based on this, the main priority measures to increase business transparency include disclosure of information on share capital; publication of financial statements by domestic and international standards; disclosure of non-financial information; raising the level of corporate culture; flexible but transparent tax policy; ensuring transparency of expenditures, including capital expenditures, as well as any funds directed to strategic goals; openness of management; advanced training of personnel manager; use of modern business technologies; involvement of an independent appraiser to evaluate the enterprise, etc.

Thus, the main advantages of conducting transparent activities include: improving business processes; greater opportunity to attract investment capital, increasing the motivation and productivity of staff, the formation of a positive reputation of the company, access to new markets, effective risk management, improving environmental management and more. A direct consequence of increasing the information transparency of key enterprises and state institutions will be the gradual transformation of their activities (under the influence of civil society) in the direction of ensuring the sustainable development of the national economy.

However, it should be noted that transparency, on the one hand, must demonstrate its competitive advantages to achieve investment attractiveness. On the other hand, by discovering its advantages, the company can make them the property of competitors who can master them without incurring symmetrical costs. In addition, the company

can count on a new level of development if it manages to attract foreign investment. Therefore, the transparency of the firm is a controversial process. It is associated with risks that require assessments.

Disadvantages include the fact that freely available information may be of interest to competitors and use it for their purposes, such as the following strategy, releasing similar products and gaining the market advantage, creating a competitive weakness for the organization. Also, employees may pass on information to interested parties or use it for other selfish purposes. This happens if there is openness and no control, so you need to remember about information security and employment contracts. In modern conditions, a competent manager must be able to find a balance: to know what information should be freely available and what should be hidden, because the potential competitive weakness of the company is also the main benefit for competitors.



**Fig. 3. The impact of transparency on the activities of the enterprise based on a security-oriented approach**

*\* Source: developed by the author*

According to the above study of the advantages and disadvantages of transparency, it should be noted that transparency must have established limits. These limits should primarily determine the amount of information that is necessary to enhance the company's reputation and at the same time that would satisfy the interests of all stakeholders and would not pose a threat to the financial security of the enterprise. In addition, there is a so-called "grey area" between such transparency boundaries, where there are risks of disclosure to competitors, for example through commercial espionage or shortcomings in the enterprise security system (See Figure 3).



A security-oriented approach to transparent activities is based on a clear definition of confidential information to be covered (trade secrets, details of competitive advantages, personal information, etc.). With clear boundaries, transparent activities will have a positive impact on financial security through key growth factors in sales revenue, net income, capital gains and turnover.

**Conclusions.** Thus, maintaining the security-oriented boundaries of the company's transparent activities will create conditions not only to strengthen competitive positions in the market, and increase investment attractiveness and market value of the business but also to ensure an adequate level of financial and economic security.

Under such conditions, the openness of information on business organization, implementation of innovations and principles of social responsibility are key elements of the company's strategy for its relations with all stakeholders. Such processes play an important role in the financial well-being not only of an individual entity but also of the country as a whole.

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## **PEDAGOGY AND PSYCHOLOGY**

### **PATHOLOGICAL DYSFUNCTIONS OF PERSONALITY IN CONDITIONS OF PERFORMANCE OF HER PROFESSIONAL RESPONSIBILITIES**

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**Annotation.** *The article focuses on the substantiation of the mechanisms of the origin and development of hypochondriacal disorders during the professional burnout of the individual and their basic psychodiagnostic approaches. The list of symptomatic features of the disorder in conditions of differential similarities and differences of control and experimental groups is indicated. Common scientific methods are used in the study of diverse sources and literature, in which case it was possible to recreate the real facts of the problem under consideration, taking into account the scientific work of domestic scientists. The analysis of the definition of etiology and the development of hypochondriacal nosologies in the group researched during professional fulfillment of duties is substantiated. The emphasis is on determining their vital values and priorities for the future in the event of a pathogenetic suggestion of complaints about dysfunction of their own health.*

*The complex approach is used in coverage of the main directions of psychodiagnostics and treatment of hypochondria as a mechanism of psychological burnout of the individual. In particular, they emphasized the disclosure of such structures as biological (includes biochemical, neurophysiological, psycho-physiological spheres), psychological (focused on the internal individual experience and human behavior), social (produced by interpersonal interaction in society) and environmental (material security, quality of life) preconditions for the development of these pathogenic phenomena.*

**Keywords:** *psychological burnout, psychodiagnostics, hypochondriacal disorders, psychosomatic disorders, psychodiagnostic principles.*

The problem of professional exhaustion in Ukraine is especially relevant, as it focuses on the importance of studying the factors of pathological dysfunctions of the individual in the conditions of fulfilling her professional duties. Complicating factors

include: unsatisfactory socio-economic living conditions, martial law, the need for increased mobilization of physical and emotional resources, lack of access to resources that help overcome stress. An analysis of these factors allows us to assert that this problem is most characteristic for specialists in the medical, pedagogical, psychological and other professions.

Intense professional rhythm of life, unregulated work schedule, increased responsibility for the life and health of other people, constant stay in the energy field of negative emotions - cause increased irritability, passivity, fatigue, lack of peace, tolerance and inner harmony, excessive concentration on one's own experiences and suggestibility . Neglect of these primary signs contributes to the emergence and development of hypochondriacal personality disorders. Due to distorted value orientations, these people look unfriendly, biased towards others, lack communication and indifference, however, in fact, they are in a phase of psychological burnout.

The purpose of the article is to diagnose pathological personality dysfunctions in the conditions of fulfilling professional duties.

Pathological dysfunctions are one of the least studied psychopathological phenomena, the main feature of which is an excessive focus on one's own psychosomatic sensations [4]. Therefore, the main objective of our study is to show the internal determinants of the manifestation of hypochondriacal phenomena in people of working age.

It is stated that the state of psychosomatic health of the population of Ukraine indicates the presence of negative trends. Thus, according to the Ministry of Health of Ukraine, from 38% to 42% of all patients undergoing inpatient treatment belong to the group of psychosomatic patients who have hypochondriacal disorders, phobias, deviations, etc. [1, 2].

In the study, which was conducted on the basis of the cardiological center of the Vinnitsa Regional Clinical Hospital named after. N. I. Pirogov from 2017 to 2019, 74 patients aged 18 to 65 years were involved, including 36 psychosomatically healthy people (control group - CG) and 38 people with certain psychosomatic disorders (experimental group - EG) , including those with violation of the skin (16 people), with disorders of the gastrointestinal tract (12 people) and with cardiovascular disorders (10 people). The composition of the experimental sample qualitatively and quantitatively represents the general population, since modeling and randomization techniques were used to form it. The experimental plan was used, the methods of statistical processing, its implementation and interpretation of the results ensured internal and external validity. All respondents underwent a comprehensive psychoneurological examination.

At the stage of empirical research, a psychodiagnostic examination of persons in the control (CG) and experimental (EG) groups was carried out using a set of methods that were valid for the identified indicators of psychosomatic health. The following psychodiagnostic tools were used: the Wiesbaden WIPPF Questionnaire by N. Pezeshkian, which is designed to assess characterological and personal characteristics and ways of processing conflicts, the D. Keirse test to determine the social type of personality, the Adaptability Questionnaire (MLO) by A. Maklakov and S Chermyanina, highlights the

possibilities of active adaptation of the individual to the conditions of the physical and social environment at all levels of the functioning of the body and the formation of personality, the test of meaning-of-life orientations (LSS) by D. Leontiev determines the system of semantic regulation of the life of the individual, "Multifactorial Personality Method 16-PF" by R. Cattell to determine the difference in the characterological profiles of the participants, the "Self-actualization test" (SAD) by E. Shostrom, the main results of which are disclosed in the dissertation research. In the article we demonstrate their significance in terms of psychodiagnostic support and methodological analysis [2, 4].

With the help of the author's psychodiagnostic questionnaire, by using quantitative and qualitative assessment criteria, individuals with psychosomatic disorders were selected and divided into three groups: individuals with cardiovascular disorders (CV), with dysfunction of the gastrointestinal tract (GIT) and skin imperfections (KD). ). The results of the distribution of types on a psychosomatic basis with a hypochondriacal manifestation are shown in Table 1.

*Table 1*

**General picture of pathological dysfunction in situations of psychosomatic disorders**

Psychosomatic disorders	Causes of hypochondriacal manifestations
Cardiovascular defects	Anxiety, hostility, suppressed anger, guilt, need for self-affirmation, introversion, intrapersonal conflicts, fear of the future, loss of faith, emotional stress, increased sentimentality, demonstrativeness, hysteria, intense life rhythm, striving for success, social significance
Gastrointestinal dysfunction	Accuracy, punctuality, pedantry, justice, politeness, self-centeredness, suppressed aggressiveness, envy, resentment, passivity, disgust for the outside world, hostility
Skin imperfections	Tendency to take a passive position in interpersonal relationships, high sentimentality with loved ones, self-doubt, risk aversion, feelings of inferiority, social isolation, negativism, accompanied by fear, irritability, disappointment, guilt, suspicion and anger

The features of psychosomatic disorders were revealed, which made it possible to obtain information about the factors that determine the behavior and manifestations of the mental properties of the persons of the experimental group. Important in this context is the definition of the state of anxiety, the assessment of the significance of life events and the forms of response to them, the adaptive potential, the diagnosis of the emotional sphere of the subjects, the level of self-actualization and the characteristics of the characterological construct of the personality.

At the stage of empirical research, a psychodiagnostic examination of persons from the CG and the EG was carried out using a set of methods that were valid for the identified indicators of the psychological stability of persons with hypochondriacal behavior. The analysis of the results of the study made it possible to identify the socio-psychological features of their psychological stability in a situation of psychosomatic disorders.

An analysis of psychodiagnostic methods showed a number of differences due to

disharmony and psychosomatic health disorders in the control and experimental groups.

It was established that the majority of respondents both from the CG and the EG had normative (within 5-10 points) indicators of features - from 61% ("fairness") to 92% ("sociability") of the studied CG, from 67% ("love") to 92% ("model/they") of the studied EGs. The following differences between the CG and the EG turned out to be statistically significant, exceeding one standard deviation ( $\sigma$ ): the average values of the scales "fairness", "honesty", "politeness", "obligation", "thrift", "fidelity" are higher in the EG, and on the scales "trust", "hope", "sexuality", "body / sensations", "model / great-we" in the CG.

Significant gender differences in the sample data were revealed: on eight scales (neatness, tidiness, frugality, obedience, patience, hope, trust, body/feelings), the average indicators of women exceeded one standard deviation ( $\sigma$ ) in relation to men. The study revealed a general trend in the sample towards a decrease in such social norms as "tidiness" and "thrift" (especially for men), and "fairness". Statistical processing of data indicates high rates of association and significant direct intercorrelations between feelings of fairness, trust and reliability ( $p \leq 0.01$ ). Since the sense of justice or injustice is formed by human experience, we can conclude that there is a basic conflict in this sphere, which in men tends to transform in the direction of expanding the contact sphere, and in women - to its limitations.

In general, the analysis of the sample data revealed that the average indicator of actual second-order abilities (cognition) is lower than the indicator of primary abilities (acceptance and love), but only in the CG this difference is statistically significant ( $t = 2.73, p \leq 0.01$ ).

Regarding the primary abilities related to love and acceptance, with a general trend towards high rates, women received more maximum data than men: the ability to be patient was declared by 39% of men and 75% of women; 56% of men and 67% of women expressed understanding of the importance of time and readiness to allocate it; 39% of men and 86% of women have a sense of hope; the ability to give and receive love was found by a significant preponderance, too, by women - 31% and 72%, respectively.

Regarding the types of reactions to conflicts, the majority of respondents in the CG received high and balanced scores on such scales as "body / sensations", "activity" and "relationships", which indicates the possession of various ways of processing problem situations, prevents somatization, determines the choice of an active style behavior of CG representatives.

A significant part of the EG sample turned out to be in the zone of high indicators for such a type of reaction as "fantasy" and partially - "relationships". The preferred reactions of the respondents to conflicts turned out to be the following: a tendency to mental passivity during activities; reliance on imagination, fantasies and intuitions, as well as the expansion of contacts and the scope of social support, the latter of which turned out to be more characteristic of the sample of respondents with gastrointestinal problems. A stable style of respondents' orientation towards fantasy and the development of hypochondriacal imagination was found, which provides for the creation of a

problem, various conjectures, beliefs and mystical judgments, reduces the criticality of respondents in the perception of a real situation.

Currently, there are many options for system analysis of the problem. Let's take a look at the most famous ones. For example, the Lazarus multimodal profile is a specifically organized version of a system analysis carried out in the direction of seven indicators - BASIC - ID (behavior, affect, sensation, imagination, cognition, interpersonal relation, drugs - behavior, affect, sensations, representations, cognitions, interpersonal attitude, drugs and biological factors) [3, 5, 7]. The use of a multimedia profile allows you to better understand the problem of the patient, on which the differential diagnosis of mental disorders is based, and allows you to simultaneously choose options for psychotherapeutic assistance. In our case, we offer a multimedia profile of a patient with hypochondriacal disorders in terms of psychosomatic illness (duodenum ulcer) (Table 2).

Table 2

**Multimedia profile of patient A. with psychosomatic disorders in terms of pathological dysfunctions**

Parameters	Characteristic	Possible options for psychotherapy
Behavior	Shyness	Behavioral analysis, application of individual training of confident behavior, group psychotherapy
Emotions	Resentment against parents, hatred	Individual psychotherapy sessions
Feel	Stiffness when talking to strangers	Secondary bodily manifestations should disappear in the course of psychotherapy, individual psychotherapy techniques in separate classes
Representation	A dream that repeats about an accident or trauma experienced about the loss of a friend	Correction of this problem in gestalt experiments, clinical role-playing games
Cognitions	Dominant attitude: "Revenge for the insult"	Replacing rational attitudes with rational, positive ones
Interpersonal relationships	Father: negative attitude towards the previous wife, creation of a coalition with the son; sister: conflicts	Family sessions with each family member
Medications	Antimicrobial agents aimed at the destruction of helicobacter pylori	Cancellation by measure of improvement in physical condition and with negative laboratory samples

This approach is recommended in the case of the first conversation with the patient during the collection of a detailed history of the disease. This is one of D. Oudehoorn's multimodal approaches for use during family therapy. Each of its levels reflects the relevant biopsychosocial theories that serve to confirm hypotheses and select psychotherapeutic interventions. D. Oudehoorn's approach is multimodal, and its application uses psychoanalytic, behavioral, cognitive, communicative and systemic

family theories, which do not contradict each other [5 - 7].

At the behavioral level of the formation of a personality with pathological dysfunctions, we note kinesthetic orientation in society, which is associated with hypersensitivity to the perception of bodily changes, various types of sensations that occur in the body and constitute a deficit of figurative thinking. The development of the disease in this category of people is based on focusing on changes occurring in the body. As a result of the ascertaining experiment, we have identified two types of persons with hypochondriacal thinking.

The alexithymic type is characterized by pragmatic (visual-effective) thinking, which, in the presence of a limited vocabulary, is not able to explain the state of one's body and psychosomatically characterize the localization of problems - the conflict of the unconscious. The auditory type is distinguished by the dominance of convergent thinking based on internal dialogue, abstract verbal interpretation of events and is based on the laws of formal logic.

Unlike the personality stagnation characteristic of neurotics, a healthy personality never stops growing. If a person is open to creativity, he will always accumulate new experience, change, improve. Psychosomatic health can also be maintained by a person who is free enough ("I" - reliable) to experiment with various possibilities and see which of them confirm their validity in the laboratory of everyday life.

It should be noted that the strength and depth of pathological dysfunctions are determined by individual psychological characteristics of a person, the level of psychological development, behavioral stereotypes and features of self-actualization, a specific reaction to a situation, a way of processing an internal personal conflict, and a degree of stress resistance. According to the results of our study, the relationship between neuropsychic stability and mental health exists, it is significant and direct ( $r_{xy} = 0.359$ ,  $p \leq 0.01$ ). This was carried out on the basis of an analysis of quantitative statistical data and the totality of sources involved.

Pathological dysfunctions are formed as a result of a number of physiological, personal and social factors. An analysis of the methods of psychodiagnostic research tools indicates such deviations in the behavior of patients outside the norm: pedantry, punctuality, helplessness, humility, recklessness, isolation, exactingness towards oneself and others, impatience, suspicion, psychological instability, dependence on guardianship and other attitudes. Somatic disorders in such patients are predetermined by pessimistic, hypochondriacal, depressive mood, self-medication and distrust of doctors. It was found that the most significant factor of psychosomatic disorders for 38 patients (51%) was social stress: 19 bol. (26%) had problematic relationships in the professional sphere, in particular, professional unfulfillment (work not in their specialty, forced activity, unemployment, etc.), interpersonal conflicts with the manager and with the team, 13 bol. (18%) - domestic problems and 6 bol. (7%) - fear for their uncertain future. In general, the empirical study showed (Table 3) an inverse correlation between psychological stability and the studied somatic disorders.



Table 3

**The relationship between indicators of psychological stability (PS) and somatic disorders**

PS indicators	ShKT	SS	KP
High PS performance	0,027	0,017	0,033
Low PS	0,227**	0,257**	0,215**

\*\* – correlation is significant at the level  $p \leq 0,01$

It was found that the average indicators of the psychological stability of women are significantly higher than those of men ( $11.13 \pm 0.32$  and  $9.07 \pm 1.02$ , respectively). Analysis of the obtained data by Pearson's  $\chi^2$  test indicates the presence of significant differences ( $\chi^2 = 16.87$ ,  $p \leq 0.01$ ) in the average indicators of psychological stability in the CG and the EG. Thus, the purpose of the study was realized through the prism of modern ideas about the mechanisms of development of pathological dysfunctions and the basic principles of diagnosis. On the basis of the comparison strategy, it was found that in conditions of psychological burnout, the reference control (psychosomatically healthy individuals) and experimental (individuals with pathological dysfunction) groups have significantly different values and distribution of signs of psychological stability. The revealed qualitative and quantitative differences became the basis of the forming strategy, the main task of which was to bring the indicators of the members of the EG closer to those of the participants of the reference CG, that is, the restoration of psychosomatic health.

It has been proven that stability in overcoming difficulties, maintaining faith in oneself, self-confidence, one's abilities, the perfection of mental self-regulation is an integral part of the mental life of every specialist. Feeling, perception, feelings and assessment of one's position determine the degree of resistance of the body, its resistance to psychological discomfort and somatic disorders, and also determine the resources of the psychological stability of the individual.

Thus, the interdependence of the action of the cerebral cortex and internal organs explains the concept of complex processes that maintain the integrity of the body. The imbalance between the psyche and somatics produced by this interaction determines the level of professional training of the individual in the genesis of hypochondriacal disorders. Their conceptual basis is psychogeny of the somatoform type, with superior vegetative disorders, which is associated with a psychoanalytic interpretation of the unconscious intrapsychic neurotic complex. The origin of symptoms mimicking bodily pathology is explained by conversion mechanisms resulting from the lack of adaptive psychological defenses and resilience.

The prospect for further research at the stage of studying the psychology of pathological dysfunctions of the personality is the subjective interpretation by the personality of the internal picture of his illness, behavior and professional activity.

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## PEDAGOGICAL CONDITIONS OF FORMATION MORAL CONSCIOUSNESS OF THE EDUCATOR

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**Annotation.** *The article considers the concept of "success", "situation of success". Analyzed essence of the success situation, it is shown necessity of its creation as a pedagogical condition. The education model of personality-oriented process has been developed. Creating a situation of success with a person-centered approach is identified. It is substantiated the principles of creating a situation of success and personality-oriented learning.*

**Keywords:** *success, situation of success, personality-oriented approach of learning, pedagogical conditions, principles of creating a success situation, model of personally-oriented process of education.*

Modern democratic society, which is based on the principles of humanity and human-centeredness, allows education to develop naturally, ie to adapt and change in accordance with the conditions of society. Teachers-practitioners did not object, but on the contrary supported the reform of the education system. The student must not only acquire knowledge, but also be able to use it.

The purpose of the article is to characterize the concept of "success", "situation of success", considering their interpretation in the psychological and pedagogical literature; show the need to create a situation of success as a pedagogical condition; to develop a model of personality-oriented process of education.

The concept of the New Ukrainian School states that "according to expert estimates, the most successful in the labor market in the near future will be professionals who can learn throughout life, think critically, set goals and achieve them, work in a team, communicate in a multicultural environment and own others. modern skills "[1].

To ensure the development of such a person, it is necessary to create pedagogical conditions. Pedagogical science has long proven that a child who sees his positive result works better, gains knowledge - for example, good grades, which determines its success.

The current orientation of education is the openness of the educational structure to other social institutions, the interaction of all participants in the educational process, freedom of expression and realization of different points of view of the learner, personal development of the child, creating a situation of success for learners. This requires the creation of pedagogical conditions for the formation of the individual's focus on success.

The situation of success was studied by Yu. Andreeva, M. Baturin, I. Bekh, O. Belkin, O. Birina, O. Bondarevska, V. Dryapika, I. Zyazyun, M. Mantrova, O. Pekhota. Analyze success through the relationship with the value of the goal K.A. Abulkhanova-Slavskaya, A.G. Asmolov, and in the context of issues of self-actualization, self-realization and the

meaning of life – A. Maslow, K. Rogers, W. Frankl. J. Allen, R. Assagioli, M. Atkinson, I. Barnet, R. Bandler, K. Bauer, J. Graham, W. James, D. Dewey, D. Carnegie, S. Robbins and others were interested in the question of success. etc.

V.O. Sukhomlinsky argued that the child draws moral strength from his failures and weaknesses in his successes. The scientist spoke of the "school of joy." That is, the educational institution should become a joy for learning about the world around us, a joy for creativity, a joy for communication. The methods used by the teacher in educational activities should arouse interest in learning about the world around [9].

"Giving children the joy of work, the joy of success in learning, to awaken in their hearts a sense of pride, self-worth – this is the first commandment of education. We should not have unhappy children who are overwhelmed by the thought that they are incapable of anything. Success in learning is the only source of the child's inner strength, which generates energy to overcome difficulties, the desire to learn," – said VO Sukhomlinsky.

K. D. Ushinsky considered one of the rules of education the need to give students the opportunity to feel the joy of their work, to succeed in learning. The scientist explained that the teacher should awaken in the hearts of children a sense of pride for their achievements. The teacher wrote that the student's mental work, successes and failures in learning – this is his spiritual life, inner world, ignoring which can lead to sad results. The student not only learns about something, learns the material, but also worries about his work, shows a personal attitude to what he succeeds or fails. K.D. Ushinsky concluded that only success supports interest in learning. But interest arises when there is inspiration, which in turn arises in the process of acquiring knowledge. A child who has never enjoyed the learning process has not felt proud of overcoming difficulties, loses interest and desire to learn [10].

K. D. Ushinsky in his study "Work in its psychological and educational meaning" concluded that the activation of cognitive activity begins only when there is inspiration and enjoyment of the difficulties that have been overcome [11].

The famous scientist Sh. Amonashvili said: "Every child came into this world not by chance: she is born because she has to be born, she came as if at the call of people. She has her own life mission, which we do not know, may be great, and for that she is endowed with great energy of spirit. And it's our job to help her accomplish that mission. " The scientist created an educational system "School of Life", based on which developed humane and personal technology. Creating a situation of success is one of its elements.

The essence of the technology is embodied in such provisions as:

- the child is the highest creation of Nature and the Cosmos and bears in them their features - power and infinity;
- the holistic psyche of the child includes three passions: passion for development, desire to become an adult, desire for freedom of action;
- education of honest and noble feelings in the hearts of children is more necessary and expensive than enrichment with various knowledge;
- lesson - the leading form of life, not just the learning process.

"A child can do anything, and the teacher must believe in this formula and inspire it

to the child," - said Sh. Amonashvili [7].

A. S. Makarenko proposed the idea of "tomorrow's joy". It embodied the prospects for the development of the team and the individual. The independent search for a teacher enriched science with pedagogical logic, team theory, individual approach to students, ideas of labor education, organization of extracurricular and extracurricular activities, theory of pedagogy of direct and parallel action, knowledge of physical culture. A.S. Makarenko generally spoke of "raising a person who is obliged to be happy."

P. P. Blonsky believes that the task of the teacher is not so much to teach and educate, but in the development of abilities for self-education and self-education. "We must educate a person who is able to create his own life, capable of self-determination. To be educated means to be self-determined, and the education of the future creator of a new human life is only a rational organization of his self-education ", - said the scientist [2]. Proper upbringing is a stimulation of the individual, encouraging him to self-development and self-improvement, which in turn help to achieve success.

The main categories of success pedagogy include the concepts of "success", "situation of success", "success".

The task of the teacher is to make the child successful, because it contributes to his development of self-confidence, self-esteem, the development of a sense of self-importance. Creating a situation of success is the main mechanism for solving this problem.

"Success" - a positive result of any business, achievement in anything ("Explanatory Dictionary of the Ukrainian language").

"Successful" - one that gives positive results, ends in success ("Explanatory Dictionary of the Ukrainian language").

According to A.S. Belkin, the situation is a combination of conditions that ensure success, and success itself is the result of such a situation. The situation of success is a purposeful, specially organized set of conditions that allows the student to achieve significant results in activities that accompany positive emotional and psychological experiences. During the situation of success, the child acquires a sense of self-worth, success leads the student to realize their own competence. A situation is something that a teacher can organize. Experiencing joy, success - phenomena that cause feelings of self-sufficiency, psychological comfort, emotional stability. In general, success is an ambiguous, complex concept, because it has different interpretations. From a socio-psychological point of view, success is the optimal relationship between the expectations of the environment, the individual and the results of its activities [5].

From a socio-psychological point of view, success is the optimal relationship between the expectations of the environment, the individual and the results of its activities [5].

From a psychological point of view, success is the experience of a state of joy, the satisfaction that the result to which the individual aspired, or coincided with the level of aspirations (expectations, expectations), or exceeded them [5].

From the pedagogical point of view, the situation of success is a purposeful, organized combination of conditions under which they create an opportunity to achieve

significant results in the activities of both the individual and the team as a whole [5].

An analysis of the thematic literature shows that there is no single understanding of the situation of success. Traditionally, the success situation model is considered as the optimal combination of conditions that provides:

- set academic achievement;
- the moment of positive experiences of the student from the achieved educational results;
- high social value, public recognition of individual achievements [3].

In modern scientific sources, there are several approaches to defining the essence of the concept of "success", which includes a number of components:

- this is what people achieve only due to their own potential, their own potential, their activity;
- is a movement on the way to the goal, the result of their own beliefs, values, abilities and habits that underlie this movement;
- is the disclosure of human potential in the process of its development and self-development, which, in turn, requires a person productive activity, which is expressed in the constant adjustment of their actions, behavior, actions and involves self-awareness, self-esteem, self-control and responsibility;
- is the mastery of the skills of human relationships [8].

The humanistic orientation of the educational process is the guiding principle of the pedagogy of success. It provides for the creation of pedagogical conditions aimed at discovering and developing the abilities of those who receive education, its positive self-realization:

- formation of professional self-awareness, which includes self-knowledge, self-esteem, self-control, self-programming for success;
- development and wide use of the self-concept aimed at awareness of their capabilities;
- recognition of the authority of the teacher and the use of his psychological and pedagogical experience in the educational process;
- mutual cooperation of the teacher and the student (student);
- creating real models of success situations that allow students to express themselves, experience the joy of success, believe in themselves, in their own strength;
- use of new pedagogical technologies and methods that provide personal development and self-realization.
- formation of students' focus on successful professional activities;
- stimulating self-education and intensifying the independent work of students [8].

An important factor in the success of the pedagogical process of forming the motivation of high school students is the scope of its practical implementation. Achievement motivation training is more effective in those disciplines that involve more specific learning activities, where the relationship between action and outcome is simpler and more obvious and where there is direct feedback between actions and their outcomes, ie the relationship between actions and their success or failure. This applies

to subjects of physical and mathematical, natural cycle, physical education. The teacher of humanities will have to make more efforts to achieve the intended result, but with the desire and appropriate pedagogical, psychological, methodological training, he will not only create a situation of success for students, but will work under its conditions [3].

The complexity of the problem of motivation determines the multiplicity of approaches to understanding its essence, structure, nature. B.G. Ananiev, S.L. Rubinstein, M. Argyle, V.R. Aseev, L.I. Bozhovich, K. Levin, A.N. Leontiev, Z. Freud, and others dealt with these questions.

“A person's motivational system has a much more complex structure than a simple set of given motivational constants. It is described in an exceptionally broad field, which includes automatically implemented settings, and current current aspirations, and the field of the ideal, which is not relevant at the moment, but performs an important function for man, giving him the semantic perspective of further development of incentives. current worries of everyday life lose their significance ”, - says V.R. Aseev [6].

In the literature it is noted that the formation of motivation is facilitated by:

- general atmosphere of positive attitude to learning, professional knowledge;
- involvement of students in joint educational activities in partnership (through pair, group forms of work);
- building a "teacher-student" relationship based on the creation of situations of success, the use of various methods of stimulation;
- curiosity, unusual presentation of new material;
- figurative, vivid speech, creation of positive emotions in the learning process;
- use of cognitive games, discussions, creation of problem situations and their joint and independent solution;
- study of the material on the basis of life situations, experience of teachers and students;
- development of independence and self-control of students in educational activities, planning, setting goals and implementing them in activities, finding non-standard ways to solve educational problems [4].

Creating in students a dominant attitude-motivation for self-esteem, the formation of the desire for self-improvement will help solve many modern problems of education. Gaining in the process of certain experience and qualities, the student begins on this basis to freely and independently choose goals and means to achieve them, manage their activities, while improving and developing their natural abilities, changing and educating themselves, their moral consciousness

The main condition for the formation of the goal is the personal meaning of the results to which the student aspires.

Older adolescents are characterized by a heightened sense of justice, social self-determination, they actively form self-esteem, seek ways of self-improvement. They need to assert themselves among their peers. We should also keep in mind the vulnerable youth psychology, difficult adolescence. Significant qualitative changes in mental and psychological development for senior school age are characteristic. This is the period

of final formation of the general culture of speech, which is manifested in the dynamic improvement of written speech. Teachers-practitioners state changes in the development of the design of syntactic constructions due to the semantic content. Adolescents begin to clearly express their position in life, to show their character. They think like adults.

The modern teacher needs to make a lot of effort to form the motivation for success, to create a situation of success during the educational process, when the child acquires theoretical and practical skills.

The subject teacher should remember that he should choose such exercises for the pupil, performing which the student would be able to realize their abilities and be able to perform them. And completing the work, to realize their knowledge, increase self-esteem. This is the secret of the individual approach that modern teachers talk about. When receiving a task, the child should not feel incompetent, unable to complete it. Next to her is a mentor-partner who will help and explain, not a controller or auditor. The pedagogy of partnership and mutual assistance can motivate a child to learn.

The teacher's task is not to pass on theoretical knowledge that is forgotten the next day, but to teach to use the acquired skills and abilities in practice.

But it is worth noting that success, which was achieved without effort, can not affect the individual. It will quickly fade into the background and be lost, as well as lead to self-confidence, complacency, deceptive skills, high self-esteem.

The student must realize that without effort, success will be a deceptive and temporary phenomenon. It is necessary to explain to the teenager that he will soon have an adult life in which he will no longer have a partner-mentor.

Researchers and teachers believe that success is needed for children with low self-esteem. This is a means of correcting it.

Today the main task of the teacher is to use the approach of personality-oriented learning. The main task of this training is to help the student to determine his attitude to himself and his environment, to the world around him, to his future profession.

Personality-oriented learning, which includes the process of education is carried out in combination with the attitude to the individual and the principles of working with him. It is necessary to take into account her abilities.

The disadvantage of this approach is the true relationship between teacher and student. The teacher teaches and speaks the truth, and the student learns and chooses whether to study or not, to accept the teacher or not.

In modern educational institutions, a student cannot choose a mentor. He is forced to accept the one who is appointed. The teacher, in turn, is forced to "find the key" to each person, even in a situation where the child does not want to perceive him as a mentor. And the teacher has no choice. He uses all his knowledge of pedagogy, psychology, philosophy, art and many other disciplines. The result of such activities is to "reach the heart" of the child.

As a teacher-practitioner, I can say that this is almost extremely difficult. After all, students in modern classes are not 5 or 6, but 20 and 30. But the main thing is possible.

The main task of a teacher today is not to teach a student, but to teach him to learn



independently and continuously! The functions of the student and the teacher need to be changed. The student learns himself, learns about the world around him, and the teacher only helps him, taking into account the individual psychological characteristics of the child.

I offer a model of personality-oriented process of education (personality-oriented approach to learning):

- Applicant (student) - the only subject of the process of obtaining education.
- The purpose of the process - to create conditions for the development of individual abilities of the child.
- The content of education - the ability and skills to apply the acquired knowledge.
- Participants in the educational process: teacher, student and his parents (guardians);
- The teacher observes the nature and development of the student and creates favorable conditions for the development of his abilities.

In order to implement the principle of individual approach and create a situation of success, it is necessary that the educational material reveals the content of the student's experience. Textbook material and didactic material (electronic in modern conditions) should transform the personal experience of the student. The student does not just listen to the teacher's information, he seeks it himself, following the teacher's instructions. But the amount of novelty you need to find should be different, given the potential of the child. A positive result will create a situation of success: the student will feel that he has fulfilled his task. And in the process of implementation will gain knowledge and skills, ie will develop subject competencies.

Having analyzed the psychological and pedagogical literature, taking into account personal experience, developing a model of personality-oriented learning, I can say that the creation of a situation of success and personality-oriented approach to the concept in practical pedagogy are identical.

The principles of creating a situation of success and personality-oriented learning are:

1. Awareness of the teacher of the individual student.
2. The principle of teamwork (not in a group or pair). Each participant is an integral part of the team, without whose activities it is impossible to complete the project.
3. Research and educational principle. The child acquires knowledge and skills in the process of search, research. Its activities only need to coordinate, help it, not perform for it, or transfer theoretical knowledge about the phenomenon.
4. The principle of variability. Different tasks for different teams. Different tasks of different team members, taking into account the interests, abilities, capabilities of the child.
5. The principle of designing the subject. The study of the subject, as a project, has certain stages. Children should proceed to the next, completing the previous ones. The study of the topic does not end with a calendar date. The child must apply the acquired knowledge and skills in the following stages of the project.

**Conclusions.** Thus, the creation of a situation of success and personality-oriented

approach to the concept in the activities of the teacher are identical. The situation of success is created by the teacher as a participant in the educational process.

The article develops a model of personality-oriented process of education (personality-oriented approach to learning) and the principles of creating a situation of success and personality-oriented learning.

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## DEVELOP OF STUDENTS' CREATIVE SKILLS IN THE PROCESS OF A VOCAL-SPEAKING WORK IN THE CONTEXT OF MUSICAL THEATER

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**Annotation.** *According to the National Doctrine of Development education, the concept of artistic and aesthetic education of students secondary schools determine the need to create favorable social conditions for the harmonious development of personality with taking into account her needs in intellectual and artistic and aesthetic culture.*

*At the present stage, art education is focused on artistic self-realization of students in the context of humanistic and personal developing approach to the educational process. Deepening knowledge of art forms, identification of their common and distinctive features actively influences the formation of creative thinking, activates the emotional and aesthetic perception of the artistic picture of the world. Therefore the problem of students' mastery of artistic creativity becomes urgent needs to improve the methods of intensifying creative activity in the field synthetic arts.*

**Keywords:** *musical performances, student-actors, pedagogical experiment, creative skills.*

The educational system always exists in a focus of social attention. The XXI century referred to as century of the bioenergy so humanity faces more complicated objectives. The educational standards are rising, mental and emotional capacity is increasing. Children can't stand this pressing and need our assistance. On the one hand, there is the increase of nervous breakdowns cases and uncontrollable behavior. On the other hand, there is a spread of passive or even negative attitude to the education.

So far a creative searching of the new methods forms and means to make the education as a need and pleasure is highlighted by Ukrainian and foreign innovating pedagogues.

Art varieties cognition has a positive influence on the creative thinking, the emotional aesthetic perception of artistic worldview. School education humanitarianization foresees the improvement of quality of artistic subjects teaching and the music-learning theory occupies an important place in it. The Arts education provides a focus on students' artistic and creative self-realization in the context of humanist perspective in the educational

circumference.

Modern professional creative activity paradigm is not so much of awareness, but of specialists' education. The intensification of school artistic education by the innovative approaches and methods provides an opportunity to upgrade the educational process to the qualitative higher level of creative, intellectual and mental level. The issue of students' mastering of artistic creativity which requires the improvement of methods of creative activity activation in synthetically types of art subsequently becomes more relevant.

The musical theater with its integrative function is an effective method to build artistic-creative skills and acquirements in the student's artistic activity. The puppet theater art issues are considered in the different ways by the scientists: as a culture's spiritual phenomenon, as a student's aesthetical taste development method, as a process of teenagers' moral-aesthetical upbringing, as a method of artistic upbringing in extracurricular and out-of-school events (O. Greff, M. Grytsai, M. Yosypenko, L. Kalinina, Y. Markovskiy, A. Mykhailova, N. Smirnova, V. Strelchuk, Y. Fedas, I. Franko).

The creative development process and aesthetic individual upbringing by the methods of theater art can be found in the researches of Ukrainian scientists: L. Kalinina, G. Tokareva, N. Myropolska, T. Borysova, I. Lavrysh, M. Tatarenko and others. The attention has been paid to the teenager's vocal culture issues by scientists: S. Gladka, N. Dobrovolska, O. Marufenko, O. Yurko. The teenagers' vocal apparatus physiological peculiarity was clarified by D. Kasteks, D. Avellis, P. Garno, E. Blumentau, P. Gerber, M. Hardy. The musical culture and musical upbringing for children and teenagers development significance is revealed in the researches of M. Vovk, N. Grodzenska, G. Padalko, O. Stakhevyh, O. Marufenko, L. Khlebnikova.

However, despite the significant quantity of publications on this issue, no means all musical-theater pedagogy's potential capabilities in the educational work are used.

The purpose of the article is to substantiate the techniques and methods of forming creative skills of students in the process of vocal and speech work in terms of musical and theatrical activities.

Learning can be successful if students master the system of special skills. Skills are knowledge in action; which dynamically change when varying the goal and are creative actions, consolidated by performing various exercises (M. Grineva and J. Borsch). According to researchers. the main features of the skill are flexibility (ability to act rationally); stability (accuracy and pace of action); strength (not lost if not used for a long time); maximum proximity to real conditions and tasks.

It should be noted that most of the considered scientific works are focused on the formation of skills of future teachers. This fact is explained by the dominant role of the teacher. It involves students in creative activities in various arts, develops creative skills based on sensory, emotional and intellectual development. The teacher must have a certain set of professional skills, which are defined as "the ability to perform actions that require independent and creative application of acquired knowledge and skills in conditions other than those in which they were acquired." In this regard, it is interesting to

study the problem of forming teacher skills, which allows the organization of productive work with intellectual load, creating a creative atmosphere in the classroom.

In the scientific literature it is noted that creativity is manifested in the creation of a new, original approach to the organization of the educational process. The formation of creative skills is influenced by the presence of creative thinking, imagination and fantasy; desire for creative self-expression; developed empathy; inner freedom; self-confidence; originality; independence of action. Thus, the teacher achieves high efficiency when his purposeful educational influence is enhanced by skills that enhance his creative collaboration with students.

The concept of "creative skills" indicates a new productive level of activity of the individual, reflects its humanistic and progressive orientation. It has such characteristic features as novelty, originality, significance for the individual or society as a whole.

Based on this, the formation of creative skills can be defined as the ultimate goal of learning - its completion, which best reflects the level of preparedness of the student, becomes his personal property. The role of the teacher in the formation of creative skills of students is not only to ensure the transmission of knowledge, but also to create conditions for the development of students' needs for non-standard actions and independent solution of tasks.

The study identifies the main components of creative skills of adolescents in artistic activity: value-oriented, cognitive-informational, creative-activity, aesthetic-communicative. On this basis, we can conclude that creative skills - the result of mastering creative action through the techniques of intellectual, artistic and practical activities, which provide independence in solving creative tasks, mastering special knowledge and their practical application.

An important feature of musical theater is the priority of music over other theatrical and stage means. Music enhances the stage action, conveys the emotional and sensory characteristics of images, combines artistic elements of musical and theatrical activities, consolidates the positive emotional experience of students, helps to develop their communicative abilities. As an integral part of the puppet show, the music throughout the rehearsal period helps to find and feel the character of each theatrical character, to create a unique emotional atmosphere. The compositional decision on instrumentation and individual musical episodes is taken into account. In general, the musical material is an important subtext of the stage action and the overall stylistic solution of the tasks of the performance.

Due to the synthesis of types of artistic activity - artistic-cognitive, artistic-speech, puppet-game, vocal-intonation, dance-plastic, stage-theatrical, favorable conditions are provided for the realization of creative potential of students. The influence on the awareness of the idea of a theatrical work as a whole is growing, as each of the individual types of art enriches the creative experience of the participants with additional means of expression.

The organization of creative activity involves the performance of schoolchildren with musical numbers in performances, children's operas with glove puppets (behind the

screen) and actors-masks in the "live plan" (on stage). Focus on the synthesis of two types of dolls has become a stimulating factor for program development and methodological solution of educational tasks.

Vocal activity in the musical puppet theater performs two functions: image-visual (creation of a bright theatrical image) and illustrative-background (musical-image characteristics of the protagonist). Students master vocal skills (correct sound production, singing breath, clear pronunciation), reproducing the emotional-aesthetic and artistic expression in the process of solo and group singing. However, the method of learning songs is complicated by the simultaneous performance of several actions: coordination of movement (work with a doll), voice (recitation, singing,), hearing (remarks, singing to music). Therefore, classes are complex with the gradual complication of the technique of performing vocal and stage skills.

To determine the degree of formation of aesthetic attitude of teenagers to puppet music, to the art of singing, speech, music (value-oriented component) students were offered to watch musical performances and performances, meeting with actors of Vinnytsia Academic Puppet Theater "Golden Key". The acquisition of the necessary knowledge and vocal skills was based on the material of songs and vocal fragments from musical fairy tales. The structure of classes included the performance of vocal and technical exercises for the development of singing breathing, diction and sound production; learning and singing folk songs; listening and analysis of musical fairy tales and children's operas performed by professional theater groups; vocal illustration of individual theatrical characters. Creative tasks were set in the classes, which included the ability to embody the artistic image of a certain character with the help of the timbre of the singing voice. To understand the synthesis of music and dramatic action, students were offered folk dialogue game songs "Winter and Spring", "Bunny", "Pumpkin walks in the garden", "Omelko" and others.

The cognitive and informational component of creative skills was aimed at clarifying the level of artistic and aesthetic erudition of students in the art of singing and artistic recitation, focused on gaining information in the field of vocal art. Cognitive and informational activities included the study of the following topics: Vocal activities included the study of the following topics: "Common features of artistic expression of music and language", "Vocal art in puppet theater", "Work on singing skills: breathing, diction, articulation, purity of intonation" , "Timbre decoration of voices", "Hygiene of voice".

The specifics of working with musical theater participants is the need to combine speech and singing during the performance, which requires special adaptation of the vocal apparatus to such work, the formation of a number of speech and singing skills, the ability to switch from speech to vocal mode without excessive effort. During the performance, students make extensive use of their vocal abilities. Yes, they need to voice their characters, imitate the sound of different characters (animals, fairy-tale characters), sing songs. Children's speech and singing abilities require special approaches to development.

Singing and conversational voice of students is one of the tools of artistic activity of young participants in the play. It should be noted that in speech and singing the voice is used in different ways, there is an activation of the mechanisms of sound production and voice, which are significantly different and provide different intensity of load on individual parts of the voice-forming system. Thus, during speech, the movement of the voice on the sound scale is not fixed, sound modulation varies depending on the emotional content of speech. At the same time, in singing the pitch changes, dynamics, duration of each syllable meet the requirements written in the musical text, that is, they are strictly fixed.

During the presentation of the literary text of the play, the student's speech activity requires mastery of the basics of oratory, acting. The student's task is not only to convey certain information, but also to interest his listener, to make an active emotional impact on his consciousness, to evoke an emotional attitude to the events described, empathy for the heroes of the play.

The course of the puppet show involves the need to alternate speech with singing during the performance, which leads to certain difficulties in the process of phonation with an insufficient level of skills of rational use of conversational and singing voice. And here the teacher needs to pay special attention to the problem of protecting the voice of the adolescent, keeping him healthy, able to withstand prolonged vocal loads. The need to alternate speech and singing is not always easy and causes an additional burden on the vocal organs. The transition from speech to singing in students in many cases causes certain phonation difficulties. Modern art pedagogy focuses on the development of vocal and choral skills, ignoring the need to prepare students for participation in musical theater performances, and the associated need to form the readiness of the vocal apparatus to speech loads caused by the need to alternate singing with speech.

Let's consider in more detail the differences that arise during the operation of the vocal apparatus during its use in conversational and singing mode. First of all, it is necessary to pay attention to the range used by the student in speech and singing during a musical performance. The range of voice used in singing is much longer than the speech. The pitch range of the voice in both speech and singing depends on the individual physiological characteristics of the functioning of the vocal apparatus, but can be successfully expanded in the course of purposeful training. During speech, middle school students can more or less actively use different voice registers, depending on gender, the degree of detection of age-related mutational changes in the vocal apparatus. In speech, middle school girls use chest and mixed registers. Boys whose voice begins to undergo mutational changes in speech use the available range of the range, which does not require the use of a mechanism to cover up the sound.

Considering the work of the generator of conversational and singing sound of vocal folds, it should be noted that in the case when children master the technique of correct, artistic speech, the intensity of closing vocal folds is close to their inclusion in singing. During singing, the degree of tension of the vocal folds changes much less often than during speech. This is achieved by mastering the skills of cantilena singing, maintaining

a high singing position, active involvement of both chest and head resonance, ensuring stable activity of the respiratory muscles, which allows you to keep the vocal apparatus in shape for the necessary time. During artistic speech, students have the skills of natural, unleashed sound in the thoracic and mixed registers, the mechanism of the vocal folds is the same as in singing. The vocal folds are tightly closed, the vocal muscles are actively involved in the work, the scapular cartilage is involved in oscillations.

In both speech and singing, the spectrum of sound contains high and low singing formants, vowel formants, and a large number of overtones that determine the clarity of diction, expressiveness of vocal speech and singing. According to B. Dmitriev, the place of formation of high singing formant is the supraclavicular cavity of the larynx, which in professional vocalists during singing is narrowed at the top due to the inclination of the epiglottis [1]. In speech, the upper part of the larynx is not covered to the same extent as in singing, which does not allow to create a sound equal to the strength of the singer during speech. But students with well-placed voices also have a slight narrowing of the entrance to the larynx. Therefore, the volume of the spoken voice, even in adolescents, can also be increased through targeted systematic exercises.

According to musical acoustics, the sounds of speech differ from each other by the presence in their spectrum of vowel formants, the strengthening of certain overtones, individually for each vowel. The vowel forms are located in the speech zone of the sound spectrum, they allow our hearing to distinguish one sound from another, give the language expressiveness and determine the individual characteristics of the student's singing voice. The zone of occurrence of speech formants is considered to be the oropharyngeal cavity. For the formation of formants that would characterize a particular loud sound requires the formation of the correct shape of the oral cavity, the position of the articulatory organs, which determine the resonant features of sound formation.

The position of the larynx also differs in speech and singing. For singing in an academic manner, the lowered position of the larynx is optimal, which helps to improve its resonant qualities, enhance the dynamics of sound, its volume, density. In students who have a voice, the position of the larynx remains stable regardless of the movement of the voice on the sound scale. The stability of the position of the larynx provides the possibility of forming a smooth sound, cantilena in singing. The larynx should be slightly displaced during speech, as the articulatory organs (mouth, pharynx, soft palate, tongue) are constantly changing their position and shape to make our language intelligible. The movement of the larynx up or down changes the length of the superficial tube, which significantly affects the conditions of sound resonance. Language is a stream of alternating vowels and consonants. The formation of each vowel requires the formation of the necessary subfolding air pressure, change the position of the articulatory organs, which is the condition for the resonance of a particular sound. Yes, the highest position of the larynx is when pronouncing the vowel "and", and the lowest it falls when we pronounce the vowel "y". This practice of working with students shows that the movements of the larynx become less sharp in children with spoken voices, which gives fluency and melody to speech, reduces muscle tension of the vocal apparatus.



The mechanism of pronunciation of consonants in speech and singing is also excellent. In singing, the pronunciation of consonants should be as clear and fast as in speech in order not to interfere with the smoothness, length of the voice, as well as to preserve the intelligibility and expressiveness of vocal language. Each consonant sound requires the involvement of an individual mechanism of the vocal fold. Thus, when pronouncing sonorous consonants, the vocal folds are firmly adjacent to each other and oscillate, and at the same time as the noise that occurs when airflow breaks through obstacles formed by articulatory organs, the larynx is included in the work. When pronouncing most deaf consonants, the vocal folds do not touch or oscillate. The teacher must take into account that the mechanism of work of vocal folds when pronouncing a consonant at the beginning of the syllable directly affects the nature of their work in the formation of the vowel sound that follows it. That is, it is necessary to take care that even the pronunciation of deaf consonant sounds was as clear, concentrated and expressive as possible, in order to provide optimal conditions for the formation of the next vowel. Expressive and clear pronunciation of consonants allows you to amplify the sound of vowels without applying extra muscular effort to the vocal apparatus. Therefore, working with students participating in a performance in a musical theater should require both in speech and in singing somewhat exaggerated clarity of pronunciation of consonants.

Breathing in speech and singing also has significant differences. Thus, during everyday speech a person does not think about how he breathes, how much air he needs to collect in the lungs, breathing will remain a natural automatic act. While in singing the student needs to focus on all phases of the respiratory process, purposefully influence the increase in the volume of inhaled air, prolong exhalation, maintain an inhalation position while singing. In everyday speech, a person mainly uses the key type of breathing. In both vocals and artistic speech, a mixed lower costal-diaphragmatic type of breathing is considered optimal, which should be produced through purposeful exercises. In different cases, depending on the emotional content of the material, students should use different types of breathing. Changes in the timbre of the voice, changes in the dynamics of sound in speech are associated with frequent transition from one type of breathing to another. And the need to constantly alternate speech with singing is an additional burden on the respiratory system and sound production. Therefore, it is very important for participants in musical theater performances to develop skills of conscious coordination of the process of breathing in speech.

The constant change in the type of respiration leads to sharp changes in air pressure in the subclavian cavity. The volume, its intensity depends on the value of the subfolding pressure, which affects the amplitude of oscillations of the vocal folds. Abrupt changes in air pressure in the subclavian cavity lead to overload of the vocal folds, laryngeal muscles, respiratory muscles, their rapid fatigue, the emergence of stiffness in the work of the vocal organs. Therefore, it is important to acquire the skill to approach the work of the vocal apparatus in speech and singing in order to achieve stability, naturalness, ease in the work of voice-forming organs.

Creative activity component of creative skills determines the degree of ability of

adolescents to independently create the image of the character, involves the disclosure of creative opportunities in mastering singing skills and artistic speech skills. In the course of classes, students perform special exercises to improve intonation (exercises with different emotional nuances: warning, fear, interest, questions; to imitate voices on the material of literary phrases); clear diction (colloquialisms, articulation exercises), sketches for the formation of correct, deep breathing, coordination of movements with speech, etc. The system of tasks involves the synthesis of several types of creative activities. For example, pick up musical fragments-characteristics for the characters of the play or create a vocal illustration for a fairy tale image and much more.

Artistic and speech activity covers a set of techniques and methods of working on an artistic text: reading works of folk genres (fables, fairy tales, myths) on symbols - scores; acquaintance with the basics of drama; structural analysis of fairy tales. Understanding the educational role of the "art of the word" involves expanding the repertoire of works by Ukrainian poets-bikers G. Boyko, L. Glibov, P. Glazov, A. Kosmatenko, O. Pchilka, V. Symonenko.

The ability to have intonationally expressive pronunciation, control their emotional state, express their feelings through gestures and facial expressions, compare, compare, analyze, improvise ensure the success of adolescents in stage activities. The art of the artistic word, singing in harmony with the stage action develops the creative thinking of adolescents. Analyzing the work, its artistic and thematic content, the student learns the thoughts of the author, his worldview, becoming a performer to co-author of the work.

Aesthetic and communicative component of creative skills determines the ability of adolescents to establish creative contact with partners and audiences, has a spiritual and practical nature and involves the establishment of interpersonal contacts in the process of artistic activity. Stage-theater play or activity in general provides a comprehensive performance of creative activities, which generally requires acting and artistic skills of the whole team.

Performing arts need attention to people's actions, the ability to see, understand the meaning, significance and purpose of the simplest actions. The strength of the direct emotional impact of the theater's artistic means is related to its synthetic nature.

Thus, in the context of the study, creative skills are considered as the ability of students to create something new in artistic activity; ability to show independence in solving artistic creative tasks. The main components of creative skills of adolescents in artistic activity: value-oriented, cognitive-informational, creative-activity and aesthetic-communicative.

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## MODELING OF PSYCHOPROPHYLAXIS OF PSYCHOGENIC DISORDERS OF TEACHERS IN THE ASPECT OF INNOVATIVE TECHNOLOGIES

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**Annotation.** *It is established that the above criteria have contributed to the release of psycho- hourly indicators of hypochondriacal diseases, which serve as a methodological basis for the development and practical implementation of the system of chronobiological prognosis of hypochondriasis, defines specific areas of medical and psychological rehabilitation specialists in various professions with hypochondriac disorders by taking into account the differentiation of mechanisms of their occurrence. On the basis of this perspective we have developed an algorithm of chronobiological forecast of psychosematic course, treatment effectiveness and optimization of adaptive capabilities of patients with hypochondriacal disorder. Its essence was to familiarize the study participants with information on recurrence, hypochondriacal disorders, the causes of their repeated emergence and consequences in the educational and information environment.*

**Keywords:** *algorithm, chronobiological forecast, innovative technology, hypochondriacal personality disorders, psychosomatic disorders, medical and psychological rehabilitation professionals, the criteria, increase of the level of readiness of future specialists to professional activity, the model of psychocorrection events and psychiatric assistance, educational and information environment.*

**Statement of the problem.** In the aspect of forming of professional competence of a person influenced by ethnocultural, gender and age factors, according to which the achievement of professional success depends on its individually-typological qualities. A person, when chooses a certain profession, needs to possess specific psychological qualities in order not to be unable professionally. The laws of corporatism begin to put forward their demands and to impose on the individual an original stereotype of behaviour, deviations from which can block your professional growth. In the long process of professional activity there are forming professionally significant personal qualities that distinguish members of one profession from another. The use of educational-

information environment is a necessary condition for the achievement of the objectives of educational informatization. Thus, changes of the psyche of individuals performing their professional duties, may provoke hypochondriacal disorder with a psychosomatic manifestation.

**Analysis of recent researches and publications.** First cases of hypochondriacal disorder were scientifically described and remembered by such scientists as G. Beard, Charcot and J. F. Raymond. They note that the treatment of hypochondriacal disorders should be comprehensive, taking into account the etiology and pathogenetic mechanisms of their development. Hypochondriacal disease is on the verge of normal experiences for the optimal functioning of the body and hyperresponsibility about your health that render destructive affects in academic performance of students and professional activity of specialists of different professions [3, 4].

In the works of V.A.Ananiev, I.F.Archive, Yu.Yu.Eliseeva, S.A.Kulakov, A.V.Joyce brothers here, S.D.Maksimenko, I.G.Malkina-TIC, V.D.Mendelevich, G.V.Lozhkin, N.Peseschkian, G.V.Starshenbaum said that the maintenance of psychosomatic health of a person is the actual problem, which means the achievement of an individual's harmonious development, maintain optimal psychofunctional state in the realization of their own creative search and professional achievements [5].

There is a need for identification and specification of relationships of the professional requirements and personal potential; to establish the factors that have contributed to the preservation of psychosomatic health, personal development and self-development in professional activity. The foregoing led to the goal and objectives of our further research.

The purpose of this article is to reveal the models psychocorrection events and psychological care of professionals by means of educational information environment. The main objective is determining the frequency of occurrence of hypochondriacal disorders in chronometric breakdown and ways of their prevention. Hypothesis of the study was the assumption that the frequency of hypochondriacal manifestations decrease in case of their timely prevention and timekeeping.

Experimental groups consisted of experts from various professions, differentiated according to the classification of A.E. Klimova ("man-nature" ("P"), man-technique ("T"), "person-to-person" ("L"), the man-sign system "E" person-artistic image ("C")) and representatives of other professions – "I", which in terms of responsibilities have symptomatic signs of hypochondriacal behavior. They were chosen from the list of persons due to stay in hospital during treatment in Vinnytsia regional hospital named after N.I.Pirogov and Pirogov Vinnytsia oblast psychoneurological hospital named after academician A.I.Yushchenko in the quantity of 200 people. The total sample for the nominative marker "psychosomatic health" (KG) was formed according to medical professional-consultative conclusion (form № 086) of the representatives of the Vinnitsa state pedagogical University named after Mykhailo Kotsiubynsky.

**The main material of the study.** With the author's psycho-diagnostic questionnaire through the use of quantitative and qualitative evaluation criteria there were selected individuals with psychosomatic disorders and hypochondriacal disorder (ED). The

composition of the experimental sample qualitatively and quantitatively represent general population, because for its formation of the applied simulation techniques and randomization. Used experimental design, statistical treatment, its implementation and interpretation of the results provided internal and external validity.

In our study, practical justifying of educational concepts of "safety culture of psychopathizing disorders in a "locus minoris resistentiae" for the development of hypochondria in man, revealed by the method of chronometric sample. Summarizing the results, we carried out the implementation at the educational process of a special course of formation of psychological competence regarding the origin and development of hypochondriacal personality disorders in the aspect of professional fulfillment. Using this approach to explore the topic, we used psychological tools such as electronic chronoscope and recorded the value of subjective perception of time with a precision of 0.001 sec. Given this uncertainty, we had the ability to differentiate between individually-typological and somatic peculiarities of hypochondriacal disorders among the respondents. According to the method of self-evaluation of anxiety of Spulber-Hanina and method of chronometric samples we determined the relationship between situational anxiety in the spectrum of the "chronotype" by means of a correlation analysis which reveals the frequency of recurrence of hypochondriacal disorders of specialists of different professions.

In the philosophical literature, simulation is understood as a method of research of objects on their models – analogues of a certain fragment of natural or social reality [4, p. 373]. The model reflects objectives, content treatment and prevention of origin and development of hypochondriacal personality disorders, methodology of its implementation and focused on the expected result – the achievement of positive dynamics in the formation of psychological competence of patients with hypochondriacal disorders (Fig.1).

The descriptive function of the model of psychocorrective and preventive actions of the development of hypochondriacal personality disorders was to clarify the psychosomatic symptoms of their manifestation. A predictive function allowed to represent future development of some of the most important human health components of the psychological status of the individual. The implementation of the regulatory functions of the model reflect the design of the desired ideal image of the process of mastering of psychological competence in the case of the birth and development of hypochondriacal disorders. In the aspect of innovation it has been introduced in educational process the system of measures for prevention of hypochondria by the standards of psychodiagnostic criteria.

These characteristics are taken into account in the simulation process for the treatment and prevention of origin and development of hypochondriacal personality disorders, allowing you to more clearly emphasize the problem of our study, to trace its connection with similar problems, to outline directions of its decisions and to predict the result which will give the opportunity to test the hypothesis of the study and develop a plan for their psychotherapy.

On the motivational value stage was the professional motives (sustainable orientation of interests and needs), which is expressed in the awareness of the public importance of their activities and understanding of professional values aimed at self-realization process activities. The criterion of formation of the cognitive stage is the presence of scientific-theoretical (general cultural preparation), operational knowledge and abilities to the organization of professional activities. Reflexive-regulatory stage is characterized by the available ability of self-regulation and reflection.

Bykov V.Yu., affirms that at the basis of analysis of modern approaches and tools for the development of the education system and specific theoretical and methodological apparatus of the system representation and study of organizational systems, there are designed model of open education, analyzes of the characteristics of the structure, design, implementation and deployment. He reports that the model systems of experimental study of objects and processes in education, are presented and analyzed in the result of application of system approach during the pilot study. According to these it was proposed models, and possible ways of implementation of research results in educational practice [1, p. 46].

We consider it necessary to allocate in the structure of psychological competence of personality on the stage of the origin and development of hypochondriacal symptoms four interrelated components: motivational, cognitive, operational, reflexive. On account of their destructive changes or due to the lack of any one component, symptoms of hypochondriacal disorder develop and differentiate with other related psychosomatic complaints. According to the allocated components, we have defined the criteria (motivational and valuable, cognitive, personal, creative-activity, reflexive-regulatory) and indicators of readiness in individuals with hypochondriacal disorders to professional fulfillment and recovery of psychosomatic health.

Motivational value criteria. The indicators are: motives, goals, interests, value orientation, attitude to professional self-realization; the need for professional fulfillment, setting to self-fulfillment; focus on the perfect mastery of professional knowledge and professional self-realization; awareness of the importance of their activities and the need for professional fulfillment.

S.Kudinov considers important in the self-identity to pursuit of self-expression that has its own power, intensity, methods and techniques of translating (dynamic characteristics). The desire can be estimated from the position of motivation orientation. The person understands and interprets it differently (cognitive side). The basis of the aspirations is goal-setting (constituent-target aspect). Such a desire is experiencing a subject and adjusts (emotional and organizational settings), providing intermediate and final result. So, personal fulfillment, according to this approach covers dynamic, emotional, organizational, motivational, cognitive, competence-personal, constituent-oriented and reflexive-evaluative components [3, p. 34].

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Cognitive-personal criterion. It is characterized by the following parameters: the level of mastering of professional knowledge; independent thinking; impatient (tendency to empathy); the formation of personal qualities (responsibility, perfectionism, conscientiousness, determination, perseverance, self-control, etc), positive professional "I-concept".

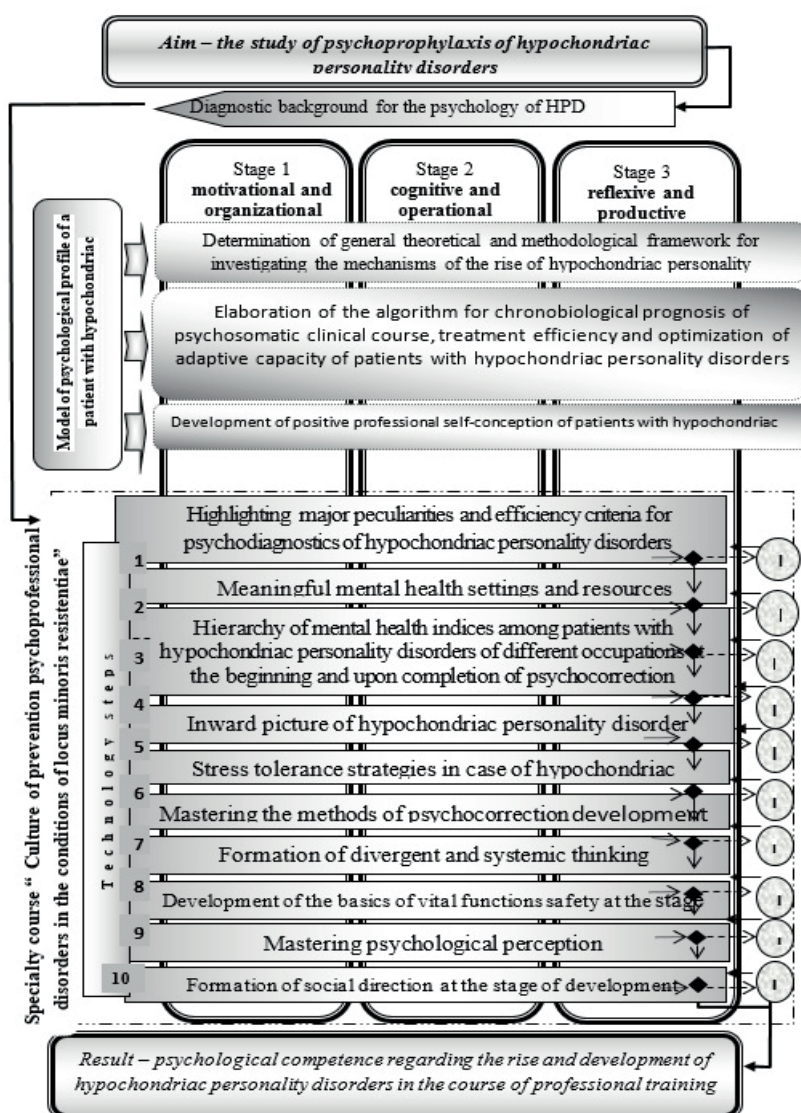
Creative activity criterion. Indicators of this criterion are: the formation of practical professional abilities and skills; creative activity, the fullest actualization and realization of professional skills in the practice process, the ability to creatively solve professional tasks; ability to interact (abilities and skills) with the patient, physician, other nurses, patient's relatives; independence in quasiprofessional activities [4].

In the study we took into account the fact that the use of ICT at all levels of technological training of professionals leads to what they become: a constant source of information; channel of communication that allows to exchange information (e-mail, forums, chats); means for expression and creativity (text editors, graphics programs, web pages, multimedia presentations); instrument of cognition and information processing; a management tool at various levels; an interactive educational resource.

However, it should be emphasized that the purpose of successful development of IOS educational institution is the creation of an automated system of this institution, which brings together all the substructures, and links its activities, which is achieved through the creation of a single information space, a developed communicative infrastructure of the system; creation and implementation of new forms and methods of management of educational institution; reducing the time period between receiving information and



making decisions; the introduction of a common standard for work with electronic documents to ensure accessibility; automation, increasing the efficiency of teaching staff, substructures; to create infrastructure for corporate knowledge management. The Internet is a resource that provides access to information materials require the creation of an infrastructure that would allow effective conservation, replenishment, management of educational information resources [4].



**Fig. 1. Model of psychoprophylaxis of hypochondriac personality disorders**

◆ - analysis HD;  
 ↓ - diagnostics HD;  
 L- lecture;  
 Notes:  
 ↓ - positive dynamics formation ; PHD  
 ↓ - lack of dynamics formation PHD

Sociologist A.V.Petrov defines the activity as another criterion of self-realization. The ability to implement activities inherent in man's potency is a characteristic of a mature personality. Active participation in daily events is a realization of the value and significance of everyday life and means the ability of a person to live in the "here and now", the ability to enjoy the current moment, without comparing it with past joys and not devaluing the anticipation.

Table 1

**Criteria of psychological competence of ill and hypochondriacal disorders to self-realization**

№	Criteria of psychological competence of ill and hypochondriacal disorders to self-realization
<b>Motivational-critical criteria</b>	
1	motives, values, interests, values orientations, self-leveling to the profession
2	self-evident need for professional self-actualization, installation for self-production
3	hidden on a thorough gully with knowledge of the profession for self-actualization
4	recognition of the importance of their own activities and the need for self-professed self-actualization
<b>Cognitive special criteria</b>	
5	Rivne conquered Fakhov's knowledge
6	self-determination
7	empathynist (schilnist to spivperezshivannya)
8	the formation of special specialties (vidpovidalnist, vimoglivist, sumlinnist, rishuchist, napoleglivist, self-mastery and that.), positive profession "I-concept"
<b>Creative-criterion</b>	
9	Formation of practical professional skills and skills
10	Creativity, maximally up-to-date actualization and realization of skills in practical processes, creativity
11	health until the time (knowledge and skills of professional skill) with a patient, a doctor, medical sisters, relatives of the patient
12	self-sufficiency in quasi-professional dyalnost
<b>Reflective-regulatory criterion</b>	
13	Health up to self-designing professional brutes, self-organization, self-management dyalnistyu
14	health before reflex
15	Health to self-regulation
16	Higher educational experience results of professional training

Reflexive regulatory criteria characterize such indicators: ability to same procedure, own professional qualities, self-organization, self-management of their work; capacity for reflection; capacity for self-regulation; the ability to evaluate and correct the results of their training.

It is worth noting that Petrov noted the complexity of studying of the self-realization because of the self-realization cannot be observed directly and objectively, we can only

observe its effects and results, as reflected in the psyche of the subject. Self-realization is difficult to measure using a high level of subjectivity and it is difficult to control during the experiment due to the effect of large number of factors that virtually eliminates the use of measuring and experimental methods of research [1, p. 14]. However, in our study, we would not observe the actual process of self-realization of respondents, and the formation of their readiness for study activities.

Criteria and indicators help to highlight the significance of professional self-actualization of patients with hypochondriacal disorders and to allow for the initial diagnosis of the researched quality; identify, justify psychological conditions of formation of this quality and spend the final diagnostic study to determine the effectiveness of our experiment.

Application of the method of chronometric samples allowed us to develop an algorithm of chronobiological forecast of psychosomatic course, treatment effectiveness and optimization of adaptive capabilities of patients with hypochondriacal disorders and it included the following stages:

1) psychodiagnostic, taking into account objective and subjective criteria for the diagnosis of hypochondriacal disorders; accordingly, this chronotype included measuring and forecasting underlying emotional background of the individual, an assessment of the level of subjective control, the determination of the tendency to the birth and development of hypochondriacal disorders, the presence of related neurotic disorders, predict the degree of subjectivity of the severity of pain;

2) definition of duration-periods, namely their characteristics in the case of periods of the phase singularity and, according to them, the planning of complex medical-psychological prevention in terms of decline in biological cycle or during the most likely manifestations of exacerbation of hypochondria.

Timely conduct prevention, according to our readings, ensure the effectiveness of professional exhaustion in the case of self-realization and prevent chronic hypochondriacal disorders. Chronotype can perform not only prognostic but also to ensure the effectiveness of physiotherapeutic treatment, during the treatment as psycho-time indicator. The main advantage of this method is electroimpulse effect on the human body, given the state of the biological clock of the individual, which includes the effect of adaptive dynamic current with a rectangular pulse shape of the corresponding frequency shift, wherein the frequency of action in consultation with their own biological clock, and its numerical value is determined using the formula:  $V = 60/HT$ , where  $V$  – the frequency of coordination to move your own biological clock of the individual,  $HT$  – chronotype. This individual approach greatly enhances the effectiveness of physical therapy effects on the human body.

So, the definition of these criteria contributed to the release of psycho-hourly indicators of hypochondriacal diseases, act as a methodological basis for the development and practical implementation of the system for chronobiological prognosis of hypochondriasis, define specific areas of medical and psychological rehabilitation specialists in various professions with hypochondriac disorders by taking into account the

differentiation of mechanisms of their occurrence, which necessitated their verification of significant criterion of truth – practice.

Focusing on the confirmation or refutation of the hypothesis, we investigated the relationship of psychosomatic manifestations of hypochondriac character, with localization of their manifestations within a certain chronotype to reveal their frequency and repeatability. Figure 2 shows the basic relationships of these structures for comparison and assessment of the state activity, their actions in the human body. That is, proving these correlation relationships, we can trace their localization and to diagnose partial course in the early stages of origin and development of hypochondriacal disorders. To this end, we tried to explore the level and form of manifestation of anxiety in the spectrum of the "chronotype" [5].

According to the method of self-evaluation of anxiety level of Spulber-Hanina and method of chronometric samples it was determined using correlation analysis of their relationship. And given the fact that the hypochondriacal disorders in the form of psychosomatics arose in a situation of high anxiety, that's why we determined their chronotype. From figure 2 it is seen that this relationship is quite high in the range of  $0.89 \leq X_{T0,95}$  of the type "X", namely:  $\eta_{X_{T1}}$ ,  $T_C = 0,77$  and  $\eta_{T_C}$ ,  $H_T = 0,68$ .

In terms of the Fig. 2 shows that the highest correlation is observed in the group of persons of the type "X" both in direct and in reverse order, indicating a high situational anxiety. Given these basic emotional installation in the human body, we can say that the situational anxiety is a trigger in the pathogenesis of psychosomatic manifestations of hypochondriac nature, namely hypochondriac behavior because of violation of the skin. Intrusive conditions include: avoiding contact with objects that serve as a source of germs and bacteria; obsession with purity and the like. Fear and feelings of inferiority, social isolation, negativity, accompanied by frustration, irritability, frustration, guilt, suspicion, anger were also observed in other indicators of the study. Therefore, a chronobiological prognosis algorithm for this type should include elements for eliminating situational anxiety during the patient's phase singularity. Note also that the frequency of recurrence of this nosology was equal to exacerbations of  $1/4C$  repeats.

There were moderate correlations between the other types of somewhat of the same order, but with pronounced situational anxiety. By type "T" in the range of  $0.72 \leq X_t < 0.8$ :  $\tau_{X_t}$ ,  $T_c = 0.7$  and  $\eta_{T_c}$ ,  $X_m = 0.62$ . hypochondriacal behavior was observed in the form of cardioneurosis with manifestations of such obsessive conditions as unnecessary murmuring and hearing or praying, complaining, cursing, etc. Unclear sense of guilt, unnecessary self-criticism activation of anxious fantasies, inability to make a decision independently with the aggravation of phase singularity from  $1/4 - 1/3 - 1/2 C$ .

Between the other types there were observed moderate correlations with somewhat similar manner, but with a pronounced situational anxiety. Type "T" in the interval of  $0.72 \leq X_{T0,8}$ :  $\eta_{X_{T1}}$ ,  $T_S = 0.7$  and  $\eta_{T_C}$ ,  $H_T = 0,62$ ., it was noted hypochondriac behavior in cardioneurosis with the manifestation of obsessive-compulsive disorder such as excessive criticism and uttering loud or silently prayers, groans, curses, and the like. A strange sense of guilt, excessive self-criticism activating disturbing fantasies, inability

to independent decision-making with the aggravation of the phase singularity from 1/4 - 1/3-1/2 C

« Chronotype» (Cht) ( in seconds )	Level of situational anxiety (SI)	Quantitative division of EG (394 = 100% )		$\eta_{Cht, Sa}$	$\eta_{Sa, Cht}$
		Qu-ve persons	%		
Cht for type «N» $0,72 \leq Cht < 0,8$	31 – 35	60	15,2	0,76	0,65
Cht for type «H» $0,36 \leq Cht < 0,42$	17 – 21	117	30,2	0,28	0,22
Cht for type «M» $0,56 \leq Cht < 0,62$	30 – 34	60	15,1	0,7	0,62
Cht for type «A» $0,89 \leq Cht < 0,95$	32 – 36	65	16,5	0,77	0,68
Cht for type «S» $0,78 \leq Cht < 0,82$	31 – 35	59	14,9	0,76	0,65
Cht for type «O» $0,6 \leq Cht < 0,62$	31 – 34	30	7,6	0,72	0,6

Note:  $\eta_{Xm}, TC$  – correlation ratio between the values of the chronotype and the level of situational anxiety;  $\eta_{Tc}, HT$  – correlation between the values of the indicators of situational anxiety and chronotype of the respondents.

Type "C" in the range of  $0,78 \leq X_T < 0,82$ :  $\eta_{X_T}, TC = 0.76$  and  $\eta_{T_c}, HT = 0,65$  traced hypochondriacal behavior with symptoms of hyperthyroidism with a compulsive desire to obtain support from others in making decisions, impaired motor skills (frequent attempts to remove hair from the face, the blinking of the eyes, eyelids), feeling of extra subject in the throat and tics because of this reason. With the phase singularity from 1/3-1/4, that is four times increased in time.

Type "P" in the range of  $0,78 \leq X_T < 0,82$ :  $\eta_{X_T}, TC = 0.76$  and  $\eta_{T_c}, HT = 0,65$  note hypochondriacal behavior with hypertensive symptom and compulsive collecting of unnecessary things, frequent checks of the things that are already done (closed doors, windows, gas taps; installation of objects in a certain order of personal belongings, furniture, canteens of funds). With the frequency of repetitions to 1/2 - 1/3-1/4 that is also to double the frequency of repetition of hypochondriacal manifestations.

The type of "Other types" in the range of  $0,78 \leq X_T < 0,82$ :  $\eta_{X_T}, TS = 0.72$  and  $\eta_{T_c}, XT = 0,6$ , there was a tendency to hypochondriacal disorders with symptoms of rheumatoid arthritis and complaining of frequent hand washing and water treatment, the obsession with clean (constant cleaning, washing, disinfection), due to fear and excessive pliability, altruism, self-sacrifice, ambition, increased patience, conscience. With the phase singularity from 1/3 wich alternates within the constancy of repetition.

Type "man - man" in the range of  $0,78 \leq X_T < 0,82$ :  $\eta_{X_T}, TC = 0,28$  and  $\eta_{T_c}, HT = 0,22$  were the lowest correlations, which indicates a low level of situational anxiety and the expression of hypochondriacal disorders [5].

Since we are talking about a test group of people, then this characteristic manifestations is associated with a tendency to hypochondriacal behavior, like dysfunctions of the digestive tract, with complaints in the area of duodenum without periodic repetitions. In this regard, we come to the conclusion that this symptomatology is not related to the structure of hypochondriacal personality disorders and is the inability to regulate the diet, in particular the disregard by the students of the requirements of proper nutrition and eating mass produced "fast-fud".

The study of the level of personal anxiety by the method of self-evaluation of anxiety level of Spulber-Hanina and by the method of chronometric samples is not appropriate in our study because it does not reveal the situationalism and the frequency of occurrence of hypochondriacal symptoms and does not specify the characteristics of the phase singularity. In the future we will discuss the findings on trait anxiety in our sample individuals, as yet not studied their individual style manifestations of hypochondria in terms of statistical values, we will not be able to grope it with the typical features of the studied.

Insights from this study and prospects for further research. Thus, the criterion-effective component of the model reflects the expected result – increase of level of readiness of future specialists to professional safety and fulfilling the criteria (motivational and valuable, cognitive, personal, creative-activity, reflexive-regulatory) evaluation of the level of formation of readiness of future specialists for professional self-realization, in particular, by means of the OIP. So, the psychological readiness of specialists with hypochondriacal disorders is focused on the identity of a particular spectrum in the "chronotype" and singularity of repetitions. The essence of psycho-correction program specified in the expected result, namely:

- 1) in the development of motives, goals, interests, value orientations, relations to the profession of specialists for professional self-realization;
- 2) in the presence of the need for professional fulfillment, setting-fulfillment;
- 3) to focus on the perfect mastery of professional knowledge and professional fulfillment;
- 4) awareness of the importance of their activities and the need for professional self-realization; increase of level of mastering of professional knowledge;
- 5) independent thinking; impatient (inclination to empathy);
- 6) in the formation of personal qualities (responsibility, rigor, integrity, determination, perseverance, self-control, etc), positive professional "I-concept";
- 7) in the development of practical professional skills; creative activity, the fullest actualization and realization of professional skills in the practice process, the ability to creatively solve professional tasks;
- 8) interoperability (abilities and skills) with the patient, physician, other professionals, relatives of the patient;
- 9) autonomy in quasiprofessional activity;
- 10) the ability to same procedure own professional qualities, self-organization, self-management of their work; ability to reflect; ability to self-regulation; the ability to

evaluate and correct the results of their own training and the like.

Thus, content-procedural component of the model reflects the organizational and methodological foundations (the content, forms, methods) of formation of readiness of future specialists for professional self-realization and life safety and includes the following steps: propedeutical-valuable, cognitive-baseline, constructive procedure, generalizing-correction; methodological tools; pedagogical conditions of formation of readiness of future specialists for professional self-realization, which will be introduced during the formative stages of the experiment: the formation of motivational installations of future specialists for professional self-realization by means of imitation modeling; intensification of cognitive activity of students and professionals in various professions by means of information and communication technologies; development and implementation of a program of extracurricular activities aimed at preparing future professionals for the security professional fulfillment; creation of the University of reflexive-oriented environment that involves the use of it in the learning process of a technique of formation of readiness of the future specialists to the security of professional fulfillment.

As a result of this study it is expected improvement of professional competencies of specialists in hypochondriac mood cases and security of their life in terms of responsibilities. The prospect of further research is to substantiate the empirical results with the coverage of their effectiveness by the indicators of psychodiagnostic methods in the case of comparative analysis of the problem.

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## THEORETICAL AND METHODOLOGICAL FUNDAMENTALS OF FORMATION OF LEGAL COMPETENCE IN THE SYSTEM OF PUBLIC GOVERNANCE

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**Annotation.** *Legal education and, as a logical consequence, the formation of legal culture, is considered one of the important areas of personal development and is one of the features of the rule of law. The article analyzes the peculiarities of acquiring legal knowledge in the process of professional training of future specialists in the system of management abroad in order to introduce the positive experience of developed countries in domestic higher education institutions. Specialists dealing with legal protection of the population are trained abroad in the field of "Law" with a small degree in specialties. The most effective training programs are those created in Austria, Great Britain, Italy, Canada, Scandinavia, Germany, USA and France.*

*According to the peculiarities of the formation of legal competence in the system of public administration, the following tasks were outlined: improvement and further development of the system of legal knowledge; practice of skills of audit of legal support on conformity of observance of normative acts; development of the individual's ability to predict the possible results and legal consequences of the decision; practice of skills to find non-standard solutions of industrial situations on the basis of legal information, selected appropriate tools and methods taking into account the principles of adult education, proposed the concept of theoretical and methodological foundations of legal competence in public administration.*

**Keywords:** *legal competence, scientific and methodological support, institution of higher education, improvement of the system of legal training, system of public administration.*

**Introduction.** European integration, which contributes to the further enlargement of the European Union, the elimination of customs borders, strengthening cooperation between its member states, harmonization of interstate legislation, have created conditions for increasing the mobility of European citizens. At present, the European labor market needs internationally renowned educational qualifications, standardization of educational services and the issuance of universal diplomas in education. Therefore, the main goal of modern reforms is to harmonize the educational resources of European countries, through the creation of European standards, transparent qualifications and a single socio-economic space. In addition, each country of the European Union and the candidate country must meet the political and economic conditions: a stable democratic government that recognizes the rule of law and the corresponding freedoms and institutions.

The study of the features of public administration and public administration in the



public administration system is multifaceted and complex, given that the effectiveness of its mechanisms is measured by the synergistic effect, in which the share of the legal component is one of the largest in the history of this institute of public relations.

Challenges of the XXI century. require a fundamentally new system of prevention and compliance with life safety in emergencies (accidents, disasters, natural hazards), as well as in eliminating their consequences, which are accompanied by uncertainty and risk. Accordingly, the management of the units of the Civil Service of Ukraine for Emergencies (SES) and other institutions involved in the field of human security requires a clear delineation of powers and responsibilities of managers at all levels. At the same time, the efficiency of the whole subdivision depends on the ability of graduates of specialized higher education institutions (HEIs) to organize and manage the work of subordinates. Increasing collective responsibility in the event of emergencies, expanding the appointment of services responsible for the safety of life, as well as the high social significance of their work highlight the growing demands for managerial training of managers.

**Initial prerequisites.** Problems of increasing legal competence in the system of public administration are in the center of attention of Ukrainian and foreign scholars. Important for our study are thorough works on the problems of professional training of civil security specialists in the SES of the SES, performed by Ukrainian scientists O. Bykova, O. Yevsyukov, M. Koval, M. Kozyar, M. Korolchuk, V. Lefterov, I. Ovcharuk, L. Pereylygina, V. Plisko, Y. Prykhdokko, O. Timchenko and others. Thus, the formation of managerial competence in future fire safety officers in the process of training was studied by V. Korol. A. Balytska and V. Pokalyuk studied some aspects of the managerial activity of the specialists of the Civil Protection Rescue Service in the context of professional adaptation. The following scientists and practitioners studied the issues of managerial competence of specialists in the field of human security: V. Bezsonov, O. Bolotin, V. Bragin, V. Grechka, T. Danilova, T. Ilyushina, I. Laukhina, E. Lukyanchikov, Yu. Pankov, R. Ratushny, M. Severin and others. Most researchers note that a radical overhaul of the educational process is needed to address pressing issues in the training of cadets and students.

Some aspects of the formation of legal competence of future professionals were considered by S. Nagornyak (defined and tested pedagogical conditions for the formation of legal awareness of students in the educational work of the college), J. Kichuk (substantiated theoretical and methodological aspects of legal competence in the training of social educators), N. Kovalenko ( identified ways and conditions of formation of legal culture of students in the process of obtaining a profession in higher education), N. Baklanov (studied the formation of legal competence of future teachers), D. Klochkova (defined criteria for the formation of legal competence of future teachers), V. Prilipko place of legal competence in the structure of professional legal culture of future specialists), I. Galushchak (considered the features of training future economists for the legal support of professional activity) [1, 2].

However, in general, theoretical developments and conceptual approaches to the

training of future human security professionals have significant differences. Currently, the mechanisms of perfection in the system of legal security are understudied, which would make it possible to constructively determine the level of preparedness for management activities of specialists in this field.

**Formulation of goals.** The purpose of the article is to substantiate the theoretical and methodological foundations of the formation of legal competence in the system of public administration. The leading idea and the formulated concept of the research are reflected in the general hypothesis of the research: the formation of legal competence of future SES specialists will be effective if the theoretical and methodological bases of forming their legal competence in higher education are substantiated, developed and experimentally tested.

At the same time, at the stage of adaptation to primary positions, SES graduates are experiencing difficulties in fulfilling their direct managerial responsibilities. Of course, the professional education of cadets and students in different areas of human security has its own specific differences, but all of them need managerial skills to ensure the well-being and health of society. In view of this, the scientific and pedagogical teams of the SES of the SES had a task: to establish an effective system of preparation for the management of cadets and students. However, our analysis of educational practice shows that there are contradictions between the solutions of this problem between [1]:

- ever-increasing societal demands on the effectiveness and efficiency of services that provide civil protection, and the level of training of human security professionals to manage units in solving organizational and managerial tasks in conditions of uncertainty and risk;

- the need for SES and other services in the heads of departments able to effectively interact with subordinates in accordance with emerging operational tasks, and insufficient soundness of theoretical and methodological principles, scientific and pedagogical approaches and methodological support of their preparation for management in extreme and staff conditions;

- objective requirements for socially and professionally important managerial qualities of specialists in the field of human security and the lack of a holistic concept that reveals the essential features of their personal, professional and moral and volitional development in the context of managerial competence;

- traditional educational and methodological tools of higher education on the development of the future leader in the field of human security and the need to improve the content and methods of their preparation for management, taking into account the didactic capabilities of the latest pedagogical technologies;

- the need for SES institutions of higher education in creative teachers who are aware of the tasks of managerial training of future professionals, and the unwillingness of research and teaching staff to modernize the educational process in accordance with management principles and modern paradigm of education.

Overcoming these contradictions requires urgent improvement of professional training of future specialists in the field of safety and protection of human life.

Presentation of the main material of the study. In order to improve the legal protection of the population, purposeful systematic training of managers in the field of human security is needed. In the conditions of transformation of the Ukrainian society, the institutions of higher education of the SES are called to form a holistic, harmonious personality, able to perform organizational and managerial functions related to performing duties in extreme circumstances, as well as effective management skills in various areas of human life. Appropriate training should involve creative interaction of research and teaching staff, commanders, cadets and students of the SES, taking into account the requirements for professional qualifications and based on a systematic approach, management theory, modern humanistic, democratic, psychological and moral and ethical principles, didactic laws and principles [1, 2].

Research work was carried out on the basis of Ternopil National University of Economics, Vinnytsia Cooperative Institute, Vinnytsia National Technical University, Vinnytsia Academy of Continuing Education, Vinnytsia Regional State Administration, Kherson Regional University, Kherson Regional Academy Municipal Institution "Physical and Mathematical Gymnasium № 17 of Vinnytsia City Council", Municipal Institution "General School of I-III Degrees № 27 of Vinnytsia City Council". The study involved 172 students of general secondary education, 475 bachelors, 175 masters and 199 students of the Academy of Continuing Education, the total number of respondents - 1021. The experiment was conducted by the Specialized Academic Council of Vinnytsia State Pedagogical University named after Mikhail Kotsyubynsky (25.09.2021). The ethical rights of all participants are respected. The study was conducted in the natural conditions of the educational process of the Free Economic Zone, providing general conditions for participation in the experiment: the same time and duration of training, the same measuring materials to diagnose the level of legal competence in public administration.

In the process of ensuring legal competence in the system of public administration, textbooks, methodical recommendations, educational programs and electronic educational-methodical materials were developed, tested and implemented in the educational process of the SES. specialists in the system of continuing education and ensure its implementation, namely:

- working curricula of disciplines "Jurisprudence", "Civil Law", "Forensic Accounting", "Accounting and legal support in industry", "Accounting and legal support of business entities of tangible and intangible production" for higher education institutions economic direction, training specialists in accounting and taxation;
- educational and methodical materials of the discipline "Jurisprudence", providing the formation of legal competence of future specialists in accounting and taxation;
- manual on the subject "Occupational Health and Safety in Management and Administration", which developed legal and organizational issues of occupational safety and health using an integrated approach that ensures the implementation of interdisciplinary integration in the training of future economists in accounting and taxation. Ukraine "On labor protection", labor protection is a system of legal, socio-

economic, organizational, technical and treatment-and-prophylactic measures and means aimed at preserving human health and ability to work;

- guidelines for independent and individual work of students in the discipline "Fundamentals of labor protection and safety", guidelines for testing in the discipline "Civil protection and labor protection in the field" for bachelors and masters, which developed legal and organizational issues of protection labor;

- educational and methodological support for each stage of a multilevel pedagogical experiment on the formation of legal competence of future specialists of the SES. At the same time, preference was given to electronic resources that are the most accessible for use and mobile until the necessary changes are made in the learning process;

- problems of a problematic nature, used for research and independent work of students.

Gradual implementation and verification of the effectiveness of the developed educational technology through the application of the developed methodological support and improvement of the content, forms, methods and means of educational interaction of subjects and objects of the educational process in a special professionally oriented educational environment. At each stage of the study, specific tasks were performed, which were characterized by certain results; each of the stages played an important role in shaping the legal competence of future specialists in the SES system of continuing education. To determine the dynamics of the levels of formation of their legal competence, diagnostic tools (components, indicators, criteria, research methods, as well as the author's diagnostic program) were developed, which can be used to diagnose student training, activate and reorganize the system of diagnosis and monitor education. methodological readiness of teachers to monitor the formation of legal competence of future specialists of the SES.

To analyze the results of the implementation of the concept of theoretical and methodological foundations of legal competence in the system of public administration, methods of mathematical statistics were used, which can be used to assess the reliability of the conclusions. Since in the course of the study control (CG) and experimental (EG) groups are formed, which form two independent samples, we consider it expedient to use Fisher's angular transformation. The application of this criterion allowed to assess the reliability of the differences between the percentages of the two samples, which register the level of legal competence. The hypothesis of the experimental study according to Fisher's criterion was formulated as follows: the share of respondents with the appropriate level of legal competence in EG is not greater than in CG; the share of respondents with the appropriate level of legal competence in the EG is higher than in the CG.

To verify the existence and significance of the research problem, as well as the possibility of ensuring the formation of legal competence of future specialists of the SES, a chamber experiment was conducted, during which the homogeneity of samples was checked using Student's test. The possibility of its application was tested by the calculated asymmetry coefficient of the distribution curve of experimental data ( $A_z$ ).

The results obtained during the ascertaining stage of the experiment proved the

low level of legal competence of future specialists (the initial level was diagnosed in over 60% of respondents) and, accordingly, the need for research on its formation at all levels of continuing education: in legal training classes education, institutions of higher and continuing education (Table 1). During the formative stage of the experiment, the following results were obtained at certain levels of the system of continuing education.

Table 1

**Dynamics of changes in the levels of formation of legal competence of future specialists of the DSNS**

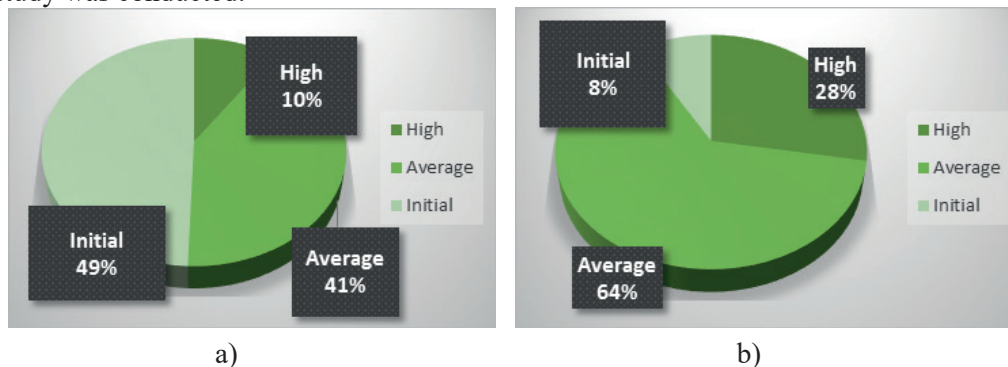
Group and status stage experiment	Levels of legal formation						Number of persons in group
	competence		Average		High		
1	2	3	4	5	6	7	8
CG (beginning)	46	49.46	39	41.94	8	60	93
CG (completion)	33	35.48	45	48.39	15	16.13	93
EG (beginning)	32	35.96	48	53.93	9	10	89
EG (completion)	23	25.84	53	59.55	13	14.61	89

The analysis of experimental data showed that at the beginning of the study a significant part of future professionals had an initial level of legal competence, respectively, 49.46% and 35.48% in CG and EG. Upon its completion, these figures changed to 35.96% and 25.84% in CG and EG, respectively. The average level was found at the beginning of the experiment, respectively in 41.94% and 48.39% of students in CG and EG. At the end of the experiment, these figures increased to 53.93% and 59.55%. A high level of legal competence was found at the beginning of the experiment, respectively in 8.60% and 16.13% of people in CG and EG, and at the end of the experiment, these figures were already, respectively, 10.11% and 14.16%. The analysis of the results of the formative stage of the experiment showed that in most of the students who studied in legal training classes, there was an increase in the levels of legal competence.

However, despite the general increase in the number of people with medium and high levels of legal competence, it was not possible to form legal competence in EG students according to the level of training in general secondary education institutions, as there was no significant improvement in their performance (statistical significance of angular transformation Fisher was not confirmed). This, in our opinion, is due to the lack of discipline in the educational program "Jurisprudence", and students - proper motivation.

The results of the formative research for greater clarity are shown graphically in Figure 1, which gives grounds to argue about changes in the structure of levels of legal competence of students (increased number of students with high and medium levels of legal competence). In order to verify the significance of the changes that occurred in the EG, Fisher's angular transformation was used, which allowed to assess the significance of the differences between the percentages of the two samples of CG and EG, where the

study was conducted.



**Fig. 1. The structure of the levels of formation of legal competence of students of EG: a - at the beginning, b - at the end of the formative study**

Thus, the formation of legal competence of future specialists of the DSNS in the real conditions of the educational process as a whole confirmed the hypothesis about the effectiveness of developed and implemented in the educational process theoretical and methodological principles of legal competence of future specialists in public administration. At the corrective stage, the experimental data of the formative stage are summarized, interpreted, systematized, appropriate adjustments are made to the educational technology and prognostic directions of further research are determined.

**Conclusions** and further prospects of research. Thus, "legal competence" is the ability to use acquired legal knowledge in professional activities, to achieve effective results in the legal way, and "legal competence of DSNS specialists" is a system of legal knowledge, practical skills, experience that allows employees to navigate. regulatory and legal field in the process of professional activity, to find legally appropriate solutions, to think in legal terms when performing internal and external tasks that arise in the process of functioning of the organization in modern market conditions. Execution of internal and external tasks that arise in the process of functioning of the public administration system determines the desire to improve and expand the professional, in particular legal, training of DSNS specialists.

Conceptually, the formation of legal competence of future professionals in the system of public administration is considered by us as a complex, multi-component long-term process that has an appropriate structure, subject to causation and involves the development of individual educational trajectory. Taking into account the peculiarities of learning at each stage of continuing education was carried out by clarifying the content of legal competence and individual educational plan.

Thus, the formation of legal competence of future specialists of the DSNS in the real conditions of the educational process as a whole confirmed the hypothesis about the effectiveness of developed and implemented in the educational process theoretical and methodological principles of legal competence of future specialists in public administration. At the corrective stage, the experimental data of the formative stage

are summarized, interpreted, systematized, appropriate adjustments are made to the educational technology and prognostic directions of further research are determined. Accordingly, the results of the dissertation research give grounds to conclude that the goal of the research has been achieved, certain tasks have been implemented, the use of the developed pedagogical system significantly increases the effectiveness of legal competence in the subjects.

Further research should be aimed at clarifying the pedagogical conditions for the formation of legal competence of DSNS specialists in secondary and postgraduate education.

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## METHODOLOGY OF RESEARCH OF CULTURAL AND LEISURE ACTIVITIES OF STUDENT CLUBS IN THE SYSTEM OF HIGHER EDUCATION INSTITUTIONS

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**Annotation.** *The article substantiates the problem of forming the methodology of research of cultural and leisure activities of student clubs in the system of higher education institutions. This methodology involves the use of a certain model of cognition, characterized by focusing on the definition of a new theory on the criteria of cognitive qualities, empirical content, terminological concepts in the context of socio-cultural research. The interpretation of paradigmatic and explanatory theories and the construction of a chain of evidence-based conclusions in the study of the activities of student clubs for the organization of youth leisure in modern Ukraine are described.*

**Keywords:** *structural-functional approach, method, methodology, principles, system approach, cultural and leisure activities, student club.*

**Formulation of the problem.** The study of the problems of cultural and leisure activities of student youth and the mechanism of its functioning in the conditions of transformations is characterized by insufficient study of fundamental components, methodological justification of the role of student club organizations and features of youth leisure in higher education. Leisure activities require both strategic and systemic-methodological approaches, as well as a clear purposeful organization of socio-cultural institutions that operate to meet the spiritual, cultural, intellectual, entertainment, recreational needs of student youth in modern conditions.

Thus, all this emphasizes the need for radical modernization of the paradigm of research of cultural and leisure activities of student clubs in the system of higher educational institutions and the relevant scientific and methodological justification.

Analysis of recent research and publications. The generalization of theoretical and methodological approaches to the functioning of the cultural and leisure sphere makes it possible to identify key areas of research. O. Antoniuk (2008), R. Dekart (1989), F. Bacon (1779), N. Hetmantseva (2009), A. Konverskoho (2010), K. Levy-Stross (1985), Yu. Lotman (1992), H. Rykkert, H. Spencer (1997), Yu. Brakes. (2003), L. White (2004), V. Vyndelband (1995). and other. In turn, theoretical and applied methodological aspects of cultural and leisure activities in the context of socio-cultural transformations are reflected in the works of M. Hryneva, & YU. Piddubna, V. Hryneva (2020), YU. Irkhina (2019), V. Tyuska (2019) and others. However, in these conditions, the methodological features of studying the cultural and leisure activities of student clubs in the system of higher educational institutions remain an urgent problem.

The aim of the article is to develop and substantiate methodological tools and build



an algorithm for its implementation based on theoretical and methodological and applied provisions for the study of cultural and leisure activities of student clubs in the higher education system of Ukraine.

**Presenting main material.** Scientific research is objective and achieves certain results only if it is methodologically expedient. In the philosophical dictionary, methodology is defined as "a set of research techniques used in any science" or as "the doctrine of the method of scientific knowledge and transformation of the world" [3, p. 214]. In a broad sense, methodology is a set of laws, principles and categories of understanding the laws of the real world, the use of research methods and their relationship in a particular field of science. The theoretical and methodological basis of the study is determined by the state of the scientific problem and the specifics of its source base and is based on a number of research methods that allow objective and impartial insight into the issues of the chosen topic.

Thus, the method of scientific research is a set of research technologies united by a single principle, which are used to solve specific research problems.

The study of cultural and leisure activities of the student club, as a unique socio-cultural phenomenon, encourages us to turn not only to research methods that have a narrow focus, but also to methods of scientific knowledge that can formulate a wide range of research problems. . topics in general.

The dialectical method proposed by Platon and widely used by us in our research, notes the importance of knowing not only the essence of being, but also the essence of phenomena. Dialectics in the teachings of Platon was enriched by verifying the truth of inductively formed concepts by considering all possible partial consequences of the found concept and comparing them with already tested concepts and recognized facts. It should be noted that the concepts (ideas) formed in this way required, according to Plato, their correlation, ie establishing a relationship between them by clarifying their subordination or subordination to each other in content [15, p. 165].

This statement is of particular importance for the study of the topic of cultural and leisure activities of student clubs in the system of higher education. The researcher draws attention to the components of this phenomenon: its content and forms of embodiment, which are on tour. n makes it possible to study a wide range and specification of details. At the same time, the cultural and leisure activities of student clubs as a phenomenon appear to be an integral part of the "essence of existence", as a socio-cultural manifestation in the history of the XX-XXI centuries.

Student clubs are defined as public associations that organize students' cultural leisure and promote their worldview, creative abilities, skills not only in the chosen specialty, but also in different cultures, arts, sports, science and is one of the effective forms. leisure. which contributes to the comprehensive development of personality.

To conduct a study, it is important to pay attention to the work of the founder of the inductive method of cognition F. Bacon (1779), which allows to obtain a general conclusion based on individual facts. F. Bacon (1779) [4, p. 165], notes that every researcher should feel responsible for choosing any research method and not overload

the work with a significant number of methods. Induction as a method involves collecting all possible and initially disparate facts, their systematization, unification, resulting in a general picture of the phenomenon, although with many unknown components.

Important remarks in the methodology of scientific research were made by the founder of rationalism R. Dekart (1989). R. Dekart's deductive method, the essence of which is to obtain partial conclusions based on knowledge of general provisions; movement of thoughts from general to specific [2, p. 260], which allows us to consider the activities of the student club as a socio-cultural phenomenon and at the same time identify the features of this area in each higher education institution. Deduction, based on conclusions and logical constructions, seeks to reproduce the whole, replacing the missing details with hypothetical assumptions, which in turn can be studied by the degree of argumentation and proximity to the reliable.

Thus, studying the state of the scientific problem, terminological and conceptual apparatus, we use both empirical (data collection) and theoretical (logical analysis) methods, which together constitute induction and deduction, to study the student club, which should be considered from two positions :

1) as a club institution subordinated to the relevant ministry, institution of higher education, trade union, which is an institution of state policy, is determined and carries out its activities in accordance with regulations;

2) as a social institution, ie voluntary association of young people in order to meet common interests, meaningful leisure, communication (Hryneva M., & Piddubna YU., Hryneva V. (2020), Irkhina YU. (2019), Tyuska V. 2019).

No less important in scientific knowledge is the use of the method of analysis. In the modern sense, the essence of the analytical method of research is the conditional division of the object of study, which acts as a whole, into parts for further study as separate elements.

Consideration of the student club as a unique social institution, characterized by the ability to analyze and combine socio-group and personal, collective and individual trends in the social life of student youth. The application of this method allowed to consider in more detail each of the aspects of the study, in particular to analyze the current state of cultural and leisure activities of student clubs in the system of higher education.

Instead, one of the founders of the theory of evolutionism H. Spencer (1997) assigns a leading role in the synthesis of cognition, the essence of which is the imaginary union of part of the object, dismembered in the analysis, which allows to establish interactions, connections. and patterns of development in order to know the object as a whole [12, p. 89].

In other words, according to the scientist, philosophy should become the core around which all existing sciences should unite; because only this core, due to the specifics of its object and subject of research, can ask scientists a number of questions that go beyond specific sciences. In our work, the method of synthesis is clearly manifested in cases of research on the problems of cultural and leisure activities of student groups.

If the analysis involves the primary splitting of the object of study, its analysis into elements for careful review and study, the next operation - synthesis - performs

the opposite, ie combining all the elements, restoring the integrity of the object. These operations allow us to study the structure of the object, its internal features and properties, the functions of each individual element in the structure of the whole. In culturology, this means that the object identified and treated as a phenomenon - the activities of the student club in higher education, is consistently studied first in the internal connections and functional dependencies of its parts, and then in external relations and interdependencies with environment.

Abstraction and concretization are also necessary methods of cultural and leisure activities. Their essence is that when studying the selected object, you can perform two diametrically opposed operations. On the one hand, it is possible to distinguish in the structure of the student club object its separate property or a separate part (element) of the organization of youth leisure in order to study in more detail all its characteristics and properties. This separation of the part from the whole as an independent object of study is called the method of abstraction.

The opposite method will be considered as a method of concretization, in which the object of the student club is perceived as the sum of all the elements that make up a single integral object of study. This method allows, on the one hand, to select a certain detail from the object for further careful study (abstraction), on the other - to combine all the studied details into a single whole, which provides an understanding of its structural and functional features. In culturological research, these methods are of particular importance, because in general, cultural and leisure activities are difficult to analyze and specify, but still its study is possible on the basis of abstraction of its individual properties and characteristics.

Thus, we see that the use of methods of analysis and synthesis, induction and deduction, abstraction and concretization, combines empirical and theoretical knowledge, which ensures the integrity of the study of student club activities for youth leisure in modern Ukraine.

Modern Ukrainian researchers N. Hetmantseva (2009), A. Konverskoho (2010) and others have dedicated their works to the methodology of scientific research.

The modern "Philosophical Encyclopedic Dictionary" states that "the method outlines and embodies the path to truth, the direction of effective activities that lead to the realization of goals, establishes regulations and normative guidelines of the cognitive process" [5, p. 373]. The range of methods used for research is quite wide and includes not only philosophical (fundamental) general science, but also interdisciplinary and interdisciplinary (special) specific scientific. It is worth noting a group of methods used by culturology and which are widely used in our study.

Studying the transformations of club activities and changes that have occurred within the direction, we turn to the application of the evolutionary method proposed by the progenitor of culturology as a science L. White (2004). Despite the materialist orientation of the views, the author emphasizes that the evolutionary processes of culture should be studied taking into account the three necessary components of possible change, namely: technological, social and philosophical (or ideological) [14, p. 596].

In the case of cultural and leisure activities of student clubs, we see that it is a kind of response to the simultaneous change of environments of all three components. This phenomenon cannot be considered separately or outside the specified period of time. In culturological study of culture, these methods are used in accordance with the objectives of the study, but usually the initial stage of research involves collecting empirical data, their generalization, but another option based on philosophical reflections on the use of logical to historical method. in understanding the phenomenon of the student club.

Thus, the diachronic method was especially relevant for the study, which requires the presentation of phenomena, facts, events of world and domestic culture in chronological order. The application of this method was appropriate when considering the time of formation and development of student clubs, as well as changes in their paradigms.

The methodological basis of the work is also a comparative method used in the culturology of two or more national cultures. It also involves the identification of general and special features, development trends, areas of interaction, and thus establishes the level of originality or kinship of cultures.

As a result of applying this method, it became possible to identify and compare student groups in different higher education institutions, highlighting the features of activities: cultural and educational, value, creative, recreational, entertainment, sports and more.

The functional method, in which the cultural and leisure activity is a holistic self-sufficient system consisting of functionally interconnected elements, and which aims to study the function or its manifestations or forms, has also been widely used in the work. Functional analysis examines and identifies the forms and means of cultural influence on the environment and in the course of the study acquires the ability to determine the specific characteristics of culture, its place and role in public life.

The use of this method allowed: to reflect the role and place of cultural and leisure activities of student clubs, to show the importance of this socio-cultural direction to explore the current state of education for further development of cultural and leisure activities of higher education. institutions.

Due to the interdisciplinary nature of the study, methods from other sciences were involved. Along with the previous, it is worth mentioning the method of studying documentary sources (Hetmantseva N. (2009), Konversko A. (2010), which is based on the analysis of information contained in its material - documents of ministries, trade unions, universities, student clubs for determining the picture of the development of the studied phenomenon, establishing its features and the main factors influencing the process of its development.

Exploring the emergence of culture as part of the development of society, as well as the history of individual cultures, Yu. Lotman (1992) identified the dependence of culture on the circumstances that limit it, which created the necessary conditions for structural analysis [10]. The essence of the structural method is that the study highlights and marks the clear boundaries of the study, ie its internal structure, the internal connections of all its components. K. Levy-Stross (1985), identified certain structural components,

establishing links and interactions between them [9]. The combination of structural and functional approaches opens up new possibilities for studying an object of such a level of complexity as culture, hence the name - structural-functional.

Thus, using the structural-functional method in our own research, we explain the essence of the student club, its important structural elements and functional components, both within the object under development and its relationship with the environment.

H. Rykkert (1913) in his works increasingly raises the topic of values: from trying to define this sphere of life as a concept to trying to typologize "values" the author notes the following: good, ie reality, the meaning of which is not limited to simple existence, but embodies value, which gives it the character of something that should be "[11, p. 4]. In addition, we note that the position of H. Rykkert (1913) on value, in the narrow and broad meanings of the sentence, occupies in our study a significant methodological and conceptual basis. Systematic value-oriented activities are aimed at forming in students a certain worldview, moral, aesthetic, social qualities.

Thus, the content of the value-oriented influence of the student club is determined by the help of student youth to understand and evaluate a certain phenomenon, to ensure optimal interaction of the individual with the social environment.

As Antoniuk O. (2008) notes: "A special role in the methodology of culturology is played by the principles that are the initial theoretical prerequisite for the formation of culturological knowledge, indicate the correct direction of the cognitive process, in evaluation they are the basis of evaluation" [1, p. 21]. The principle is the main starting point of scientific theory, which serves as the first and most abstract definition of the idea as the initial form of systematization of knowledge. The principle does not exhaust the full content of the idea. If the theory is always based on one idea, there may be several principles [8, p. 14].

The transformation of club activities is considered in the study as an integral part of the educational activities of higher educational institutions of Ukraine. Therefore, undoubtedly, the principle of historicism occupies a prominent place in the work, the essence of which is to reflect the objective reality as a whole, and is seen as a complex system of objects, phenomena and processes based on certain causes, conditions and factors influencing their origin, change and development.

The principle of objectivity used in the study allowed us to look at the object of study from different angles, taking into account the findings of previous researchers, thus eliminating the subjective, biased attitude to the topic. And also in the case of research of historiography of the topic, where we observe a change in the views of the creative and scientific community, on the peculiarities of the organization of youth leisure in student clubs.

This study also uses the sociological principle, which is used to oppose universal, national-class ideals and values, to identify the social dimensions of culture. This made it possible to emphasize the "active role of the human person in the organization of relations in society and the creation (production) of cultural products" [5, p. 53].

The principle of systematization, which involves "the study of objects in terms of

universal interconnection of all objects and phenomena that exist in the world" [8, p. 64].

Thus, the methodological basis of the study is presented in a clear classification of general philosophical (basic), general scientific, purely culturological methods. That is why the question of disclosing the method of writing a paper is one of the tasks of our study.

Note that club activities are an important lever in the process of personality formation, especially in cases where students have natural abilities and seek to implement them in cultural and leisure activities. Defining methodological approaches is important for the logical construction of scientific research, because it directly affects the nature of its results.

The methodological basis in the study of the student club is a structural and functional approach based on both empirical material and general scientific methods of cognition. We see that the most thorough study of the activities of student clubs for the organization of youth leisure in modern Ukraine in the late twentieth - early twentieth century can be provided using the following approaches:

a) historical and cultural approach, as we consider the student club as a voluntary organization that unites student youth for recreation, cooperation, communication, whose activities are aimed at meeting their own and collective needs that have common interests and motivational values, addressing the connection between the past and the future, history and the present;

b) interdisciplinary approach, as the student club can be studied from different scientific fields: history, culturology, pedagogy, psychology, sociology, philosophy, etc.

c) a systematic approach that allows to consider the student club in the interaction of cultural and leisure activities in the system of higher education, as well as its dynamics and development, sequence, functioning systems aimed at achieving this goal.

**Conclusions.** Based on the analysis of the study of cultural and leisure activities of student groups formulated their own methodology for the formation and implementation of the author's approach to this research topic.

1. Research methods will be based on the basic principles of analysis of cultural and leisure activities as a system of cultural phenomena. The conceptual and methodological core of the study is a systematic analysis of cultural and leisure activities of student clubs as a complex system that is developing in the socio-cultural coordinate system of higher educational institutions of Ukraine.

2. The basic in the study is the structural-functional method, which reveals the structural component and its functional significance, which is determined by the interaction of the environment and leisure culture of the student club.

3. The concept is also implemented using the following methods of scientific knowledge: first of all, analysis and synthesis, induction and deduction, abstraction and concretization - to highlight the common and different in the activities of the student club; historical method of identifying the general dynamics of the student club and periodization of its development; diachronic method, comparative method, functional method, method of studying documentary sources to reveal the paradigmatic basis that

determines the specifics of the student club for youth leisure in Ukraine in the late XX - early XXI century.

Prospects for further research in this area are methodological justification of the role and importance of cultural and leisure activities of student clubs and the peculiarities of its formation in higher educational institutions of Ukraine in modern conditions.

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## SCIENTIFIC AND METHODOLOGICAL SPECIFICS AND BENEFITS OF STUDYING MATHEMATIC MODELING BY HIGH SCHOOL STUDENTS

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**Annotation.** *One of the principal components of mathematical education consists in fulfilling its applied orientation – forming competence in the realm of practical application of mathematical knowledge in real life. The link between mathematical facts and practical phenomena and processes is best established visually through employing mathematical modeling while resolving mathematical problems. This article explains the utility of mathematic modeling as means of fulfilling practical and applied orientation of studying mathematics and of interdisciplinary ties. The authors explore scientific and methodological specifics and benefits of acquiring basic mathematic modeling skills by high school students and analyze substance of applied orientation of studying mathematics as it should be fulfilled in high school course.*

*In the process of studying mathematics in high school students acquire mainly skills in analytical and imitational modeling (simulation.) Analytical modeling is used for resolving applied problems and further developing mathematical theory. The most efficiently analytical modeling skills are formed in studying courses ‘Foundations of geometry’ and ‘Numeral systems’. Simulation envisages reproducing algorithms of system functioning and its behavior, and what is imitated are mostly elementary phenomena composing the process while their logical structure and course of development are preserved. It allows to get data about the state of the process at particular moments of time proceeding from the input facts and thus evaluate the system’s characteristics. Successful training of students in imitative mathematical modeling occurs while studying probability theory and mathematical statistics, numerical methods, informatics, economic theory.*

*System of applied problems from various mathematical disciplines occupies central place in the process of forming students’ competence in mathematical modeling. This process should be conducted within the framework of particular studying disciplines in a systematic continuous way and within several mathematical disciplines – along parallel lines and relying on similar heuristic scheme of mathematical modeling.*

**Keywords:** *mathematical modeling, applied task, practical and applied orientation of studying, practical competence, interdisciplinary ties, studying process, physical modeling, economic modeling.*

**Problem statement.** *Formation of skills of practical application of mathematical knowledge is one of the main goals of teaching mathematics. A radical means of realizing the applied orientation of mathematics is the wide, systematic application of the method of mathematical modeling. This includes introducing concepts, identifying connections between them, the nature of illustrations, proofs, the exercise system, and finally the*

control system. Ensuring the applied orientation of mathematics teaching contributes to the formation of stable motives for learning in general and for learning mathematics in particular.

Practical competence in the field of mathematical modeling implies that a graduate is able to build and study the simplest mathematical models of real objects, processes and phenomena, and related problems, using mathematical objects of relevant mathematical problems.

Mathematics as a science in the course of its historical development has accumulated many facts that indicate that mathematical concepts, operations, methods of logical reasoning are significantly influenced by practice and have a definite practical origin. Many sections of modern mathematics were formed under the direct influence of the needs of technology, economics, military affairs, management, and so on. Therefore, it is very important in educating the worldview of young people is to reveal the role of practice in the development of mathematics and show its practical, applied value. This can be done effectively by building mathematical models to solve applied problems.

Applied problems are problems that are set outside mathematics and are solved by mathematical means. Applied tasks, like any other task, in the process of teaching mathematics perform didactic functions, the main of which are the teacher (the formation of a system of mathematical knowledge, skills and abilities at different stages of learning); educational (formation of scientific worldview, cognitive interest and independence, skills of educational work, moral qualities of personality); developing (development of logical thinking, mastering effective methods of mental activity). The solution of any problem of an applied nature is to build and study an appropriate mathematical model.

Implementation of the applied orientation of teaching mathematics in the educational process means: 1) creating a stock of mathematical models that describe real phenomena and processes, have general cultural significance, as well as studied in related subjects; 2) the formation of students' knowledge and skills necessary for the study of these mathematical models; 3) teaching pupils and students to build and study the simplest mathematical models of real phenomena and processes. The applied orientation of mathematics education is significantly increased due to the introduction of computers in the teaching of mathematics, the full introduction of probabilistic-statistical content line in the course of school mathematics.

**Analysis of recent research and publications.** Appropriate and important provisions for solving the problem are also in the works of scientists who speak about the importance of forming in students methods of applied activities, modeling in educational activities (Ya. S. Brodsky, S.I. Velikodny, T,V, Krylova , O,L Pavlov, N,G, Salmina, A,K, Slipenko, N,A, Tarasenkova, M,O, Tereshin, Z,Y, Khametov, etc.).

The methodology of mathematical modeling is rapidly evolving, penetrating new areas - from the development of large technical systems and their management to the analysis of the most complex economic and social processes [14, p. 4].

Regarding the teaching of mathematical modeling to high school students, it should be noted that in the context of specialized teaching of mathematics, issues related to

mathematical modeling are declaratively reflected in the curriculum, but are not adequately covered in textbooks.

Due to this problem, the continuity and continuity of teaching mathematical modeling in secondary and higher education is not ensured. The unresolved nature of these problems is due to the general problem of modern mathematics education, namely the significant reduction in the number of hours devoted to the study of mathematics.

The authors of the article have been dealing with the problem of teaching mathematical modeling to students of various fields of training, including future teachers of mathematics, for the last two decades [10-15; 22].

The purpose of the article. This article is devoted to the study of the importance and feasibility of using mathematical modeling as a means of implementing practical and applied orientation of mathematics and interdisciplinary links, identifying scientific and methodological features and benefits of teaching mathematical modeling to students of higher education, analysis of the implementation of applied mathematics [1, p. 13].

**Research methods.** The presented research is performed with the help of a number of basic general scientific, interdisciplinary and special mathematical methods of cognition. First, the authors, based on the method of scientific abstraction and generalization, define and characterize the concepts of mathematical model and mathematical modeling, identify and compare the types of mathematical modeling that often appear in the educational process, then apply the method of matching (correlation) to identify those disciplines and their components. , during the study of which the main techniques of mathematical modeling are mastered, and, based on the method of identifying cause-and-effect relationships, reveal the competencies, skills and abilities that should be formed in students to master the basics of mathematical modeling. The method of structural analysis, systematization method and comparative method are also used in the work.

**Presenting main material.** In the scientific literature, the concept of "model" is interpreted quite broadly. This term refers to such concepts as mathematical description of a process or object, algorithmic description of an object; the formula that determines the law of operation; graphical representation of the object (process) in the form of a graph, flowchart or curve that characterizes the dynamics of the studied process and a number of other forms and concepts [18].

"Under the model (from the Latin *Modulus* - measure, sample, norm) means such a material or imaginary object, which in the process of cognition (study) replaces the object - the original, while retaining some important features of this study. The process of building and using a model is called modeling" [2, c. 123].

Mathematical models of applied problems correspond to the definition formulated by A.M. Tikhonov: "Mathematical model - is an approximate description of any class of phenomena of the world with the help of mathematical symbolism" [20, p. 574].

As noted in the work of I. I. Blechman et al., Mathematical model in the simplest cases "... can be a segment, function, vector, matrix, scalar quantity or even a specific number" [3, p. 130]. In more complex cases, it allows you to reduce the study of non-mathematical object to solve a mathematical problem, using a universal mathematical

apparatus and as a result to obtain not only quantitative but also qualitative information about the object under study.

Mathematical modeling is a process of establishing correspondence to a given real object of some mathematical object, which is called a mathematical model [1, p. 13]. In the process of teaching mathematics in higher education, the ability of analytical and simulation mathematical modeling is formed.

Analytical mathematical modeling is used to solve applied problems and develop mathematical theory. Consider didactic opportunities for the formation of students' skills of analytical mathematical modeling:

- be able to determine the external conditions in which the object of modeling and characterize them with certain values;
- be able to find connections and relationships between elements of the system and write them in mathematical form;
- be able to identify system-forming connections, the record of which in mathematical form is the desired mathematical model;
- be able to choose the criteria for evaluating a mathematical model for excellence;
- be able to implement a hierarchical method to create mathematical models;
- be able to give examples of specific mathematical models of physical, biological, economic, information processes;
- be able to interpret mathematical dependencies in terms of specific mathematical theories.

The skills of analytical mathematical modeling should also include all the skills aimed at creating an axiomatic theory and its analysis. Such skills can be most successfully formed in the process of studying the courses "Fundamentals of Geometry" and "Numerical Systems".

Simulation modeling reproduces the algorithm of system functioning (process flow, changes in the state of the phenomenon) in time - the behavior of the system, and simulates the elementary phenomena that make up the process, while maintaining their logical structure and sequence of flow. This allows the initial data to obtain information about the state of the process at certain points in time, which makes it possible to assess the characteristics of the system. The main advantage of simulation compared to analytical is the ability to solve more complex problems. Simulation models allow you to easily take into account such factors as the presence of discrete and continuous elements, nonlinear characteristics of system elements, numerous random effects and others that often create difficulties in analytical research. Nowadays, simulation is the most effective method of studying systems, and often the only practically available method of obtaining information about the behavior of the system, especially at the stage of its design.

In simulation there is a method of statistical testing (Monte Carlo method) and the method of statistical modeling. The Monte Carlo method is a numerical method used to model random variables and functions whose probabilistic characteristics coincide with the solutions of analytical problems. It consists in the repeated reproduction of processes that are the implementation of random variables and functions, with the subsequent

development of information by methods of mathematical statistics. If this technique is used for machine simulation in order to study the characteristics of the functioning of systems subject to random influences, then this method is called the method of statistical modeling [22, p. 160-162].

The method of simulation modeling is used to assess the structure of the system, the effectiveness of different algorithms for controlling the system, the impact of changes in various parameters of the system.

Students can be effectively taught simulation mathematical modeling by studying probability theory and mathematical statistics, numerical methods, and computer science. In the process of teaching simulation mathematical modeling in the study of the above disciplines are formed, first of all, the following skills of mathematical modeling:

- be able to choose the criteria for evaluating the mathematical model for excellence (in accordance with the objectives of training);
- be able to perform experimental verification of the mathematical model of the object for consistency of the model with the real object;
- be able to ensure consistency (within the permissible errors) of the mathematical model with the real object, the relative simplicity of the model and its availability for research;
- be able to outline the limits of applicability of the mathematical model;
- be able to give examples of realities, models of which are mathematical objects, give examples of problems with real content that lead to mathematical concepts (derivative, integrals, probabilities), etc., as well as all skills related to the study of mathematical model using computer technology.

Creating a mathematical model of a real process, phenomenon, object through analytical or simulation modeling involves the formation of all the skills specified in the curriculum of mathematical disciplines for universities. But these skills are best formed in combined (analytical-simulation) modeling, which combines the benefits of analytical and simulation modeling. This condition is provided when studying special courses in mathematical modeling [14].

Depending on the specific situation, the following approaches to building mathematical models are possible:

- direct analysis of the modeled image;
- conducting a limited experiment with the image of modeling;
- use of analogue;
- analysis of initial data [18].

(The image of modeling should be understood as a system, phenomenon, process, object, etc.)

Methodological approaches to building mathematical models today are extremely diverse [16, 17]. This diversity may indicate the impossibility of unambiguously identifying the most promising and effective ways to organically combine mathematics with other areas of knowledge, as well as emphasize the need to improve the fundamental training of specialists in mathematical disciplines.

Mathematical models of applied nature are related to research planning, analysis of initial data and measurements and are based on modern statistics, experimental planning, sampling method and design of panel surveys, multidimensional statistical analysis, econometrics, etc. Models of applied nature are also abstract, but the results of such model studies are widely used in various applied problems by determining the minimum and at the same time sufficient amount of empirical information in which the mathematical model would be adequate to the real process with certain pre-fixed constraints.

Mathematical modeling is a means of realizing interdisciplinary connections within one mathematical discipline, as well as interdisciplinary connections between different mathematical and other disciplines.

The problem of implementation of applied orientation has always been and is in the field of view of methodologists, scientists, authors of textbooks in mathematical disciplines. For many decades, starting from the 50s of the last century, general approaches to the creation of mathematical models were developed and "General principles of mathematical modeling" were developed:

1. The principle of using the fundamental laws of nature.
2. Variational principles and mathematical models.
3. The principle of analogy in the construction of models.
4. Hierarchical principle in the construction of mathematical models.

The most common method of building models is to apply the fundamental laws of nature to a particular situation. These laws are generally recognized, repeatedly confirmed by experience, are the basis of many scientific and technological advances. Therefore, their validity is beyond doubt, which, in addition, provides the researcher with psychological support. Examples of the application of the fundamental laws of nature to the construction of mathematical models are given in the textbook [17, p. 73-79].

Variation principles are general statements about the object under consideration (system, phenomenon) and state that of all possible variants of its behavior (motion, evolution) choose only those that satisfy a certain condition. Under this condition, some object-related quantity reaches an extreme value as it transitions from one state to another. Variation principles are used in problems to find the minimum or maximum value of a quantity. An example of such a task is given in the textbook [17, p. 80-82].

Hamilton's variational principle is widely used in the construction of mathematical models. The general scheme of using the Hamilton principle is described in the textbook [17, p. 79-82].

The advantage of using Hamilton's principle is its universality, strictly formalized sequential procedures that do not depend on the details of a particular system. For many complex objects, variational principles are actually the only method of building models. For example, the mechanical parts of most robotic devices consist of a large number of different elements connected in different ways. Their mathematical models include a large number of equations, unambiguously obtained mainly through variational principles. This approach is also successfully applied to systems of other nature (physical, chemical,

biological) for which the relevant general statements about the nature of their evolution (behavior) are formulated.

The fact that Hamilton's principle and the application of the fundamental laws of nature give the same models is natural because they describe the same source object. Of course, such a match is guaranteed only with the same source data about the object.

Mathematical modeling is closely related to economic modeling, is its basis and contributes to the in-depth study of various economic processes of formation and development of Ukraine's economy and the development of world economic systems.

Mathematical modeling connects educational mathematical disciplines with computer science. The creation of mathematical models of a research nature, ie mathematical modeling as a creative process, is impossible without the appropriate level of skills in computer science and computer technology. With the help of computer science, mathematical modeling from the method of educational cognition grows into a method of scientific research. That is, students, mastering the method of mathematical modeling in the study of mathematical disciplines, have the opportunity to improve their skills of mathematical modeling in creative, research activities, which they can conduct either independently or under the guidance of a teacher in writing term papers, qualifying papers circles or speeches at scientific conferences [19].

Considering mathematical modeling as a method of scientific research, future teachers need to develop the ability to use mathematical models in pedagogy and psychology. B.V. Gnedenko drew attention to the need for this in 1981. In his book "Mathematical education in universities" he writes: "Mathematical approach to the study of various pedagogical phenomena can provide real help and serve a deeper insight into the problems of learning, student psychology, purposeful pedagogical experiments. In my opinion, mathematics can already be successfully used to solve the following problems:

- 1) planning and conducting pedagogical experiments;
- 2) processing the results of pedagogical experiments;
- 3) construction of quantitative models of teaching and education " [6, p. 168].

**Conclusions.** The importance of teaching mathematics modeling to students to form a system of effective knowledge and skills is emphasized by the fact that modern mathematics programs for schools and mathematics curricula for universities indicate the need to teach mathematical modeling.

The system of applied problems in various mathematical disciplines occupies a central place in the process of forming the skills of mathematical modeling in students - future teachers of mathematics. The formation of mathematical modeling skills through a system of applied problems is implemented within each discipline systematically, continuously, within several mathematical disciplines - in parallel and necessarily according to the same heuristic scheme of mathematical modeling.

To form the skills of mathematical modeling in future teachers of mathematics in the process of teaching mathematics and methods of its teaching should be based on the continuity of the method of mathematical modeling as a method of educational knowledge

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## MODEL, ORGANIZATIONAL AND PEDAGOGICAL CONDITIONS OF PREPARATION OF FUTURE EDUCATORS FOR INCLUSIVE LEARNING

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**Annotation.** *Based on the generalized experience of training future educators and the introduction of inclusive education in preschool education, a model of the researched process is designed, consisting of three blocks: target, procedural-technological, diagnostic-effective.*

*Gradually building a model and establishing relationships between blocks and structural elements allowed us to obtain new information about a set of conceptual ideas, organizational and managerial measures and scientific and methodological developments to create a system of training future educators for inclusive education in preschool education; contributed to understanding the peculiarities of the educational process in higher education, which allowed us to identify the best ways to theoretically substantiate the research problem and the organization of research and experimental work and characterize the pedagogical conditions of future educators' readiness for inclusive education in higher education. educators; end-to-end application of innovative technologies in the process of teaching disciplines of professional and practical training; development and implementation of the training program "Formation of readiness to organize the education of children with special educational needs".*

*In the process of designing the model and pedagogical conditions, we came to the conclusion that this process should be implemented in the opposite direction - from analyzing the features of inclusive education in general to its implementation in preschool education and further to the peculiarities of training students in higher education. relationships.*

**Keywords:** *model, pedagogical conditions, future educators, inclusive education, innovative technologies.*

Conceptual foundations of the Incheon Declaration "Education 2030: Ensuring universal inclusive and equitable quality education and lifelong learning" (2015); Laws of Ukraine "On Education" (2017), "On Higher Education" (2014), "On the basis of social protection of persons with disabilities in Ukraine" (2017); "Concepts of inclusive education development" (2010); Resolutions of the Cabinet of Ministers of Ukraine "On Approval of the Procedure for Organizing Inclusive Education in Secondary Schools" (2011) and "On Approving the Procedure for Organizing Inclusive Groups in Preschool Institutions" (2019) provide for training in higher education institutions management with creative thinking, capable of harmonious development of students' personality, their physical and mental health, formation of values to the natural and social environment, to themselves and mechanisms of social adaptation and creative embodiment in an inclusive environment in which everyone has the opportunity to express his opinion, to

be heard and to participate in his life.

Modeling in pedagogical research is considered as one of the theoretical methods of scientific knowledge, which allows to reproduce the characteristics of a particular object (the process of preparing future educators for inclusive education) on another object specially created for its study. preschool education) reflecting and reproducing in a simpler and more general form the structure, properties, relationships and relationships between the elements of this object.

Any modeling begins with the analysis of models already presented in the scientific literature. The study of sources on the research problem shows two trends: a small number of models of training future teachers to work in inclusive educational space and the practical lack of models of training of teachers of preschool education (ZDO) to include inclusive education.

By the nature of the models they are divided into subject or material-mathematical (reproducing the behavior of the original), physical (dynamic or functional characteristics of the original) and symbolic or logical semiotic (presented in the form of structural diagrams, drawings, formulas, signs or symbols). Different types of models are interconnected and complementary, as noted in their studies I. Zakharova, L. Zdanevich, N. Polishchuk, G. Sukhodolsky, V. Shadrikov and others.

In addition, models are divided into structural and functional, which are of two types: semantic and activity. In the first case, it is about the competencies and program learning outcomes that must be mastered by students. In the second - with the use of which methods and technologies they must achieve this goal.

The method of modeling is integrative, as it allows to combine empirical and theoretical in pedagogical research, ie to combine in the process of studying a pedagogical object experiment with the construction of logical constructions and scientific abstractions. In our opinion, the most complete definition of modeling is given by V. Shadrikov, who notes that "Model (in a broad sense) - image (conditional or imaginary - image, description, scheme, drawings, graph, plan, map, etc.) or prototype (sample) of any object or system of objects ("original" of this model), which is used under certain conditions as their "deputy" or "representative" [1, p. 27].

Summarizing the different approaches to the definition of "model", we can conclude that in the most general sense, "model" is a materially or mentally represented object, which in the process of cognition (study) replaces the original object, retaining some important for this study typical features.

In the context of the first trend, the approach of L. Zdanevich is interesting. According to the scientist "The desire of teachers and researchers to find ways to harmonize and pedagogize the professional environment, mitigate crisis factors, effective involvement of students in educational values - all this has naturally led to the need for systematic research in higher education pedagogy" [2, p. 153]. We share the opinion of S. Arkhangelsky and V. Slastyonin, etc., who characterize the pedagogical system as large, complex, reflected in the infinite variety of states, positions, relationships and connections.

We agree with the conclusions of L. Zdanevich, who notes that the system of professional training of future educators PEI "means a closed objective unity of related elements, organized according to certain principles and defined purpose and objectives of its operation, which has developed forms, tools and methods that provide the end result, namely: readiness to work with maladapted preschoolers "[2, p. 154] that as a result of systematic work on the development, testing and implementation of the model should be formed readiness for professional activity.

Important in the context of the first trend is the study of the preparation of future educators for the emotional development of preschool children, conducted by N. Trofaïla. The scientist concludes that the model of training includes goals, objectives, stages with appropriate pedagogical support of the educational process (content, forms, methods, techniques); pedagogical conditions, components (cognitive, motivational, activity), criteria (organizational-informational, value-oriented, operational-effective), indicators and levels (sufficient, satisfactory, low) readiness of future educators for emotional development of preschool children and diagnostic tools" [3, p. 143].

In a number of studies (S. Alekhina, Y. Boychuk, O. Borodin, O. Gnoevskaya, G. Kosareva, N. Trofaïl, I. Hafizullin, etc.) there are also models in which the preparation of future educators to work in the educational environment of PEI presented as a complex dynamic system consisting of goals and objectives, content, acceptable methods and forms of educational activities, stages (stages) of development of this process and evaluation of its results.

Analyzing the research of V. Bekh, E. Shalimova [4], E. Lodatko [5] and others. we concluded that a carefully planned, designed and functioning model does not reveal the essence of the whole process, it is associated with limitations, simplification of the system, with the selection of only certain aspects of the object of study, so to build a model blocks, components, elements); select those components that can be quantified; combine components according to common features, reducing their list; determine the quantitative relationships between the input components of the educational process and the output criteria (the result of training).

When designing the training model, we consider it important to take into account the diversity of pedagogical goals and objectives of the educational process, which requires the construction of a specific educational environment and the use of various tools. These include: the content of educational material; methods of its study, management and control; forms of organization of educational activities; technical means; skill of the teacher in the organization of cognitive activity of students. To improve the educational process, the harmonious arrangement and skillful combination of these tools in the structure of the Higher Educational Institutions are of great importance.

Z. Shevtsiv implemented the model of preparation of future primary school teachers for work in an inclusive environment of a secondary school closer to the structure. innovative technologies (problem, modular, informational and contextual learning technologies), methods (explanatory-illustrative, verbal, visual, practical, research, interactive, project method, testing, mathematical modeling) and forms (lectures,

practical and laboratory classes); diagnostic and effective, which involved identifying those elements of education that will ensure the formation of future primary school teachers structural components of socio-pedagogical competence to work in an inclusive environment "[6, p. 24].

Based on the above models and taking into account the generalized experience of training future educators and the implementation of inclusive education in PEI, we have developed a model of the research process.

The model of preparation of future educators for inclusive education in PEI consists of three blocks: target, procedural-technological, diagnostic-effective.

The target block of the model was developed taking into account the social order, the requirements of the Standard of Higher Education of Ukraine and the educational and professional program of knowledge 01 "Education" specialty 012 "Preschool Education", features of the student body, curricula, programs and syllabi. During the design of this unit we paid special attention to the peculiarities of preparing future educators for the organization of inclusive education in HEI, the formation of a person capable of individualizing the educational process for preschoolers with disabilities and providing support to each child according to his needs.

The purpose of developing the model is to determine the readiness of future educators for inclusive education in PEI; the main tasks of professional training - the formation of motivation for the implementation of inclusive education in PEI; development of a conscious understanding of the basic principles of inclusive education in Ukraine; formation of skills of application of innovative technologies in educational process; developing the ability to organize the work of a team of inclusive class support specialists.

In determining the objectives of the model, we focused on the requirements for knowledge and skills and competencies defined in the educational and professional program, assessing them from the standpoint of qualification requirements formulated in the Standard of Higher Education of Ukraine. "Education" specialty 012 "Preschool education" and job description of the educator PEI.

The procedural-technological block of the developed model is characterized as a systematic way of organizing joint activities of students and teachers, aimed at solving the problems of future professional activity and forming the readiness of future educators for inclusive education in PEI.

Developing a system of training, determining its content and guidelines, we proceeded from the fact that "all students are able to fully master the necessary educational material, if properly organized educational process" (O. Yudina). The only criterion for evaluation was the achievement of readiness of future educators for inclusive education in PEI, the formation of all necessary competencies, including inclusive. The philosophical basis of this system is based on the ideas of personality-oriented education of the American philosopher and educator D. Dewey. Today, interest in this system is extremely high: it is effective, provides a practical opportunity to individualize the educational process, helps to improve the quality and level of knowledge of even insufficiently prepared students.

Conducted on the basis of Communal Higher Education Institution «Vinnytsia

Humanities Pedagogical College» and Vinnytsia State Pedagogical University named after Mykhailo Kotsyubynsky research based on the analysis of educational and professional programs, curricula and syllabi, monitoring of teachers, as well as diagnostics of self-assessment of readiness for inclusive education of future educators to inclusive education in PEI has the following characteristic factors:

1. The technology of preparing educators to work in the IEE included the following stages: immersion in activities to solve professional problems, problematization, goal setting and planning, designing the process of solving professional problems and its implementation, reflection on activities.

2. The learning process was based on the principle of integrativity; the design of interdisciplinary links was carried out, taking into account the continuity of knowledge acquired by students and the main stages of achieving the goal (formed readiness of future educators for inclusive education).

3. The selection of the content of education was realized in accordance with the didactic properties and features of inclusive education, the tasks were differentiated (depending on the individual abilities and capabilities of students).

4. Tasks for course and diploma design, pedagogical practice included issues of designing a correctional and educational process taking into account the special educational needs of children with SEN.

5. Innovative technologies were systematically used in the educational process, which contributed to the development of inclusive competence, critical and creative thinking of students. focused on professional and personal development of teachers, which allows you to personalize their training and form in them a value attitude towards children with SEN. Innovative technologies such as contextual learning technology, critical thinking development technology, group work technology, case study technology, focus group work technology, individual correctional and educational route design technology, etc. were used in the process of preparing teachers for inclusive education.

6. The possible influence of the developed pedagogical conditions and models on the nature of thinking and behavior of participants in the educational process was constantly predicted. Taking into account all the factors requires a more detailed analysis of the definition of pedagogical conditions for preparation for professional activity in the context of inclusive education in the PEI. First of all - theoretical analysis of the literature in order to develop scientific research, study of pedagogical experience and problems faced by both teachers of pedagogical HEIs and educators during the implementation of inclusive education in PEI.

Training of highly qualified specialists for inclusive education is one of the conditions for the implementation of the Resolution of the Cabinet of Ministers of Ukraine "On approval of the Procedure for organizing the activities of inclusive groups in preschool education" (2019). Currently, the solution to this issue is the least secure both organizationally and methodologically. Already in the first stages of the implementation of inclusive education, educators have a fear of the unknown, professional insecurity, unwillingness to change, psychological unwillingness to work with children with SEN.

In order to assess the quality of the organization of inclusive education in the PEI, it is necessary to develop a comprehensive program for monitoring indicators of the dynamics of the process of organizing inclusive groups, one of the indicators of which is the readiness of future educators for inclusive education.

The study of scientific research and analysis of the results of the ascertaining stage of the experiment allowed us to conclude that the pedagogical conditions for the formation of readiness of future educators for inclusive education in PEI in pedagogical HEI are provided during:

- formation of inclusive competence of future educators;
- end-to-end application of innovative technologies by teachers in the process of teaching disciplines of professional and practical training;
- development and implementation of the training program "Formation of readiness to organize the education of children with special educational needs."

Let's analyze the features of the implementation of selected pedagogical conditions in more detail.

Formation of inclusive competence of future educators.

Important in the context of our study is the opinion of G. Kosareva, who notes that integration and inclusion in the PEI largely depends on the qualifications of staff, and this, in turn, requires changes in the process of training future educators. We agree that "the problem of forming inclusive competence of future educators is especially important, without which a child's stay in a secondary school becomes spontaneous, a formality that not only does not benefit, but is harmful to the child, because without appropriate correctional care psychophysical the child's development is only complicated "(G. Kosareva [8, p. 331]).

Research of the definition of "inclusive competence" in the works of I. Bondar, Y. Boychuk, G. Kosareva, S. Maksymyuk, T. Pyatakova, T. Solovey, I. Hafizullina, M. Tchaikovsky and others. testifies to the existence of different scientific approaches to its formulation, which makes it impossible to static the structure of this multifaceted phenomenon.

Thus, T. Bondar interprets this concept as "the level of knowledge and skills necessary to perform professional functions in an inclusive education" [10]. A similar view is shared by T. Solovey and M. Tchaikovsky, who define inclusive competence as "the necessary amount of knowledge and skills embodied in the ability to perform professional functions, taking into account the special needs of young people with disabilities and integrate them into the environment., creating conditions for development and self-development "[11, p. 221].

Contrary to previous views, a number of authors interpret inclusive competence as an integrative and personal education that determines the ability to perform educational and professional functions.

O. Kolisnyk emphasizes professional functions, noting that it is "integrative-personal education, which determines the ability to perform professional functions in the process of joint learning of children with special educational needs and their peers

who develop within the norm, taking into account different educational needs of students ensuring their inclusion in the general educational environment, creating conditions for their development and self-development, full socialization, bearing in mind that the components of inclusive competence are motivational, cognitive, operational and reflective components "[12, p. 90].

G. Kosarev is of a similar opinion, believing that this is "an integrative personal education of future educators, which determines the ability to perform professional and pedagogical functions in the process of inclusive education, taking into account different educational needs of children and ensures inclusion of children with special educational problems." for its development and self-development "[8, p. 331]. However, in contrast to previous views, the author highlights the ability to perform professional and pedagogical functions of future educators.

M. Tchaikovsky in his research emphasizes the educational functions of inclusive competence, the scientist believes that it is "integrative personal education, which determines the ability to perform educational functions in the process of inclusive learning, taking into account the educational needs of students with special needs." educational environment, to create all conditions for their full development and self-development "[13, p. 191].

In contrast to the previous views of I. Hafizullin emphasizes the ability of teachers to "perform professional functions in the process of inclusive education, taking into account the different educational needs of children, which allows the inclusion of children with disabilities in the educational organization and creates conditions for their development and self-development "[14, p. 87].

Inclusive competence of future educators refers to special (professional, subject) competencies. We believe that inclusive competence is an integrative subjective personality trait that characterizes the ability of educators to perform professional functions in the process of inclusive learning, ensuring equal opportunities for every child in preschool education, identifying educational needs of children with SEN and designing IEE for their ontogenesis and proliferation.

Based on the above, the problem of forming and diagnosing the level of inclusive competence of future educators is relevant and timely, the results of which will open the prospects for developing effective measures to improve the quality of their training in inclusive education.

We believe that the main components of inclusive competence of educators implementing inclusive education are: knowledge of theoretical and practical principles of pedagogy, age and individual psychological and physiological characteristics of children, including children with SEN, diagnostic methods to identify unique needs, strengths and the potential of each child in the group; skills and abilities in creating a safe, developing environment; skills and abilities of personality-oriented interaction with children; skills of organizing joint activities and communication of children; possession of various educational activities and technologies, skills and abilities to interact with parents; skills and abilities of team interaction.



Our study proposes an andragogical cycle (continuous professional development) for the formation of inclusive competence, which will ensure the formation and development of future educators of inclusive competence at a high level, which will ensure their readiness for inclusive education in PEI.

Through the use of innovative technologies by teachers of HEI in the teaching of disciplines of professional and practical training.

The modern educational process is not only to impart knowledge, develop professional skills and abilities of future professionals, to develop their thinking, but also to teach them forms, methods and means of self-acquisition of knowledge, which contribute to innovative learning technologies, inculcation of research skills activities.

Future educators will be better prepared for inclusive education if they master the peculiarities of working in IEE while studying in HEI. We believe that the cognitive activity of students should be adequate to future professional activity, ie should reproduce the features of the professional activity for which the specialist is preparing, which encourages the need to use in the educational process such innovative learning technologies that mimic future professional activity.

In our study, the use of innovative technologies creates a situation for solving specific problems in IEE, and puts students in a certain professional role, allows them to independently and creatively apply the acquired knowledge, make informed decisions, be able to take responsibility for their implementation and consequences.

An important trend of innovative didactic research, according to I. Zyazyun, is "...a combination of different types of extracurricular educational activities not only in procedural manifestations, as ways to build learning, but also in content, as objects of learning, mastering (from research to teaching research, from teaching through discussion - to teaching discussion, etc.)"[15, p. 5].

The formation of the readiness of future educators for inclusive education should take place in an organized educational process, through rethinking the technology of all types of classes and the systematic use of innovative technologies. Professional training of future educators becomes more real and purposeful when innovative technologies are used instead of reproductive ones (techno-strategy, modeling of pedagogical situations, technology of focus-group work, technology of contextual learning, technology of critical thinking development, technology of designing individual correctional educational route, technology of group work , case-coaching, integrated learning technologies, development of a portfolio of preschool teacher with the use of digital technologies, online exchange of experience, didactic-technological styling, personal site), based on modeling educational and professional situations of professional activity in IEE, their discussion, analysis and evaluation, seminars, workshops, discussions, brainstorming, etc., which allows higher education students to master the subject and social aspects of inclusive education, the system of relationships and issues that are characteristic of inclusive education environmental environment PEI.

Development and implementation of the training program "Formation of readiness to organize the education of children with special educational needs."

The specifics of the work of the educator in the conditions of IEE is to solve educational, educational, correctional tasks; development of an individual correctional and compensatory program of education and upbringing of each child, taking into account nosologies; focus on the cognitive abilities of each child; creating conditions for the adaptation of children with SEN and the acquisition of important social skills, and this puts forward appropriate requirements for the structure and organization of the educational environment of free education, methods, forms and technologies of learning.

The essence of the formation of the readiness of future educators for inclusive education is to master the methods of solving quasi-professional problems with the active use of innovative technologies. It is necessary to teach students to apply the acquired knowledge, as well as to find and creatively use information to make competent decisions in future professional activities. To this end, we have developed a training program "Formation of readiness to organize the education of children with special educational needs".

The program will help prepare future educators to understand the deep content and essence of inclusive education, will acquaint them with the benefits of inclusive education, will help them prepare to work with children with SEN.

Among the main objectives of the course are the following:

- acquaintance of students with the legal provision of inclusive support for children with SEN;
- stimulating creative and social activity, initiative of future educators;
- acquaintance of students with behavioral therapy; features of the model of early intervention; with effective ways to interact with children with emotional and volitional disorders;
- development and implementation of non-traditional techniques and techniques when working with children with SEN;
- formation of skills to provide the necessary assistance, advisory support on issues related to the education and upbringing of children in the IEE;
- development of motivation to organize educational work with parents of children with SEN.

The diagnostic-effective block of the designed model provides an assessment of the components of the formation of the readiness of future educators for inclusive education in the PEI. Based on the requirements for future educators working in inclusive education, we have formulated components (motivational-value, activity and reflective-evaluation), indicators and levels of readiness of teachers to implement inclusive education.

It should be borne in mind that future educators are learning new activities for them, moving from the observation and analysis of educational situations to application in the educational process and, finally, to master a full-fledged professional activity. Therefore, the design of the model should take place in the opposite direction - from the analysis of the features of inclusive education in general to its implementation in the PEI and then to the features of training students in the HEI, while maintaining the relationship.

It is determined that the important components of designing the model and

pedagogical conditions of preparation of future educators for professional activity in the conditions of inclusive education in PEI in combination with the appropriately formed educational environment of pedagogical HEI are:

1) purposeful design of the educational process based on the model of preparation of future educators for inclusive education in PEI, which includes as the main structural blocks of the target, content-procedural and diagnostic, and as important components of readiness - motivational-value, activity and reflexive-evaluative;

2) susceptibility to the changing requirements of stakeholders to the components of professional competence of graduates with unconditional compliance with the requirements of educational standards;

3) focus on the ideas and provisions of personality-oriented, systematic, integrative approaches, which form the basis of the competence approach and which are characterized by: - recognition of independence, uniqueness, individuality of each participant in the educational process, with a clear exceptional social character;

- orientation of education on self-actualization, self-development and self-realization of higher education seekers in educational-professional and research activities, when cognitive activity acquires creative, exploratory character, intellectual and creative potential of students develops, their research abilities are realized;

- readiness of the pedagogical staff to introduce innovative technologies in the process of preparing students for the specialty 012 "Preschool Education" and to develop in future educators the professional, spiritual and moral-ethical qualities necessary to work with children with PDD;

- integration of content, forms and methods into a holistic process in the form of an educational environment that adapts students to the realities of work in IEE, through educational, quasi-professional, research and socially significant activities;

- application of tasks that have an interdisciplinary nature in order to reduce the time of adaptation of students to future professional activities in the conditions of work in the IEE;

- development and implementation of integrated training courses, as well as early immersion in various types of practices at the stage of profiling students to pedagogical activities with children with special educational needs;

- creation and implementation of innovative approaches to the implementation of inclusive education by designing an individual trajectory of training and creating new ways of educational communication and new forms of educational interaction;

- focus on the national and European credit transfer system ECTS organization of the educational process and the method of determining the level of professional readiness of the future specialist, which provides for four levels of readiness for professional activity: unacceptable (F, FX); medium (E, D), sufficient (C, B), high (A)

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## PEDAGOGICAL ASPECTS OF FORMATION OF THE LEADERSHIP COMPETENCE OF FUTURE FOREIGN LANGUAGE TEACHERS

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**Annotation.** *Modernization of modern pedagogical education in Ukraine necessitates improving the quality of teacher training, professional level of teachers, development and improvement of their leadership skills in accordance with the requirements, goals and objectives of national education as part of the European educational space. An important factor in increasing the leadership competence of future teachers is to equip them not only with pedagogical knowledge and skills, but also a set of leadership knowledge, skills, abilities and professionally important qualities that reflect the degree of their purposeful activity.*

*An important feature of leadership most scholars consider the leadership potential, which is a socio-psychological personality trait that reflects the individual's ability to succeed in leadership, as a set of internal needs, means, values that contribute to such a level of integration of competence, responsibility, activity and sociability, which provides a leading influence on the members of the group in the joint solution of problems in different activities and sets a positive direction of the process of professional development. The level of leadership potential is determined by the degree of development of its individual and universal components. The leadership potential of the individual from the standpoint of psychological analysis has the following components: sociability, purposefulness, responsibility, perseverance, motivation to succeed, balance, prudence, positive self-esteem, self-confidence, sincerity, determination, intuition, sensitivity, willingness, readiness, readiness critical and self-critical and is realized through emotional, behavioral and cognitive flexibility. The research is aimed at finding and implementing ways, methods and means to improve the leadership competence of future foreign language teachers, which will further model the professional activities, careers and socially significant values of teachers in educational institutions.*

**Keywords:** *leadership competence, leadership, postulate, future foreign language teachers, formation criteria.*

The changes in socio-economic foundations of the Ukrainian state and society are accompanied by processes of modernization of education in general, the main focus of which is the formation of an educated, creative personality with leadership competencies. At the present stage of education development, the formation of leadership competence of future foreign language teachers is an important task. After all, the ability to organize the activities of future foreign language teachers based on their abilities, competence, business and personal qualities is extremely important. Analysis of research and publications on the research problem has shown that the problem of leadership is not new in modern literature. Some aspects of it are presented in scientific sources by a number of scientific and practical studies of domestic scientists (O.A. Dubaseniuk, S.A. Kalashnikov, L.M. Karamushka, T.I. Lurina, N.Yu. Serdyuk, O.P. Yakubovsky and

others). However, in the field of training a future foreign language teacher, the problem of forming his leadership competence, which would correspond to the increase in the level of professionalism, new social and educational trends, needs to be studied.

The purpose of the article is to highlight the theoretical justification of the project for the formation of leadership competence of future teachers.

The purpose of the study is specified in the following tasks:

1. To analyze the conceptual and categorical apparatus of the project.
2. To find out the content, procedural bases and essential characteristics of the formation of leadership competence of the future teacher of foreign languages.
3. To determine the criteria and levels of formation of leadership competence of the future teacher of foreign languages.
4. To develop a model for the formation of leadership competence of future teachers of foreign languages and test its effectiveness.

The project is built on such a triad of basic postulates:

The first: the formation of leadership competence should be carried out in parallel with the formation of a harmoniously developed personality (creative, moral, physically healthy), who knows himself well.

The second postulate: the process of formation of leadership competence is carried out in the education system and continues in organizations at the place of work.

The third postulate: learning the basics of forming leadership competence starting with students.

The scientific novelty is that: the model of formation of leadership competence of future teachers of foreign languages is theoretically substantiated; the semantic, procedural bases and essential characteristics (systematization, integrativity) of the formation of leadership competence of the future teacher are clarified; developed criteria (attitude to the work of a teacher as a manager of their own and students' activities; the formation of characteristic personality of a manager of leadership qualities; the presence of stable professional motives) and indicators (persistence and activity; friendship and agreement; honesty and honesty; emotional stability and self-control) the formation of leadership competence.

Leadership is a managerial relationship between the leader and subordinates, based on an effective combination of different sources of power for the situation and aimed at motivating people to achieve a common goal. The best leader is the super leader (turns most of the people who follow him into leaders). Steps to superleadership: becoming a leader for yourself; realize their potential for work in life; show an example of such "self-leadership" to others; give them the opportunity to see that self-leadership brings success; ability to formulate goals to build a plan of self-development; the ability to reward yourself.

The main conditions of leadership are:

The first (required). Possession of power in specific formal or informal organizations of various levels and scales, from the state and even a group of states to government agencies, local government or people's and public groups and movements.

The second. Bring development to people.

The third. Awareness of the leader of their qualities and their deliberate application in their (and not only in their) life path.

Action plan for the formation of leadership competence: 1) creating a favorable educational environment; 2) creating a favorable professional environment; 3) university in the community.

Approaching systematically, we can identify five main areas of growing influence of the leader on the world: the sphere of personality; the sphere of the family as a small social group; the sphere of the social group or several groups in the area; the sphere of the ethnic group, that is the nationality where he lives; sphere of humanity, that is the fame in different countries.

The developed model of formation of leadership competence of the future teacher of foreign languages includes: the purpose, the basic spheres of influence of the leader, components (target, stimulating-motivational, semantic component, evaluative-effective). The defining component of the model of formation of leadership competence of the future teacher of foreign languages is the target component, which combines the goal of formation of leadership qualities with a specific task - the formation of leadership qualities. One of the important components of pedagogical activity is its motivation.

The stimulation-motivational component provides stimulation of students' interest in the problem of leadership. There are the following motivational orientations: external motives (for example, the motive to achieve the prestige of working in relevant educational institutions) and internal motives (focus on the process and result of their activities, personal and professional growth, self-actualization). The specific motive is the focus on dominance, the motive of power. Signs or effects of the need for dominance are the desire to: control your social environment; influence other people's behavior and guide it through advice, persuasion or command; encourage others to act according to their needs and feelings; to persuade to cooperate, to convince others of their rightness. The content component consists in the introduction into the curriculum of special courses ("Building your own image", "Business etiquette", "Business communication", "Management") and special courses aimed at moral and psychological preparation of future teachers for teaching and development of pedagogical skills. It is important to use additional training with computer support. Moral and psychological readiness for pedagogical activity - a stock of professional knowledge and qualities that provide a high level of professional functions: responsibility, organization, emotionality, beliefs, pedagogical abilities. The abilities of the subject of pedagogical activity, which is formed and developed, largely determine its success.

Let's generally present pedagogical abilities according to the following definitions.

1. Didactic abilities - the ability to provide students with educational material, to arouse interest in the subject, to encourage students to think independently.
2. Academic abilities - abilities in the relevant field of knowledge.
3. Perceptual abilities - the ability to penetrate into the inner world of the student.
4. Speech abilities - the ability to clearly and distinctly capture thoughts and feelings



through speech, facial expressions.

5. Organizational skills - the ability to organize the student body and their own work.

6. Communicative abilities - the ability to communicate with children, the ability to find the right approach to students, the presence of pedagogical tact.

7. Ability to distribute attention simultaneously between several activities. As a person develops, he activates his innate inclinations and inclinations, which "resonate" with one sphere.

This resonance reveals and focuses a person on leadership in a certain group. The personal qualities of a leader can be grouped into five broad concepts: persistence and activity; friendship and consent; honesty and integrity; emotional stability and self-control; intelligence and the desire for improvement. The first area of development of your unique personality is the main interest of young people. Around this interest there are groups of formation and development of the physical body, the sphere of feelings, the sphere of intellect. The result of the activity is the recognition by society of the leader's efforts to promote himself.

The second area of self-realization of leaders is the family and its interests. These include the continuation of family tradition in a particular profession, as well as the birth and upbringing of children. The result of the leader's activity is to increase the social status of the family and the kind of leader, recognition of his leading role.

The third area concerns the social realization of leaders through the promotion of formal and informal social pyramids. Formal pyramids are clearly structured social institutions that perform socially significant functions, such as school, college, university. Informal means public associations associated with shared hobbies or problems. The main goal of the leader in society is to achieve the level of development resources and, accordingly, social status in the chosen pyramid.

The fourth area - the creation of works of culture and art, moral values. The result in this area is the recognition of talent in the creation of life values.

The fifth sphere allows the leader to realize his abilities on an even wider plane. The result achieved for the leader is to become the leader of the international movement for informal organizations, or to be elected or appointed to a high position in a state or, possibly, in an international organization.

Evaluation-performance component provides a description of the formation of leadership competence, provides self-assessment of students' achievements in their spheres of influence as leaders, which stimulates future teachers to improve their results by focusing on valuable end product, which is self-realization, useful to self, employer, family, labor and other social circles.

Criteria for the formation of leadership qualities of the future teacher are:

1) the attitude to the work of the teacher as a manager of their own and students' activities;

2) the presence of stable professional motives (social significance of work; the ability to teach and educate children, engage in science; creative work; the need for continuous self-improvement; the profession corresponds to the nature, abilities;

diversity, complexity of work; results of pedagogical work);

3) the formation of characteristic personality of the manager of leadership qualities (dignity, optimism, determination, diligence, tact, tolerance, sociability, creativity, observation, purposefulness, initiative, self-criticism, desire for self-improvement, demanding, fair, responsible).

Based on the criteria, three levels of formation of leadership competence of the future teacher and the corresponding indicators are identified: low level - (elementary) - lack of interest in the teacher's activities; low formation of characteristic qualities of the teacher's personality as a manager of own and student activity; mastering some elements of managerial knowledge, the practical significance of which is not realized, the inability to effectively apply knowledge in practice; intermediate level - partial expression of interest in the professional activity of a teacher; formation of the basic qualities characteristic of the teacher's personality as a manager; mastering the basic concepts and provisions on the specifics of managerial activities of the teacher; awareness of managerial knowledge and their practical application in standard and some non-standard situations); high level - (professional) - stable professional interest in the work of the teacher; humanistic orientation of the formed basic qualities characteristic of the teacher's personality as a manager; high theoretical awareness of the specifics of the content of the teacher; creative application of knowledge in non-standard situations).

Formation of future teachers' leadership qualities through learning a foreign language should consist of certain components. Model of forming the teacher's leadership qualities in the pedagogical process of the university is understood as an interconnected and interdependent complex consisting of three components: target, substantive-procedural and control-diagnostic, ensuring the formation of leadership qualities and differentiating levels of their formation (Vyunova 2012).

The key component reflects the goal, tasks, principles and functions of process of forming leadership qualities important in pedagogical activities. The model is focused on the achievement of psychological and pedagogical readiness for professional activity based on forming the teacher's leadership qualities in the educational space and includes a set of tasks.

To achieve this goal it is necessary: to give some opportunities to students to develop their communication (foreign language) skills within the pedagogical process of the university; to promote organizational competence, significant for educational activities; to ensure the formation of confidence in professionalism, based on the pedagogical competence of the future teacher.

The process of forming leadership qualities is based on principles systematic, continuity, activity and action, ensuring logical interconnection, complementarity and conditionality of all elements of this process, interdependent and interpenetrating nature training and education, the integration of theoretical and practical aspects training, as well as activates targeted activities that reflect the essence of the leadership position. Within the process of forming the leadership qualities of the future teacher it is necessary to realise the following tasks: to make sure the communicative competences to be

developed within the pedagogical process; to provide with organizational competencies that are important in forming future teachers' leadership qualities; to form confidence in professional training based on the pedagogical competence of the future teacher (Vyunova 2012).

The content reflects the essence of the formation of leadership qualities necessary teacher:

- identification of the essence and purpose of the qualities of a leader in pedagogical professions;
- the study of the main approaches to the formation of leadership qualities in future teachers;
- the development of communicative competences in the process interactions in the educational space;
- obtaining organizational leadership competencies that are significant in pedagogical activity;
- independent creative activities on building own leadership style in pedagogical situations, based on qualities of the leader, which are important for professional success of the future teacher.

The result of the process of forming future teachers' leadership qualities is estimated with a diagnostic component. The success criteria is psychological and pedagogical readiness of the future teacher to the professional activity. It combines leadership qualities that can be assessed by indicators (communication and organizational competence, confidence in teacher training), having a quantitative expression, and also levels of formation (low, medium, high).

Leadership (social, economic, and academic) might be viewed and should be studied in the multidimensional and multi-angle perspective (Strielkowski and Chigisheva 2018). Taking into consideration the specific of the future profession – the teacher – since the first-year studying a student should be prepared as a leader, and the Pedagogical College/ Institute/ University must help the student to create a strong motivation to study and to develop key leadership qualities which every future teacher should possess. Unifying these points leads to good results in preparing the teacher.

The very important thing is that the lecturers themselves must be professionally experienced in what they do. Leaders have credibility, and they've earned the right to ask people to listen to them and follow them. They influence other people and conduct them to a common goal (Bennis 1998).

It is especially very important for future teachers. Bennis (1998) is an American scholar who widely regarded as a pioneer of the contemporary field of Leadership studies. He defined leaders as persons “who do the right thing” (Bennis 1989). He distinguished six personal qualities which are correlated with preparing future teachers. They are integrity, dedication, magnanimity, humility, openness, creativity. As for formation of future teachers' leadership qualities through learning a foreign language it is necessary to develop them. For example, within the discipline content “Professional speaking the foreign language (English)”, by means of a foreign language, students may be taught

to listen to ideas that are outside one's current mental models, being able to suspend judgement until after one has heard someone else's ideas. Creativity means thinking differently see things that others have not seen and take a new and different viewpoint on things. In such a way critical thinking of future teachers is developed. Within this discipline future teachers as learn a professional foreign language as form their critical thinking. For example, they do language tasks, using Matrix of importance (Covey 2004), answer philosophical questions like: “Are you right now? Who you want to be? What do I have to say about myself? How do you want to be remembered?” and so on. In a result we achieve a goal - future teachers' leadership qualities through learning a foreign language are formed.

**Conclusions.** Thus, in the conditions of modern reform of education in Ukraine, the problem of forming the leadership competence of the future teacher as a component of his professional activity becomes especially important. It is established that, in addition to pedagogical abilities (didactic, academic, perceptual, speech, organizational, communicative), the teacher must have leadership qualities: perseverance and activity; friendship and consent; honesty and integrity; emotional stability and self-control; intelligence and the desire for improvement. The proposed model will enable the qualitative formation of leadership competence of the future teacher under the conditions of formation of leadership qualities of future teachers, motivation of interest in leadership problems, introduction of special courses in the curriculum of higher pedagogical educational institution. Based on the developed criteria, this model should provide a high level of leadership competence of the future teacher.

The development of all components of communicative competence is a condition for a cognitive activity of future teachers. They assimilate development of leadership qualities by means of inner and outside motivation to learn a foreign language, formation a strong foreign language and speech skills, start a critical thinking. The result of the process of leadership formation will result into self-confidence, public speaking skills, competitive qualities, independent thinking, creativity of future teachers.

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## THE PROBLEM OF INTEGRATION OF KNOWLEDGE THROUGH THE INTEGRATED MODEL OF FORMATION OF WORLDVIEW IN SENIOR PRESCHOOL AND PRIMARY SCHOOL AGE

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**Annotation.** *The article reveals the problem of worldview formation in senior preschoolers and junior schoolchildren through an integrated model of worldview formation in senior preschool and primary school age.*

*The concepts of «picture of the world» and «image of the world» are defined. A holistic picture of the world, reflecting its various aspects, and above all the generalized image of the social environment, is the initial condition of human existence. principles of ensuring the integrity of the perception of the image of the world. The following principles are revealed: the first is to ensure the integrity of the perception of the image of the world, the second principle is the presence of "gaps" or «empty cells» in the picture of the world; the third principle - the principle of concentric assimilation of the holistic picture of the world; the fourth principle is the principle of cumulateness, according to which the picture of the world does not change radically in the process of its study, but only expands, deepens and clarifies; the fifth principle is to ensure the contribution of different pictures of the world in the formation of its holistic image; the sixth principle - the account of cognitive possibilities of subjects of knowledge of a picture of the world at a choice of categorical paradigms of world knowledge and acts in which this process occurs; the seventh principle is the use of universal conceptual and sensory categories of human consciousness in teaching.*

*The publication provides an elemental comparison of pedagogy based on technocratic worldview (given in the form of social order and relevant pedagogical technologies) and pedagogy based on a holistic picture of the world, which corresponds to the humanistic principles of worldview in older preschoolers and younger students.*

**Keywords:** *«Picture of the world», «image of the world», worldview, integration, integrated model, junior high school student, preschooler.*

So, in the concept of the Ukrainian national school-family [1] two alternative types of training are considered: the ideologically dogmatic type and the cultural-ecological type. In the first of these types, a whole series of «pedagogical myths» function: the ideological type of instruction, the priority of scientific and technical education, the subject class-lesson system, the oriented textbook, the basis of instruction, etc. These

myths are primarily related to school education, but in many respects, these myths function implicitly in the existing system of preschool education.

Proceeding from this ideologically dogmatic logic, the child must master a number of subject knowledges, which makes him ready for school knowledge. Accordingly, the many-sided development of the child (music, English, gymnastics, computer, etc.), the presumably functioning preschool institution. At the same time, given the fact that the breadth of the range of knowledge and skills of the child determines the success of the educational process, this objective success is not a single, and most importantly, a system-forming criterion of success. By the end of the 20th century, more and more teachers and psychologists are inclined to the view that the development of the child's personality should be the true criterion for the success of educational work in the preschool age, which translates the educational and educational processes from the subject plane into a personal one. However, the adoption of such a package poses a serious and still unresolved problem: how much didactic success leads to the development of the individual and vice versa.

As we showed earlier, on the one hand, many existing education systems focus on didactics, conventionally assuming that the cognitive development of the child itself inevitably leads to personal development. This, for example, refers to the system of developmental education or the school of the dialogue of cultures [2].

However, as shown by the interesting work of A. K. Developing [3], this mechanism is not as simple and straightforward as it seems.

In our view, motivational factors, and especially the development of children's personalities in these didactic systems is entirely dependent on the personality of the teacher, and the like are by-and little controlled study.

In addition, there is no personality in the activity approach in psychology, only a subject of activity. The main definition of activity is objectivity, which simultaneously characterizes the psyche. However, the space of personality is a break between activities. E. Fromm showed that such a purely human attitude to the world, as «love is subjective»: true love is not to be an object of love, but its subject. This same subjectivity of attitude towards the world is manifested in the position of «being», not «having». This is not an activity-transforming attitude toward the world, in the space of which there is only a subject of activity, but a contemplative, in the space of which a person exists.

The personality is characterized not by what the person did, but by what he refused to do.

On the other hand, many humanistic pedagogical systems, on the contrary, place emphasis on the personality of the learner (for example, pedagogy of K. Rogers centered on the student, the pedagogy of J. Korczak [4], the love and freedom pedagogy of You.

In these systems, the focus of attention is focused on the development of the individual, thereby placing the upbringing of learning, thereby overcoming the limitations of the technocratic paradigm (consisting in the primacy of objective knowledge in relation to personal and semantic development). Here, the general strategy and tactics of upbringing determine the importance of the «subjectivity» of the human world, in the

words of M. Buber, «a purely human attitude to «You».

In Table 1 there is an element-by-stage comparison of pedagogy based on a technocratic worldview (setting in the form of a social order and corresponding pedagogical technologies) and pedagogy based on and pedagogy based on a holistic picture of the world that corresponds to humanistic principles.

*Table 1*

**Element wise comparison of the technocratic and «holistic» pedagogics**

Ideological and dogmatic type of education	Cultural and ecological type of education
Methodology of ideology	Philosophy of Education
The child is the object of pedagogical action	The child is the subject of pedagogical action
Broken mechanical world	A holistic picture of the world
Ideological constructions	National values
Monologue of ideologies	Dialog of cultures
Events	Relation
Subject	Integrative course, problems
Objectification	Problematical character
Estrangement	Attachment to family life
Class-lesson system	Lessons, communication
Methodology	Game philosophy (directing of school subjects)
Accumulation of knowledge	Renovation, Awakening, Skills' development, Knowledge enrichment
KAS (knowledge, abilities, skills)	Knowledge integration
Unified program for everyone	The right to choose, Variability of programs
Knowledge (to give)	Knowledge (to receive)
Education and upbringing	Upbringing and education

The most paradoxical fact in this situation is that despite the «culpability» of science in many global problems of our time, humankind has to turn to the same science to solve these problems.

Therefore, the main task facing modern society and its institutions is not to eliminate technocratic thinking and not to mechanically join humanistic thinking, and «not even in translating technocratic science into a reflective level of consciousness, but in expanding the consciousness of the entire scientific community. It is just that, i.e. not only technical, but also natural, and humanitarian. «There is a demand for «ecological awareness» of knowledge, an increase in understanding of the universal interconnection of phenomena and regularities of micro- and macro worlds, the deep inseparability of ethical, spiritual, aesthetic and scientific problems [5].

The orientation in solving this problem can be the movement of the center of consciousness of pedagogical science to the boundary of the existential and reflexive layers, i.e. spiritual and material layers. Such location of the center of scientific consciousness, in the opinion of V. P. Zinchenko and E. B. Morgunov, will make both



layers equally durable, giving the being layer a reflexive coloring, reflective – the being. «Border consciousness ... fulfills not only the integrating function in relation to its layers, but it is also their focus, the place of their interaction as well as play, the point of the full consciousness of science, the point at which both layers meet at their greatest discrepancy» [6].

The solution of this worldview task at the macro social level will make it possible to solve the task of forming a new personality, having a fundamentally new view of the world, to his place in it.

Such tendencies towards the integrativity of universal knowledge, among other things, closely overlap with the traditions of national philosophical thought. V.S. Soloviev wrote: «The all-unity of human knowledge (sensory, rational, theological and even mystical) is both the starting point of its development, and the most complicated result to which leads a difficult and long way - the path from the primary gestalt through mediation by the entire human culture to the immediate and immeasurably richer image of the world and human in it» [7]. The ideas of V.S. Soloviev were developed by P. A. Florensky, N. A. Berdyaev, A.F. Losev, and others.

In the light of the foregoing, the concept of a «picture of the world» is the most promising for analyzing and constructing an integrated knowledge in the pedagogical process. Thus, E. L. Nosenko, relying on the idea which was expressed at the end of the life of A. N. Leontiev that the basic psychological category is the «image of the world» and that the person proceeds in his life from his image of the world that is the primary in relation to activity, speaking of a picture of the world, has in mind two images:

- 1) this some objectively existing meta-individual level, which characterizes this integration in the space of society;
- 2) the individual level, formed due to the processes of training and interiorization of the picture of the meta-individual level [8].

The author highlights the content (the ideal object) and the sign form in which this individual object is represented. Since the picture of the world pretends to create a holistic image of the world, it is its ideal object. In different world scenes, this holistic image is created in different ways, in particular due to such forms of awareness of reality as mythology and religion (regarded as pre-scientific forms), philosophy and science (scientific forms) and art (unscientific forms). In each of these independent spheres of social consciousness, the corresponding pictures of the world have been created: mythological, religious, philosophical, scientific, and artistic.

E. L. Nosenko believes that the goal of organized education is to lead a student into the world of experience (i. e. all forms of the world picture). In accordance with this, principles are formulated to ensure the integrity of the perception of the image of the world.

The first one is the principle of ensuring the integrity of the perception of the image of the world. There is one very strong argument in favor of this principle. It is evidence of the data of cognitive psychologists who argue that those who study are advisable to introduce into the circle of broad concepts relating to the object of cognition. These

concepts serve as a kind of «leading organizers», after mastering which are easier to perceive small details that deepen the understanding of the essence of the object.

The second principle is the presence of «lacunae» or «empty cells» in the world picture. It means that the integrity of the image of a particular picture of the world should not exceed the student's perception capabilities.

The third principle is the principle of concentricity in the assimilation of an integral picture of the world. The content of this principle is that the object of cognition must be preserved at different stages of learning, and the level of detail of the image and the level of abstractness of the interpretation of details should increase at subsequent levels of instruction.

The fourth principle is the principle of cumulative, according to which the picture of the world does not radically change in the process of its study, but only expands, deepens and refines.

The fifth principle is to ensure the contribution of different world pictures to the formation of its holistic image: practical (which is formed spontaneously and requires objectification), mythological, religious, artistic, general scientific and philosophical.

The sixth principle is the consideration of the cognitive possibilities of subjects of cognition of the world picture when choosing the categorical paradigms of the world-knowledge and the acts in which this process takes place.

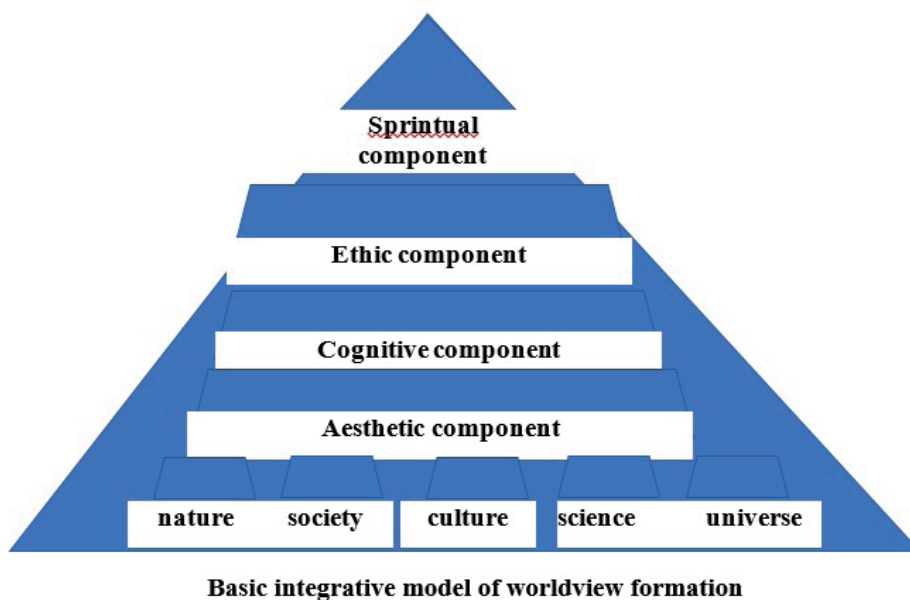
The seventh principle is the use during the training of universal conceptual and sensory categories of human consciousness that are used to create images of the world while providing and filling them in different ways and taking into account the features of their perception depending on the level of cognitive abilities of subjects of cognition.

However, we note that the task of forming integrated knowledge, in our opinion, is extremely topical and at the same time an insoluble task. The problem is that at the meta-individual level, the relationship of different world pictures cannot be linked up to now into a single whole [9]. Synthesis of these paintings is not even the subject of near future.

At the same time, at the level of preschool and primary school education, we can try to present the «torn world» as a single whole.

At the same time, it must be remembered that it is possible to talk about the unity of the world and the unity of the world's pictures only at the level of didactics, as a means of comprehensive development of the child. The integrative model of the formation of the worldview, which we propose, requires to this goal.

Proceeding from the universal demand for integrity, presented today to all forms of scientific theory and practice, we propose a basic integrative model of the worldview, which includes the cognitive, ethical, aesthetic and spiritual components, the general direction of which is the diversified development of the child's personality, the formation of the basis for an integral perception of the world picture, correct orientation in objective reality and successful activity in it.



At the same time, its content is not limited to the sum of certain information units, but implies laying the holistic basis of relations to the surrounding world, other people and oneself, identifying and supporting the tendencies of the child's personal growth, creating psychological prerequisites for coordinated development of his unique abilities and mastering the historical experience of humanity.

In addition, as well as the Basic component of preschool education, the integrative model guides teachers to unify the experience of senior preschool children and junior schoolchildren in the main fields of activity and ensure harmony between the physical, emotional, strong willed, moral, social and intellectual development of children.

The fundamental condition for the realization of the proposed model is the principle of unity of development, upbringing and education. Specific conditions for the implementation of the model are the following: Systemacy determines the structural organization of the model.

The model is a complex of interrelated components (cognitive, ethical, aesthetic and spiritual), which are organically interconnected, enriching and complementing each other. Formation of one component (for example, aesthetic) contributes to the development of others (cognitive, ethical and spiritual).

Humanism defines the objective function. The model of the formation of the world outlook is oriented toward the child's personal growth - the development of congruence; empathic understanding of other people, sincere respect and acceptance, and openness to new experiences [9].

**Conclusions.** Polimodality defines the didactic means of implementing the model. It provides for the impact in the process of education and upbringing on all sensory

modalities and, accordingly, the system of representation of the child's information, which increases the effectiveness of the didactic and educational impact on the child.

Age differentiation determines the content specificity of the implementation of the model. It presupposes the consideration of age-related opportunities for the formation of various components of the worldview; it is based on the principle of leading activity.

National specificity determines the specific nature of the implementation of the model. There is reliance on the diversity of Ukrainian cultural traditions and values.

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## **PHILOSOPHY AND THEOLOGY**

### **USING PROJECT MANAGEMENT IN THE FIELD OF EDUCATION**

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**Annotation.** *The research is the author's attempt to implement elements of project management into the field of education. The technology for writing qualification works by graduate students using SCRAM-methodology is presented.*

**Keywords:** *education, project management, SCRAM-technology, qualification work.*

The quality of educational services is a topical issue both for the subjects of education and for the subjects of all spheres of the national economy and business that are interested in qualified personnel. Many researchers deal with the quality of education and compliance of educational competencies with professional requirements. Thanks to the cooperation of educators and representatives of various structures, we have a single concept of the National Qualifications Framework, based on European and national educational standards and principles of quality assurance in education. In the national and European system of higher education, educational qualification levels are assigned through examining and writing qualification papers by graduate students. In this article, we consider it appropriate to focus on this important aspect – the process of writing and defending qualification papers. Qualification paper or diploma thesis is the quintessence of the acquired knowledge, skills and abilities of the student, as well as a demonstration of their analytical, organizational, leadership and communicative competencies.

The master's thesis testifies to the author's ability to solve specific research and applied problems, their ability to make an independent research or development, to use theoretical knowledge and practical skills acquired in the learning process [3].

The problem, in our opinion, is that most qualification papers (mostly in the Humanities) have no practical implementation and therefore do not have the appropriate educational, practical or scientific value. Students focus more on the complication of theoretical developments than on solving a real theoretical and practical problem. In addition, the process of organizing, writing and defending a qualification work is far from perfect. In most cases, the dialogue takes place only between the student and the supervising tutor of the diploma project, and the Board that accepts the defense is represented mainly by research and teaching staff. There is no partnership between all the stakeholders: students, tutors, experts, employers, etc.

The purpose of this study is to prove the feasibility of using project management, namely SCRAM-technology, to organize the writing and defense of qualification works.

In the Ukrainian system of higher education, each graduating department of a

university usually develops guidelines for writing a qualification work, including its content component, so graduate students have an excellent experience in delving into the issues of professional activity. In our opinion, using SCRAM-technology in this process will give the opportunity to get a really valuable or useful product – an analysis of a real problem with specific recommendations for its solution.

Each university has a relevant Regulation on the Qualification Work for higher education seekers developed based on:

- Law of Ukraine “On Education” dated 05.09.2017 No. 2145-VIII (as amended);
- Law of Ukraine “On Higher Education” dated 01.07.2014 No. 1556-VII (as amended);
- Resolution of the Cabinet of Ministers of Ukraine “On Approval of the National Qualifications Framework” dated 23.11.2011 No. 1341 (as amended by the Resolution of the Cabinet of Ministers of Ukraine dated 12.06.2019 No. 509);
- Resolution of the Cabinet of Ministers of Ukraine “On State-Recognized Documents on Higher Education (Scientific Degrees)” dated 31.03.2015 No. 193;
- Resolution of the Cabinet of Ministers of Ukraine “On Approval of Licensing Conditions for Educational Activities of Educational Institutions” dated 30.12.2015 No. 1187 (as amended);
- Standards of higher education;
- Regulations on the organization of the educational process;
- Regulations on the examination board for attestation of higher education seekers;
- DSTU 3008:2015 “Information and documentation. Reports in the field of science and technology. Structure and design rules”;
- DSTU 8302:2015 “Information and documentation. Bibliographic reference. General provisions and rules of compilation”;
- Regulations of the National Repository of Academic Texts (Order of the Ministry of Education and Science of Ukraine dated 04.07.2018 No. 707);

According to the above documents, Qualification work is a final work that gives an opportunity to identify the level of mastering of the theoretical and practical training by the student, their ability to apply knowledge in solving professionally oriented tasks, ability to perform scientific research on selected topics. The purpose of the qualification work is to determine the level of preparation of the student to solving a set of scientific and applied tasks within the generalized object of activity based on the application of a system of theoretical knowledge and practical skills acquired during the entire period of study [3].

Preparation of the qualification work must provide:

- systematization, consolidation, expansion and application of knowledge during the implementation of specific research and applied tasks;
- development of independent work skills;
- implementation of the ability to carry out their own analysis of the main categories of theoretical concepts on the selected topic;
- mastering the research methods in solving scientific and applied problems [3].

To fulfill the purpose of writing a qualification work, we consider it appropriate to turn to the Agile methodology as the main tool of project management, as the qualification work and the process of its writing is undoubtedly a study project.

Agile is a flexible approach to management that includes various methodologies (Scrum, Canban, XP). If we are precise in defining Agile, it is rather a management philosophy that summarizes different approaches that:

- Focus the team on customer needs;
- Simplify organizational structure and processes;
- Offer work in short cycles;
- Actively use feedback;
- Give more authority to employees;
- Are based on a humanistic approach;
- Is not a final state, but rather a way of thinking and acting [4].

This approach emerged in 2001 in the field of IT, where dynamics of the environment and rapidity of development and innovation reaches their peaks. And the main goal of any project team is to respond quickly to current needs, creating the best product. The general principles of the Agile approach are contained in the official Agile Manifesto Declaration. The following four values reflect the general philosophy of the method:

1. “People and interaction are more important than processes and tools.” According to the humanistic approach, the most valuable resource of any organization is people - employees. According to Agile, the most important thing is interaction between employees during which their individual potential develops, new ideas emerge and the collective result is strengthened.

2. “A working product is more important than detailed documents.” According to Agile technology, documentation takes a back seat so that approval procedures do not delay product development. Document flow and subordination in such structures is simplified as much as possible.

3. “Cooperation with the client is more important than agreeing on the terms of the contract.” One of the main achievements of Agile is the maximum approaching of the customer to the final product through constant cooperation between the team and the customer. The client is being informed, invited to meetings of the development team, they has the opportunity to test the product and give a feedback. Thus, all their requirements are taken into account and terms of the contract simply do not make sense.

4. “Readiness for change is more important than adhering to the original plan.” This Agile principle says us to create the best solution, product, result due to the adequate attitude to changes and adjustments during the work process. If our ideal initial plan does not work, or realities have changed and new needs have arisen, the project team must always be ready for change. To stay relevant, the team holds sessions once a week to discuss new customer requests and the possibility of implementing them in the product [1].

To implement these principles when writing a thesis, we turn to the SCRAM-methodology (flexible approach to the development of innovative products), which in turn is based on the following principles:

- Team work;
- The single goal to which all the work of the team is dedicated;
- Rhythm – planning what and how the team will do.

The most important element of the SCRAME methodology is the team, i.e. the working group that works on the project and demonstrates the best result of joint efforts. It is a complementary cross-functional team, whose members work in conditions of openness and mutual respect, generate bold ideas and decisions, are focused on a single goal and feel personal responsibility for the overall result. As practice shows (Google, Apple, IBM, Facebook), such teams are independent, creative and efficient.

That is why we believe that preparation of a diploma project should present collective work of such a team, consisting of:

SCRAME-master – a tutor, who is a profile expert on the issues of the diploma project. Their functions are to organize, motivate, inspect the work of the team and provide them with advice. The tutor should lead the introductory meeting of the team, convey the general idea and purpose, familiarize the team-members with the rules, set the overall rhythm of the group. Conduct control meetings (Sprint review meeting), provide individual and peer consulting sessions that the team might need in the course of work.

Developing – team members (4-10 persons). Students who have different knowledge, skills and competencies. Collective work in this context has the following benefits:

- formation of personal responsibility for the overall result;
- awareness of the processes of intragroup dynamics;
- strengthening the self-concept;
- development of communication skills;
- gaining new knowledge and experience through communication.

Product Owner – representative of the customer company. That is, it is a specialist from an external organization, within which the diploma project is written and whose task the team tries to solve. Involving such a specialist to the diploma project removes the problem of detachment of theory from practice and is a guarantee that students solve a real industrial or scientific problem when preparing a project, and the organization or institution will be able to use the results of such a work. The task of the company's representative is to have a set of requirements for the final product and to test the intermediate results of the team's work.

The main goal of the team is also the main goal of the thesis project; in SCRAME-methodology it is called Epic. The main goal must be divided into intermediate goals and a number of tasks that must be consistently performed to achieve the main goal. In the diploma project the main purpose, goals and objectives are specified in the plan of graduation work, intermediate goals and objectives correspond to the sections and divisions of the diploma project. The task of the team and its leader is to distribute the tasks and responsibilities for implementation among the members of the team, and perform them step-by-step, approaching the main goal.

Uniting of the team with the main goal is embodied in the Rhythm of the team.



That is, how exactly the team will work, how many general stages of work there will be, how often the team will meet to discuss their actions, how communication among the members will take place, to which extent Scram-masters and Product Owners will be involved to the process. As for the diploma project, it makes sense to divide it into 4 stages (sprints):

- preparation and writing of the methodological section;
- preparation and writing of the theoretical section;
- preparation and writing of the practical section;
- preparation for the defense of the diploma project.

The team works on each stage for an average of 2 weeks. Before the beginning of each 2-week stage, the team holds an introductory meeting, where it forms a list of tasks for the stage, and at the end of each stage – a meeting on the results achieved. All team members, together with the master and the representative of the external institution, must be present at both the initial and final meeting. The team every day holds internal 15-minute meetings, where team-members discuss their achievements and problems and adjust tasks.

This organization of work on the project allows maintaining a balance between freedom and responsibility, between independence and control. It gives the graduate students an opportunity to demonstrate self-organization, communication skills, teamwork and leadership and has a number of benefits:

- implementation of planning and timing skills;
- optimization of brainstorming skills;
- improvement of analytical skills;
- application of flexible methods of goal setting.

Diploma project leader also has the opportunity to evaluate the personal work and contribution of each team-member, as well as the overall efforts and results of the teamwork.

SCRAM-methodology, in our opinion, allows to comply with modern requirements for organization of the educational process and provides:

- transparency of processes;
- risk minimization;
- fast resolving of issues;
- efficiency;
- personal interest of each participant.

This technology is the implementation of Agile principles in action, where people, product, willingness to change and cooperation are much more important than bureaucratic documentation, long negotiations and plans. This is what modern higher education in Ukraine lacks so much. Thus, in the course of this small study, we concluded that the principles of flexible management, which are successfully used in many areas of business, are extremely relevant to the education system and can adapt to the realities of higher education, simplify and optimize learning processes.

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## THE SOUL IN THE CONTEXT OF THE ANTHROPOCENTRIC DOMINANCE OF THE UKRAINIAN CULTURAL WORLD

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**Annotation.** *The article explains the problem of the soul in the context of the ideals of holiness, humble wisdom, and hesychasm, which most clearly reveal the authentic anthropological principles of the Ukrainian cultural tradition. It shows that the universe of ancient and spiritual culture is a complex symbiosis of ideas that formed the basis of chronicles, written records, biographies, legends, stories, Apocrypha as well as Christian patristic and official literature.*

*It is claimed that the issue of the soul in the Ukrainian philosophical tradition is primarily related to the spread of Christianity and the reception of the religious heritage of Eastern Christian teachings in the context of knowledge of higher ideals. Authors proved that due to this the article is enriched with semantic intentions of religious and anthropological understanding of the soul and personality, and the verbal height of ethical and moral principles of personal education in its content is identical to metaphysical, which is properly expressed in the soul through the essence of the human heart. Appearing at the same time as a deep and high essence, the soul reveals itself in the guise of the heart, according to which the heart is the home of the soul, which signifies human essence. This was greatly facilitated by the practice of hesychasm, which was cultivated in the then monasteries, which became the centers of spiritual revival of Ukraine-Rus.*

*It is revealed that the phenomenon of the soul in the culture of the period of Kiev Rus is permeated with human-centered intentions, which became an essential expression of the experience of cultural and personal self-identification.*

**Keywords:** *soul, culture, spiritual culture, holiness, paternal tradition, 'humble wisdom', hesychasm.*

Modern humanities knowledge highlights the need to understand its own genesis and authenticity of cultural foundations, based on which builds socio-anthropological experience due to the rejection of mechanistic ideas about the world and the dominance of positivist-scientific imperatives, which is clearly traced to the twentieth century. The

tendency to integrate science, associated with human-centered intentions, which have become an important experience of cultural and personal self-identification, refers us to authentic cultural sources, and especially ancient cultural syncretism, which was a unique fusion of philosophical ideas, religion, literature, literature, literature, folklore, law and significantly influenced the formation of the anthropocentric dominant of the Ukrainian cultural world. The universe of ancient spiritual culture is a complex symbiosis of ideas that lay in its foundation. This content consists of chronicles, chronicles, biographies, legends, stories, words, Apocrypha, as well as Christian patristic and official literature – which contains important philosophers, whose development “was subject to the logic of the development of those forms of social consciousness in which these philosophers consisted” (Pustarnakov, 1988, p. 41).

The need for the reception of the soul is most clearly outlined in the meaningful life continuum of this cultural universe. It is underlined in investigations by S. Bondar, O. Vdovyna, V. Horskyi, Iu. Zavhorodnii, O. Kyrychok, I. Lysyi, V. Liubashchenko, T. Tselyk, T. Chaika etc. It is noteworthy that O. Marchenko considers the main criterion of the Ukrainian type of philosophizing, not the subject, but the subject of creativity, whose thinking is based on their own mental experience, so that “universal is understood not as an objectively impersonal reality, but fate...” (Marchenko, 2003, p. 6). In the work of V. Horskyi “Philosophical ideas in the culture of Kyiv Rus XI – early XII centuries”. Emphasis is placed on the spiritual vector of the human dimension, given by Christological theocentrism, as well as moral and ethical guidelines that formed a specific image of “practical philosophy” for Kyiv Rus, which nurtured the ideal of holiness and the ideal of humble wisdom, voiced by ancient scribes as “humble”.

Defining the inner spiritual priorities of man, Christianity actualized two plans of his existence, the first is related to the temporality and transience of earthly existence, and the second is with the desire for eternal and imperishable. Earthly existence is the embodiment of God’s providence and reconciles real and surreal causality, which marks the eternal struggle of good and evil, the bridgehead of which is the human soul, which combines all manifestations of its earthly essence with the highest plan of the Creator. Feeling his presence, man dissolved his ‘I’ in the higher being, which became a kind of cultural space, the author of which was God. That is why the written culture of Kyiv Rus, formed on the basis of the Christian Biblical-Alexandrian (V. Horskyi) spiritual tradition, realizes itself in an unnamed supra-individual guise. And researchers' dispute over the authorship of the “Word” still remains unresolved. However, this nameless writing did not displace the main thing - the human soul, which is an organic part of the ancient Rus cultural world, in which all nature: animals, trees, herbs, flowers not only are endowed with the ability to experience joy and fear, love and despair, but also to distinguish good and evil, and this already shows their involvement in the sacred. In the work, ‘Three Philosophical Reflections on “The Word of Igor’s March” by I. Zakhar, the main motive of the work is repentance, which organically entered the context of Christian anthropological culture as an important factor in purifying the soul. According to the researcher, the evidence that the repentance of Prince Igor is a deeply internal

conscious act is that he does not publicly “sprinkle his head with ashes” (Zakhara, 2012, p. 46), and after escaping from captivity he hurries to the temple of the Mother of God of Pirogoshch to apologize for the death of his fellow Rusychi, who “they put it on the belly, they put the soul from the body”, “throw the pearl soul from the brave body” (A Word About of Igor, Igor, Son of Sviatoslav, Grandson of Olga).

And despite the contradictory interpretations of the prince's worldview, this fact allows us to talk about his Christian beliefs, because repentance in the Christian tradition paves the way for humble wisdom, one of the most important spiritual virtues of man. After all, God “he himself opposes the insightful, but gives grace to the humble” (Celik, 2012), – this idea becomes a kind of leitmotif of the oratorical and preaching prose of Cyryl Turovskyi, who was called Zlatoust for his insightful eloquence. Having received the rank of the bishop of Turov, Cyryl worked diligently in the pastoral field. His sermons, parables, teachings, prayers-confessions testify to a deep understanding of Christian doctrine and strict adherence to the highest commandment of love. The parable nature of his works allows the author to appeal to allegorical images: “Every scribe, learn the kingdom of heaven, is like a householder’s husband...” (Celik, 2012). The allegory of the “householder’s husband” in ‘The Parable of the Human Soul and Body’, known as the “Parable of the Blind and Lame”, refers us to God, who is the master of all good and gives everyone the right to choose, for which they will have to take responsibility. According to the plot of the parable, the master hired a blind man and a lame man to guard his vineyard, and he promised to return soon. During that time, tempted by the aroma of the vineyard, they found an unusual way to deprive the owner of the harvest: The Blind man sat on the Lame man and broke the fragrant bunches, believing that the common natural weakness will remove any suspicion. However, the “Muz domovyty” exposed the conspiracy and punished the perpetrators with a fair trial. The ancient Rus interpretation of the images of the Blind and the Lame resembles the soul of the Blind and the body of the Lame. The soul rises considerably above the body, commanding it. Despite the fact that the soul often leads the body to sin, the body “is the throne of God” (Celik, 2012) and does not cease to be, and therefore the soul and the body must be jointly responsible for the sin that makes them flawed and because of which they pain and suffering. Cyryl Turovskyi calls the cause of sin “The fearlessness of God’s commandments and the baking of the body, the non-birth of one’s own soul” (Celik, 2012). The thought of the mental disharmony caused by sin appeals to the recognition of moral guilt and gives rise to repentant motives. The allegory of human infirmity allowed Kyryll Turovskyi to demonstrate the imperfections of the physical and mental nature of man, and in this connection to assert the need for contact with God as Creator, Thinker and Judge.

Note the breadth of the associative field of this parable, variants of which are 'Jewish – from the Babylonian Talmud, Arabic – from “Thousand and One Night’, and Western European - from “Gesta Romanorum” (Franco, 1982, p. 314–316).

It is important to emphasize that the explication of the mental and physical dimension in the book culture of Kyiv Rus is realized on a kind of sacred border, given

the invisible line between life and death, earthly and otherworldly, whose transgression marks deep emotional experiences. “What is a man, as if you remember? ”, – This statement from the Psalms sets the general tone of Vladimir Monomakh’s “Teachings”, which is permeated by the tragedy of the life situation caused by princely strife, as well as the feeling of imminent death either on the battlefield or from disease or simply from his own inevitable physical weakness. In "Instructions ('Testament') the author appears in two guises as a wise father and as a steadfast ruler, whose authority is sacralized. A word that cannot be disobeyed. The first thing the prince demands is to keep the purity of his faith, the flame of which must purify the soul that reveres God, that is why “First, for God and your soul, have the fear of God in your heart”, – calls the prince. Caring for his own soul which is struggling because it wants to overcome the mortal in life, the prince seeks to cleanse it with repentance, to be ready to stand at any moment before the formidable Judge (The Teachings of Monomakh). According to T. Tselik, in “Teachings” there are two sections of the semantics of the heart: one marks the way to join the greatness of the world, permeated by the wisdom of God's creation, and the second - is associated with personal experiences, pain during trials (Celik, 2012, p.158). Appealing to the work of St. Basil the Great, Vladimir Monomakh, who was baptized with the name of Basil, bases his teaching on understanding the humble wisdom of his spiritual patron (The Teachings of Monomakh. <http://www.monomah.vladimir.ru/pouchenie.htm>).

Ancient Rus writing saw in the heart an invisible world arranged according to spiritual laws, it could not be empty. If a person lost touch with God, the devil who brought death with him became the master of the heart. This is what happened to Sviatopolk Okayannyi who encroached on the lives of his younger brothers Boris and Hlib who became the first saints canonized by both the Rus and Constantinople Church. Occupying the prince's throne in Kyiv, Sviatopolk was afraid of the brothers' rivalry and sent assassins to meet them. Informed of Sviatopolk's treachery. Boris could have avoided the massacre, especially since the militiamen offered him to go to Kyiv. However, Boris immediately rejected this offer, “don't let me lay hands on my brother” (Legend and Passion and Praise of the Holy Martyr Boris and Hleb). The words of the prayer, uttered by the author of ‘Skazannia’ tell the depth of the mental suffering of Boris who at the time of his death comforts himself with the feat of martyrdom: “My heart is on fire, my soul is confusing and it’s not possible to whom to turn and to whom to extend this bitter sorrow? .... Yes, if my blood is shed and my murder is tormented, I will be a martyr to my Lord” (Legend and Passion and Praise of the Holy Martyr Boris and Hleb). Boris's heart was pierced with spears during his prayer in a tent on the banks of the Alta River on August 5, 1015.

Hlib's death prayer which asks God to have mercy on Sviatopolk is just as striking. “Brother and enemy, – Glib is turning to his future slaughter, – see the scourge of my heart and the ulcer of my soul” (Legend and Passion and Praise of the Holy Martyr Boris and Hleb). Like Cain, Sviatopolk whose heart was gripped by evil found no consolation in anything. He was not even saved by fleeing to Poland, and after his death,

according to chroniclers, an unbearable stench came out of his grave. Believing princes-sufferers became famous for the gift of healing. They were the first to show Rus a feat of great humility which overcame the evil of renunciation of blood feuds which was commonplace in the pagan world. For a long time in Rus, the princely strife was stopped.

The ideal of humble wisdom resonates with the semantic space of the "Collection of 1076" which is an important source of understanding the status of the soul in the Kyiv and Rus cultural dimensions. Humility before the Lord is proclaimed in him by the highest wisdom of the heart: "This is how the wisdom of the heart is tempered: the grub in Bogo's speech: the spirit is crushed, the heart is crushed and humble - God cannot be fooled" (Izbornik 1076, 2009, p. 549). Humble wisdom produces love from the whole heart and strength and mind to love God and gives strength to fight against sin and in the "Collection" indicates several ways of this struggle. Firstly, you need to protect the soul from the penetration of evil" (Izbornik 1076, 2009, p. 174), secondly, it is necessary to develop a constant readiness to resist evil, (Izbornik 1076, 2009, p. 322)]. Third, it is necessary "keep your heart from evil thoughts, collect your property in heaven" (Izbornik 1076, 2009, p.469) since the goal of every Christian is the salvation of the soul. The posthumous participation of the soul depends on how strong a person's faith is and to what extent the heart is able to resist evil thoughts: "Grief to the weakened heart, as if not to believe" (Izbornik 1076, 2009, p. 325).

Such a spiritual vector naturally follows from the general semantic outline of the text in which translations of excerpts from apologetic and patriarchal works, in particular, are organically interwoven such as Basil the Great, Athanasius of Alexandria, Justin the Philosopher, Macarius of Egypt, Maximus the Confessor, John of Damascus, Ioanna Listvychnyka, etc. "They form the ideal of a wise, bookish, kind, merciful man on the basis of doctrinal and anthropological principles" (Mozgovyi), whose soul is whole and not subject to decay, and the body, although it is animate flesh, can not avoid decay and destruction, because "Love your body more than your soul, you won't receive God's grace" (Izbornik 1076, 2009, p. 462). Therefore, one should avoid carnivorous thoughts that appear as filthy not only to the soul but also to the body itself, and remember that any consolation is accompanied by weeping, and the greatest loss is to lose eternal bliss because of the sin from which one must flee, "like a warrior who destroys your soul" (Izbornik 1076, 2009, p. 168). We emphasize that the heart is the container of the soul and is called as "ancient house" (Izbornik 1076, 2009, p. 496). And although the soul and the heart are inextricably linked, they still have some autonomy. "From the deepest heart" (Izbornik 1076, 2009, p. 26) one should pray to God for the salvation of the soul. To do this, the heart must be open and prepared by prayer and fasting. He opens the door of the human soul to God "fear of the Lord", which 'rejoice the heart and give joy and long years" (Izbornik 1076, 2009, p. 317) when her heart is sanctified by the divine presence. We emphasize that the "Collection", claiming the deification of human flesh, which is the container of the spirit as much as possible illustrates the spread in Rus of mystical insights of hesychasm.

According to H. Florovskiy, "Rus received baptism from Byzantium. And this

immediately determined its historical destiny, its cultural and historical path. This immediately included her in a defined and formed circle of connections and influences” (Florovsky, 1991, p. 4). It should be noted that the concept of Hesychasm means not only a specific way of existence of monasticism, which occurs in the late III - beginning IV century in Egypt, Palestine and Asia. It consists of complete isolation from the world for the creation of Jesus' prayer. It is not only peace and silence, and even more so not only the system of theological concepts - in the process of hesychia the possibility of unity with God is asserted during which the whole fullness of human integrity is transformed. This is largely a personal divine self-revelation, manifested in Palamism, a theological and religious movement that emerged in the 14th century as a result of Gregory Palamas' controversy with Barlaam, Akindin, and other religious opponents.

It is noteworthy that Palamism was a catalyst for a cultural upsurge in Byzantium in the 14th century which led I. Medvedev (Medvedev, 1997) to call it the Byzantine revival by analogy with the processes that took place in Western Europe, including Italy. Despite the fact that the basis of both the Byzantine and Western European Renaissance was permeated with the idea of man as the center of the world as the crown of creation, as a kind of microcosm that absorbed the universe, as it turned out, this was far from enough to put an equal sign on these planes. The controversy between H. Palamas and his opponents proved the absolute dissimilarity of their views, it clearly demonstrated “the clash of the Renaissance spirit with its inherent ideal of man, who asserts his autonomy from God and builds a life on earth with his own hands according to ancient Hellenism, with the Christian doctrine of man...” (Losev, 1993). According to O. Losev, these planes are opposite to the “last depth”, so it is impossible for them to reconcile. And that was the struggle for man. Western European humanists cherished the Renaissance ideal of man, elevated him to an unprecedented height of pride, and turned God into a purely abstract idea.

I must say that at the origins of European humanism were Francesco Petrarca and Boccaccio whose private tutors were the same Uniate scholar, author of treatises on logic and astronomy, brilliant orator Barlaam of Calabria, who was contemptuous of the Byzantine and Byzantine anti-Byzantine spirituality tried to prove the creation of the Favor light, considering it only a mental image, which is not energy, or the power of God, inseparable from God. His evidence was based on the laws of formal logic and far from the practice of spiritual life. Barlaam argued that according to church teaching, God is inaccessible and inaccessible to human senses, and therefore, if we recognize the Favorite Light not as an essence but as energy, it turns out that God is divisible.

To defend the truth, Gregory Palamas, together with the Athos ascetics, adopted the “Tomas of Mount Athos”, which was a refutation of the heresy of Barlaam, as a result of which Barlaam demanded an open ecclesiastical court. In May 1341, the Cathedral of Constantinople was held in the Church of St. Sophia where the heresy of Barlaam was condemned. The Council defended the position of Gregory Palamas that the Light of Favor is neither the essence of God nor the creature, but the fresh energy of the Divine essence, different from the essence itself, but inseparable from it, that in his energies



God presents himself not only to the individual but and the whole world. And although these energies are created and perceived by the senses, God himself is present in them, who descends to man as his creation, as a result of which man is completely transformed.

It is no coincidence that D. Makarov in the work “Anthropology and Cosmology of St. Gregory of Palamas” (Makarov, 2003, p. 471) writes that St. Gregory, practicing intelligent prayer, which is performed in the secret depths of human personality, felt the effect of special grace and the transformation and desire for divine light, which he preached, is a holistic and all-encompassing transformation, not only of the soul but also of the body, not only a transformation of the individual, but also in the long run – the enlightenment of the social, political, state whole. Therefore, the personal transformation of a person is able to initiate the transformation of other people and even the whole world. Note that the doctrine of hesychasm-Palamism precludes any mediation in the act of personal communication with the Creator.

Accordingly, “those who have decided to listen to themselves in the hesychia must return and keep the mind in the body, and especially in the inner body of the body, which we call the heart, “says Gregory Palamas” (Palamas, 2004, p. 47). And if a person resists sin and wants to receive the prize of the winner in this virtuous struggle or at least a pledge of virtue, he must put his mind inside the body and even deeper - deep into the heart, so you need to cultivate and protect your heart because it is “treasure intelligent ability of the soul and the main bodily weapon of reason” (Palamas, 2004, p. 47). According to G. Palamas, a person who has purified his heart and reconciled with God passes into a supernatural state of consciousness, in which the normal functioning of the mind and sensory organs atrophies. Instead, their place is taken by higher-level mental activity, which does not extinguish, but, on the contrary, reveals to the highest degree the personal potential of the Hesychast, who acquires the ability to see not in the senses or mind, but in a rationally incomprehensible way.

One cannot ignore the teachings of hesychasm about the three kinds of light sensory, intellectual, and spiritual. The first two types of light express belonging to the earthly: sensory light is perceived by the senses, and intellectual – by the mind, showing its ability to build logical constructions, proofs, mental operations, scientific intuition, and the theoretical dimensions of the world. However, they do not penetrate into the transcendent and do not break the boundaries of the gross materiality of the earth.

This role is performed by the divine uncreated light, which is the light of divine energies, through which man opens the immeasurable dimension of gnostic spaces and transforms his whole nature. This light deprives a person of spiritual blindness, as a result of which the heart sees through. Developing the mysticism of the heart, G. Palamas gives a philosophical and theological theoretical justification for one of the most important tenets of the Eastern Christian mentality – a high view of the heart in the spiritual, mental, and physical existence of man.

In the asceticism of hesychasm, the heart is the only existential-energetic center in which all the forces and aspirations of man, his feelings and thoughts, the subtlest movements of the soul and mind are gathered together. It must be said that hesychasm

places considerable emphasis on the ability of the heart to absorb and contain the divine light that the ascetic receives.

European humanism does not take into account the path of this feat. Moreover, man is guided by earthly ideas about God, and therefore his height remains unattainable, man measures the immeasurable by the measure of the comprehensible. There is a substitution that can only be seen in a spiritual light. And that is why the hesychastic practice of theosis is so important - the deification of man, which is a mystic of light.

The spread of hesychasm in Kyiv Rus was by rewriting the works of Basil the Great, Neil of Sinai, Diadoch of Photics, John the Baptist, Maximus the Confessor, and collections of works by Peter of Damascus, Simeon the Theologian testified to the culture of practical hesychasm. "Heart prayer", which appears as the only key to the mysticism of hesychasm, was practiced in monasteries. The Kyiv-Pecherskyi Monastery was primarily connected with the hesychastic movement in Ukraine, the founder of which St. Anthony arrived in Kyiv with the blessing of Mount Athos, bringing here the rules of Athos monastic life. The introduction of the Study Charter contributed to the spread of hesychastic practice of intelligent prayer, as evidenced by the message of Archimandrite Dositheus of Pechersk to the priest Pachomius, which speaks of the "Athos rule", Jesus' prayer and the practice of silence, which is strictly followed by monks (Nikolskyi, 1897, p. 141-144).

Conclusions. Christian austerity in the Ukrainian lands found fertile ground - monasteries began to be built here, the number of fraternities ready to test the highest degree of spiritual asceticism grew, book culture was nurtured, and contacts with Bulgarian and Athos monasticism were strengthened. The exploits of the monks were accompanied by heartfelt prayer and penitential weeping. Dositheus in the late twelfth century XIII century.

Thus, the Ukrainian cultural tradition traces the reception of the religious heritage of Eastern Christian teaching in the context of knowledge of higher ideals, so it is enriched by the semantic intentions of religious and anthropological understanding of the soul and personality. In this aspect, it should be noted that the verbal height of ethical and moral principles of personality education in its content is identical to metaphysical, which is properly expressed in the discovery of the soul through the essential basis of the human heart.

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## **MEDICINE AND PHISIOLOGY**

### **RESEARCH OF BIOMECHANICAL SYSTEM “DENTITION - SPLINT” RIGIDITY USING CAD/CAE METHOD OF MODELING**

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**Annotation.** *The objective of the study is to determine the optimal position of the splinting construction of the maxillary dentition in children at mixed occlusion depending on the formation of the root and dual directions of functional load of the teeth. The object of the study is three-dimensional computer models of the biomechanical system (BS) of the maxilla with a splinting system for dentition fixing. To meet the targets, models of tensely-deformed state (TDS) of the maxilla BS with splinting structures of the dentition have been made using CAD / CAE methods and computed tomography (CT) data.*

*Due to analysis of the results obtained, the qualitative characteristics of displacement and stress fields were established. Teeth having 70 % of unformed root are less capable of impact under the pressure of compression and bending. The system exhibits a greater resistance at 2.8 times to the compression of the Pzi than the bend of Pyi. The absence of contact contributes to the mobility of the system at 1.5 times.*

*The pathogenetic factors that influence the rigidity of the splint fixation on the injured teeth have been identified including a degree of root formation, the direction of the force impact, the position of the splint on the crown of the tooth, the presence of contact between adjacent teeth.*

**Keywords:** *teeth trauma, tooth injury, dental trauma, tensely-deformed state, biomechanical system, maxilla, final elements method, teeth, splinting construction.*

**Introduction.** The issue of making an option of a fixation method in case of dental traumatic injuries is still relevant at present, especially in children of different age [7, 13]. It is nearly impossible to study and assess fixation rigidity of splinting structures of the injured teeth conducting primal full-scale experiments in children. Clinical evaluation used for this objective is not enough to determine fixation period and the conditions that make it less strong. Therefore, the method of mathematical modeling based on the fundamental principles of the mechanics of a solid deformed body enables to reproduce the mechanical “behavior” of the “dentition-splint” system with high precision; besides that, it allows to define the conditions affecting the rigidity degree applying computer technology. Currently, computer modeling combined with experimental methods of

studying tensely-deformed state of biomechanical systems are the most informational sophisticated tools for both planning surgical operations as well as identification of an opportunity and the way to apply fixing devices [6, 11].

The Final Element Method (FEM) is well adapted to the complex geometry of the maxillofacial tissues. Its first use in the field of dentistry was conducted by Thresher and Saito, 1973 [12]; Takahashi et al., 1980; Moss et al., 1985; Kawasaki et al., 1987. They were mostly concerned with orthopedic dentistry [8-10]

To plan surgical interventions in the area of the middle zone of the face, a standardized reproducible loading pattern of the upper dentition has been developed; it adequately reflects the pressure of the lower teeth onto the upper ones in the central occlusion and can be used to make computer simulation models [1, 3, 11]. These studies were carried out using data of computed tomography of adults and reproduced models of the biomechanical system of the formed dento maxillary appliances [3, 6, 14]. As for the age aspect, there are no such studies.

The objective of the study is to determine the optimal position of the splinting construction of maxillary dentition of a child at mixed occlusion depending on the root formation and dual directions of functional load of the teeth.

**Materials and methods.** The object of the study is three-dimensional computer models of the biomechanical system (BS) of the maxilla with a splinting system for dentition fixing. To meet the targets, models of tensely-deformed state (TDS) of the maxilla BS with splinting structures of the dentition have been made; the methodology and algorithm of imitational mathematical modeling of the BS TDS methods have been used by means of CAD/ CAE and computed tomography (CT) data.

Reproduction of the dimensional geometry of the biological object of the maxilla with teeth was carried out using a CT scan data of a 12-year-old child.

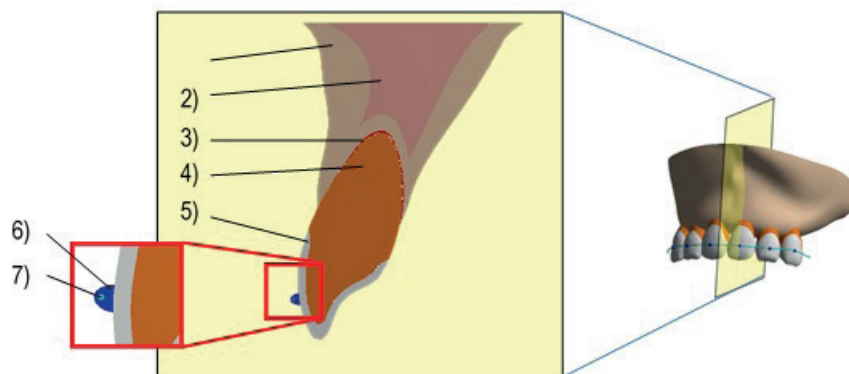
The porous, heterogeneous structure of bone tissue has been approximated by cortical and spongy layers; for dental models, layers of enamel, dentine and periodontal ligament have been distinguished obtained from CT images in accordance with Hounsfield values [13].

Reproduction of a three-dimensional solid model of the maxilla with teeth and a splint has been made in the CAD package CATIA.

The assessment of the results' adequacy of computed mathematical modeling of the tensely-deformed state of biomechanical systems was carried out by checking the completeness and correctness of the input data of a discrete model, the correlation of calculated forces, tension and deformation with empirical and literature data [2].

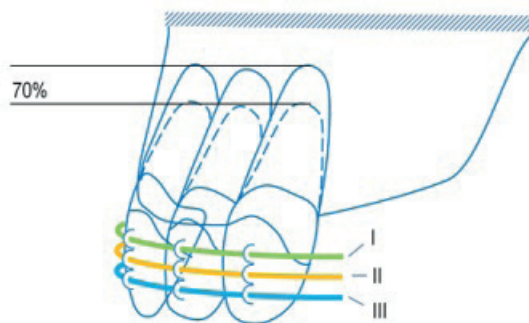
According to the terms of the problem, the load models were represented by vectors of unit forces as well as the qualitative characteristics of displacement and stress fields were established.

Research results. Within the set task, the geometry of the maxilla of a healthy child with a symmetrical arrangement of 13,12,11,21,22,23 teeth has been simulated (Fig. 1).



**Fig. 1. Solid-state computer biomechanical model of the maxilla with the splinting construction of dentition 1) cortical bone; 2) spongy bone; 3) periodontal ligament; 4) dentin; 5) enamel; 6) glue; 7) steel wire.**

Three cases of the splint arrangement on the teeth were simulated - the crown of the tooth was conventionally divided into three equal parts in height. The position of the splint in the upper third of the crown (closer to the neck of the tooth) was taken as the I-st, the position of the splint in the middle of the crown of the tooth (corresponding to the equator) was taken as the II-nd;). The root length was determined as 100 % in completely formed teeth and 70 % in the teeth with incomplete formation of the root (permanent teeth), or (in temporary teeth) where physiological resorption has begun (Fig. 2).

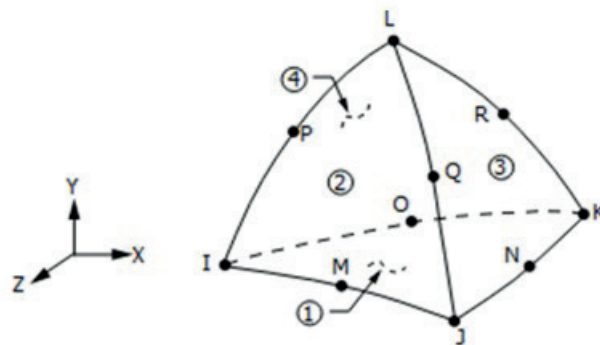


**Fig. 2. Schematic representation of the studied parameters of the biomechanical system model of the maxilla with three options for the arrangement of splinting structures (I – top, II – middle, III – bottom) and two options for the length of the dental roots (100 % and 70 %).**

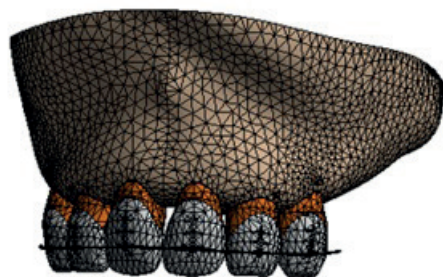
Each biomechanical model of the maxilla with the splinting structures of the dentition was a collection of 27 structural elements (Fig. 2), for which rigid contact conditions for adjacent bodies were formed in the CAS software package ANSYS Workbench in

semi-automatic mode. To study the influence of contact conditions between the teeth on the rigidity of the biomechanical system, models with contact and without it between adjacent teeth were additionally created.

For all biomechanical systems, final element sampling was carried out in semi-automatic mode using contact and 10 node pyramidal 3D SOLID187 final elements (Fig. 3).



**Fig.3. The schematization of the 10-node CE SOLID 187 high order 3D, which is used to simulate irregular grids [15].**



**Fig.4. Three-dimensional final element model of the biomechanical system of the maxilla with the splinting construction of dentition (NN: 165418, NE: 78752)**

On the average, each final element model accounted for 165,418 nodes and 78,752 pyramidal final elements (Fig. 4).

The isotropic mechanical properties of materials of structural elements of the biomechanical system obtained according to literature data [4, 5] are presented in Table 1, where the elastic modulus of the first type (tensile modulus) is a physical quantity that characterizes the elastic properties of isotropic substances. Elastic modulus under stretching is the ratio of the normal stress to the corresponding linear strain over the linear stress state to the proportional line. Poisson's ratio is the ratio of the relative transverse deformation to the relative longitudinal deformation that characterizes the

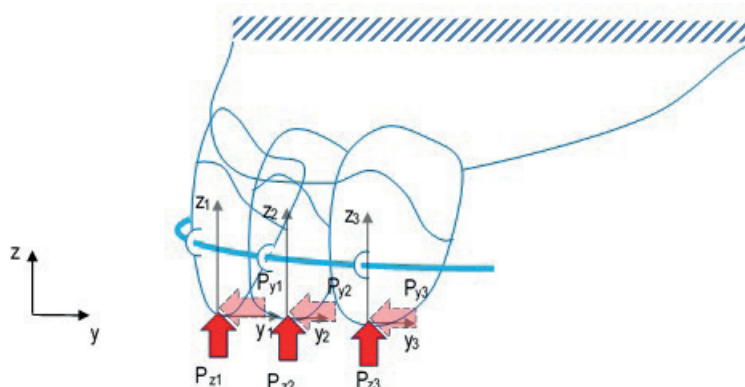
elastic properties of the material.

Table 1

**Models of materials of the biomechanical system of the maxilla with the splinting construction of the dentition**

Material name	Elastic modulus E, MPa	Poisson's ratio $\nu$
Cortical bone	10000	0.25
Spongy bone	1000	0.3
Periodontium	35	0.47
Dentine	18000	0.28
Enamel	43400	0.3
Splint	193000	0.31
Glue	4250	0.3

In this study, two extreme physiologically possible variants of the directions of functional force loading of teeth have been reviewed for models of biomechanical systems of the maxilla with splinting constructions of the dentition. The direction of the force vectors' action has been determined by six local coordinate systems located on the corresponding parts of the teeth. The loads are represented by "compressing"  $P_{zi}$  and "bending"  $P_{yi}$  force vectors (Fig. 5).



**Fig.5. Load patterns of the biomechanical system of the maxilla with splinting construction of the dentition.**

For this study, the total bite force was taken as 1. The load models were characterized by relative values of the efforts calculated using Agapov's weights coefficient presented in Table 2.

Totally, 24 models with a combination of parameters were made and investigated: the lengths of dental roots 100 % and 70 %, 3 variants of splint arrangement, 2 variants of contact conditions between the teeth and the vectors for compression and bending loads.



Table 2

**Distribution of efforts onto the teeth**

Tooth number	Agapov's weights coefficient	Coefficient of effort onto the tooth
1	2	0.08
2	1	0.04
3	3	0.12

The results of experiments' calculations of the maximum values of movements of completely formed teeth models concerning the compression and bend have shown the dependence of the splint fixation rigidity on these factors (Table 3).

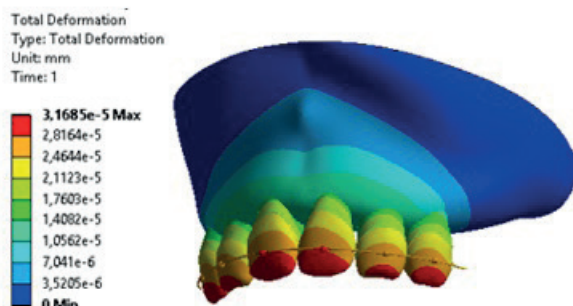
Table 3

**The maximum values of the movements of the biomechanical system "dentition splint" models having completely formed dental roots under load on the list (Pzi) and in the bending (Pyi).**

Position of the splint	Maximum values of teeth movements $u$ , mm * $10^{-5}$			
	Load $P_{zi}$ (compression)		Load $P_{yi}$ (bend)	
	With Contact	Without contact	With Contact	Without contact
I - upper	3.1685	4.8204	8.9006	10.7930
II – middle	3.1693	4.8291	8.8974	10.7890
III - lower	3.1697	4.8346	8.8941	10.7850

In case of compression load (Pzi) the level of overlapping splint structure on the crown of the injured tooth having the full length of the root in case of the contact between adjacent teeth almost does not affect the alteration of the maximum value of displacement fields: I – upper position of the splint –  $3.1685 \times 10^{-5}$  mm, II – middle position –  $3.1693 \times 10^{-5}$  mm, III – lower position of the splint –  $3.1697 \times 10^{-5}$  mm. Providing that there is no contact between the adjacent teeth under the compression load (Pzi), the mobility of the system increases: in the upper position of the splint –  $4.8204 \times 10^{-5}$  mm, average –  $4.8291 \times 10^{-5}$  mm and in the lower –  $4.8346 \times 10^{-5}$  mm. In the case of bending load (Pyi) the maximum values of displacements of teeth having full root length are the smallest on condition of contact between adjacent teeth when applying the splint in the lower position of the tooth crown –  $8.8941 \times 10^{-5}$  mm, and it gets increased at medium –  $8.8974 \times 10^{-5}$  mm and upper positions –  $8.9006 \times 10^{-5}$  mm (Fig. 6).

If there is no contact between the adjacent teeth, the indicators gradually increase from the lower position of the splint –  $10.7850 \times 10^{-5}$  mm, to the middle –  $10.7890 \times 10^{-5}$  mm and the upper one –  $10.7930 \times 10^{-5}$  mm when to act on the bend (Pyi).



**Fig.6. Fields of movements' distribution of the biomechanical system of the maxilla with splinting structures of the dentition in compressive  $P_{zi}$  load, lower position of the splint and 100% length of the root of the tooth.**

The results of calculations of the maximum displacements of dental models that have 70 % of formed roots have shown the dependence of the rigidity of the splint fixation on the contacts between the teeth, the action of compressive and bending load vectors and 3 levels of splint positioning on dental crowns (Table 4).

*Table 4*

**The maximum values of the models' displacements of the biomechanical system of the maxilla with teeth having 70 % of formed roots and the splinting construction in compression load ( $P_{zi}$ ) and the bend ( $P_{yi}$ ).**

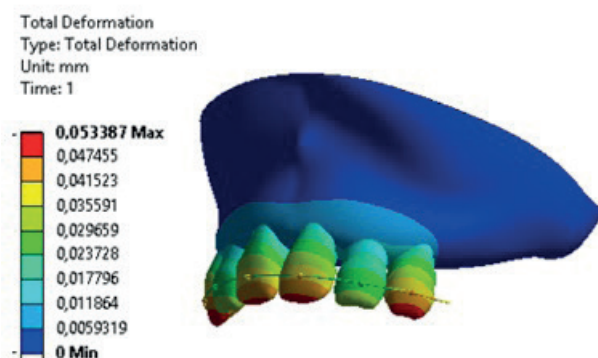
Position of the splint	Maximum values of teeth movements $u$ , $\text{mm} \cdot 10^{-5}$			
	Load $P_{zi}$ (compression)		Load $P_{yi}$ (bend)	
	With Contact	Without contact	With Contact	Without contact
I - upper	3.6611	5.7631	10.5830	13.3470
II – middle	3.6598	5.7728	10.5770	13.3430
III - lower	3.6579	5.7914	10.5720	13.3390

When fixing teeth with an unformed root (70 % of the length) and the existing contacts between adjacent teeth, the reduction of the maximum value of displacement fields under compression load ( $P_{zi}$ ) is from  $3.6611 \times 10^{-5}$  mm at the top position of the splint to  $3.6598 \times 10^{-5}$  mm – middle and  $3.6579 \times 10^{-5}$  mm at the bottom. The lack of contact between adjacent teeth adds mobility to the system: in the upper position of the splint –  $5.7631 \times 10^{-5}$  mm, the middle –  $5.7728 \times 10^{-5}$  mm, in the lower –  $5.7914 \times 10^{-5}$  mm. Teeth with an unformed root (70 % of the length) and the existing contacts between adjacent teeth, show less capacity under the influence of the load in the bending ( $P_{yi}$ ). Thus, the maximum values of tooth movements when applying the splint in the lower position of the injured tooth constitute  $10.5720 \times 10^{-5}$  mm, the average –  $10.5770 \times 10^{-5}$  mm, and

in the upper position –  $10.5830 \times 10^{-5}$  mm. The lack of contact between adjacent teeth reduces the stability of the system: from the lower position of the splint –  $13.3390 \times 10^{-5}$  mm, to the middle –  $13.3430 \times 10^{-5}$  mm and the upper one –  $3.3470 \times 10^{-5}$  mm.

A combination of parameters was determined due to experimental calculations of the maximum displacements of the biomechanical system modules of the maxilla with the splint structure of the dentition under compressive ( $P_{zi}$ ) and bending ( $P_{yi}$ ) load, at which the system showed the least stability. This is a biomechanical system with a geometry model of 70 % of the tooth root length, without contact between adjacent teeth and in case of the bending load vector  $P_{yi}$ . To define the limit values of the indicated most unstable BS, the modeling of the tensely-deformed state was made with the indicators of the functional values of the loads onto the teeth, based on  $P_{\Sigma} = 800$  N for the entire jaw.

The results obtained have shown that in such conditions the largest total deformation occurs in the lower third of the crowns of central incisors and canines –  $5338.7 \times 10^{-5}$  mm, the smallest – in the middle part of the crowns of lateral incisors and cervical areas of central incisors and canines –  $2372.8 \times 10^{-5}$  mm (Fig.7).



**Fig.7. Distribution fields of the biomechanical system displacements of the maxilla with a splint construction of dentition in the bending  $P_y$  loading, lower position of the splint and 70 % of dental root length, under the action of functional loads.**

**Discussion.** Maximum values of teeth displacement are presented in very small absolute numbers-thousands shares of millimeters. Such numbers are not essential in themselves, they are important as a material to detect and analyze behavior patterns of the biological system while making a mathematical modeling of the tensely-deformed state depending on the input data and the application of the unit effort vector. That is, having revealed this pattern we can calculate the stability rate of fixation system of the injured teeth in this or that clinical case dependently on the area of splint application on the dental crown taking into account physiological masticatory load made onto it and the length of the root.

The rigidity analysis of the splinting construction depending on its application

extent on the crown of the injured tooth having complete length of the root as well as a contact between the adjacent teeth, provided that there is (Pzi) compression load has shown that the system is more steady if to apply a splint on to the upper third of the crown: compared to the mid position by  $0.0008 \times 10^{-5}$  mm and the lower one by  $0,0012 \times 10^{-5}$  mm. The mobility of the biological system enhances at 1.5 times in the case of no contact between the adjacent teeth under the load made in compression (Pzi). The steadiest indices were obtained at the top position of the splint: in comparison with the mid position by  $0.0087 \times 10^{-5}$  mm and the lower one by  $0,0142 \times 10^{-5}$  mm. If to compare the system with evident contacts between the teeth, maximum values of displacement is greater: at the top position of the splint by  $1.6519 \times 10^{-5}$  mm, in the middle – by  $1,6598 \times 10^{-5}$  mm and in the lower one – by  $1.6649 \times 10^{-5}$  mm.

Under the pressure made in the bend (Pyi), the maximum values of teeth displacement while applying the splint into the lower position of the injured tooth with complete length of the root and provided that there are aproximal contacts are less by  $0.0033 \times 10^{-5}$  mm than in case of the splint positioning in the middle of the crown by  $0.0065 \times 10^{-5}$  mm – at the neck of the tooth, therefore, the system is more stable if the splint is fixed in the area of the lower third of the dental crown. Such alteration pattern of maximum values of teeth displacement fields under the pressure made in the bend (Pyi) has been noted in case of having no contact between the adjacent teeth if to apply the splint in the lower position: by  $0.004 \times 10^{-5}$  mm less than in the position of the splint in the middle of the crown and by  $0.008 \times 10^{-5}$  mm – at the neck of the tooth, that is the system is more steady in the lower positioning of the splint. The absence of contacts between the adjacent teeth under the pressure applied in the bend (Pyi) provides more mobility to the system on the average of 1.21 times independently on the extent of the splint application.

Comparative analysis of maximum values' indices of dental displacement of biomechanical system having the complete lenth of the root depending on the type of load made onto the injured tooth has demonstrated that BS identifies higher resistant capability in compression (Pzi), than in the bending (Pyi) on the average at 2.8 times. In case of the contact between the adjacent teeth, this ratio constitutes as 1:3 on the average. Provided that there is no contact between the adjacent teeth this index decreases up to 1:2.2. It indicates that the system's steadiness lowers under compressive force (Pzi) if aproximal contacts are absent.

It has been found out that the system becomes more stable while applying the splinting construction in the area of dental crowns' equator in case of pressure made in compression (Pzi) and in the bending (Pyi) on the crown of the injured tooth having complete length of the root as well as in the presence or absence of contacts between the adjacent teeth.

While fixing teeth having an unformed root (70 % of length) and evident contacts between the adjacent teeth, higher stability of systems has been detected if to apply the splint onto the lower third of the crown: compared to the mid position by  $0.0019 \times 10^{-5}$  mm, and the upper one -by  $0.0032 \times 10^{-5}$  mm. Under the pressure made in compression (Pzi) absence of contact between the adjacent teeth adds some mobility to the system at

1,6 times on the average. Furthermore, mobility of the splinting construction increases from upside down: the difference of maximum values of displacement between the upper and middle positioning of the splint is  $0,0097 \times 10^{-5}$  mm, the upper and lower one-  $0,0283 \times 10^{-5}$  mm. Compared to the system with evident contacts between the teeth maximum values displacement is bigger: at the top position of the splint by  $2.102 \times 10^{-5}$  mm, the middle one – by  $2.113 \times 10^{-5}$  mm, and in the lower position – by  $2.1335 \times 10^{-5}$  mm.

The tendency towards the decrease of resistance capability under the pressure made in the bending ( $P_{yi}$ ) is kept even in teeth with an unformed root (70 % of the length) and in case of presence or absence of the contact between the adjacent teeth. Consequently, provided that there is contact, the system gets the most steady while applying the splinting construction in the lower third of the crown: in relation to the middle position by  $0.005 \times 10^{-5}$  mm, and the upper one – by  $0.011 \times 10^{-5}$  mm. The comparison of the influence of the efforts' vectors in compression ( $P_{zi}$ ) and in the bending ( $P_{yi}$ ) has revealed that the maximum values rise of the fields of dental displacement occurs under pressure made in the bend ( $P_{yi}$ ): in the upper position of the splint by  $6.9219 \times 10^{-5}$  mm, in the mid one – by  $6.9172 \times 10^{-5}$  mm, and the lower position – by  $6.9141 \times 10^{-5}$  mm. So, under these conditions, the system is more stable if to apply the splint in the area of the cutting edge of the dental crown. If there is no contact between the teeth, it adds mobility to the system at 1.276 times on the average in contrast to the presence of contacts: at the top position – by  $2.764 \times 10^{-5}$  mm, the mid one – by  $2.766 \times 10^{-5}$  mm and its lower position – by  $2.767 \times 10^{-5}$  mm. Its highest stability the system shows in the lower position of the splint: in relation to the mid position by  $0.004 \times 10^{-5}$  mm, and the upper one – by  $0.008 \times 10^{-5}$  mm.

Under the conditions of teeth fixation having an unformed tooth (70 % of the length) depending on the type of load, the indices' analysis of maximum values displacement has confirmed that the system demonstrates its higher resistance capability in compression ( $P_{zi}$ ) than in the bending ( $P_{yi}$ ) almost at 3 times. Having a contact between the adjacent teeth, the ratio of displacements under the action in compression ( $P_{zi}$ ) and bend ( $P_{yi}$ ) is 1:2.8, while in case of contacts' absence, it constitutes 1:2.3. Correlations of compression ( $P_{zi}$ ) to bend ( $P_{yi}$ ) is similar both in the teeth possessing complete length of the root as well as formed roots up to 70% of the length.

It has been identified that the system gets the highest steadiness when applying the splinting construction in the lower third of the crown under the pressure made in compression ( $P_{zi}$ ) and in bending ( $P_{yi}$ ) of the injured tooth crown with 70 % of the root length, formed or resorption tooth to 1/3 and the presence of contacts between the adjacent teeth. The system is more stable while fixing the splint in the area of the dental crown middle provided that there are no approximal contacts.

Teeth with an unformed root in contrast to formed one demonstrate less resistance capability under the influence of load in compression ( $P_{zi}$ ) both if there are contacts – at 1.15 times as well as they are absent – at 1.19 times. Under the pressure made in compression ( $P_{yi}$ ), the same tendency has been noticed: in evident contacts between the adjacent teeth – at 1.18 times, and in case of no contact – at 1.23 times.

It has been established that tension occurring in structural elements of the

biomechanical system does not exceed bounded values, that is, they have no threat to the integrity of osseous tissue and dental structures in accordance with the data of the tensely-deformed state (TDS) modeling, the most unsteady BS with a geometric model of 70 % of the dental root length, having no contact between the adjacent teeth and under the action of the bending vector  $P_y$ , in functional load.

**Conclusions.** Computed modeling of the biomechanical system of the maxilla with the splinting construction of dentition enables to investigate in details the effect and significance of geometric parameters as well as the conditions of loads on the tensely-deformed state and rigidity of the biomechanical system.

1. Pathogenetic factors which affect the rigidity of the splint fixation on the injured teeth have been determined. They include:

- the degree of root formation (teeth with an unformed root by 70 % are less resistant under the pressure made in compression and in bend);
- the direction of the force impact (the system shows higher resistance in compression  $P_{zi}$ , than in the bending  $P_{yi}$  at 2.8 times);
- the presence of contact between the adjacent teeth (absence of contact adds mobility to the system at 1.5 times);
- the rate of the splinting construction application.

2. The rate of the splinting construction application is identified in the area of equator of dental crowns under the pressure made in compression ( $P_{zi}$ ) and in bend ( $P_{yi}$ ) on the crown of the injured tooth with complete length of the root as well as the presence or absence of contacts between the adjacent teeth. In case of roots formation by 70 % of the length and evident contacts between the adjacent teeth, the rate of the splinting construction application are observed in the lower third of the crown, if there is no contact between the adjacent teeth, the system is more stable in the middle positioning of the splint.

3. It has been determined that there is no critical overload threat to the structure of the tooth under the physiological load onto the “dentition-splint” system that could result in the impairment of its integrity.

**Conflict of interest.** All the authors declare that they have no conflict of interest.

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## FOUNDATION FOR PREVENTION OF PORT-SITE HERNIAS AFTER LAPAROSCOPIC CHOLECYSTECTOMY

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**Annotation.** *The results of treatment of 56 patients aged 30 to 75 years ( $56.2 \pm 1.5$ ) with acute calculous cholecystitis after laparoscopic cholecystectomy were analyzed. In all patients diastasis of the rectus abdominal muscles was observed for a width of 2 to 3 cm. Depending on the method of sewing port-site wounds, patients were divided into 2 groups. Group I - 29 patients, who performed stitching wounds without rectification of direct muscle diastase, Group II - 27 patients, who used the procedure developed by us. A morphological study of the musculo-aponeurotic tissues of the paraumbilical area was performed in 80 patients aged 30 to 75 years ( $57.2 \pm 1.2$ ). Patients were divided into 3 groups. I group consisted of 30 patients who underwent the study during laparoscopic cholecystectomy. Group II consisted of 30 patients with port-site hernias of the paraumbilical area after laparoscopic cholecystectomy. Group III (comparisons) were 20 patients who underwent upper-median laparotomy. After 48 months in group I patients, hernias were observed in 7 (24.1%). Among the patients of group II who underwent the operation developed by us, port-site hernias were not observed. When morphological examination was carried out, 21 (70%) patients of group I, who had diastasis of rectus muscles measuring 2 to 3 cm in the paraumbilical area, were found to have moderately expressed muscle and aponeurosis atrophy. Patients of group II with port-site hernias of the abdomen expressed atrophy of muscles and aponeurosis, an increase in the area of connective tissue, uneven distribution of collagen fibers, lysis sites of collagen fibers, and foci of lipomatosis. Among the patients of group III (comparison), with diastase of the rectus muscles of the paraumbilical area, moderately pronounced aponeurosis and muscle atrophy was observed.*

**Keywords:** *diastasis direct muscle, atrophy of muscle-aponeurotic tissue, port-site hernias, laparoscopic cholecystectomy, prevention of port-site hernias.*

**Introduction.** Trocar hernias account for 3.4–6.7% of the total incidence of abdominal hernias [2, 5, 8]. Factors contributing to trocar hernias can be divided into the general (common to all hernias) and specific (unique to trocar hernias) [3, 4, 10]. The general ones include: age, gender, overweight, functional connective tissue deficiency, infection at the surgical site, early physical activity, comorbidities, and increased intra-abdominal pressure [6, 7, 9, 13]. Specific factors for the access and surgery features include: trocar size and shape, trocars positioning, wound expansion for tissue extraction, method of insertion into the abdominal space, method of the wound suturing, insufficient relaxation of the anterior abdominal wall muscles at the time of trocar extraction [11, 12, 14]. Trocar hernias occur in 0.23% of cases at the 10 mm port site, in 1.9% of cases at the 12 mm port site and in 6.3% of cases at the 20 mm port site. These figures increase markedly up to 12% for obese patients with a body mass index of more than 30 kg/m<sup>2</sup>.

The incidence of paraumbilical hernia after laparoscopic cholecystectomy is



4.6-14.1%. This is due to the fact that in most cases (25-30%) there is diastasis recti abdominis (DRA) in this paraumbilical region of abdominal wall which is not eliminated when stitching a trocar wound and becomes the cause of trocar hernia.

The main pathogenetic link in the trocar hernias occurrence at the paraumbilical region after laparoscopic cholecystectomy is the DRA which is observed in 70% of patients and accompanied by a thinning of aponeurosis of this region, moderate atrophy of aponeurosis, recti abdominis which increases after 10 mm trocar installation.

Study object. Justification and development of prophylaxis ways to prevent trocar hernias of the paraumbilical region during laparoscopic cholecystectomy by the studying the morphological state of aponeurosis and the muscles of the paraumbilical region.

**Materials and methods.** The treatment results of 56 patients aged 30 to 75 years ( $56.2 \pm 1.5$ ) with acute calculous cholecystitis after laparoscopic cholecystectomy were analyzed. DRA have been observed in all patients to a width of 2-3 cm. There were 38 (67.9%) women and 18 (32.1%) men. Depending on the method of the trocar wound stitching after laparoscopic cholecystectomy, the patients were divided into 2 groups. The Ist group consisted of 29 patients who underwent trocar wound suturing after laparoscopic cholecystectomy without DRA elimination. The IInd group consisted of 27 patients treated with the surgery we designed [1]. Preperitoneal space was mobilized above and below the trocar wound to the DRA width, a polypropylene mesh of appropriate sizes was placed preperitoneally and fixed to the muscular aponeurotic tissues. The edges of the trocar wound were sutured over the mesh.

The postoperative management of patients in groups I and II was conventional one and did not differ each other. The results of surgical treatment have been assessed in 6, 12, 24 and 48 months. In addition to examination, abdominal ultrasound investigation was performed.

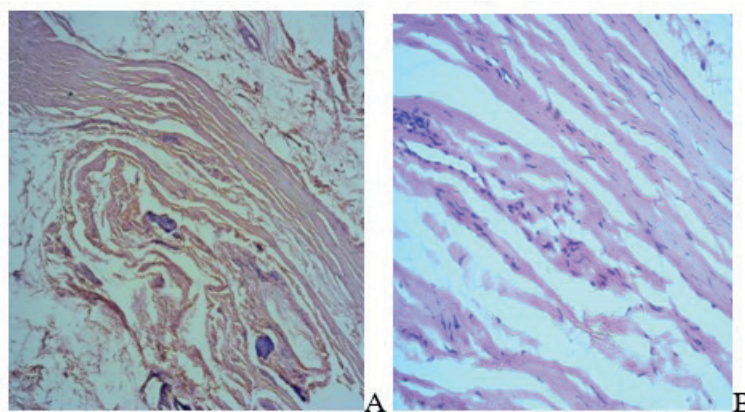
To justify the prophylaxis of trocar hernias of the paraumbilical region, a morphological study of the muscular-aponeurotic tissues of mentioned region was performed in 80 patients aged 30 to 75 years ( $57.2 \pm 1.2$ ), there were 56 women (70%), 24 men (30%). The patients were divided into 3 groups. The first group consisted of 30 patients who were examined during laparoscopic cholecystectomy. Among them, 21 (70%) had the DRA of paraumbilical region, 2-3 cm in size. The second group consisted of 30 patients with paraumbilical trocar hernias after laparoscopic cholecystectomy. The third group (comparison group) consisted of 20 patients who underwent upper-median laparotomy for perforative gastric and duodenal ulcer (6), acute adhesive obstruction (9) and other acute abdominal diseases (5). All patients were diagnosed with 2-3 cm DRA of the paraumbilical region.

**Results and discussion.** After 48 months among 29 patients of group I whom surgical wounds were stitched without DRA elimination hernias were observed in 7 (24.1%). Among the 27 patients of group II who underwent our surgery for trocar hernias prophylaxis, no hernias were observed.

The following results were obtained in the course of morphological examination.

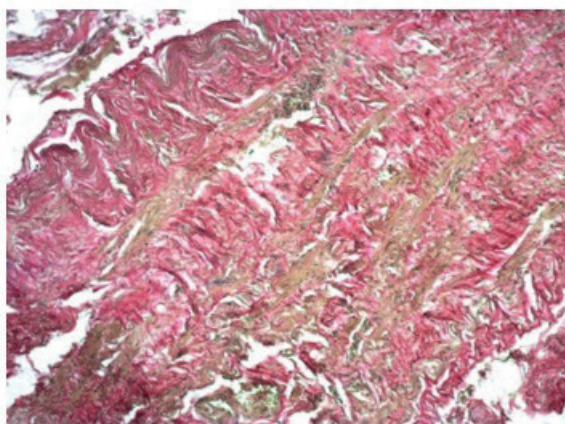
Among the 30 patients of the Ist group whom the sampling has been performed

during laparoscopic cholecystectomy, 9 (30%) had a normal muscle and aponeurosis structure (Fig. 1).



**Fig. 1. Aponeurosis of the paraumbilical region. Hematoxylin & eosin staining. Magn.  $\times 50$  (A),  $\times 100$  (B).**

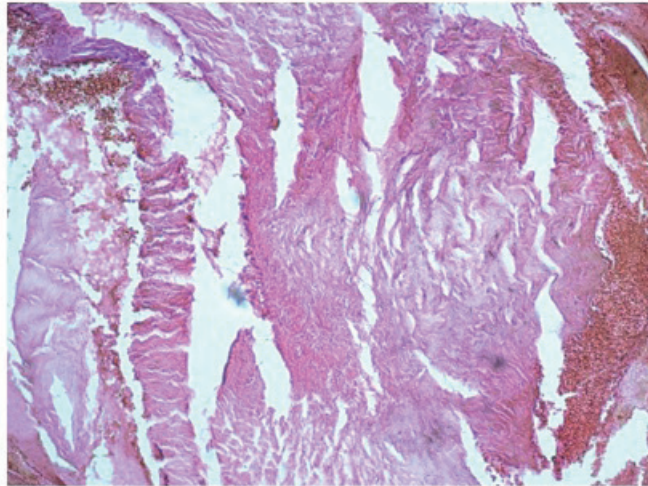
In 21 (70%) patients diagnosed with DRA of paraumbilical region sized of 2-3 cm, a moderate muscle atrophy and aponeurosis was defined (Fig. 2).



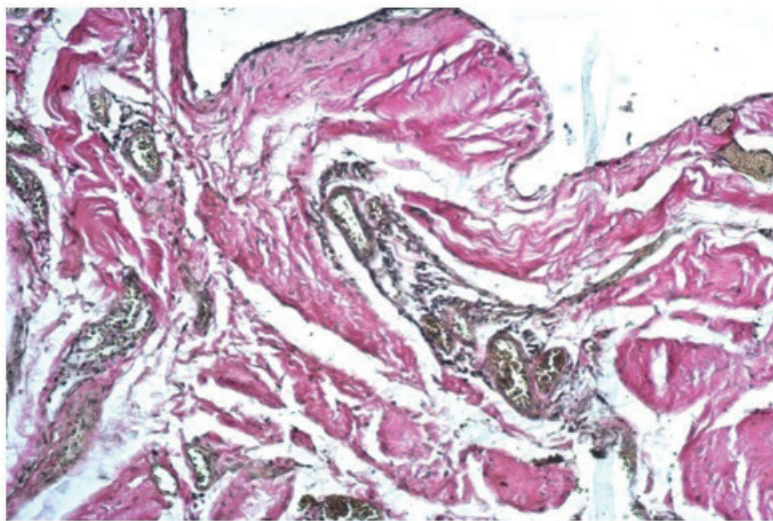
**Fig. 2. Aponeurosis of paraumbilical region in patients with gallstone disease associated with DRA. Van Gieson staining. Magn.  $\times 100$ .**

The pronounced atrophy of muscles and aponeurosis, increased connective tissue area, irregular distribution of collagen fibers, areas of their lysis, foci of lipomatosis were defined in 30 patients of group II with trocar abdominal hernias (Fig. 3).

The moderate atrophy of the aponeurosis and muscles have been observed among the 20 patients of comparison group (group III) with DRA of paraumbilical region (Fig. 4).



**Fig. 3. Atrophy of DRA aponeurosis. Hematoxylin & eosin staining. Magn. ×100.**



**Fig. 4. Moderate atrophy of the aponeurosis of the anterior abdominal wall. Bundles of collagen and elastic fibers. Hematoxylin & eosin staining. Magn. ×100.**

Moderate muscles atrophy and aponeurosis is present when DRA is detected in both 70% of patients of the I group and in the IIIrd group (comparison group). Such morphological changes create the basis for the occurrence of paraumbilical region hernias.

Pronounced muscles and aponeurosis atrophy, increased connective tissue area,

irregular distribution of collagen fibers, areas of collagen fibers lysis, lipomatosis foci in IInd group (of trocar hernias) are present not only at the formed hernia, but are the confirmation of the trigger mechanism of paraumbilical region hernias formation due to trocar installation.

**Conclusions.** The presence of diastasis recti abdominis of paraumbilical region and the use of trocars during laparoscopic cholecystectomy are potentially provoking factors for trocar hernias occurrence in the late postoperative period.

DRA elimination with fixation of a preperitoneal mesh implant can be considered as an effective method to prevent trocar hernia of the paraumbilical region after laparoscopic cholecystectomy.

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## TECHNICAL SCIENCES

### **DETERMINATION OF TECHNOLOGICAL PARAMETERS FOR THE CONSTRUCTION OF SAND LAYERS WITH TUBULAR DRAINS**

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**Annotation.** *The article considers technological parameters for the construction of road surface base layers – sand layers with drainage pipes. The dynamics of changes in the area of the pneumatic coil stamp of different weights depending on changes in tire pressure are shown. Based on the finite element method, the stress-strain state of a typical road structures weakened by tubular drains made of materials of various origins was studied.*

**Keywords:** *Road, road structure, roadbed, shallow cross drainage, drainage layer, tubular drainage, pneumatic roller, roller stamp.*

**Problem statement.** One of the main factors affecting the reliability and durability of the road surface of highways is the presence of excess free water, especially during thaws in the spring or significant precipitation. The presence of free water leads to changes in the deformation characteristics of the soil of the base and drainage layer of the road surface, the soil's own weight, the appearance of hydrodynamic forces of the filtration flow, and so on. It is known that additional deformations of natural and artificial bases occur when they have excess free water. During emergency situations (excessive precipitation, excessive load from heavy vehicles and freezing of drainage layers and soil of the base, etc.), the magnitude and intensity of growth of these factors can change significantly, which leads to significant vertical deformations of the road surface in the form of tracks. These deformations complicate, and in some cases make it impossible, the operation of highways.

On public roads there are about a third of the characteristic areas – bent in the longitudinal profile, with a longitudinal slope greater than the transverse, in low embankments, in recesses, zero marks, the vast majority of which are built with tubular shallow drainage. The condition of such areas does not always correspond to safe operating conditions and in the spring, after thaws, they need to be repaired.

A road structure with tubular drains under layers of road surface is atypical, unlike standard ones. Such design decisions are reasonable, but the problem of their construction and operation was not given due attention. Failure to take into account the technological features of the device of drainage structures of shallow laying at the construction stage leads to the development of deformations at the initial stage of operation. This requires

the development of special technological solutions for compaction modes of the base layers and assessment of the condition of drainage pipes made of materials of various origins.

**The main part.** The problem of drainage from the road structure, in particular from the working area of the roadbed, is based not only on design methods but also on the technological features of the drainage device under the influence of road vehicles.

When installing a drainage layer of medium-grained sand, mainly use pneumatic rollers of various modifications. A distinctive feature of pneumatic wheel rollers is the deformation of the working bodies during the compaction of road surface layers. As a result, the contact area of the roller tire and the time of force impact on the surface of the compacted layer increases. Currently, there are many modifications of rollers that allow you to adjust parameters such as wheel load and tire air pressure during the compaction process. The load on the wheel can be changed by ballasting, which allows you to increase the range of applications of the roller for compacting various types of soil. Increasing the mass of the roller allows, accordingly, to increase the thickness of the compacted layer, but almost does not affect its density, which is achieved at equal air pressures in the tires.

The dimensions of the contact surface and the maximum contact pressure depend on factors such as soil resistance to external loads, the size and type of tires, the air pressure in them, and the load on the wheel, as well as on the optimal and actual soil moisture. During the first passes of the rollers at the beginning of the compaction process, when the soil is still loose, only the soil itself is deformed. In the process of compaction, the soil becomes denser and therefore the pneumatic wheel gradually begins to deform. At the end of the compaction process, when the soil is already dense, the deformation of the pneumatic wheel is maximized. But the compaction process itself also affects the drain pipe. The thickness of the drainage layer is determined according to the project and is determined by the filtration coefficient, the freezing depth in the construction area and the specified operating conditions (absorption or drainage). When designing drainage layers, not enough attention is paid to the impact of loads on the pipe body made of materials of various origins in terms of such indicators as brittleness or ductility. The condition and integrity of drainage pipes after exposure to sealing agents depends on these properties, which will further affect their working conditions.

The influence of sealing agents in the process of installing drainage layers, in particular, the parameters of the roller pneumatic tire track on an atypical structure weakened by tubular holes, can lead to the formation of deformations in the body of the tubular drain, which in the future will affect the processes of drainage from the working area of the roadbed.

The maximum air pressures in the roller tires that correspond to the last stage of compaction should be closest to the strength limits of both dense soils and drainage pipes.

According to the studies conducted in [5], the nature of the pressure distribution over the contact surface of the tire with dense soil does not depend on the speed of the

wheel but is determined by the load and the air pressure in the tire. The contact shape of the pneumatic tire with a hard surface is an ellipse. If, at constant air pressure in the tire, the load acting on it gradually increases, then the deformation of the tire in the transverse direction becomes more and more noticeable. Therefore, the same tire may have contact surfaces with different ratios between their axles, and the same contact surfaces may be obtained at different ratios between the wheel load and the air pressure in the tire.

The vertical load creates pressure from the wheel to the surface. The estimated width of the stamp depends on the width of the wheel and is:

$$b = B(0,65 \dots 0,75),$$

where  $b$  – stamp width, m;

$B$  – wheel width of pneumatic roller, m.

The estimated length of the stamp depends on the force with which the wheel acts on the surface, the pressure in the wheel and the estimated width of the stamp:

$$a = \frac{F}{b \cdot P},$$

where  $a$  – stamp length, m;

$F$  – the force with which the wheel acts on the surface, N;

$P$  – roller tire pressure, MPa.

As the tire pressure increases, the roller's footprint area becomes smaller and the track depth increases. The initial compaction of the drainage layer of medium-grained sand is performed with the minimum allowable pressure in the tires of the middle roller. As the number of passes of the roller increases, the pressure in the wheels increases and, accordingly, the pressure on the surface.

Taking into account the initial parameters of pneumatic rollers and determining the length and width of the stamp, the area of the stamp is determined as:

$$S_u = a \cdot b,$$

where  $S_u$  – stamp area, m<sup>2</sup>.

According to dependencies (1-3), the technological parameters for compaction of the sand drainage layer are determined, which are given in Table. 1 and in Fig. 1.

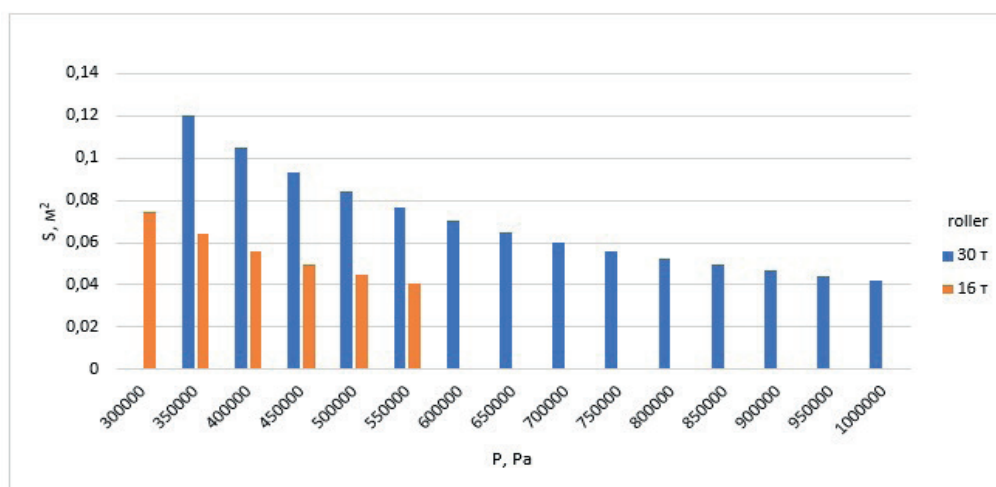


Table 1

**Technological parameters for compaction of the sand drainage layer**

roller weight, t	P, actual minimum tire pressure, Pa	P, actual maximum tire pressure, Pa	b, estimated stamp width, m		a, the estimated length of the stamp at minimum pressure, m		a, the estimated length of the stamp at maximum pressure, m		S at minimum pressure, m <sup>2</sup>	S at maximum pressure, m <sup>2</sup>
			b=B(0,65)	b=B(0,75)	b=B(0,65)	b=B(0,75)	b=B(0,65)	b=B(0,75)	b=B(0,65) and b=B(0,75)	b=B(0,65) and b=B(0,75)
			16	300000	550000	0,208	0,24	0,3593	0,3114	0,1960
30	350000	1000000	0,2405	0,2775	0,4994	0,432	0,1748	0,1515	0,1201	0,0420

The dynamics of change in the area of the pneumatic roller stamp of different weight depending on the tire pressure is exponential (Fig. 1).



**Fig. 1. Dependence of the area of the roller stamp on the pressure in its tires**

As a tool for studying the stress-strain state of atypical road structures with round holes, according to the method proposed in [9], used the design and calculation complex SCAD Office, which is based on the finite element method. The scheme of the road construction model was chosen for modeling, which is a typical design solution of the third category roads, the length of which is the largest in Ukraine. The construction of

finite-element grids was determined from the conditions of the stamp of the pneumatic tire of the roller on static load, according to Table 1. To predict the stress-strain state of drainage layers with transverse tubular drainage of shallow laying on the roadbed, a series of numerical experiments were performed. In numerical modeling of the structure under consideration, a static load was used, as the most unfavorable in duration during the process of installing a drainage layer. For two types of tubular drainage materials, real-world construction conditions were modeled, which provide for step-by-step compaction of drainage layers.

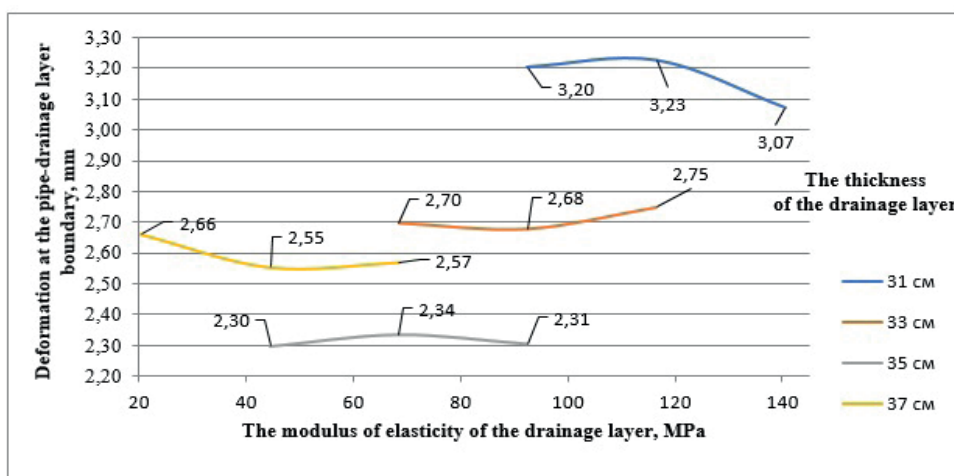


Fig. 2. Dependence of deformations Z on the modulus of elasticity of the sand drainage layer with concrete pipe

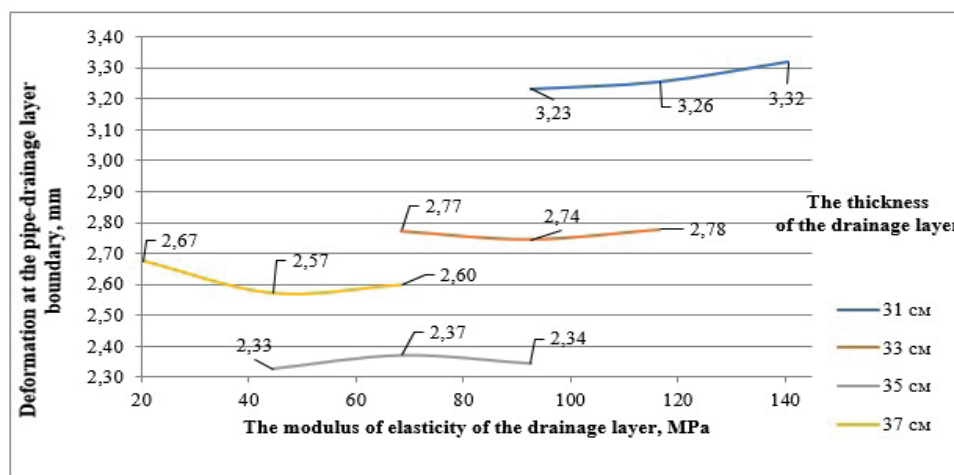


Fig. 3. Dependence of deformations Z on the modulus of elasticity of the sand drainage layer with PVC pipe

This allowed to obtain the dependence of the deformations  $Z$  on the modulus of elasticity of the drainage layer at the boundary of the layer – tubular drainage of different materials in the working area of the subsoil, taking into account the type of road roller.

According to the technology of arranging drainage layers of sand, the initial thickness of the drainage layer was determined – 37 cm. To obtain a 30 cm thick layer at the end of the compaction process, a medium roller weighing 16 t with a minimum pressure and a maximum tire pressure is used first, followed by a heavy roller weighing 30 t.

**Conclusions.** According to the calculation results for models of a road structure with a polyvinyl chloride pipe, under standard conditions of compaction of the drainage layer, the pipe body perceives maximum normal stresses of 3.86 MPa, which are more than 15% of the permissible tensile stress of this material. In contrast, the model with a concrete pipe operates in an extremely stressed state. Despite the presence of crushed stone sprinkling, which additionally perceives and redistributes the load on the pipe body. Under standard compaction conditions of the sand drainage layer, the concrete pipe body experiences a maximum stress of 6.3 MPa, which is significantly higher than the permissible tensile stresses of concrete.

In the process of installing a sand drainage layer, concrete pipes can deform, which leads to their destruction, unlike polyvinyl chloride pipes, for which such deformations are permissible. Destruction of the concrete drainage pipe body can lead to further significant deformations of the structural layers of the road surface and, as a result, to a significant change in the wet-thermal regime: accumulation of moisture infiltrate, creation of ice lenses in winter and spring.

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## INFORMATION TECHNOLOGY FOR ORGANIZATION OF THE ASCERTING STAGE OF PEDAGOGICAL EXPERIMENT

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**Annotation.** *The article considers the conditions and peculiarities of conducting pedagogical experiment. The content and conditions of the organization of the ascerting and forming stages of the pedagogical experiment are analyzed. The procedure for carrying out the experiment and the tasks of each stage of the pedagogical experiment are determined. The results of the ascerting phase of the pedagogical experiment concerning the formation of motivation for the self-educational activity of the students of technical specialties of Vinnytsia National Technical University are presented.*

**Keywords:** *pedagogical experiment, ascerting stage of experiment, forming stage of experiment, self-education activity, formation of motivation, training of specialists in technical specialties.*

**Introduction.** At the current stage of the education branch development, intensive search is being made to improve the methods of teaching, didactic systems, in particular, on the basis of the competence approach requirements. The role of pedagogy in higher education institutions is also growing, because according to its principles, the purpose and content, forms and methods of future specialists training for professional activity are determined.

However, any developed models of the formation of certain qualities and properties, methodology or methodical system, implemented in the educational process, must be experimentally verified for the efficiency and expediency. There appears the problem of qualitative and quantitative comparison of the traditional and developed or improved methodology. Thus, at the beginning of the pedagogical experiment, it is necessary to determine the initial level of development of the qualities that are being studied in order to work on their improvement.

Analyzing the conditions of the pedagogical research organization, Academician S. Goncharenko noted that "the best results are obtained after the pedagogical experiment,

consisting of the following parts: small by volume and statistical sample experiment, which serves for the verification of ideas and the model of the educational process (sometimes it is called chamber or laboratory); correction of the concept, hypothesis and model of the educational process: improvement of the research documentation, eliminating the elements of uncertainty, ambiguous interpretations, etc. ; mass pedagogical experiment" [1]. Typically, a chamber pedagogical experiment is conducted under the same conditions in several classes or groups, and as control groups classes or groups with somewhat higher academic performance are often deliberately taken.

The greatest complexity of the experiment in psychological and pedagogical research is that the course of the studied psychological and pedagogical phenomenon or process depends on a large number of interconnected factors, and there appears the need to determine the impact of which factors can be neglected and the impact of which factors is determinant.

**Basic part.** An essential feature of pedagogical experiments is that all pedagogical processes are of ambiguous character. Sometimes the effect of a non-significant factor leads to unexpected changes at the end of the experiment. Besides, a pedagogical experiment, carried out according to one plan for different categories of students will give different results. And if in chemistry or physics it is possible to repeat the experiment with a predictable result, using the same materials and creating similar conditions for conducting it, the repeated experiments in pedagogy always have *зусгдшфк* results.

In view of this, researchers are making their conclusions cautiously, understanding the relative nature of the conditions in which they were received. Only a multiple repetition of observations enables to determine the most characteristic tendency of the investigated phenomenon [2].

Pedagogical experiment in the institutions of higher education is conducted on the basis of several, usually 5-8 educational establishments with the students of a particular field of training. The ascertaining stage of the experiment provides the identification of the factors that have a positive impact on the investigated phenomenon. The formative stage of the experiment consists in proving the effectiveness of the developed methodology in increasing the level of indices of the investigated phenomenon [1]. At the ascertaining stage of the experiment, the students, who participate in the study, form the control and experimental groups.

An important condition, often neglected by the researchers is the verification of the homogeneity of selected student groups. Although the control and experimental groups are selected in such a way that approximately the same level of the investigated phenomenon or process is observed in these groups. But even a small difference between them requires validation. For this purpose, a number of criteria is used. The most widespread is C. Pearson ( $\chi^2$ -hex-squared) criterion [3].

The expediency of using this criterion in pedagogical research in this case consists in formulation of the zero hypothesis  $H_0$ , according to which the discrepancy between the laws of the distribution of the levels indices of the investigated phenomenon or the process of the experimental and control group is random.

Determination of the differences between the output and acquired indices of the investigated phenomenon occurs by means of comparison of the indices, obtained at the ascertaining stage of the experiment with the following stages of the study. For this purpose, the researcher develops a methodology for carrying out a pedagogical experiment, substantiates pedagogical conditions, means, methods, he introduces into the educational process and diagnostic tools. Before the beginning of the pedagogical experiment a hypothesis is formulated, which further must be validated or disproved. According to the scientist S. Goncharenko, the hypothesis should be formulated so that it can be experimentally tested [1]. It should be noted that the obtaining of statistically reliable results is greatly influenced by the sample size. For example, L. Sacks [4] proposes to calculate the minimum required student sample size, at which one can confirm the reliability of the obtained experiment results by the formula

$$n = \frac{t^2 p(1-p)}{a_0^2},$$

where  $n$  – the number of members of the sample set;  $t$  – known coefficient (for the given confidence probability –  $P$ );  $p$  – statistical authenticity (set reliable probability);  $a_0$  – known error, by which the sample size is evaluated.

In general, the procedure for conducting pedagogical experiment is shown in Fig.

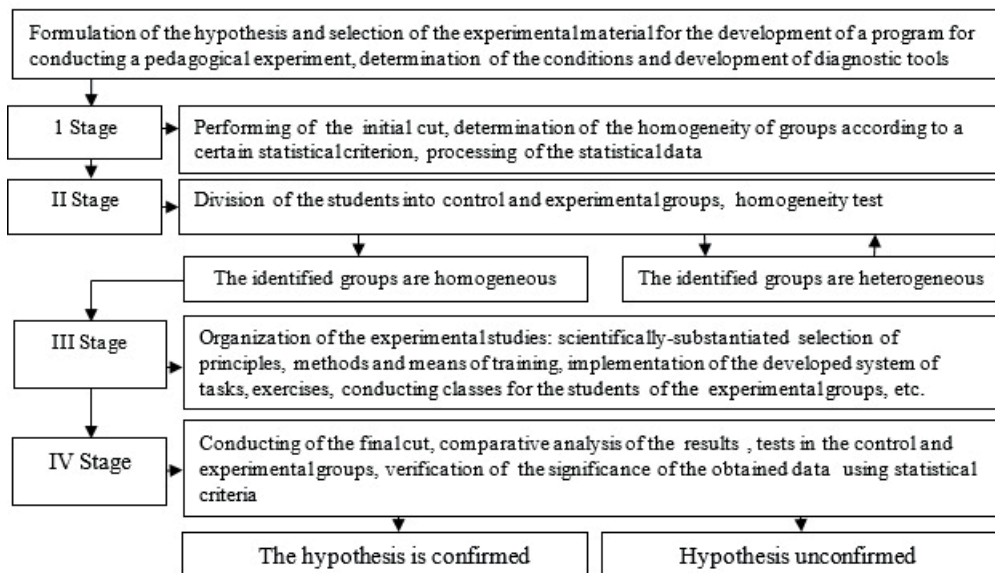


Fig.1. Stages of the pedagogical experiments in higher education institutions

Let us consider the results of carrying out of the ascertaining stage of the pedagogical experiment regarding the formation of motivation to self-education of students of technical specialties. For a specialist to be able to improve during the period professional activities, at the university he must acquire the relevant knowledge and skills, form the needs for systematic improvement of his professional level. This statement is substantiated by a number of scientific and methodological developments. In particular, the peculiarities of the organization of self-education activity are reflected in the works of the domestic (A. Eisenberg, A. Gromtseva, V. Zagvyazinsky, O. Malikhin, V. Slastenin A. Petrova, P. Podkassityi, O. Dubasenyuk, O. Kochetova), and foreign (Y. Bartletzky, J. Bruner, G. Gishba, K. Klein, N. Chakirov, G. Sharelman) scholars.

Within our research, under the self-educational activity of students of technical specialties we mean independent individual-cognitive activity, directed by the personality and aimed at gaining knowledge, improvement of professional culture and personal development [5]. A specialist will be ready for self-education, if in the course of studying at a higher education institution he will form a positive attitude and motivation for self-education, he will acquire the skills of planning and carrying out this activity, analyzing the results and correcting his own actions.

Quantitative evaluation of the results of the experiment was carried out by the method of correlation: the percentage of students of technical specialties of Vinnitsa National Technical University, which have a certain level of motivation to self-education activity at the beginning and at the end of the experiment, as well as the average index, which allowed to make a conclusion regarding the dynamics of this process, was calculated. Experimental (EG) and control (CG) groups of students of technical specialties were selected for the formative stage of the experimental research. Distribution of the students between the control and experimental groups we carried out, taking into account the following features of pedagogical design:

1) in the control and experimental groups there were almost identical quantitative values of the formation of motivation to self-education;

2) when determining the control and experimental groups, the student's academic performance was also taken into account as one of the indices of motivation degree for the implementation of self-education activities.

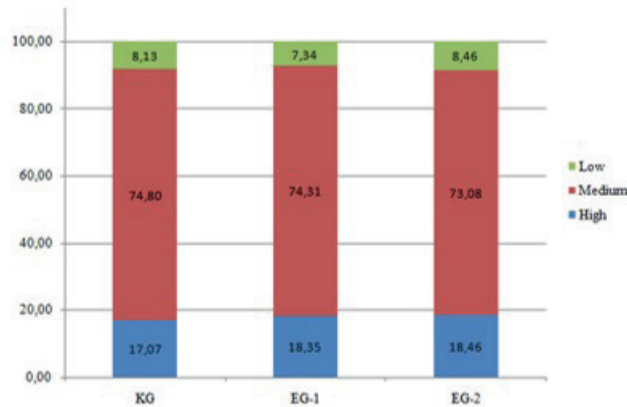
*Table 1*

**Comparison of the results in the control and experimental groups of students (the ascertaining phase of the experiment)**

Groups	Levels of motivation for students						Number of people in a group
	Low		Medium		High		
	of	%	of	%	of	%	
CG	21	17,07	92	74,80	10	8,13	123
EG-1	20	18,35	81	74,31	8	7,34	109
EG-2	24	18,46	95	73,08	11	8,46	130



The results of the determination of the level of motivation to self-education activities at the stage of the experiment are shown in Table 1.



**Fig. 2. Comparison of the results of the ascertaining stage of the experiment by the levels of motivation of the students to self-education activities**

Before introducing the developed structural and organizational model for forming the motivation of the students for self-education, it was determined how the control and experimental groups were selected. Since the sample is rather large (more than 50 people in control and experimental groups), we use the non-parametric criterion of C. Pearson:

$$\chi^2_{\text{empirical}} = N \cdot M \cdot \sum_{i=1}^L \frac{\left( \frac{n_i}{N} - \frac{m_i}{M} \right)^2}{n_i + m_i},$$

where  $N$  and  $M$  are the number of the members of the control and experimental groups;  $n_i, m_i$  – number of members of the control and experimental groups that showed the  $i$ -th level of knowledge;  $L$  – number of the allocated levels.

At determining the "zero hypothesis"  $H_0$  we assume that the distribution of the students by the levels of motivation to self-education in the experimental groups that participate in the pedagogical experiment - is the same. If the value  $\chi^2_{\text{empirical}}$  of pairwise comparison of levels of cognitive activity in the control and experimental groups is less than  $\chi^2_{\text{empirical}}$  the hypothesis  $H_0$  will be considered to be confirmed. Alternative hypothesis  $H_1$ : the level of motivation to self-education of the students of technical specialties of the control and experimental groups is not equal.

We determine the empirical value of the  $\chi^2_{\text{empirical}}$  criterion pair-wise for the control and experimental groups, obtained by the levels of motivation to self-education. We will find the number of the degrees of the freedom of variation  $\nu = k - 1$  where  $k = 3$  - the number of ratings.  $\nu = 3 - 1 = 2$ . Having substituted the corresponding values in formula (2), the following results were obtained (Table 2).

For CG and EG-1:

$$\chi^2_{\text{empirical}} = 123 \cdot 109 \cdot \left[ \frac{\left(\frac{21}{123} - \frac{20}{109}\right)^2}{21 + 20} + \frac{\left(\frac{92}{123} - \frac{81}{109}\right)^2}{92 + 81} + \frac{\left(\frac{10}{123} - \frac{8}{109}\right)^2}{10 + 8} \right] = 0,11$$

For CG and EG-2:

$$\chi^2_{\text{empirical}} = 123 \cdot 130 \cdot \left[ \frac{\left(\frac{21}{123} - \frac{24}{130}\right)^2}{21 + 24} + \frac{\left(\frac{92}{123} - \frac{95}{130}\right)^2}{92 + 95} + \frac{\left(\frac{10}{123} - \frac{11}{130}\right)^2}{10 + 11} \right] = 0,07$$

On the basis of the reference data of  $\chi^2_{\text{empirical}}$  criterion for the levels of statistical significance  $\alpha \leq 0,05$  and  $\alpha \leq 0,01$  at different degrees of freedom [6] we find  $\chi^2_{\text{critical}}$  by the level of significance  $\alpha \leq 0,05$  and  $\alpha \leq 0,01$  and its value will be written in Table. 2.

Table 2

Value of the criterion  $\chi^2$  of C. Pearson on the control slice

Groups CG and EG	Estimated value $\chi^2_{\text{empirical}}$	$\chi^2_{\text{critical}}$ by significance levels	
		0,01	0,05
CG and EG-1	0,11	9,2	6,00
CG and EG-2	0,07		

The application of  $\chi^2$  C. Pearson criterion at the significance levels of 0.01 and 0.05 showed that there are no statistically significant differences between the control and experimental groups in the levels of motivation to the self-educational activity of students of technical specialties at the beginning of the pedagogical experiment, because all the calculated values of are lower than critical values of . From this assertion we conclude that the zero hypothesis is confirmed. Therefore, we will assume that in the control and experimental groups at the ascerting stage of the experiment we have equal by the the level of motivation to the self-education activity body of the students of

technical specialties.

Further content of the experimental work is the following:

1. Determination of the participants of the formation stage of the pedagogical experiment among the teaching staff of VNTU, their familiarization with the specific tasks for the period of experimental work, provision of the necessary materials.

2. Specification of the methodical measures, needed for the implementation of pedagogical conditions for the formation of motivation for the self-education of students of technical specialties; organization work for their implementation in the educational process of VNTU.

3. Experimental verification of the effectiveness of the developed structural and organizational model of the formation of students' motivation for self-education activity, the processing of statistical data, summing up.

**Results and discussion.** Y. Babansky considered the pedagogical experiment to be a complex method, which provides the combination of observation methods, interviews, questionnaires, video recordings, tests, creation of special situations, transcripts of lessons at all the stages of each type of the experiment [7]. A. Quiverialg substantiated that the selection of methods depends on the type and purpose of the experiment. The development, combination of the methods or their groups becomes the nucleus of the formation of a research method [8].

In the process of the organization of pedagogical experiment, O. Kochetov stated that the researcher needed to carry out a theoretical analysis of works on the subject of study, investigate the state of the educational practice in the context of the problem, as only a deep study of the scientific foundations of the problem under study creates a solid foundation for the successful conduct of the pedagogical experiment [9].

The systematization of the methods of pedagogical research was carried out by O. Josan in his study and distinguished traditional pedagogical methods (pedagogical observation, research interview, study and generalization of the pedagogical experience, primary sources, documentation study), pedagogical testing, sociological methods (questionnaires, testing), quantitative methods and pedagogical experiment [10].

G. Ruzavin noted, regarding the pedagogical experiment: "... if there is a sufficiently developed theory of the studied phenomena, the allocation of significant factors is achieved rather easily. If such a theory is not available, the allocation of significant factors may prove to be a rather difficult task. In principle, any factor may prove to be important, therefore, it needs to be thoroughly checked. In addition, a factor that is insignificant in one experiment may be significant in another. Consequently, the concept of a significant factor is relative, depends on the tasks and conditions of the experiment" [11].

The leading factors of the successful pedagogical experiment were identified by E. Panasenko in her publications. Among these factors the researcher mentioned scientific and methodical conditions of ensuring the conceptuality, systemicity, reliability, reproducibility of the experiment, the motivation conditions for entering the experiment and its implementation, staff training for the professional implementation of all participants in the pedagogical experiment, material and technical, financial

and economic conditions for the implementation of experimental activities, and also information conditions regarding the current results of experimental activity [12].

According to V. Zagvyazinsky and R. Atakhanov, due to different types of research, carried out in education science, it is necessary to clarify some basic principles of pedagogical research for each of them, as the success of any research is determined by the general scientific and partial principles of the methodological culture of the teacher-researcher [13].

M. Sadovy analyzed the peculiarities of the pedagogical experiment in dissertation research, he drew the attention to the fact that the researchers in their dissertations make references to the Bayes, Chebyshev, Poisson theorems, Bernoulli, Lagrange formula, the normal distribution function, the local and integral Laplace formulas, the variation series, Student distribution, Kolmogorov-Smirnov test, Gauss method, factor, regression analysis, correlation coefficient of Pearson, Spirman without proper justification [14]. The researcher generalized the ways of processing the results of the study.

A. Ogurtsov and V. Platonov consider the cause of complications in pedagogical studies the complexity of determining the criteria, because in pedagogy "we are talking about unique and irreversible situations that need to be analyzed from the standpoint of synergistic approach" [15].

A. Belyaeva determined the factors that provide the scientific validity of the pedagogical experiment, in particular: the introduction of one essential variable into the experiment and the neutralization of the additional variables; obtaining in the experiment of the direct and indirect data; comparison of the results of the experiment with the statistically average data, characterizing the studied phenomenon and the results, achieved by means of other methods of scientific research; obtaining the repetitive data during the experiment in different groups, including conditions and groups not dependent on the experimenter; use of methods of mathematical statistics. This is confirmed by the experience of foreign colleagues.

**Conclusions.** Thus, the pedagogical experiment is a complex and multidimensional process. In the pedagogical research the confirmation of hypothesis regarding the need to improve the content, forms, methods, determination of ways and means of the enhancement of the educational process in the institutions of higher education is carried out on the basis of the results of the experiment, carried out. Confirmation of the authenticity and correctness of the results of the forming pedagogical experiment is only a statistical processing of the experimental data.

The article considers and analyzes the results of the ascertaining stage of the experiment, concerning the formation of motivation to self-education of students of technical specialties. Prospects for further research we see in the carrying out of the forming stage of the pedagogical experiment and the introduction of structural and organizational model of the motivationforming in students for self-education, as well as processing of the statistical, obtained during the experiment.

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## CONCEPT OF IMPLEMENTATION OF INFORMATION MODELING IN TRANSPORT CONSTRUCTION OF UKRAINE

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**Annotation.** Systematic implementation of information modeling with further state regulation is planned in Ukraine. Individual design institutes already use BIM technologies in civil and industrial construction, mainly determined by static models of design, storage, and transmission of information separately in paper and electronic formats. The Concept aims to set goals for implementing BIM technologies in transport construction as a tool for further reform, modernization, and digital transformation of transport infrastructure in Ukraine. Postwar restoration of the road industry with the proper state regulation can be a significant impetus for the rapid introduction of information modeling in road network development.

**Keywords:** Building Information Modeling, variant design, Bridge Information Modeling, parametric modeling, digital information.

**Introduction.** Transport facilities are objects of the critical infrastructure of Ukraine. During the war with Russia, 23000 kilometers of roads and more than 300 bridges were destroyed as of May, according to open sources. Losses in monetary terms have not yet been reliably calculated, but it is already clear that they reach hundreds of billions of hryvnias.

After the victory of Ukraine, the task will be to restore the transport infrastructure, taking into account the engineering and construction features of the facilities after the destruction due to warfare. With such destruction, each bridge must be treated with special care, considering the availability and condition of residual structures, road categorization, the need to bring technical and economic indicators to current regulations, the availability and amount of funding, and others. Given the European vector of Ukraine's development, the question of using modern computer technology in the design of these facilities will be aroused, which will reduce labor costs for project development, partially solve the lack of specialists in bridge and road industries by increasing efficiency, and will fully implement variant design visualization of the project with a revised estimate.

**The objective of the study.** The work aims to present the Concept of implementation of information modeling in transport construction in Ukraine and brief analysis of the prospects for its implementation in the road industry.

**Terminology.** Each of the analyzed State Standards of Ukraine [6, 7] begins with the definition of terminology in Construction Information Modeling. The defined terminology directly translates the terms presented in the English-language normative documentation. Such translation is non-harmonized and does not consider the peculiarities of the organization of the design process in Ukraine. This is due to significant differences in the structure of project organizations in Ukraine and the EU, and North America. For example, some terminology has been developed considering the position of Construction Project Manager, whose primary job responsibilities are project management [5]. In contrast, the approximate position in Ukraine – Chief Project Engineer (Holovnyi Inzhener Proektu [Ukrainian]) – is more likely to make and approve technical decisions [12]. In the Concept of BIM implementation (Building Information Modeling) in Ukraine [1], the terminology is presented in a direct translation with explanations for better perception of information by Ukrainian engineers unfamiliar with the foreign design process but not fully harmonized.

Building Information Modeling abroad has been developing rapidly since the early 2000s. However, the issue of dividing the field of BIM technologies into the fields of transport construction, industrial construction, civil engineering, etc., has become relevant recently [2, 4]. The above sources do not consider the specifics of projects and the life cycle of building structures for various purposes.

The initial idea of implementing Building Information Modeling is the “seamless” design of buildings. This idea was the impetus for developing a universal Industry Foundation Classes (IFC) data exchange format, which should simplify and speed up the design process. It later emerged that its versatility was a shortcoming in designing specific structures, such as bridges and highways. With this in mind, The Federal Highway Administration (FHWA) has adjusted the development strategy [3] of the data-sharing format for transport construction, considering all the life cycle features. As a result of the US government’s implementation of the TPF-5(372) program was open software focused on the design of transport facilities – Bridge Information Modeling (BrIM) [13]. Obviously, with the active process of branching of BIM-technologies, a problem of determining the terminology for each construction industry arises.

**Information Modeling in transport construction.** Analysis of the history of construction shows that the profession of the design engineer is the youngest of all construction specialties. Civil engineering and architecture have long been under the control and direction of civil engineers. The civil engineer was responsible for the project, coordination on the construction site, construction technology, and phasing, which significantly accelerated the construction schedule, but often with a lack of reliability and safety. A striking example is the monumental building of the late 19th century – The Tay Bridge [9].

The beginning of the 20th century marks the end of the “era of civil engineers”. At this time, design engineers appeared, which required more drawings, calculations, and other documents. This has led to the fragmentation of engineers and an increase in the total number of state-building standards governing the construction process in a society

based on a growing number of laws. The implementation of the laws has resulted in increased concerns about responsibilities, which all too often stifle innovation in the construction industry.

Advances in automation and information technology over the past few decades have led to the computerization of previous manual workflows, primarily in the work of design engineers. The beginning of the 21st century in engineering is the debut of Building Information Modeling (BIM) technologies. The purpose of BIM technologies is to accelerate the implementation of innovative construction solutions for integration into the construction process at all life cycle stages.

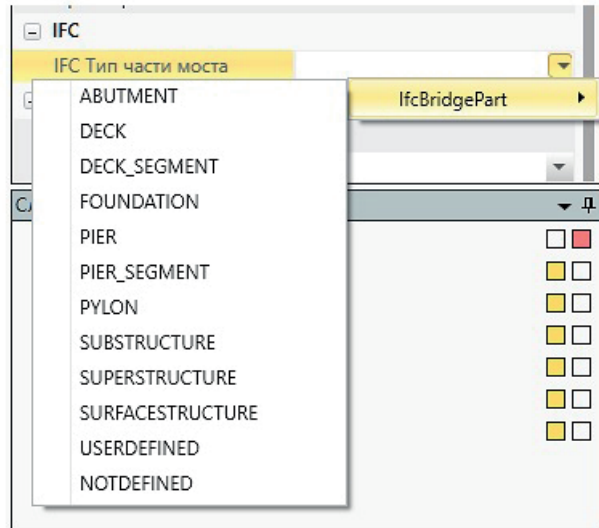
BIM technology allows a design engineer to manage and create an information model during the design, construction, and operation in a single ecosystem and integrate controlled parameters to create detailed dynamic digital models that are managed in an open cloud platform for real-time collaboration. The use of BIM gives a better visual perception, optimizes technical solutions, increases the reliability of the structure, and improves technical and economic performance.

Bridge Information Modeling (BrIM) is developing more slowly in transport infrastructure than Building Information Modeling (BIM) in commercial sectors. The purpose of using information modeling in transport construction is to take advantage of the rapid progress of computer information technology and develop new methods of designing structures to improve technical and economic performance.

The project's development is accompanied by a significant consumption of paper and consumables for office equipment. Hence, as the business world develops, more and more attention is paid to reducing these costs and the transition to electronic data formats. The study of ways to standardize the information transmitted between BIM users from the development of the project concept to the end of its service life remains an unresolved global issue. This is a difficult task, given how many staff are involved throughout the life of the transport facility. The solution to the problem can be achieved by the compatibility of digital data between all users and the designed objects with the effective optimization of the data transmitted and, ultimately, the implementation of development in the design of transport facilities.

Modern BIM modeling is based on the use of the vendor's software to create models in the data format specific to the program. To share data with other programs and applications, organizations and users require data exchange using a certain agreed "standard". A standard file system called Industry Foundation Classes (IFC) is widely used in the construction industry to share digital information. However, this system was not fully developed for linear transport construction, encouraging software developers to develop specialized engineering systems for modeling transport structures and improving existing IFC (Fig. 1).





**Fig. 1. Adaptation of the IFC data format for bridge design of Nemetschek AllPlan Bridge 2022**

The study examines the functionality of modern BIM complexes in the design of transport facilities (table 1).

*Table 1*

**Functionality of BIM software in transport construction**

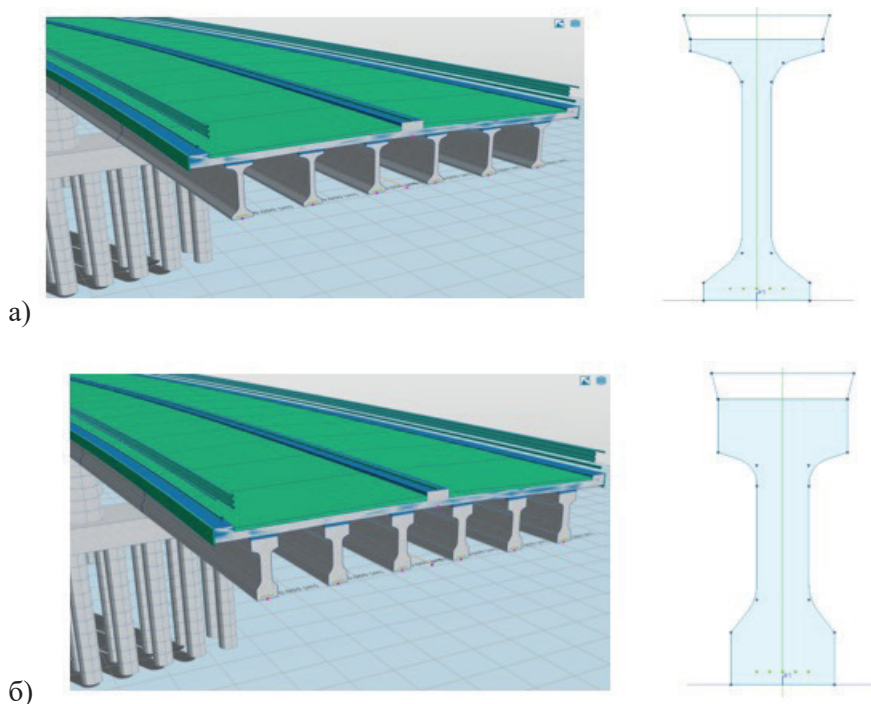
BIM name	BIM parametric modeling	Roads	Bridges	Calculation of two groups of limit states	Hydrology and hydraulics	Transport flow modeling
Autodesk Infracore	+	+	+	-	-	+
Bentley Software	+	+	+	+	+	+
Nemetschek AllPlan	+	+	+	+	-	-
OpenBrIM Platform	+	-	+	+	-	-
Tekla Software	-	-	+	-	-	-

Table 1 presents BIM software from global manufacturers that have the functionality to work in transport construction without taking into account the cost of use. Most of the additional functions and modules have been developed in the last five years, and their number is growing every year. Manufacturers understand the need to develop transport

infrastructure and are increasingly oriented in this direction.

**BIM parametric modeling.** A new approach in BIM design is developed to significantly reduce labor costs during variant design, complex geometric shapes, and rapid changes in the project. Consider the design of a section of the highway of considerable length [14], when the pavement is calculated and approved [10], but at the final stage of the project, there is a need to change the axis of the route. Using BIM parametric simulation, it is necessary to enter controlled parameters of the route axis – as a result, the software takes into account changes in all design documentation of the highway.

Alternative design solutions for bridges involve considering three options and, in some cases, ten or more, which is accompanied by high labor costs. Parametric modeling of the bridge [4, 8] allows you to change the geometric shape of the structure and its elements, material, longitudinal profile, and axis of the object according to mathematical laws or in tabular form. For example, in the framework of variant design, a beam bridge is considered, where the girder structure differs in the type of beams (fig. 2). The initial variant in which necessary parameters change is developed. The software considers the parameters resulting in changes in the project reinforcement, concrete consumption, construction operations schedule, the whole set of drawings, etc., without additional labor costs on the part of the designer. The total time spent in our case to change the type of beams of the girder structure along the entire axis of the structure (fig. 2) is 3 minutes.



**Fig. 2. BIM parametric modeling Nemetschek AllPlan Bridge 2022**

The study [15] considers the variant design of an architectural object of complex geometric shape – a bird, a dragonfly. Parametric modeling easily allows such a form of design to be achieved by a designer who has basic programming knowledge and can describe the form using mathematical dependencies.

The Concept of the introduction of information modeling in transport construction of Ukraine. The main tasks of BIM technology implementation are:

1. Reduction of labor costs at all stages: concept development, engineering surveys, design, issuance of design documentation and its approval, construction support, and operation.
2. Improving the technical and economic performance of the designed facilities.
3. Implementation of bold, innovative solutions with integration into construction.
4. Visualization, simulation, collision avoidance, human error reduction.
5. Optimization of durability, reliability, and cost of the structure's life cycle.

Executing tasks on the introduction of information modeling in transport construction of Ukraine is possible with the use of any software complex given in table 1. The main difference is the functionality, which can be used in the form of additional modules depending on the complexity of the project. The most significant number of such modules has Bentley Software, which 100% cover the needs of engineers, while the relevance of using all the functionality in most projects is questionable. The most functionally balanced software for vehicle design in table 1 is Autodesk InRoads and Nemetschek AllPlan. The main advantage of Nemetschek AllPlan is calculating the bridge for two groups of limit states. At the same time, Autodesk InRoads is more focused on designing public roads and streets of settlements with the ability to simulate traffic.

In the medium term, the implementation of the BIM Design Concept in Ukraine depends on the quality of training of qualified personnel in educational and professional programs “Bridges and Transport Tunnels”, “Highways, streets and roads of settlements”, which will significantly increase the efficiency of transport design. The study examined BIM technologies from the angle of one ecosystem, namely “seamless” design. Today, most small, medium, and large bridges can be designed this way. However, in some cases, with complex engineering and construction conditions and individual construction of unique facilities, it is necessary to use separate calculation systems, such as Midas Civil, Sofistik, ABAQUS, and others.

**Conclusions.** 1. The beginning of implementation should be the state standard of Ukraine to define the terminology of BIM design in transport construction. Terminology should be harmonized, considering the organization of the design process in Ukraine, current legislation, and state building codes.

2. Transport construction in Ukraine requires standardization of the development of dynamic BIM models.

3. BIM software has a standard digital information exchange system. Branching out BrIM/BIM technologies will not significantly affect the exchange of digital information between competing software. Implementation of the Concept in transport construction is possible with any specialized BIM complex. The designer decides which software with

support for BrIM/BIM technologies he works with.

4. Implementation will solve the lack of qualified personnel by reducing labor costs during project development.

5. Implementation of BIM technologies in transport construction in Ukraine will solve the problem of optimizing the time of project development with increasing technical and economic indicators and integration of European design solutions. The prospect of using software for construction information modeling is based on the analysis of the legal framework of Ukraine and the state policy of integration into the Trans-European Road Network.

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