MARCH 14, 2021

INTERNATIONAL SCIENTIFIC CONFERENCE

SCIENCE AND INNOVATION 2021: DEVELOPMENT DIRECTIONS AND PRIORITIES

MELBOURNE, AUSTRALIA

International Conference

“Science and innovations 2021: development directions and priorities”

March 14, 2021

Melbourne, Australia

Proceedings of the International Scientific Conference **"Science and innovations 2021: development directions and priorities"**. Part 1
(March 14, 2021. Melbourne, Australia)

ISBN 978-0-6451024-1-3 (AUSPUBLISHERS, online)
ISBN 978-5-905695-87-5 (Infinity publishing, print)

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DOI 10.34660/INF.2021.33.18.001

INFLUENCE OF NEW FACTORS ON THE RUSSIAN STOCK MARKET

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Abstract. *The current study examines the influence of unqualified investors' operations on pricing processes in current conditions of the Russian stock market, to assess the reliability of market efficiency theory in terms of a massive influx of irrational investors (unqualified investors).For the period of 17th September 2013 to 12th January 2021 we applied approaches of technical analysis namely: logical inference, selection and grouping information, data analysis, and generalization. To determines the influence of irrational investors' operations on a pricing process in the Russian stock market.*

The current study proposes using the noise trading model for forecasting prices on the Russian stock market, and to explain the pricing process in the market. Furthermore, this result can be used to analyze trends and behavioral patterns in the Russian stock market.

Keywords: *fair pricing, rational investors, irrational investors, unskilled investors, fundamental factors, non-fundamental factors, interest rate, inflation, market efficiency theory, noise trading theory.*

Introduction

The financial literature discussed the factors that change the stock price, the effect of each factor or group of factors on the stock price, and on the investors' savings.

This topic is particularly discussed in periods of sharp changes in stock price such as The Asian financial crisis, the Global financial crisis, the economic recession after the annexation of Crimea, and the Coronavirus pandemic. These periods carry new factors that had no effect on the stock price in economic stability periods.

Nowadays, in conditions of restrictions imposed by the economic close after the Coronavirus pandemic, a trend of price change has actually been formed in both the local financial market and international financial markets, as a result of investors' buy/sell decisions to specific financial assets.

Price trends create opportunities for rational investors to get abnormal returns, guided fundamental and technical analysis the rational investor estimates, the factors that affect the securities price, and the fair price of the security. Thus, the rational investor achieves abnormal return by taking investment opportunities in securities that overvalued, or undervalued.

Studies of Al Saady W. (2020), Semenkova E. (2018), and Podgorny B. (2017) indicate that there are a large number of irrational investors (speculators) in the Russian stock market. The current study examines if this could influence the change in the pricing model in the Russian stock market, and whether following market efficiency theory would be appropriate when a rational investor chooses analysis tools and models.

Literature Review

Neoclassical finance theory embraces that underlying paradigm asserts that financial systems in equilibrium. So, the investors circulate their capitals to achieve the highest rates of return. In other words, the paradigm states that the stock value reflects the present value of the firm's expected future net cash flows capitalized appropriately Modigliani F. and Miller H. (1958), Fama E. (1970), and Weston F. (1989).

Alfano S. et al. (2020) argues that investor is not rational paying attention to his own signals, and disregard the other signals, even when these other signals can be inferred from prices.

HirshleiferT. et al. (2008) assume that investors have bounded rationality and they focus exclusively on a firm’s reported earnings, while ignoring other numbers and economic signs.

Focusing more immediately on the subject of the study (the Russian stock market), Podgorny B. (2017) concludes that professional investors (dealers, institutional investors, and assets managers) are mostly speculators.

Lomakin I.et al. (2018) point that a large proportion of foreign investors in the Russian stock market are speculators looking for arbitrage opportunities in international markets. MirkinYa. et al. (2015) carries a mention that there is a large number of speculators in the Russian stock market. Thus, a fair estimate is that the majority of investors in the Moscow Exchange can be regarded as speculators.

The current study discussesthe influence of irrational investors' operations on a pricing process in the securities market,it considers the application of the main provisions of the efficient market hypothesis in current conditions.

Data and methods

Under the influence of fundamental factors, changes take place in the Russian stock market, forming a new reality for investment.

The current study analyzes the effect of the following fundamental factors on the paradigm of pricing in the Russian stock market:

1) The joint effect of the volatility of the interest rate and inflation on the Russian stock market;

2) The effect of income tax on individuals deposits on the Russian stock market;

3) The Effect of adding individual investment accounts (IIS) on the Russian stock market;

4) The behavioral motive that increases the risk tolerance.

The study sample covers the period from 17.09.2013 to 12.01.2021. The monthly data of the MOEX stock index and individual investment accounts were collected from the official website of the Moscow Exchange (RTSI Archive), the monthly data of inflation, and interest ratewere collected from the newsletters of the Bank of Russia. Tax data were collected from the official website of the Ministry of Finance of Russia.

The natural log of the ratio of the closing prices was used for the monthly index frequencies to produce a time series of continuously compounded returns, such as that:

$$Log\ R_t = Log\ (\frac{P_t}{P_{t-1}}) \quad (1)$$

Where $Log\ R_t$ – the natural log of closing prices; P_t, and $Pt\text{-}1$ represent the value of the index at time $t$and $t\text{-}1$, $t \in \{1,2,\ldots,X\}$. Where X represents a natural number for any monthduring the study period.

1) The joint effect of the volatility of the interest rate and inflation on the Russian stock market:

The analysis of the interest rate dynamics as a basic instrument of monetary policy from 17.09.2013 to 12.01.2021 shows that the interest rate high volatility is positively related with increase/decrease of inflation.

Figure 1 shows the relationship between inflation and the interest rate from

17.09.2013 to 12.01.2021 creating a unique opportunity for the market investors to get a practically risk-free return.

The interest rate is 4.25%,while the annual inflation is 4.4%according to the Central Bank of the Russian Federation [Newsletters of the Bank of Russia A, B]. Based on this information, the current study estimates a slight increase in annual inflation until the middle of the first half of 2021.

It is clear that the convergence between the interest rate and inflation increase the investors' risk tolerance in the Russian stock market. Therefore, changes occur in the financial market. Thus, low-interest rates joint with high inflations are creating a new investment reality.As a result, the Russian stock market gets more attractiveto the capital of the irrational investors.

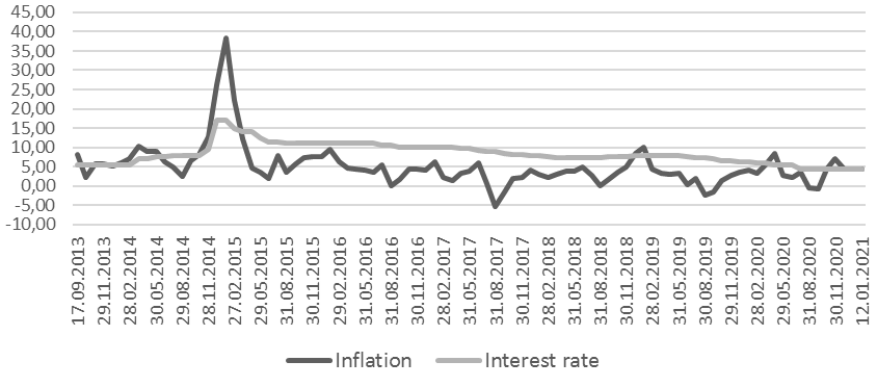

Figure 1. *The relationship between the inflation and the interest rate of the Central Bank of the Russian Federation*

Source: Newsletters of the Bank of Russia[Bank of Russia A, B].

2) The effect of income tax on individuals deposits on the Russian stock market:

Another reason attracting unqualified investors to the Russian stock market is adding an income tax on individuals deposits in the commercial banks.

Guided by the principle of fair taxation, since the beginning of 2021 an income tax has been established for deposit holders on the interest income they receive. The tax rate is equal to the income tax rate (i.e., 13%), however, the object of taxation is a percentage of interest on deposits in commercial banks that exceed the non-taxable interest income[1]. Undoubtedly, changes in the tax law will motivate an influx of unqualified investors to the Russian stock market.

[1]The non-taxable amount of income is set at the average interest income on the deposit in the amount of 1 million rubles for the taxation period from 01.012021.

Also, it can be assumed that the restrictive procedure as a result of the COVID-19 virus limited the demand and the current consumption. In this regard, there is an increase in Russian citizens' savings, on the other hand, they were motivated by attractive investment opportunity to deposit in individual investment accounts(IIS)[2], that are used by unqualified investors to invest temporarily in risk-free funds.

The Effect of adding individual investment accounts(IIS) on the Russian stock market:

Adding IIS makes the Russian stock market more attractive to investors. So, it is easy to notice that at the end of 2018 there were 597 thousand investors in IIS accounts. In August 2019 the millionth IIS account was registered on the Russian stock market, then in December 2019, the number of IIS accounts reached 1.5 million. This notice provides empirical proof on the IIS account as an attractive instrument in the Russian stock market.

It should be noticed that investment in SII that is overly popular in the market now could be so risky because what is happening is unsustainable. The Global financial crisis 2007-2009 and the Big depression 1929-1932 happened because debt growth rates were unsustainable creates paradigm shifts that most investors get caught overextended doing something overly popular and get really hurt. On the other hand, the institutional investors (such as Sberbank and VTB Bank)are expert enough to understand these shifts. Thus, they navigate them well or at least protect themselves against them.

The behavioral motive that increases the risk tolerance:

There are always unsustainable forces that drive the stock market paradigm. In the Russian stock market from 17.03.2015 and 11.11.2020 the MOEX returns are stationary between 0.8 support and 1.2 resistance limits as shown in figure 2.

Furthermore, the MOEX returns volatility increases in periods of financial crises namely: the economic recession after the annexation of Crimea from 21 November 2013 to 11 February 2015, and the coronavirus pandemic from 20 February 2020 till now, but the MOEX returns do not break the limits of support and resistance limits mentioned above.

Thus, the use of technical analysis and fundamental analysis will lead the investors to achieve abnormal returns in the market. Also, this result gives solid evidence to reject the weak-form efficiency in the Russian stock market. As the return series is stationary.

[2]Individual investment accounts IIS: is a class of retail investment arrangement first introduced in 1999 in U.K., the accounts have favorable tax status. Payments into the account are made from after-tax income, then the account is exempt from income tax and capital gains tax on the investment returns, and no tax is payable on money withdrawn from the scheme. [the Ministry of Finance of Russia, 2020]

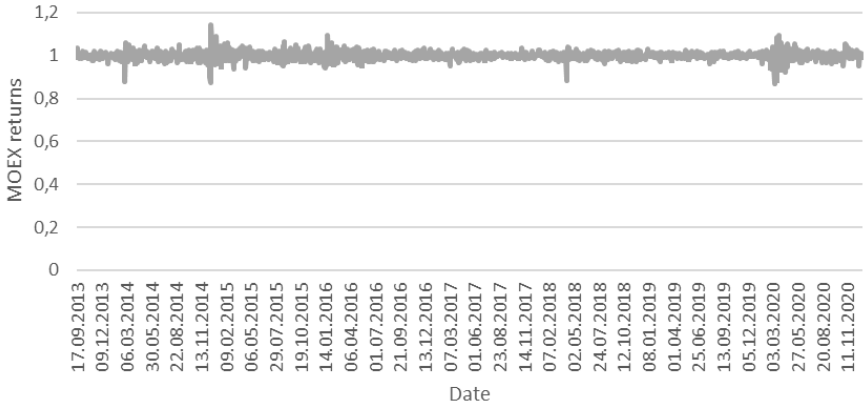

Figure 2. *MOEX returns volatility from 20.11.2020 to 29.12.2020*
Source: Source: Prepared by authors (Moscow Exchange, 2020A)

While At the end of November 2020, a non-financial factor affected prices in the Russian stock market,when the investors in the Russian stock market were dominated by global positive news about vaccine development against the COVID19, and the recent news of U.S.A elections.

Figure 3 shows an increase in risk tolerance of the investors in the Russian stock market from 20.11.2020 to 29.12.2020. Due to the U.S.A elections results and the news about the vaccine against COVID19. As MOEX returns remained relatively positive during that period and broke the resistance limit 1.2 three times.

This result spots the light on that the unsustainable forces that drive the Russian stock market paradigm. Stay long enough for people to believe that they will never end even though they obviously may end at any time. As in our case, an investors' emotions changed due to the positive news.

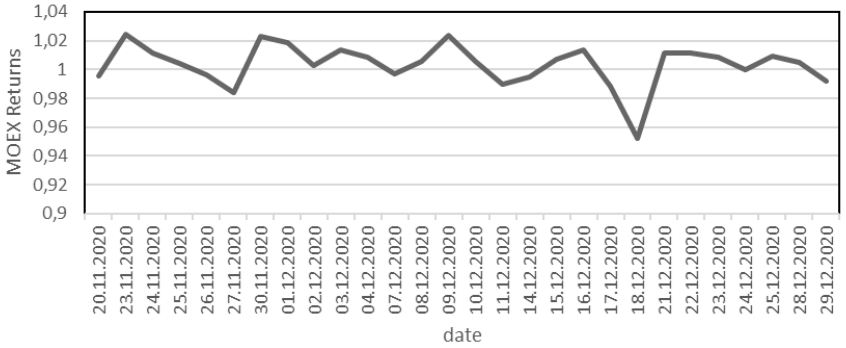

Figure 3. *MOEX returns volatility from 20.11.2020 to 29.12.2020*
Source: Source: Prepared by authors [Moscow Exchange, 2020B]

Discussion

The current study discusses the basic concept that determines the ability of the market to establish a fair (equilibrium) price of financial assets.

According to the market efficiency theoryof Fama E. (1963), when evaluating information structures, and the process of editing stock prices according to new information, the main hypothesis is the rational behavior of investors.

Factors as an announcement of new information cause volatility in the stock prices.Starting an anomaly in the market efficiency theory Watts R. (1973), and BenartziS. et al. (1997). Therefore, the new information drives an arbitrage chance between the market price and the fair price.

Thus, the rational investor gets a chance to achieve abnormal returns by buying shares when their fundamental valuation is lower than fair price (the market undervalues the shares), and selling shares when their fundamental valuation is higher than it is fair price (the market overvalues the shares).

Fama E. (1996) argues that according to the market efficiency theory, a long-term return anomaly are economically and statistically marginal. So, arbitrage chances are limited and difficult to access, However, the current study argues that is right if the market investors are rational, as the market efficiency theory assumes. But in the Russian stock market the results of MirkinYa.(2015), and Alsaady W. (2020)assume that the majority of investors are speculators (irrational investors).

The current study argues that the influx of unqualified investors into the Russian stock market will raise the numbers of irrational investors, whose financial decisions follow emotions, conjectures, rumors, crowd orders, blind faith, and so on.

Guided by such estimates, most often irrational investors reinforce existing anomalies in the market. As a result, the market price of overvalued share will rise, while undervaluation will fall, and arbitrage operations of the rational investors will never bring the share price to it is fair value.

Figure5 shows fundamental factors that increase the share of unqualified investors in the Russian stock marketin a generalized form.

In 2020 those factors lead together to a security price increase of 6.7% in the Russian stock market, taking into account factors such as March collapse due to falling in the crude oil prices and lockdowns around the world to limit spreading the COVID19.

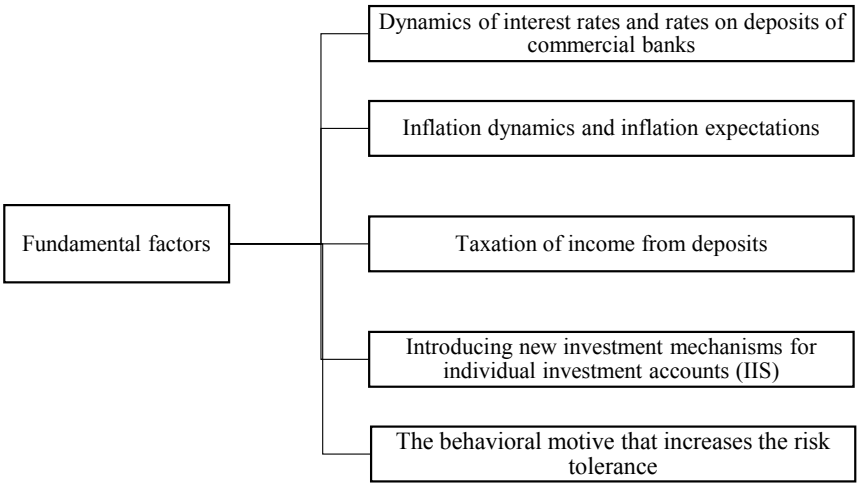

Figure5. *Fundamental factors that increase the share of unqualifiedinvestors in the Russian stock market.*

Source: Prepared by authors.

Taking this result into account, the current study assumes that testing the Russian stock market efficiency will never show its effectiveness, even in a weak form of efficiency, as a result to prevalence of irrational investors in the market.

Therefore, a different pricing paradigm seems promising in the Russian stock market, namely the theory of noise tradingDe Long B. and Magen K.(2009), Schleifer K.(2009), Wildman J.(2003), the current study suggests that use of noise trading theory can explore those models of price behavior, which large market operators impose on irrational investors.

Conclusion

The current studyexamines the influence of unqualified investors' operations on pricing processes in current conditions of the Russian stock market to assess the reliability of market efficiency theory in terms of a massive influx of irrational investor.

Low-interest rates joint with high inflations, the new income tax on individuals’ deposits, and the individual investment accounts(IIS) are creating a shift in the Russian stock market paradigm, as they make the Russian stock market gets more attractive to the capital of the irrational investors.

Furthermore, the MOEX returns volatility increases during periods of financial crises create an opportunity for the experienced institutional investor (who can carry the risks of investing in an inefficient market) to achieve abnormal returns at the expense of irrational investors whose financial decisions follow emotions, guesses, rumors, crowd orders, and blind faith, etc.

Testing the Russian stock market efficiency will never show its effectiveness, even in a weak form of efficiency, as a result to prevalence of irrational investors in the market.

This study suggests that use of noise trading theory can explore those models of price behavior, which large market operators impose on irrational investors.

References

1. Al Saady, W.(2020). Finansovy yekrizisyiikhvliyaniyena effektivnost' rynkaaktsiyna Moskovskoy birzhe [Financial crises and their impact on the efficiency of the stock market on the Moscow Exchange]. Finance, money, investment, 6(4), 32–38. – DOI: 10.36992 / 2222-0917_2020_4_32

2. Alfano, S., &Feuerriegel, S. (2020). Neumann D. Language Sentiment in Fundamental and Noise Trading: Evidence from Crude Oil.Applied Economics, 52(49), 5343-5363.–DOI: 10.1080/00036846.2020.1763245

3. Bank of Russia.(2020A). Inflation data https: //xn----ctbjnaatncev9av3a8f8b. xn--p1ai/%D1%82%D0%B0%D0%B1%D0%BB%D0%B8 % D1% 86% D1% 8B-

4. Bank of Russia.(2020B). Interest rate data https://base.garant. ru/10180094/#friends

5. Benartzi, S., Michaely, R., Thaler, R. (1997). Do dividend changes signal the future or the past.Journal of Finance,52, 1007-1034.

6. De Long, B., Magen K. (2009). The US Equity Returns: Past, Present, and Future. Journal of Economic Prospects,23(1), 193-208. https://pubs.aeaweb.org/ doi/pdfplus/10.1257/jep.23.1.193

7. Fama, E. F. (1963). Mandelbrot and the Stable Paretian Hypothesis. The Journal of Business, 36(4), 420-429.–DOI:10.1086/294633

8. Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. The Journal of Finance, 25(2), 383–417. – DOI:10.2307/2325486

9. Fama, E. F., & French, K. R. (1996). Multifactor explanations of asset pricing anomalies. The journal of finance, 51(1), 55-84. – DOI: 10.1111/j.1540-6261.1996.tb05202.x

10. Hirshleifer, D. A., James, N. M., Linda, A. M., Siew, H. T. (2008).Do individual investors cause post-earnings announcement drift? Direct evidence from personal trades. The Accounting Review, 83(6), 1521-1550.

11. Lomakin, D. I., Korneev, A. A., Kurgan, A. V., &Machinskaya, R. I. (2018). Risk Disclosure and Deviant Behavior in Adolescents. Russian Journal of Cognitive Science, 5(4), 4–14.

12. Ministry of Finance of the Russian Federation: official site. (2020). Clarification payment of personal income tax from interest income on deposits http://www.garant.ru/products/ipo/prime/doc/73732718/#ixzz6hSoy4dVF

13. Mirkin,Ya.M., Khestanov, S.A, Andryushenko, A.O.,Volkova A.D. (2015). Sovokupnoyepovedeniyeroznichnykhinvestorovnarossiyskomfondovomrynke [Aggregate behavior of retail investors in the Russian stock market].Finance: theory and practice,3, 100-106.– DOI:10.26794/2587-5671-2015-0-3-100-106

14. Modigliani, F., Miller H. (1958). The Cost of Capital, Corporation Finance, and the Theory of Investment. American Economic Review,48(3), 261-297.

15. Moscow Exchange. (2020A). Moscow Exchange Indices (MOEX Russia Index and RTS Index). Retrievedfromhttps://place.ММВБ.com/useful/koronavirus-i-fondovij-rynok

16. Moscow Exchange. (2020B). Moscow Exchange Moscow Exchange Indices (MOEX Russia Index and RTS Index). Retrievedfromhttps://www.ММВБ.com/s2184

17. Mustafa A. I., Brattsev V.I., ALSaady W., Hammoodi L.K., Russia's fiscal policy in the context of oil price volatility/A.I. Mustafa, V.I. Brattsev, W. ALSaady, L.K. Hammoodi, Jour of Adv Research in Dynamical &Control Systems, Institute of Advanced Scientific Research, Kansas City, USA, Vol.11 №09-Special Issue, 2019г.p:1210-1213. Podgorny, B.B. (2017). Professional'nyyeuchastnikirossiyskogofondovogorynka: gabitusipraktiki [Professional participants of the Russian stock market: habit and practice]. modern research of social problems, 8(6), 67-88. http://ej.soc-journal.ru

18. Semenkova, E.V., Andrianova, L.N., Krinichansky, K.V. (2018). The Concept of Fair Pricing in the Regulation Framework of the Russian Securities Market. Journal of Reviews on Global Economics, 7,562-571. – DOI: https://doi.org/10.6000/1929-7092.2018.07.52

19. Shleifer, A.Ineffective markets: an introduction to behavioral finance,A. Shleifer. OUP Oxford: IPK Business and Economics, 2009, - 224 p.

20. Watts, R. (1973). The information content of dividends.Journal of Business,46, 191-211.

21. Weston, F. (1989). What MM Have Wrought.Financial Management, 29-38.

22. Wildman, J. (2003). Modeling health, income and income inequality: the impact of income inequality on health and health inequality. Journal of Health Economics, 22, 521-538.

DOI 10.34660/INF.2021.25.49.002

GLOBAL TECHNOLOGY SPACE IN THE XXI CENTURY: FORMATION OF A BIPOLAR CONFIGURATION

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Annotation. *The article examines the tendency towards the formation of a bipolar configuration of the global technological space in the context of the fourth industrial revolution. The article analyzes the positions in the field of high technologies of two world leaders - the USA, which has been leading in technological innovation since the beginning of the twentieth century, and China, which has made a real technological breakthrough over the past 20 years. The coronavirus pandemic not only does not reverse the trend towards bipolarity in the global technological space, but, on the contrary, makes it even more pronounced. It is becoming more and more difficult for other countries to bridge the technological gap with the United States and China, which creates new challenges for the stable development of the global economy. The article concludes that for Russia in these conditions, aggravated by tough Western sanctions, the main strategy should be to rely on its own potential in combination with the adaptation of available Chinese technologies. Russia needs to more effectively use international cooperation in the field of digitalization with the EAEU and BRICS countries, as well as additional opportunities provided by the Chinese Digital Silk Road project.*

Keywords: *global technological space, world technological leader, bipolar configuration, technological power, technological wars, digital technologies, Digital Silk Road.*

Introduction

The most important condition for successful economic development is technological progress. The modern "coronavirus shock" only underlines the relevance of this postulate. Thanks to technological breakthroughs over the past 20 years,

China has become a global technology leader alongside the United States, bringing the global technology space to a bipolar one. Technological inequality in the world is growing and increasing its instability.

The purpose of the study is to analyze trends in the balance of power between the leaders of the global technological space - the United States and China - in the XXI century.

Materials and methods

The research is based on the materials of the World Bank, the UNESCO Institute for Statistics, as well as scientific publications of domestic and foreign experts. General scientific research methods were used: analysis and synthesis, induction and deduction, systems approach, comparative analysis, economic and statistical analysis.

Results and discussion

According to leading researchers in the field of economic growth, the contribution of technological factors and innovations to the country's economic dynamics ranges from 1/3 to 2/3 [1,2,3]. Technological innovations, according to the theory of big waves by N.D.Kondratyev, always give impetus to the next upward wave of a new long economic cycle lasting 55 years.

Economic leadership at all times belongs to countries that have gained superiority in technological development. Thus, Great Britain, which during the first industrial revolution (early 18th - mid-19th centuries) invented and introduced steam engines, mechanical looms, new methods of iron smelting, became a world leader in industry, world trade and colonial expansion.

The second industrial revolution (the last third of the 19th century - 1914) brought the United States to a leading position in the world economy thanks to the active introduction of such innovative technologies as electricity, the transition to mass production, the use of assembly lines, replaceable units and parts, the use of internal combustion engines .

During the third industrial revolution (1980s - early 21st century), South Korea, Taiwan, Hong Kong, Singapore broke out into the ranks of world leaders, who, on the basis of automation and computerization, were able to achieve great success in electronics (household computers and individual components), in computer production control systems. Finally, the new, fourth industrial (technological) revolution, which began in the second decade of the 21st century, is characterized by radical technological shifts as a result of the integration of physical, biological and digital technologies, which leads to the blurring of boundaries between individual industries and types of human activity, the massive introduction of cyber-physical systems, the emergence of fundamentally new products and markets of the future [4,5].

The coronavirus pandemic, which has masked the already approaching global

economic crisis, has once again confirmed that any country needs sufficient technological potential to overcome the cyclical crisis and to overcome the shock conditions provoked by non-economic factors. So, Russia, significantly inferior in many areas to the world technological leaders, nevertheless proved its superiority and high scientific potential in the field of biotechnology and genomics, thanks to which it was the first in the world to register an effective vaccine against coronavirus, which was named "Sputnik V" [6,7,8].

The current “coronavirus shock” sharply enhances the role and importance of a wide range of technologies for maintaining and monitoring health, including those based on the convergence of biotechnology with IT. It should be expected that the role of remote and sparsely populated industries (robotics), blockchain technologies in the financial sector, unmanned vehicles, including using artificial intelligence, partial virtualization of movements (primarily tourism) [9,10,11]. The pandemic not only does not cancel the main trends operating in the global technological space, but, on the contrary, makes them more pronounced.

The influence of the technological factor on economic development in our time has increased significantly, the phenomenon of technological power has appeared, which largely determines economic power. After all, if there are no technological innovations, then the economy is deprived of long-term development prospects. An increasingly active role in the struggle for technological power is played by technological wars, which are becoming an indispensable element of economic wars. An example of this is the US policy towards the Chinese company Huawei, which leads the world in the production of telecommunications equipment and ranks second in the world in the production of smartphones (20% of the world market). The United States also launched a technology war with other Chinese high-tech companies, most notably another telecommunications giant, ZTE. Similar wars can be expected in the field of satellite Internet, 5G networks, and shale oil production. As a reaction to the threat of technological wars, there is a tendency towards technological isolation, for example, a number of countries consider it necessary to insure themselves against disconnecting the national segment of the Internet from the global network. As a result of such actions, costs will inevitably increase, and the quality of the final product of import substitution will decrease in comparison with the world analogue.

The development of the fourth industrial revolution is increasingly giving the global technological space a bipolar configuration, the centers of which are the United States and China. These two countries now account for 75% of all blockchain technology patents; 90% of the market capitalization of the 70 largest digital platforms; 69% (344 out of 500) of the most powerful supercomputers (China has 227, the United States has 117); more than 40% of data centers existing in the world; more than 50% of expenses on the Internet of Things; 36% of global

e-commerce turnover; more than 75% of open cloud computing technologies [12].

According to experts, no country will be able to resist the formation of a bipolar structure of the global technological space in the foreseeable future. It is becoming more and more difficult for other countries to bridge the technological gap with the United States and China. Technological inequality is turning into a new challenge for the stable development of the global economy.

If the technological and economic hegemony of the United States dates back to the beginning of the twentieth century, then China has made a technological breakthrough in a historically short time. The PRC demonstrates very high rates of assimilation of new technologies and their rapid promotion to the markets. This is largely facilitated by the extremely capacious domestic market, which creates a growing demand for innovative products.

China currently accounts for 90% of the world's PC and mobile phone shipments. The number of Chinese firms operating around the world from 2010 to 2018 increased from 10.2 thousand to 37.2 thousand. In terms of the number of global companies, China is only slightly behind the United States: in 2018, the Global Fortune-500 included 111 firms from mainland China and Hong Kong and 126 from the United States to its list. In 2018, 64.8% of all patent applications registered in the world were Chinese and 18.6% of all articles published in scientific and technological journals [13].

In some important technological indicators, China is already significantly ahead of the United States, while in others it is gradually catching up. The latter include indicators in the field of artificial intelligence, which is assigned a special role in the technological race of the 21st century. In 2017, China adopted a plan to take the country to a leading position in the world in the field of artificial intelligence by 2030, and already in 2018 the country's investments in this area exceeded 50% of the world. The main share is provided by three Chinese technology giants - Baidu, Alibaba and Tencent [14].

An important competitive advantage of China is 5G technologies, which accelerate information transfer by more than 100 times compared to 4G networks and allow various things to be connected to the Internet. The Chinese company Huawei has more than 16,000 patents in the 5G field, which has made it a world leader. Such technologies, combined with artificial intelligence, become the basis of the country's technological superiority in various industries and spheres of human activity, giving it enormous technological and economic power.

China will have the largest number of 5G connections by 2025, at 416 million, according to the Global Association of Financial Markets, more than North America and Europe combined. Meanwhile, the PRC has already begun developing networks of a new generation - 6G, which allow wireless remote access to artificial intelligence at the level of the human brain in real time.

China came out on top in the world in terms of the number of industrial robots installed and second in terms of production of liquid crystal panels. He is also leading in the "quantum race", expanding his quantum communications around the world. About 50% of quantum technology innovations in the past 10 years have been developed by Chinese companies and universities. China is ahead of all other countries in the number of patents obtained for communications using quantum technologies. At the same time, the USA remains the leader in the number of patents for quantum computing, including software [15].

Quantum computers can crack the best classical encryption in seconds, so quantum encryption may be the only way to secure communications. It should be noted that quantum technologies are dramatically accelerating developments in the field of artificial intelligence. Therefore, the PRC has created the National Laboratory of Quantum Sciences, the volume of investments in which is about $ 1 billion. China's rapid advancement is observed in the field of blockchain technologies, big data, drones, unmanned seagoing vessels, military and space technologies, and biotechnology.

It is important to emphasize that China is actively pursuing a policy of localizing modern technologies in national jurisdiction. Thus, the "Made in China" program, which has been in effect since 2015, provides for the conquest of 40 to 90% of the market by domestic players in 11 out of 23 subsectors allocated in the program. In fact, this means a policy of import substitution in the field of high technologies.

China's technological advances are associated with large expenditures on research and development, which from 2000 to 2019 grew 50 times and exceeded $ 450 billion, which brought China to the second place in the world after the United States in this indicator and provided a significant lead in third place in Japan. During 2015-2019. Every year, China became the world leader in promotion in The Global Innovation Index, which is calculated by 82 indicators and reflects the level of innovative development of 129 countries. China overtook the United States in the number of fast-growing technology private startups (unicorn companies) with a capitalization of over $ 1 billion. At the end of 2019, it was in first place in the world, with 206 “unicorns” (42%), while in the United States there were there were 203, and in Europe - only 34. At the same time, in terms of the total capitalization of “unicorns” - 262 billion dollars - China surpassed the United States four times [16].

Foreign investment plays a significant role in China's technological development. For 2010-2019 The 20 largest foreign multinational companies (MNCs), primarily Amazon, Alphabet and Wolkswagen, have implemented 73 projects in the PRC in the field of innovative development, and in the following India and the UK - 59 and 55 projects, respectively. Note that if in the early 2000s multinational

companies preferred China due to the low cost of land, capital and labor, now they are attracted by the presence of highly qualified specialists and high technologies.

China's technological breakthrough was also facilitated by a change in strategy regarding the structure of foreign assets. In 2010, China abandoned the strategy of acquiring fuel and raw materials assets and companies to enter new foreign markets in order to expand exports and switched to a strategy of buying brands and technologies necessary to orient its economy primarily towards domestic consumption. At the same time, China began to transform from a country that copies innovations into a country that generates them. This has significantly expanded the geographic presence of the PRC in the global technological space. Currently, 23 of the largest Chinese technology companies have 2500 overseas points of presence, 447 university and research partnerships, 115 projects to create smart cities or public safety systems, 88 initiatives to develop 5G in different regions of the world [17].

Despite China's indisputable technological breakthrough, its scientific, technical and technological potential is still inferior to that of the United States. China has closed or even closed the technological gap with the world leader, primarily in the field of technologies of low complexity with relatively low technological barriers. However, for a number of complex technologies, China's dependence on foreign supplies and developments remains significant. The McKinsey Global Institute estimates that China still receives technology from multinational companies 20-40% of the time.

China's dependence on the United States and some other countries in the field of key technologies remains due to the lack of basic research in the country. For this reason, China is characterized by an import-dependent model of participation in global technological exchange. In 2018, the volume of its import payments for the use of intellectual property amounted to $ 35.8 billion, while export receipts for the use of Chinese property were 6.4 times less - 5.6 billion. For the United States, on the contrary, an export-oriented model is characteristic. So, in 2018, their technological exports amounted to $ 128.7 billion (33.8% of the global volume), which is 2.3 times higher than the corresponding imports ($ 56.1 billion) and 23 times higher than the volume of Chinese technological export. At the same time, more than 30% of China's import payments for the use of intellectual property came from the United States. For example, in the manufacture of sophisticated robots, China relies on imports of American advanced technology for key components: servo motors, gearboxes, and control systems.

Aware of its continued technological dependence on the United States, China is pursuing a flexible foreign economic policy that takes into account the country's real capabilities. In exchange for some of the US trade concessions, China has made a number of significant commitments to US intellectual property in technol-

ogy. The fact is that, according to the United States, its annual losses from China's illegal use of American intellectual property rights range from $ 300 billion to $ 500 billion. As a result, China had to agree to the following US demands for the protection of its intellectual property: forms of coercion of American companies operating in China to transfer technologies in favor of local firms; compliance with strict rules in e-commerce in order to suppress the supply of substandard and fake goods; the use of only licensed software by state institutions and state-owned companies, etc. [18].

A new successful decision in the Chinese foreign economic strategy was the promotion of the Digital Silk Road initiative from 2019. This vibrant brand brings together several official government programs and export concepts covering various areas of digitalization of the Chinese economy: «Made in China 2025», «Internet Plus», «Manufacturing Superpower», «Big Data Strategy», «Cyber Sovereignty», «Development Strategy of Cloud Technologies», «Standardization of Artificial Intelligence».

Aliplay, a Chinese electronic payment platform part of the Alibaba Group, has established a direct presence or operates through local operators in more than 40 countries in Europe and Asia. China has launched the Spatial Information Corridor, which consists of communications, positioning and surveillance satellite systems it supports. In strengthening China's technological influence, an important role is assigned to the creation of telecommunications infrastructure in the states participating in the Belt and Road Project. Experts believe that the Digital Silk Road has become the focus of this project, since data flow management is an important condition for changing the geopolitical balance in favor of China.

Conclusion

World economic development is characterized by unevenness, periodic changes in the balance of power between the participants in the global economy. This, in turn, is due to the patterns of development of technological progress, the emergence, development and implementation of technological innovations in different countries. In the 21st century, a significant reformatting of the global technological space is taking place, in which two main development poles - the United States and China - are becoming more and more distinct. This poses new challenges for all other countries. As for Russia, due to tough and constantly increasing Western sanctions, its main strategy should be relying on its own potential, complemented by the adaptation of available Chinese technologies. It is necessary to effectively use the additional opportunities provided by the Chinese Digital Silk Road project. The possibilities of international cooperation in the field of digitalization, including cooperation with the EAEU and BRICS countries, are far from being fully realized by Russia. The national project "Digital Economy" proceeds from the

preservation of a significant share of foreign software in state corporations and companies with state participation (up to 30%). In this regard, it seems necessary to work out a "roadmap" for the coordinated development of the digital space of the EAEU with the Chinese "Digital Silk Road". As you know, 2020 and 2021 have been declared "cross" years of Russian-Chinese scientific, technical and innovation cooperation, which makes it possible to significantly increase the number of joint technology projects within the framework of the Digital Silk Road.

References

1. Solow R. (1957). Technical change and the aggregate production function. Review of Economics and Statistics, Vol. 39, No. 3, pp. 312-320. https://doi. org/ 10. 2307/1926047

2. Nelson R.R., Romer P.M. (1996) Science economic growth and public policy. Challenge, Vol. 39, No 1, pp. 9-21. https:// doi org/ 10.1080/05775132.1996.11471873

3. Broughel J., Trierer A. (2019) Technological innovation and economic growth: A brief report on the evidence. Arlington: Mercatus Research, Mercatus Center at George Mason University.

4. Schwab K. The fourth industrial revolution / K. Schwab. - M .: EKSMO. 2017 . - 288 p.

5. Narimanova O.V. New technological revolution and its prospects in Russia. - In the book: Financial policy of the state: current trends and prospects: Proceedings of the All-Russian scientific-practical conference (Ryazan, September 29, 2018) / under total. ed. A. A. Gracheva. - Ryazan: Academy of the Federal Penitentiary Service of Russia, 2018 . - P. 131-135.

6. Narimanova O.V. Russian Pharmacy in the context of the coronavirus pandemic// Proceedings of the International conference «Process Management and Scientific Developments» (Birmingham, United Kingdom, January 13, 2021). Part 2. – Scientific publishing house Infinity, 2021. – P. 23-29. https://doi 10.34660/ inf.2021.42.28.003

7. Narimanova O.V. The global economic crisis and the contours of the post-crisis system // Proceedings of the annual scientific conference dedicated to the 70th anniversary of the founding of the Ryazan State Medical University named after academician I.P. Pavlov / under total ed. Honored Worker of the Higher School of the Russian Federation, prof. V.A. Kiryushin. - Ryazan: Publishing house of RyazSMU, 2013. - P. 285-287.

8. Narimanova O.V. The concept of "Century stagnation": what are the reasons for the slowdown in economic growth? // Proceedings of the annual scientific conference of RyazSMU named after Academician I.P. Pavlov, dedicated to the 65th anniversary of the university in the Ryazan land / under total ed. Honored Worker of Higher School of the Russian Federation, prof. V.A. Kiryushin. - Ryazan: Publishing house of RyazSMU, 2015. - P. 262-265.

9. Narimanova O.V. Blockchain technologies and their role in transforming markets // Topical areas of fundamental and applied research XIX: Proceedings of the Conference. North Charleston, 28-29.05.2019, Morrisville, NC, USA 27560: Lulu Press, Inc. 627 Davis Drive. 2019. Suite 300. - P. 201-207.

10. Narimanova O.V. Blockchain technologies and their implementation in financial markets. - In the book: Financial policy of the state: current trends and prospects: Proceedings of the All-Russian scientific-practical conference (Ryazan, September 29, 2018) / under total ed. A. A. Gracheva. - Ryazan: Academy of the Federal Penitentiary Service of Russia, 2018 . - P. 135-139.

11. Narimanova O.V., Narimanov N.F. Criptocurrency market: current state and developments trends// Proceedings of the International conference «Process Management and Scientific Developments» (Birmingham, United Kingdom, January 13, 2021). Part 2. – Scientific publishing house Infinity, 2021. – P. 30-35. https://doi 10.34660/inf.2021.14.69.004

12.URL:https://www.Top500/org/news/china-extends-fead-in-number-of-top500-supercomputers-us-holds-on-to-performance-advantage/

13.URL: https://data.worldbank.org/indicator

14. Castro D., McLaughlin M., Chivot E. (2019). Who winning the AI race: China, the EU or the United States? Washington, DC: Center for Data Innovation.

15. Gibney E (2019) Quantum gold rush: The private funding pouring into quantum start-ups. Nature, Vol. 574, No. 7776, pp. 22-24. https://doi. org/ 10.1038/d41586- 019-02935-4

16. Kheyfets B.A. Technological rise of China: New challenges for Russia// Problems of Economics. - 2020. – N 6. – pp.104-120. – [Electronic resource]. URL: https://doi.org/10.32609/0042-8736-2020-6-104-120

17. Cave D., Hoffman S., Joske A., Ryan F., Thomas E. (2019) Mapping more of China’s tech giants. Australian Strategic Policy Institute.

18. Samanta R. (2019) US accuses China of IPR violations, shakes trade deal. Market Realist , October 27. https://articles 2. marketrealist.com/2019/10/us-accuses-china-of-ipr-violations-shakes- trade-deal/#

19. Kitson A., Liew K. (2019) China doubles down on its Digital Silk Road. Reconnecting Asia, 14 November. https:// reconnecting asia. csis. org/analysis/ entries/china-doubles-down-its-digital-silk-road/

DOI 10.34660/INF.2021.57.71.003

CHOOSING AN OPTIMAL LEADERSHIP STYLE AT DIFFERENT STAGES OF THE ORGANIZATION'S LIFE CYCLE: I.ADIZES' THEORY

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Annotation. *The article analyzes the concept of one of the most authoritative modern representatives of the theory and practice of management, Yitzhak Calderon Adizes, on the choice of the optimal management style of an organization at various stages of its life cycle. This analysis acquires particular relevance in the context of a sharp increase in the dynamism, uncertainty and unpredictability of the external environment of organizations in the 21st century. The main attention is paid to I.Adizes's research in the field of the structure of the emotional intelligence of a leader, which is necessary for the correct management of an organization at different stages of its life cycle. This intelligence integrates four character dominants or four leadership styles. According to the conclusions of I. Adizes, the top management team must necessarily combine the carriers of four complementary leadership styles, which are conventionally designated " Producer ", "Administrator", "Entrepreneur", "Integrator".*

Keywords: *management, organization, top manager, organization life sycle, stage of organization life sycle, leadership style, integralleadership style PAEI.*

Introduction

Against the background of a sharp increase in the instability and unpredictability of the global economy in the context of the coronavirus pandemic, as well as the dynamic changes in the technological environment caused by the fourth industrial revolution, competent management of organizations is becoming an increasingly difficult task. In this regard, it is very important to implement in management practice the I.Adizes' concept of an optimal leadership style at different stages of the organization's life cycle.

The purpose of the study is to analyze I.Adizes' concept on the choice of the optimal leadership style at different stages of the organization's life cycle and

show its practical significance.

Materials and methods

The research is based on the study of the works by I. Adizes. General scientific methods were used: analysis and synthesis, induction and deduction, systems approach, comparative analysis, economic and statistical analysis.

Results and discussion

One of the management axioms is the correct choice of an effective leadership style, or leadership, for the successful development of an organization at different stages of its life cycle.

The study of the life cycles of commercial organizations began in the West relatively recently - from the 50s of the XX century. The impetus for these developments was the new social sciences, primarily psychology. The authors of the first works devoted to the use of the life cycle concept in business were American scientists E. Penros, who studied the analogies of firms and biological organisms; D. Chain, who analyzed the stages of development of corporations; L. Steinlitz, who observed the dynamics of growth and survival of firms. An article by L. Greiner entitled “Models of Organizational Change” (1970), in which the author identified five stages in the development of firms, was of key importance for the popularization of research on the life cycles of business organizations.

In the 1980s and early 1990s. there have been many works devoted to various problems of the life cycles of organizations. So, D.Boulding and E.Wetten considered the stage of "decline", J.Meiner wrote about "types of entrepreneurs" and "bureaucratic stages", R. Berenheim - "about natural selection and survival", P. Mirvis and W. Dyer - “about changes in family firms”. Several longitudinal studies of the "efficiency" and "predictability" of life cycle stages have been carried out by such scientists as D. Miller, K. Cameron, R. Quin, R. Friesen, R. Drazing, R. Kazanjan and others. D. Miller and R. Friesen analyzed the five stages of growth and decline of organizations using 54 variables with a predominance of "complementary variables" at each stage. R. Draizin and R. Kazanjan used a business procedure for predictive analysis of three-stage models of “life cycle imperatives” [1].

The most authoritative scientist in the field of research on the life cycle of organizations is the American scientist Yitzhak Calderon Adizes, a well-known "guru" of management theory, who generalized and successfully promoted the scientific developments of his predecessors. Adizes is the founder and director of the Adizes Institute in Los Angeles, California, and the director and director of the Adizes Graduate School for the Study of Change and Leadership, which operates at the institute. Since 1975, he has been developing a diagnostic and therapeutic methodology for implementing organizational change, now known throughout the world as the "Adizes methodology". Itzhak Adizes applies his methodology in a variety

of organizations with the number of employees from 30 to 150 thousand people. His organizational therapy methods have helped commercial and non-profit organizations in the USA, Canada, Sweden, Denmark, Iceland, Norway, Finland, France, Germany, Switzerland, Russia, Yugoslavia, Holland, Belgium, Austria, India, China, Israel (all in this list are companies from more than 50 countries) to achieve high results and take leading positions in a variety of industries. Currently, more than 1,000 companies around the world apply the Adizes methodology and more than 200 certified graduates of the Adizes Institute serve organizations around the world. Adizes owns more than twenty monographs, translated into 30 languages, which summarize his long-term practical experience of working with various companies [2].

According to the Adizes methodology, the life cycle of an organization is in many ways similar to the life of a person. The organization is born in creative and entrepreneurial agony, experiences the difficulties and joys of adolescence and youth, and finally reaches maturity. Then many organizations begin to age, and old age can be followed by organizational death. But here the fundamental difference between the organization as a socio-economic system and a biological organism is revealed. After all, the life cycle of an organization is not strictly limited by some time period. There are many examples of organizations that have thrived for decades, some of which are a hundred or more years old. Their leaders managed not only to raise their business to the top of success, but also to stay on it for a long time.

One of the main tasks of management is precisely to find a recipe for the health of a business at different stages of its evolution and to ensure its overall longevity. To solve it, it is necessary to clearly understand the features of each stage of the life cycle of organizations, objectively arising at each of them, as well as the optimal leadership style in these conditions.

The uniqueness of the methodology proposed by I. Adizes for researching the life cycle of organizations is that it allows you to analyze the objective (normal) and abnormal problems of organizations on the typical path of their life cycle, as well as to formulate effective principles for managing organizations on the optimal, that is, faster and safer path. development. The optimal path of evolution, of course, does not exclude problems, but quickly brings organizations to the stage of flowering and ensures their longer stay in this state. It should be noted that it is at the stage of flourishing that the organization will face the most difficult tests. This is where the test of her will to win begins. After all, success is relaxing. And the test of success, fame, recognition that comes to the company and its management at the stage of flowering and maturity are its test of strength. This is a period when it becomes clear to what extent the previously achieved successes were associated with the strength of the personality of their leader, his strategic vision, his ability

to create a cohesive team and lead it, and in what extent - simply with favorable market conditions. At the same time, it is often necessary to overestimate past values and look for new guidelines.

When the euphoria of success gives way to a kind of managerial hangover, the development of the company suddenly slows down. The collective, which until recently seemed like a team of like-minded people, are beginning to shake open and hidden conflicts. This means the destruction of the synergistic effect, which until recently has multiplied the capabilities and overall potential of the company. Internal and external problems are growing, and yesterday clear development prospects disappear. The heyday of a company is replaced by inevitable aging and decline, if its management does not realize that it is impossible to stay “at the top” without making regular and fundamental changes [3].

According to I. Adizes, the choice of the correct leadership style at different stages of the organization's life cycle is a key condition for its movement along the optimal path of development. The special type of intelligence that successful leaders and managers must possess is extremely important. This type of intelligence is called emotional. Emotional intelligence requires the ability to convince, inspire, and lead people. This is a special talent that has become the subject of special research in management theory in recent years. The development of emotional intelligence is interpreted today as perhaps the most important thing in business. Often, brilliant scientists have weak emotional intelligence. Conversely, people with an intellect not sufficient to master complex fundamental science sometimes (although not always) find themselves endowed with remarkable emotional intelligence by nature.

The scientific merit of I. Adizes is the analysis of the structure of the emotional intelligence of the leader, which is necessary for the correct management of the organization at different stages of its life cycle. Such intelligence integrates four dominants of character or four leadership styles (Adizes calls them “vitamins of success”) [4,5]. Business management presents top management with a seemingly insoluble problem. The fact is that in order to successfully manage a company, its leader must simultaneously possess many qualities. He needs to constantly take care of the interests of clients and the image of the company; to be an excellent administrator, that is, to be able to rationally organize, streamline, systematize the work of subordinates, establish strict and timely financial reporting and control; have a strategic vision, which means the ability to correctly determine development prospects, be creative and enterprising, ready for risk, for extraordinary decisions; be able to create a strong corporate culture, act as an integrator, inspire teamwork in the name of corporate goals, and experienced crisis management. In other words, top management of any organization must fulfill four functions: production of results, administration, entrepreneurship, and integration.

It is easy to see that managers with all the necessary skills do not exist in nature and cannot exist. After all, these qualities are often mutually exclusive and cannot be equally present in the character and intelligence of one person. It follows from this that a leader should not strive to be the best at everything, but should form a team of the company's management staff in such a way that the owners of all the necessary qualities and talents are simultaneously represented in it. In other words, the leadership team must unite the carriers of four complementary management styles. I. Adizes is convinced that it is their synergistic unity that feeds the growing company, like vitamins that stimulate the healthy functioning of a living organism. The qualities required for a manager are thus combined into the following four leadership styles, or four types of leaders: “Producer”, “Administrator”, “Entrepreneur”, “Integrator” [6,7].

Let's consider the features of these styles. The first of them - "Producer" - I. Adizes designated the Latin letter "P" (from the English "Producer"). A leader with this style is responsible for the production of goods and services. It is focused on results, that is, on high-quality customer satisfaction. If the company's products meet the needs of customers, then they constantly turn to it for goods and services, recommend them to their relatives, friends, acquaintances. Thus, they help to promote the company's products and increase its market share. Consequently, the role of the P-style leader is to work tirelessly to ensure the production of quality products that meet the needs of customers. Note that the importance of such a function for the success of companies was also noted by another well-known management theorist - Peter Drucker. One of the conditions for business success, he formulated as "the ability to do the right things" ("doingtherightthings"). This skill just means the ability to correctly identify and often anticipate the needs of customers, to guess what kind of goods and services will be in demand. However, consumer needs should be met with an optimal cost-benefit ratio. Peter Drucker called it “doing thethingsright”. This refers to the provision of economic efficiency, which requires the maximization of profit per unit of cost while maintaining the required quality of products [8].

The problem of economic efficiency and optimal use of the organization's resources should be dealt with by the second type of manager - "Administrator", whose style is conventionally designated by the letter "A" (from the English Administrator). Such a leader ensures the correct organization of activities, the optimal combination and interaction of all elements of its internal environment, including economic, informational and human resources. He oversees the distribution of powers and responsibilities of officials, compliance with rules and procedures, implementation of the planned strategies, tactics and policies of the company.

Successful development of a company is impossible without competent stra-

tegic planning that allows you to see the future, adapt to the rapidly changing economic, technological, political, socio-cultural environment. The development of a strategy, a strategic vision requires a special intuitive gift from the manager, creativity, and entrepreneurial spirit. All these traits should be possessed by the third type of leader - "Entrepreneur" with style "E" (from the English "Enterpreneur"). A leader with such a style is called upon to be the initiator, inventor of new ideas and solutions in various areas of the company. It is his innovation that helps keep the company in its prime and postpone its decline.

Finally, the fourth type of manager is called the "Integrator" and is designated by the letter "I" (from the English "Integrator"). This is a leader-leader, whose function is to create and maintain the corporate culture of the organization, taking into account its mission and strategy. Corporate culture includes the general philosophy, or concept, of the organization's activities, its policy in relation to personnel and customers, a system of values, traditions, norms, attitudes, unwritten rules, rituals, and "rules of the game" common to the employees of this organization. Studies by American scientists T. Peters, R. Waterman and others have shown a stable relationship between the content of corporate culture and the effectiveness of companies. This determines the importance and complexity of the functional role of the "Integrator". Such a leader must be a bright, charismatic leader who provides a synergistic effect in the team [9].

Ideally, all four types of leaders should be represented in the management of the company at any moment. Taking into account the letter designations used by Adizes, the integral management style can be conventionally designated as the PAEI code. Depending on the stage of the organization's life cycle, at any given moment, some leadership styles should be dominant, while others should be complementary, secondary. The logic of the combination and alternation of these roles is dictated by the priority tasks of a particular stage of the organization's development. At the same time, Adizes denotes “capital”, key leadership styles in capital letters, and supplementary ones in small letters. For example, if top management is convinced that it is necessary to adjust the company's development strategy (that is, to strengthen the role of the “Entrepreneur”) and make the necessary changes in the production of goods and services (to activate the “Producer” function), then the management code can be expressed as a combination of styles: “PaEi ". If you need to focus on improving the organization of activities ("Administrator" style) and strengthening the corporate culture ("Integrator" style), then the general leadership style is designated "pAeI".

The choice of the optimal combination of management styles depends on the ability of top management to correctly "diagnose" the company, that is, to accurately determine the needs and characteristics of a given stage of its life cycle. This approach to company management allows avoiding many managerial pathologies,

that is, serious mistakes.

The complexity of managing a company, taking into account the stages of its life cycle, is also associated with the fact that various structural divisions of organizations “age” at different rates and may at the same time be at different stages of the life cycle. For example, the marketing department is in its prime and the manufacturing department is aging. It follows from this that the management of any structural unit of the company requires an individual approach and the formation of a special management code that corresponds to its state. However, this is still not enough for competent leadership of the organization. After all, it is still necessary to correctly and convincingly bring to the managers orders about which of them comes to the fore and who goes into the shadows, and help them realize the need for such a “castling” [10].

Conclusion

The PAEI model proposed by Adizes is a unique management technology that allows you to fully implement a situational approach to managing organizations. It is no secret that one of the most difficult problems of practical management is change management in organizations. Changes in organizations should be a reaction to changes in the external environment. In the context of today's technological revolution, it is especially important to consider technological changes. Unlike living organisms, companies do not have systems of internal automatic self-regulation, they are deprived of any “built-in stabilizers” and shock absorbers. Everything that happens to them in the course of their evolution is the product and result of the conscious efforts of top management. Knowledge of the specifics of each stage of the life cycle, the trends and patterns of change inherent in this stage, and typical managerial pathologies save the organization from “groping” by trial and error. Application of Adizes' recommendations on the choice of the optimal integrated management style allows to mitigate the threats and risks arising from an unstable and uncertain economic and technological environment as much as possible.

References

1. Adizes I. Managing Corporate Lifecycles / Ichak Kalderon Adizes. – SPb: Piter, 2007. 672 p. (in Russian)

2. Narimanova O.V. Optimal leadership style at different stages of the organization's life cycle // Personality in a changing world: health, adaptation, development: network journal. 2017 vol. 5 no. 2 (17). URL: http://humjournal.rzgmu.ru/art&id=260 DOI: 10.23888 / humJ20172169-179.

3. Adizes I. Mastering Change. The Power of Mutual Trust and Respect in Personal Life, Family Life, Business and Society . – SPb: Piter, 2008. 224 p. (in Russian)

4. Adizes I. Food for thought / Ichak Kalderon Adizes. M: Eksmo, 2017. 144 p. (in Russian)

5. Adizes I. Insights on Management / Ichak Kalderon Adizes. – M: Mann, Ivanov and Ferber, 2017. 150 p. (in Russian)

6. Adizes I. The Ideal Executive: Why You Cannot Be One and What To Do About It / Ichak Kalderon Adizes– M: Alpina Pablicher, 2014. 360 p. (in Russian)

7.Adizes I. Leading The Leaders: How To Enrich Your Style of Management and Handle People Whose Style Is Different From Yours / Ichak Kalderon Adizes – M: Alpina Bizness Buks, 2008. 259 p. (in Russian)

8. Michael H. Meskon, Michael Albert, Franklin Khedoury. Management, Third edition. – M: OOO «I.D. Wilyams», 2007. 672 p. (in Russian)

9. Adizes I. Management/Mismanagement Styles: How to Identify a Style and What to Do about It / Ichak Kalderon Adizes. – M: Alpina Bizness Buks, 2009. 199 p. (in Russian)

10. Adizes I. Pursuit of Prime: Maximize Your Company's Success with the Adizes Program / Ichak Kalderon Adizes. – M: Mann, Ivanov and Ferber, 2017. 256 p. (in Russian)

DOI 10.34660/INF.2021.21.78.004

RUSSIAN UNIVERSITY AND ITS NEW ROLE UNDER THE CONDITIONS OF GLOBAL TECHNOLOGICAL CHANGES

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Annotation. *The article analyzes the new requirements for universities in the context of modern global technological changes, implying a radical transformation of their role, mission and objectives. The article contains an assessment of the prospects and problems of the implementation by Russian universities of the National Technological Initiative (NTI) University model - a domestic version of the University 3.0 concept, which has become widespread internationally in the context of the new ("fourth") technological revolution. According to this concept, universities are assigned a “digital code” based on the number of their missions. University 3.0 receives the status of a university, where the third mission is added to the two traditional missions - educational and research - the commercialization of knowledge and technology. Universities of the "third generation" form entrepreneurial ecosystems, promising technology markets and ensure the global competitiveness of the domestic economy.*

Keywords: *the fourth industrial (technological) revolution, technological development, markets of the future, the concept of University 3.0, NTI University, university missions, knowledge commercialization.*

Introduction

At present, the main task of the Russian system of higher education, and first of all university education, is to provide an adequate response to the challenges posed by global changes in the technological environment. The pace and results of Russia's inclusion in the so-called "fourth industrial" revolution, which the advanced countries have already entered, largely depend on the efficiency and speed of response of Russian education to the requirements of the time. In this regard, it is important to correctly formulate the tasks of Russian universities in the new conditions.

The purpose of the study - is to analyze the impact of global technological

changes on the goals, objectives, and missions of Russian universities, as well as to assess their capabilities in solving urgent technological and economic problems of the country.

Materials and methods

The study is based on the analysis of regulatory documents governing the implementation in Russia of the National Technology Initiative University model, as well as on scientific publications of domestic and foreign scientists. General scientific research methods are used: analysis and synthesis, induction and deduction, systems approach, comparative analysis, economic and statistical analysis.

Results and discussion

The content of the new technological revolution is the transition to flexible production of an individualized product based on the latest technologies, covering quantum technologies, new and portable energy sources, wireless communication technologies, big data, distributed ledger systems, robotics, neurotechnology, artificial intelligence, virtual and augmented reality technologies. technologies for controlling the properties of biological objects. The use of digitalization, computer-aided design, and platform solutions is already radically changing the functionality of companies and the structure of markets. The release of fundamentally new products will lead to the disappearance of many old markets and give life to the markets of the future based on the principles of a distributed economy, i.e. on a global network of horizontal links between autonomous institutional actors. Among them are AeroNet (distributed systems of unmanned aerial vehicles); such markets MariNet (distributed systems of maritime transport without crew); AutoNet (distributed network of vehicles without a driver); HealthNet (the market for distributed systems of high-tech medical services); NeuroNet (distributed artificial components of consciousness and psyche); EnergyNet (distributed energy); FoodNet (a market for distributed food production and delivery systems). According to experts, the peak of revolutionary technological changes will occur in the 2020s - 2030s. By this time, not only will the structure of the economy be fundamentally updated, but also there will be a sharp polarization of countries, some of which will act as technological leaders, while others will turn out to be technological periphery [1].

At present, efforts are being made in our country at the state and government level to implement breakthrough technological development. For this purpose, the strategic program "National Technology Initiative" is being implemented, designed for the period until 2035, the national projects "Digital Economy", "Science", "Education", "Small Business and Support of Individual Entrepreneurial Initiatives", etc. are being implemented. the priority goals for Russia are the formation of a scientific base and an educational environment capable of responding to new technological challenges in the present and the future, the preparation of

centers for generating new technologies and new markets on the basis of leading higher educational institutions, and the implementation of projects to increase the global competitiveness of Russian universities.

The universities of the future are named National Technology Initiative Universities (NTI Universities) and are the Russian model of University 3.0. The concept of University 3.0, which is now widely spread in the international educational space, involves the assignment of a "digital code" to universities, taking into account the number of their missions. So, if a university is engaged only in educational activities, the name University 1.0 is assigned to it. Such a university carries out the transmission of knowledge, training of personnel and provides a social lift. In case of simultaneous execution of two missions, it acquires the status of University 2.0. Its teaching and research functions are the generation of new knowledge through research activities and consulting services for market players. University 2.0 carries out research and development on orders of the industry and creates technologies "to order".

An even higher status is characteristic of University 3.0, where the third mission appears - the commercialization of knowledge and technology. Such a University manages intellectual property rights, forms an entrepreneurial ecosystem, promising technological markets, turns into a platform for creating the country's economic superiority at the global level. It is these universities that define the face of the modern technological revolution [2,3,4,5].

The concept of University 3.0 is based on the research of J.Wissema, Professor of Entrepreneurship and Innovation at the Delft University of Technology (Netherlands). In his opinion, the content and number of missions of a modern university is changing for the following reasons: the world's leading universities are increasingly in need of alternative government funding sources and are therefore interested in cooperation with high-tech companies; 2) the transition from monodisciplinary to interdisciplinary scientific research; 3) aggravation of the global competition of universities for the best students, teachers, contracts, for leadership in the practical implementation of inventions and know-how; 4) the desire of universities to derive new benefits from the knowledge they create, increasing their role in the implementation of the state policy of economic growth; 5) the need to ensure the economic efficiency of universities in the new increasingly complex conditions; 6) experimenting with the differentiation of mass and elite education programs in modern universities in connection with the massive influx of students [6].

Code 3.0 was assigned to the leading universities in the USA, Great Britain, and China. They form an economic and technological environment that is 5-10 years ahead of reality. It is from this environment that companies grow, which in 10-15 years become the flagships of global business in new industries. In par-

ticular, the graduates of such universities created the companies Hewlett-Packard, Yahoo, Google. Universities 3.0 combine flows of human and financial capital, become system integrators of the main processes of technological entrepreneurship within innovation ecosystems, create inter-university networks, hubs and networks for the exchange of technological competencies. Such universities are becoming leaders not only in the formation of startups, but also in determining the trends of entire industries. For example, the American Carnegie Mellon University is currently setting the key directions for the development of robotics. Through the University of Cambridge, joining forces with the business community and the local county, which has become a world center of government, Cambridgeshire was created high-tech industries.

To move to University level 3.0, the university must have higher competencies in understanding markets and the patterns of their development than the corporate environment surrounding it. Only in this case it will, like a magnet, attract the best representatives of the business community for the implementation of joint innovative projects [7].

Formation of the concept of University 3.0 was prepared by the development of the system of university education in the USA and European countries in the XX century in the conditions of rapid scientific and technological progress. The growing business demand for innovation has spurred innovation, and universities have also joined. It should be noted that in the second half of the 20th century, natural mechanisms for stimulating innovation were formed in developed countries, without which the new mission of third-generation universities would have been simply impossible. These mechanisms are based on the activities of venture capital companies and corporate venture funds that finance high-risk projects and startups. Corporate venture funds currently account for 25% of the venture capital economy in the United States. They provide an effective system of interaction between the sphere of inventions and discoveries with the sphere of business, as a result of which all promising technological ideas are quickly implemented in practice. It is important to take into account that innovative activity in modern countries is based on well-developed legislation on intellectual property, where the rights of all subjects of the innovation process, including universities, are clearly defined, the procedure and proportions of the distribution of remuneration from the sale of intellectual property are indicated. It is also important that in the United States about half of the universities are private and do not have any restrictions on participation in entrepreneurial and commercial activities as intellectual property rights holders.

Let us assess the prospects for the implementation of the concept of University 3.0 in our country, in particular, its domestic version, the NTI University. The system of higher education that has developed in Russia is still focused on the in-

dustrial culture of the second half of the 20th century and does not meet the needs of an innovative and technological breakthrough. In our country, an approach has taken root, according to which the competence and development prospects for universities are determined by the state. This condemns Russian universities to lag behind the world leaders in the field of higher education, which, as already noted, have long become "trendsetters" in the field of competencies and the formation of market trends. A significant number of Russian universities correspond to the University 1.0 model, i.e. fulfills only an educational mission. In other universities, thanks to research work, the status of University 2.0 has been achieved. There are practically no 3.0 universities involved in the commercialization of knowledge in Russia, with extremely rare exceptions. Even elite Russian universities do not actually conduct innovative and entrepreneurial activities, which are mandatory for University 3.0. Most of the leading Russian universities operate on the principle of “there are patents, there is no income,” and the patents are mostly Russian; 28 elite universities do not have international patents at all, and 11 have the number of such patents ranging from 1 to 3. Tomsk Polytechnic University is the leader in this area, which received 11 international patents, but its average annual income from intellectual property management does not exceed 800 thousand rubles. [8,9,10,11].

In the state priority project "Universities as centers of innovation creation space", which was approved on October 25, 2016 by the Presidium of the Council under the President of the Russian Federation for Strategic Development and Priority Projects, it was planned to ensure sustainable global competitiveness in 2018 at least 5, and in 2025 year - at least 10 leading Russian universities; create in the constituent entities of the Russian Federation in 2018. at least 55, in 2025 - at least 100 university centers for innovative, technological and social development of regions.

Currently, according to the prestigious international rankings (RUR, THE, QS, Shanghai), the positions of Russian universities have improved significantly, from 10 to 20 of them, according to various rankings, entered the TOP-1000. Among them are Moscow State University, MIPT, MAI, Tomsk State Polytechnic University, Novosibirsk State University, Bauman State Technical University, RUDN, Russian State University of Oil and Gas, ITMO University. It is they who are currently making active efforts to become universities of the "third generation", or NTI Universities.

Within the framework of the National Technology Initiative program, the creation of University Advanced Development Areas is recognized as a key area of training specialists for the markets of the future. The program stipulates that the NTI University should carry out fundamental and applied research on NTI topics; to form an innovative infrastructure (technology transfer centers, business incuba-

tors, technology parks, etc.); train professionals as drivers of future development; to carry out for the STI markets, i.e. work with talents effective management of intellectual property, commercialization of developments and generation of new businesses in the NTI markets. According to the plan, the NTI University should become the center of ecosystems focusing on them the resources of promising technological development programs. It should provide interactive interaction between the market and inventors, stimulate creativity at the personal and organizational levels [12,13,14].

However, the creation of the NTI University in Russia requires overcoming many barriers, the main of which are:

1) low demand for innovations on the part of Russian business;

2) the lack of an effective mechanism for interaction between consumers and suppliers of innovations, which leads to the export of intellectual property from the country, the drain of scientists, highly qualified specialists, capital against the background of the import of technological solutions;

3) a shortage of scientists and specialists capable of implementing complex interdisciplinary projects, acting as market leaders in the field of competencies, integrators of science-intensive processes;

4) insufficient coordination of the action plan for the implementation of the National Technology Initiative program ("NTI roadmaps"), which prevents the formation of a holistic picture of technological development;

5) limited opportunities of Russia in meeting the demand for fundamentally new areas of knowledge and profession, which also leads to the outflow of gifted youth from the country;

6) inconsistency of Russian legislation with the tasks of NTI: in accordance with the Law on Education, an educational organization in our country has the legal status of a non-profit organization, so it can only carry out income-generating activities, but has no right to engage in entrepreneurial activities;

7) insufficiently developed legislation on intellectual property;

8) high academic load on teachers of Russian universities, which condemns universities to 1.0 status and hinders active scientific and innovative work, participation in cooperation with business entities [15, 16].

The legal problems of the implementation of intellectual property deserve special attention. It seems that the lack of legal certainty about the rights to intellectual property objects is one of the main obstacles to the innovative activity of Russian universities, their commercialization of knowledge and technologies. This is the main obstacle to innovation in the country as a whole, the creation of corporate venture funds and venture companies. After all, for both domestic and foreign investors, when deciding whether to invest in research and development or in the purchase of new technology, it is important to clearly understand in what

order and in what proportion rewards from the sale of intellectual property will be distributed. Otherwise, the interest of both business and universities in the commercialization of patents, inventions, and discoveries is sharply reduced. Without resolving the issues of the legal nature of intellectual property and its rightholder as a subject of legal relations, it is impossible to provide an effective mechanism for the interaction of business with the sphere of inventions and discoveries, which means that a single “innovation chain” in which universities would participate will not develop [17, 18].

Conclusion

Thus, the inclusion of Russia in the new technological revolution urgently requires the modernization of the activities of the leading Russian universities in accordance with the concept of University 3.0, the Russian model of which is the University of the National Technology Initiative. Ensuring the global technological competitiveness of the Russian economy is impossible without deep institutional transformations aimed at transforming leading universities into centers of entrepreneurial ecosystems, leaders in the formation of technological and market competencies, and drivers for the development of future markets.

References

1. Idrisov G.I., Konyakhin V.N., Kudrin A.L., Rozhkova E.S. New technological revolution: challenges and opportunities for Russia // Problems of Economics. - 2018. - No. 4. P. 5-25.

2. Karpov A.O. Modern University as a Driver of Economic Growth: Models and Missions // Problems of Economics. - 2017. - No. 3 - P. 58-76.

3. Karpov A.O. Modern university: environment, partnerships, innovations // Alma Mater. Bulletin of the Higher School. - 2014. - No. 8. – P. 8-12.

4. Kuznetsov Ye.B. Universities in the knowledge economy // Izvestia. December 11, 2016. URL: http://izvestia.ru/news/650622

5. Lunev V.V., Luneva T.A., Rakhinsky D.V. Landmarks for the development of a modern university // Creative Economy. - 2019. - Vol. 13, No.2 - P. 279-290. doi10.18334 / ce.13.2.39925

6. Wissema J. Third Generation University: University Management in a Transitional Period. Moscow: Sberbank, 2016. - 422 p.

7. Universities 3.0 in NTI. [Electronic resource] URL: http://ff.tsu.ru/sites / default / files / Universities% 203.0% 20 (1)

8. Monitoring the effectiveness of innovative activities of Russian universities. SPb.: ITMO University; RVC. 2016.

9. Narimanova O.V. Concept "University 3.0." and its prospects in Russia / Proceedings of the annual scientific conference of the Ryazan State Medical University named after academician I.P. Pavlov 15.12.2017 / editorial board: R.E. Kalinin, I.A. Suchkov; Federal State Budgetary Educational Institution of Higher Education RyazSMU of the Ministry of Health of Russia. - Ryazan: Publishing house of RyazSMU, 2017. - 220 p., P.51-53.

10. Narimanova O.V. Modern university: role in innovative development and economic growth / Collection of scientific papers of the departments of humanitarian disciplines //ed. B.I. Repin; Federal State Budgetary Educational Institution of Higher Education RyazSMU of the Ministry of Health of Russia. - Ryazan: Publishing house of RyazSMU, 2017. - Issue. 18, P. 99-111.

11. Narimanova O.V. Modern University: Problems of Transformation // Proceedings of the III International Scientific and Practical Conference "Topical Problems of Economics, Law and Education in the XXI Century". 24.05. 2017 / Witte Moscow University, Ryazan branch. - M.: Publishing house of Witte Moscow University, 2017. - P. 109 -113.

12. Narimanova O.V. Creativity at the personal and organizational levels: modern models and concepts // Personality in a changing world: health, adaptation, development: network journal. 2018 vol. 5 no. 2. URL: http://humjournal.rzgmu.ru/art&id=260 /dx.doi.org/10.23888/humJ20182256-278

13. Narimanova O.V. Models and concepts of creativity in organizations // Collection of scientific papers of the departments of humanitarian disciplines // ed. B.I. Repin; RyazSMU of Ministry of Health and Social Development of Russia. - Ryazan, Publishing house of RyazSMU, 2011, Issue 12. - P. 185-197.

14. Narimanova O.V., Narimanov N.F. Creativity models and their implementation in contemporary management practice // International Scientific Conference "Global Challenges and Prospects of the Modern Economic Development" 06–08 December 2018. - The European Proceedings of Social & Behavioral Sciences EpSBS. vol. LVII-GCPMED 2018, p. 768-779. WWW. FutureAcademy.org.UK// doi: https://dx.doi.org/10.15405/epsbs.

15. Narimanova O.V. Russian University: a new mission in the context of the modern technological revolution // Pedagogical interaction: opportunities and prospects: Proceedings of the I scientific-practical conference with international participation (May 14, 2019); Saratov State Medical University. Saratov: Publishing house of SSMU, 2019. - 828 p., P. 570-578.

16. Narimanova O.V. University 3.0 Concept: prospects for implementation in Russia under the conditions of a new technological revolution. Personality in a changing world: health, adaptation, development: a network journ. 2019; 7 (2). Available at: http://humjournal.rzgmu.ru/art&id=377 Accessed: dd Month yyyy. doi: 10.23888/humJ20192350-363

17. Barkov A. V., Grishina Y.S., 2017 "University 3.0": Legal model of the university's participation in innovative entrepreneurship // Bulletin of the Kant Baltic Federal University. Ser.: Humanities and social sciences. - 2017. - No. 3. - P. 5-15

18. Dezhina I., Leonov I. Intellectual property in Russia: problems of state regulation. URL: https: //www.iep ru / files / personsl / dezhina / innovatsii

DOI 10.34660/INF.2021.31.22.005

MECHANISMS FOR THE FORMATION AND DEVELOPMENT OF ENTREPRENEURIAL COMPETENCIES IN THE CONTEXT OF THE DIGITALIZATION OF THE ECONOMY

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Abstract. *Digital skills and competencies are the key to the full development of the digital economy. Digital literacy should be one of the key competencies. The article defines the essence of entrepreneurial competencies, identifies the features of the development of entrepreneurial competencies in the digital economy. The mechanisms for the formation of digital competencies are also considered and ways of their further development are proposed.*

Keywords: *competencies, digital entrepreneurship, digital economy, formation and development of digital competencies.*

Today, the issues of forming and building up entrepreneurial competencies in the context of the decentralization of the economy and its digitalization are gaining special importance and relevance. Competence is a group of interrelated behavioral actions that, when shown by a candidate and considered by an observer, characterizes competence in a specific aspect of the work performed [1, p. 264].

"Competency" is broader than competency. Most modern researchers define competency as the possession, mastery by a person of the appropriate competence, including his personal attitude towards it and the subject of activity.

The components of the competence are shown in fig. 1 [2, p. 293].

It should be noted that specialists in any field of activity must have general competency (the ability of a person to analyze, synthesize, general knowledge, the ability to learn independently, cooperate and communicate, purposefulness, leadership qualities, organization and the ability to plan) necessary for existence in society, to solve any situations, even not related to a specific professional activity [3, p. 75]. Along with the general competency of any specialist, there are professional competencies, corresponding to the type of activity, specialties, the necessary certain knowledge, experience, personal qualities. For example, the following types of competencies are distinguished in terms of the competency of learning in

the European Higher Education Area (fig. 2) [4, p. 122].

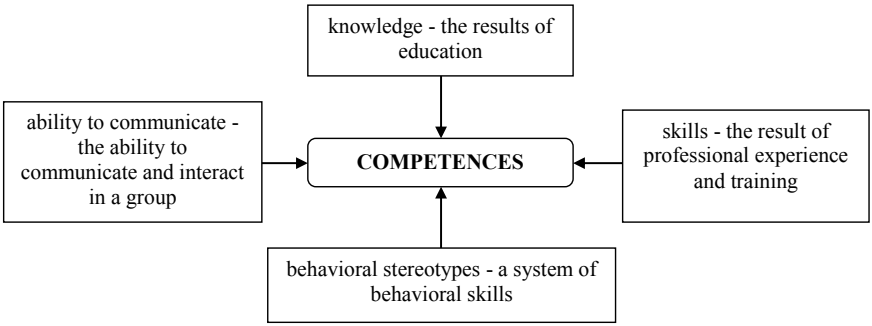

Fig. 1. *Components of competence*

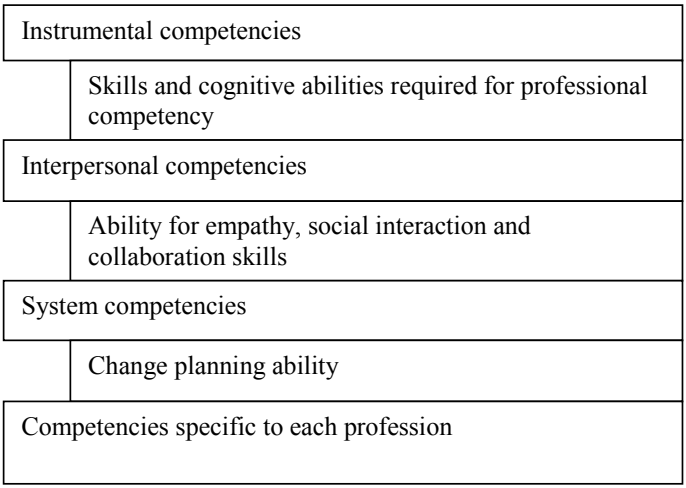

Fig. 2. *Types of competencies in terms of the learning competency of the European Higher Education Area*

Professional competency should be considered as an integrated result of acquired experience associated with mastering professional knowledge, the ability to use their totality in professional activities, the formation of the corresponding personal qualities of an individual. Competency of an employee is formed on the basis of existing competencies (knowledge, skills, abilities) and motivation. In a competitive environment, the main priorities of the professional competency of a

specialist is the ability to adapt to rapid changes and new needs of the labor market, to be informationally educated, to act actively, make quick decisions and learn throughout life [1, p. 147].

Entrepreneurial competency is a personal quality, ability, and behavior model necessary for successfully solving certain business problems and achieving high results in entrepreneurial activity.

In the European Reference System (Key Competetences for Lifelong Learning. A European Reference Framework), entrepreneurial competency is interpreted as the ability of an individual to translate ideas into the sphere of economic life, as an integrated quality based on creativity, creativity, innovation, the ability to take risks, as well as the ability to plan and organize entrepreneurial activity [5, p. 8].

The approach to the formulation of competencies for successful employment in the digital economy differs among different authors: some argue that four main types of competencies are needed: professional, communicative, informational and digital [6]; others write that in relation to the digital economy such a paradigm of terms has emerged: "hard skills", "soft skills", "digital skills", which reflect fundamental changes in the educational sphere [7].

The introduction of digital technologies is accompanied by challenges that society must overcome for the successful implementation of the digital economy in life, among which are: insufficient competencies and knowledge, low level of digital literacy of the population; short-term decline in labor productivity from the introduction of new technologies; rising technological unemployment; significant changes in the regional structure of the distribution of productive forces; lack of qualified personnel to implement a digital transformation strategy; lack of a strategy and regulatory framework for the use of digital technologies for competition and innovation [8, p. 40].

The strategy of digital transformation of the business environment requires the improvement of consumer service and the transition to a customer-oriented service system, the development of partnerships and flexible integration with partner companies (digital partnership is becoming one of the factors of business scale), the use of databases, the introduction of new HR strategies and culture innovation.

Digital entrepreneurship competencies include the confident, critical and responsible use and engagement with digital technologies to study, work and participate in society. These are information and data literacy, communication and collaboration, digital content creation (including programming), security (including digital well-being and cybersecurity-related competency), and problem solving.

The acquisition of digital competencies is seen today as a need for the entire society. This problem was also identified at the level of government through the development and implementation of mechanisms for the formation of digital competencies in society.

The following types of mechanisms for the formation of digital competencies can be distinguished (fig. 3).

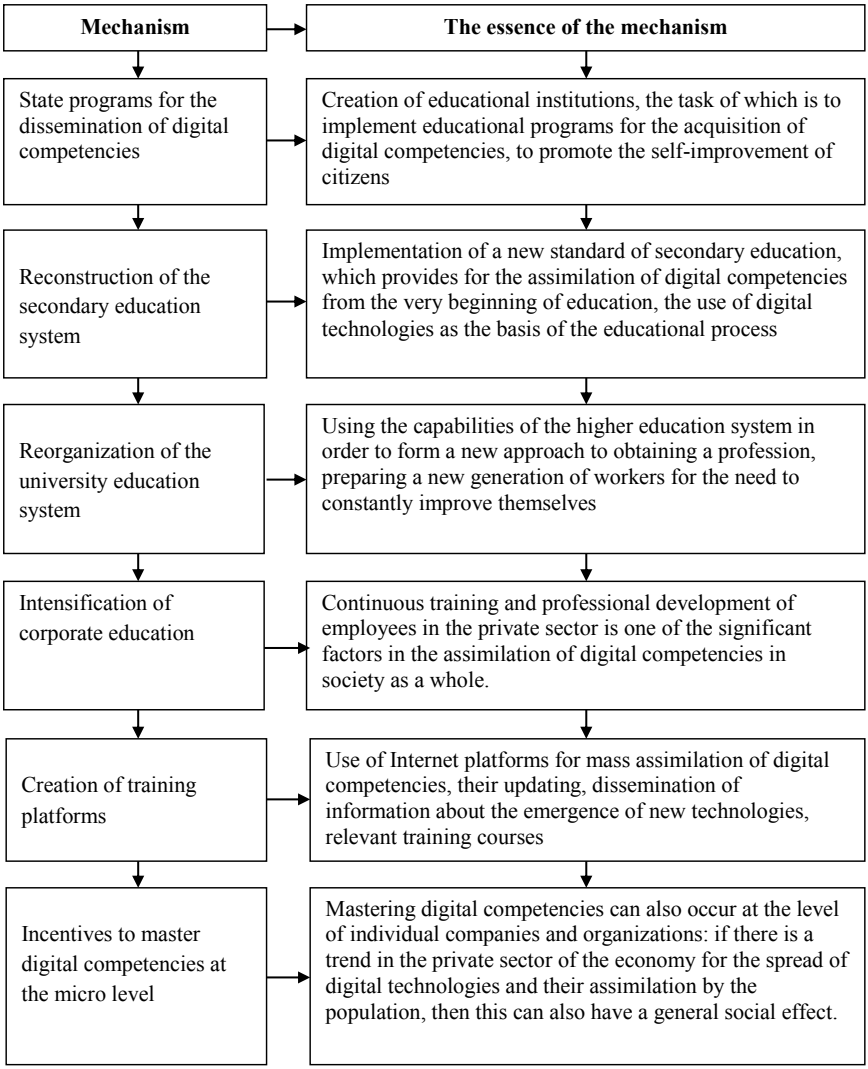

Fig. 3. *Mechanisms for the formation of digital competencies (Author's development)*

The most common mechanism for the formation of digital competencies in society is government programs aimed at adapting society to the conditions of the digital economy. Among the existing programs, one can single out those whose priorities are overcoming the digital inequality, intensifying the innovative activity of the population, and increasing competitiveness. Personnel and education are classified in the Program "Digital Economy of the Russian Federation" as one of the key institutions within which conditions are created for the development of the digital economy. The Program outlines the main goals of the direction related to personnel and education: "creating key conditions for training the digital economy; improving the education system, which should provide the digital economy with competent personnel; the labor market, which should be based on the requirements of the digital economy; creating a system of motivation for mastering the necessary competencies and the participation of personnel in the development of the digital economy of Russia "[9].

Businesses need to be critical of the accuracy, reliability and impact of information and data that is digitally accessible, and be aware of the legal and ethical principles associated with the use of digital technology. Companies that have relied on global trends are among the world leaders, but how long they can stay is a big question, largely related to the competencies of their employees. The new higher education model forms "competency portfolios" based on an assessment of the future demand of companies. The introduction of this model is largely due to the coincidence of the action of three groups of factors: active use of new technologies (including online education); transition to the concept of an "entrepreneurial university" combining education, science and business; development of demand from end users within the framework of the concept of lifelong learning [10].

The modern educational policy should be based on such approaches as the openness of education to external demands and demands of the labor market, the needs of society, practice-oriented, innovativeness, the use of innovative pedagogical technologies aimed at developing graduates of the XXI century skills and professional competencies, competitive identification and support leaders who successfully implement innovations in practice, informal communication with business, in particular, the formation of innovative student research in the form of startups. The creation of favorable conditions and the search for appropriate models of public-private partnerships with operators of non-formal education, their support, will contribute to the growth of private investment in this area. The emergence of new operators will significantly expand the opportunities for citizens, especially in the regions, to acquire relevant digital skills and master new professions.

One of the important tasks is to update the state classifier of professions, develop and approve a list of digital professions based on the requirements of the

labor market, digital trends, with the subsequent development of an appropriate program for their implementation in specialized educational institutions. Digital technologies in Russia should be accessible both from the point of view of organizational and technical access to the relevant digital infrastructure, and from a financial and economic point of view, through the creation of conditions and incentives that will encourage businesses to digitalize.

Integration of digital technologies into production processes, or digitalization of industry, is a priority of state industrial policy. The state policy of stimulating the development of digital competencies of entrepreneurs has three directions [8, p. 42]:

- creation of the infrastructure of "Industry 4.0" - industrial parks, industry technology centers;
- access to capital for the creation of new innovative industries;
- development of digital skills to train personnel capable of working with Industry 4.0 technologies.

To develop the potential of "Industry 4.0" in Russia, it is important to implement such initiatives as: targeting; industrial informatization, or a program of education and transfer of the best practices of the IT sector and digital industries to the industrial sectors; creation of engineering clusters; development of sectoral roadmaps for digital transformations [8, p. 42].

Thus, the massive dissemination of information and communication technologies contributes to the formation of network relations and the emergence of information networks built on the interaction of individual members of society. The creation of programs, trainings, continuous improvement of the level of digital competencies of entrepreneurs is an urgent need for economic development at the present stage. The formation of professionally competent personnel allows to improve the quality of work performed and ensure high labor efficiency in a competitive environment. The priority task on the way to the accelerated development of the digital economy is the creation and implementation of a national training program for general and professional digital competencies.

References

1. Kondratenko A.I. Theoretical aspects of building a model of personnel competencies // Alley of Science. 2018. V. 4. № 1 (17). P. 264-268.

2. Sleptsova E.V., Tumanova M.Yu. Competence management in the personnel management system // Economics of sustainable development. 2018. № 3 (35). P. 293-297.

3. Chulanova O.K. Competence-based personnel management: monograph. M.: SRC INFRA-M, 2018. 122 P.

4. Vasilyeva E.V. Competency approach in civil service: what knowledge and skills do civil servants choose? // Issues of state and municipal management. 2018. № 4. P. 120-144.

5. Definition and Selection of Competencies. Theoretical and Conceptual Foundations (DeSeCo). Strategy Paper on Key Competencies. An Overarching Frame of Reference for an Assessment and Reseach Program - OECD (Draft), 2001, P. 8. [Electronic resource]: text. URL: http://www.oecd.org/education/skills-beyondschool/ 41529556.pdf (appeal date 02.03.2021).

6. Sizova I.L., Khusyanov T.M. Labor and Employment in the Digital Economy: Problems of the Russian Labor Market // Bulletin of SPbSU. Sociology.2017. V. 10. Iss. 4. P. 376-396.

7. Participation in the management of the university: Scientific publication / Ex. ed. O. Bychkova. SPb.: Norm, 2016. 120 P.

8. Vernikov V.A., Khambazarov Sh.B. Strategic planning and labor productivity management in the field of digital entrepreneurship through the development of entrepreneurial competencies // MIRBIS Bulletin. 2019. № 2 (18). P. 38-46.

9. Program "Digital Economy of the Russian Federation". Approved by the Order of the Government of the Russian Federation dated July 28, 2017 № 1632-r. [Electronic resource] // Official website of the Government of Russia. URL: www.government.ru/docs/28653/ (appeal date 02.03.2021).

10. Human Development Report 2018 in the Russian Federation / ed. S.N. Bobyleva and L.M. Grigoriev. M.: Analytical Center for the Government of the Russian Federation, 2018. 172 P.

DOI 10.34660/INF.2021.50.20.006

CRIMINALISTIC CHARACTERISTICS OF CRIMES RELATED TO THE DISTRIBUTION OF EXTREMIST MATERIALS

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Abstract. *The scientific article analyzes the problems of the distribution of extremist materials in the Russian Federation. The methods of execution of the illegal act are given. Separate, most relevant areas of forensic activity are identified. The authors consider the most typical elements of the criminalistic characteristics of the crime of extremist orientation.*

Keywords: *extremism, extremist materials, law, multinational state.*

Introduction

The criminal legislation of the Russian Federation provides for illegal actions that are expressed in the incitement of hatred. Extremism is a socially dangerous offense, which is defined by article 282 of the Criminal Code of the Russian Federation. These are actions directed against a group or a person. The criminal is motivated by a negative attitude towards others, which was born on the basis of hostility: racial, national, religious, social or other [1].

Article 1 of Federal Law No. 114-FZ "On Countering Extremist Activities" establishes the legal wording of actions considered extremist.

Extremism (extremist activity) in the Russian legal theory marks the forced

modification of the foundations of the constitutional system and the violation of the integrity of the Russian Federation, the public justification of terrorism and other terrorist activities, the incitement of social, racial, national or religious discrimination, agitation of the election, advantage or disadvantage of an individual according to the criterion of his socio-cultural, racial, national, religious or linguistic involvement or attitude to a denomination(creed), violation of human rights, freedom and legitimate interests of a person and a citizen depending on their social, religious, national, class or language affiliation or attitude to religion, preventing citizens from exercising their electoral rights and the right to participate in a referendum or non-compliance with the secrecy of voting supported by coercion or the threat of its use, preventing the legitimate activity of state state bodies, local self-government bodies, election commissions, public and religious associations or other organizations, combined with violence or the threat of its use, propaganda and public demonstration of Nazi props, public calls for the implementation of these acts, or mass distribution of obviously extremist materials, as well as their production (production) or storage for the purpose of mass distribution.

Thus, the incitement of enmity or hatred, as well as humiliation, is recognized as criminal if it is made officially, publicly [2].

Purpose of the study – to establish the content of the elements that characterize the crimes of spreading extremist materials, as well as to develop proposals that contribute to the prevention and investigation of such illegal acts.

Materials and methods

The methodology of this research consists of the general scientific dialectical method of cognition, as well as the system-structural, structural-functional, comparative-legal, formal-legal, and other special methods of scientific cognition.

Results and discussion

Public relations are recognized as the object of encroachments. The essence of extremism or nationalism is to deliberately provoke a negative reaction from a non-specific number of people. That is, the attacker encroaches on the order in the public order by insulting, humiliating one of his groups. The subjective side is the presence of criminal and criminal intent. The person understands that his words will cause a negative reaction in a group of people.

A citizen from the age of 16 is recognized as a subject. At the same time, legal behavior will include only the system of practical activities of the subjects of legal relations on the execution and application of law [3, p. 10]. A real action, an oral or written appeal to people-this is the objective side. It doesn't matter how many people know the content of extremist publications. In addition, the message must contain content that is offensive to others. Only such actions are considered incitement to ethnic or other discord.

The code describes different types of acts: simple and qualified. Qualified

actions increase the culpability, hence the punishment. And the punishment for "simple" extremism is prescribed in part 1 of Article 282 of the Criminal Code of the Russian Federation. This is a misdemeanor of a person directed against an indefinite group, as well as certain people. It is essential that the basis is anger, hostility, hatred, spilled into society. Part 2 of Article 282 of the Criminal Code sets out the qualified composition. It is recognized as such if the act is committed: by an organized group; with violence or the threat of using it; an official during the performance of his duties. Each of the circumstances requires additional clarification.

Among the methods of execution of an illegal act, one can distinguish:

1. publication of offensive information;

2. creation, storage and promotion of extremist materials;

3. using the Internet to incite and provoke negative emotions in certain social groups.

The emergence of a technical opportunity to convey the point of view of each person to a wide audience increases the responsibility of each. A careless and thoughtless word can lead to criminal prosecution for extremism.

Since the Russian Federation is characterized by a multinational state, in this regard, measures to counter extremist activities are prescribed at the legislative level. One of the main and most important areas of countering extremism is the prevention of extremist manifestations.

You can highlight the following:

1. Educational and cultural institutions of the region constantly carry out activities aimed at preventing extremism, forming a humane, friendly attitude towards others, people of different faiths, for this purpose, film festivals, literary and musical evenings are held, allowing citizens to develop a positive worldview, fostering respect for the cultures of other peoples. Tolerance lessons are taught in educational institutions.

2. The Ministry of Justice of the Russian Federation implements state-wide supervision over the state registration and activities of social and ideological communities in order to prevent the emergence of extremism in their activities.

3. Law enforcement and control services continuously monitor and monitor the Internet in order to find and install publications of extremist content, since there is no filtering of the content of sites [5].

Before the adoption of Federal Law No. 114-FZ of 25.07.2002 "On Countering Extremist activities", the policy of countering the spread of extremist materials began to be formed long ago.

According to many publishers, it is possible to emphasize several relevant areas of activity.

The first direction is the prevention of extremism of minors, the formation and

implementation of the methodology of educational work. In general, this work, according to many (Rean A. A., Regush L. A., Dandarova Zh. K., Kolominsky Ya. L., Marcinkovskaya T. D., Dubovskaya E. M., Belinskaya E. P., etc.), should consist in ensuring an effective process of adaptation of the individual [4].

The second direction is the work of a professional psychologist of the educational system with asocial, predisposed to extremism children and adolescents.

Within this area, it is possible to identify the scientific and methodological implementation of basic campaigns for correctional work, strategies for special seminars and individual correctional work. As significant and topical branches of such developments, we assume, we can consider: the formation of the personality trend, the improvement of the positive Self-concept, the building of socio-psychological readiness and the basics of sane interpersonal interaction in the group, the formation of the responsibility of the individual. Within the framework of the same direction, an important goal is to recreate highly effective interaction and subordinate activities with caregivers and with the family.

The third direction is to substantiate the specifics and explain the jurisdiction of possible management structures in the field of correcting anti-social attitudes, predisposed to extremism of minors. First of all, we are referring to such social institutions as vocational schools, schools, juvenile affairs units (PD), and specialized counseling centers.

The fourth direction is to build an effective structure for additional training, retraining and advanced training of psychologists in the field of problems of antisocial, deviant behavior of minors, and personal resocialization. The problem of personal improvement of adolescents and young people is a complex socio – psychological problem that requires permission and the provision of psychological protection and support to them.

Conclusion

We believe that it can be concluded that the legislator in Russia is considering effective measures to combat the emergence and spread of extremist materials. But at the moment, it is extremely difficult for a law enforcement officer to rely on the existing provisions on countering extremist activities and the Federal List of Extremist Materials due to the lack of significant signs of extremist materials in them, as well as other fundamental definitions in the field under study (for example, extremist ideology). Therefore, at this point in time, it is extremely relevant and significant to conduct and arrange comprehensive studies on countering and resisting the spread of extremist materials and calculate them in practice in order to have the prospect of making criminological motivated and justified judgments.

References

1. Criminal Code of the Russian Federation No. 63 of June 13, 1996 (as amended). from 24.02.2021 No. 25-FZ) [Electronic resource] // URL: http://www.consultant.ru/document/cons_doc_LAW_10699/ (accessed: 26.02.2021).

2. Federal Law No. 114-FZ of July 25, 2002 "On Countering Extremist Activities" (as amended). from 08.12.2020, No. 429-FZ) // URL: http://www.consultant.ru/document/cons_doc_LAW_37867/ (accessed: 26.02.2021).

3. Brager D. K., Dzhunusova D. N., Zemtsova S. I., Nazarov V. N., Pestova T. P., Tataurov A. A. Legal, law-making and law-enforcement activities: Western and Russian studies: monograph. - Electronic ed. - Electron. Text data. (1 pdf file: 73 p.). Nizhny Novgorod: Professional Science LLC, 2018. - Access mode: http://scipro.ru/conf/monographlaw.pdf (accessed 12.02.2021).

4. Methodological materials on countering the spread of extremism among young people. [Electronic resource] // URL: https://www.garant.ru/products/ipo/prime/doc/71293532/ (date of request: 17.02.2021).

5. Responsibility for posting extremist information on the Internet. [Electronic resource] // URL: https://beskudnikovo.mos.ru/presscenter/news/detail/1429964.html (accessed: 17.02.2021).

DOI 10.34660/INF.2021.36.58.007

INDIVIDUAL PROBLEMS OF COLLECTING EVIDENCE FROM ELECTRONIC MEDIA

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Abstract. *The scientific work deals with the legal aspects of the normative consolidation of the concept of electronic media. The problems of collecting evidence from electronic media and ways to solve them are analyzed. In this paper, only one of the most common problems of criminology was analyzed. Namely, some problems of the process of collecting evidence from electronic media. All problems require additional discussion and solution. Ways to solve this problem were also suggested.*

Keywords: *evidence, electronic media, electronic evidence, Criminal Procedure Code, investigative actions.*

Introduction

Currently, science and technology do not stand still, day by day, undergoing significant modernizing changes. Not an exception are the ways of transmitting information, which are also developing significantly. This development of the technosphere has an impact on all types of social relations, including the criminal environment.

So, as a rule, the latest technologies can be used not only with a plus sign, but

also to commit specific types of crimes. Due to the increasing number of crimes using the latest technologies, there is a need in criminology to develop new techniques and methods for their disclosure and investigation.

The development of scientific technologies has led to the formation of a new type of evidence in law – electronic evidence, which is currently a little-studied area, regardless of the legal industry.

So, to date, the Criminal Procedure Code of the Russian Federation classifies electronic evidence into physical and other documents. As a result, this type of evidence is not allocated to a special group, but is combined with other existing ones. These issues, in one way or another, are regulated by Articles 84 and 86 of the Code of Criminal Procedure of the Russian Federation.

Purpose of the study – to establish the legal definition of electronic media, to investigate the procedure for collecting evidence from electronic media by specialists, to develop recommendations for improving the current legislation.

Materials and methods

The methodological basis of this research is based on the general scientific dialectical method of cognition of objective reality, as well as on the use of system analysis, structural-functional, comparative-legal, system-structural, formal-legal, and other particular methods of scientific cognition.

Results and discussion

In order for the evidence to be recognized by the court as admissible, it is necessary to collect it in accordance with the current criminal procedure legislation. Thus, the evidence must be collected through certain investigative actions, which include inspection, search and seizure. It should be noted that various omissions made during the investigation of criminal cases may lead to the termination of criminal prosecution and this will allow the guilty persons to avoid criminal punishment [4, p. 118].

Thus, the legislator does not give a clear definition of the term "electronic media" and uses it in the production of investigative actions: search, seizure and investigative inspection.

The collection of electronic evidence must be recorded in the protocol of the investigative action. The protocol is drawn up by an authorized person with the participation of a specialist who has knowledge in the field of computer technology. The participation of a specialist is particularly important, since he will directly examine the received electronic evidence. Thus, the specialist examines the evidence, and the investigator and interrogator creates and saves screenshots, as well as directly and inspect the site [5, p. 21].

It is important to keep in mind that electronic evidence must be recorded in a timely manner. The urgency of fixing is that electronic evidence, by its very nature of origin, can be quite easily changed or destroyed in an instant.

The following features of recording evidence in electronic form can be distinguished:

1. It is performed promptly;

2. It is necessary to involve a specialist;

3. It is carried out with the help of technical means, on which information is recorded, stored and reproduced [6, p.122].

The Code of Criminal Procedure of the Russian Federation specifies in Part 2 of Article 164.1 the need to involve a specialist in the seizure of an electronic data carrier, as well as to ensure that information is copied to another medium at the request of its legal owner [2].

Part 3 of Article 164.1 of the Criminal Procedure Code of the Russian Federation obliges the investigator to copy information from electronic media in the course of conducting investigative measures, making an appropriate entry in the protocol. An electronic media of the copied information is attached to the protocol. The participation of a specialist in this case is not required [2].

To date, a clear regulatory definition of an electronic carrier is not given. This makes it possible to equate almost any electronic, computing and other equipment that allows you to accumulate information with electronic media [8, p. 186].

To date, such a definition as "electronic information carrier" is fixed in GOST 2.051-2013, which states that an electronic medium is "a material medium used for recording, storing and reproducing information processed using computer technology" [3].

Taking into account the concept under consideration, it can be concluded that any technical means that allows you to accumulate information (from a CD/DVD disc to a computer) can be recognized as an electronic medium.

Due to the breadth of the definition of the concept of electronic media, there is a problem of equating any technical means with electronic media.

When collecting evidence from electronic media, the investigator is forced to invite a specialist. This can serve as a problem of a shortage of personnel in the IT field in large cities or in remote, remote areas of the country, where the probability of bringing a specialist from one area to another is extremely difficult.

It should be noted that the investigator, as an independent procedural person, has the right to withdraw and seal a simple (small equipment: an MP-3 player, a mobile phone) or complex (large - sized and multi-component elements) electronic media. In the process of studying the content of information on complex electronic media, it is worth resorting to the help of a specialist [7, p. 41].

Conclusion

To date, large-scale work is needed in the field of solving the problem of collecting evidence from electronic media, namely:

- in the current Code of Criminal Procedure of the Russian Federation, it is

necessary to fix the exact concept of electronic media;

- Article 164.1 of the Code of Criminal Procedure of the Russian Federation should reflect the requirement to attract a specialist to conduct procedural actions with electronic media, as well as the need to train investigators to continue working with electronic media when withdrawing and copying information from them independently;

- divide the concept of electronic media into types: simple and complex. Accordingly, to use the services of a specialist in relation only to complex media, some complex types have connections that require the help of a specialist, because if the connection is incorrect, the equipment may malfunction.

Also, it is necessary to legislate the right of the investigator to make an independent decision on the need to attract a specialist. Since, during the production of investigative actions, only the investigator can objectively assess the situation and the possibility of independent seizure of electronic media in order to use them as admissible evidence in the future.

References

1. The Constitution of the Russian Federation of December 12, 1993 (as amended). from 14.03.2020, No. 1-FKZ) [Electronic resource] // URL: http://www.consultant.ru/document/cons_doc_LAW_28399/ (date of request: 2.02.2021).

2. The Criminal Procedure Code of the Russian Federation of December 18, 2001 (as amended. from 30.12.2020, No. 543-FZ) [Electronic resource] // URL: http://www.consultant.ru/document/cons_doc_LAW_34481/ (date of request: 2.02.2021).

3. GOST 2.051-2013. Unified system of design documentation. Electronic documents. General provisions. Moscow: Standartinform, 2014. 50 p.

4. Bodarovskaya D. V., Brager D. K. Modern problems of presentation tactics for identification and ways of their solution // Modern science: actual problems of theory and practice. Series: Economics and Law. 2020. No. 10. pp. 118-122.

5. Efremov I. A. On the reliability of electronic documents in the implementation of criminal proceedings // Information Law. 2006. No. 2. pp. 21-23.

6. Zigura N. A. Computer information as a type of evidence in criminal proceedings: monograph. Moscow: Yurlitinform, 2011. 176 p.

7. Mukhudinova N. R. Procedural activity of the defender on collecting and presenting evidence in the Russian criminal proceedings: monograph. Saransk, 2008. 63 p.

8. Starichkov M. V. Questions of using computer information carriers as evidence // Izvestiya Tulskogo gosudarstvennogo universiteta. Economic and legal sciences. 2014. No. 2. pp. 119-125.

DOI 10.34660/INF.2021.15.59.008

INDIVIDUAL PROBLEMS THAT ARISE IN THE PROCESS OF CONDUCTING FORENSIC EXAMINATIONS

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Abstract. *The scientific article analyzes the problems that arise during the production of expert examinations in the investigation of crimes. It describes the basis of forensic examinations, the quality of implementation. The objectives and the issue, the objects of forensic examinations are outlined. The necessity of conducting expert examinations is determined, the significance of their conduct in the process of judicial and pre-trial consideration of criminal cases in the criminal process is displayed.*

Keywords: *expertise, forensic activity, reform, freedom, security, investigation, criminal case.*

Introduction

The irreversibility of Russia's course towards global integration calls for fundamental changes in the political, legal, economic and social spheres of our state. One of the key areas of reform at the present stage is the implementation of judicial reform, which should implement the practical implementation of the rule of law and ensure the functioning of the judicial system and related legal institutions in accordance with international standards and best practices. In this context, spe-

cial attention should be paid to the issues of forensic practice, the meaning of which is to equip the judiciary with autonomous, professional and valid expertise, which is aimed at fully exploiting the achievements of science and technology.

When building a legal state, one of the acute problems of today is the problem that is associated with the development of effective models [5, p.66] of the production of forensic examinations. The extreme importance of this institute is eloquently evidenced by the opinion of E. Yu. Samuticheva, who noted that "the authority of the conclusions of experts is extremely high, since they focus on advanced scientific thought and the repeatedly proven experience of professionals. Therefore, despite the fact that in our criminal proceedings none of the evidence has a pre-established force, when assessing the evidence by the subjects of proving the expert's conclusion, special importance is involuntarily attached, special trust is expressed" [6, p. 2].

And as Mishin A.V. notes, forensic examination is one of the most effective ways to establish the truth on issues that are the subject of proof [4]. It should be noted that the study of the organizational and legal foundations of forensic activity is devoted to the work of such famous scientists as T. V. Varfolomeeva, V. I. Galagan, A.V. Mishin, E. Yu. Samuticheva and many others. However, there are still relevant issues related, in particular, to the protection of the freedom of a forensic specialist and the accuracy of his conclusion. As stipulated by the Constitution of the Russian Federation (Part 1, art. 46), exclusively the laws of the Russian Federation determine the basis of forensic expertise [2].

This constitutional provision emphasizes the national significance of this issue, which cannot be regulated at the level of subordinate legal acts. From the point of view of forensic expert work, the main normative provision is the Federal Law "On State Forensic Expert Activity in the Russian Federation" of May 31, 2001, which defines the legal, organizational and financial bases of forensic expert activity. At the same time, Article 7 of the Law declares the protection of the freedom of the judicial specialist and the accuracy of the final decision [3]. At the same time, a systematic analysis of the provisions of the current legislation makes it possible to make sure that some of the declared protections for the freedom of the judicial specialist and the legality of the final decision do not have a sufficiently realistic content. In particular, this applies to the inaccessibility under the threat, calculated by the law of obligation, to interfere with someone in the implementation of forensic expertise.

Purpose of the study – to establish the current problems that arise in the activities of forensic experts, and after analyzing the current legislation, to propose solutions for its improvement.

Materials and methods

The methodological basis of this research is based on the general scientific

dialectical method of cognition, as well as on the use of structural-functional, system-structural, comparative-legal, formal-legal, and other particular methods of scientific cognition.

Results and discussion

First of all, the legislation on expert activity corresponds to the norms of Article 195 of the Criminal Procedure Code of the Russian Federation, which takes into account the responsibility for preventing the appearance of an expert in court, bodies of inquiry, temporary investigative bodies and a special temporary investigative commission, pressuring him to refuse to give the necessary information or decisions, including giving deliberately false testimony or the conclusion of a specialist by threatening murder, violence, destruction of the property of a forensic specialist or his relatives, or disclosing information that compromises the expert, or corruption of an expert with the same meaning, as well as blackmail in order to perform these actions out of revenge for previously given testimony or conclusion [2].

The analysis of the objective side of the specified corpus delicti allows us to conclude that it does not cover all cases of illegal influence on the expert. For example, forcing an expert to refuse to give, or even to give deliberately false testimony, or it is not excluded that the final decision can be made by the only means of threats of murder, pressure, liquidation of property or disclosure of information that disgraces the victim. In this situation, the logic of the legislator regarding the significant truncation of possible forms of influence on the expert is absolutely incomprehensible, since in practice there are much more such forms.

At the same time, the legislation of the Russian Federation on criminal liability contains many examples of criminalization of any form of influence on a certain person in order to prevent them from fulfilling their official obligations, and may achieve criminal results.

It is also necessary to establish that Article 307 of the Criminal Code of the Russian Federation takes into account the obligation not more than for the pressure of the expert to refuse to give evidence or conclusion, at the same time to give deliberately false testimony or conclusion. At the same time, illegal influence on the expert may not pursue the goal of deviating from giving evidence or conclusions, including giving deliberately false testimony or conclusions. On the other hand, such influence may pursue the goal of countering or hindering the implementation of forensic activities in general.

Conclusion

Thus, on the one hand, a direct ban is established, under penalty of punishment, for non-performance of the duties provided for by law for the implementation of forensic expertise, and on the other hand, the legislator provides for liability only in a small number of cases and does not cover many elements of influence on the

personality of the expert. Another serious problem in the implementation of forensic activities is interference in the activities of a forensic expert, which negatively affects the independence of such a person.

Thus, there are frequent cases of abuse of the right during the interrogation of an expert by the investigating authorities during the pre-trial investigation, as a result of which pressure is exerted on the experts and interference in their activities. The solution to this problem may be to amend certain articles of the Criminal Procedure Code of the Russian Federation, which show the position of an eyewitness in criminal proceedings, fix the guarantees of an expert, and so on. In the first place, the Criminal Procedure Code of the Russian Federation should provide that experts cannot be questioned as witnesses-about the conclusions they provided. Secondly, the Criminal Procedure Code of the Russian Federation should remove the provisions that oblige the expert to come to the investigator or prosecutor and give answers to questions during the interrogation, leaving the corresponding duty of the expert exclusively to the court. Third, similar in content to the previous sentence, the corresponding changes should also be made to the Code of Criminal Procedure of the Russian Federation, providing for the obligation of the expert to give evidence only to the court.

The next issue that needs to be considered concerns the development of important provisions for the work of a forensic expert, its financial and social support. In particular, it was assumed that employees of state specialized institutions (not military personnel and those who do not have the ranks of ordinary and commanding personnel), who have the qualification of a forensic expert, official salaries are set at an amount that is not less than 10 of the subsistence minimum established for able-bodied persons.

This provision should be an important step towards improving the material security of the forensic expert. At the same time, the State Budget for 2020 stopped the action on the amount of official salaries of forensic experts for this year. In this regard, we can express the hope that in the State Budget for 2021-2022, the expenses for the remuneration of judges within the limits of official salaries will be supported by appropriate financial capabilities.

Thus, it can be stated that the regulation at the level of the law of forensic expert practice at the present stage is characterized by certain gaps and shortcomings, the presence of which does not contribute to the full protection of the autonomy of the forensic expert and the accuracy of his conclusions. This situation requires an urgent solution, given the special role of expert activities in the context of judicial reform.

References

1. The Constitution of the Russian Federation of December 12, 1993 (as amended). from 14.02.2020, No. 1-FKZ) [Electronic resource] // URL: http://www.consultant.ru/document/cons_doc_LAW_28399/ (date of appeal: 24.02.2021).

2. The Criminal Procedure Code of the Russian Federation of December 18, 2001 (as amended. from 30.12.2020, No. 543-FZ) [Electronic resource] // URL: http://www.consultant.ru/document/cons_doc_LAW_34481/ (accessed: 24.02.2021).

3. Federal Law No. 73-FZ of May 31, 2001 "On State Forensic Expert Activity in the Russian Federation" (as amended). dated 26.07.2019, No. 224-FZ) // URL: http://www.consultant.ru/document/cons_doc_LAW_31871/ (accessed: 24.02.2021).

4. Mishin A.V. Actual problems of appointment and production of forensic expertise // VEPS. 2017. No. 1. URL: https://cyberleninka.ru/article/n/aktualnye-problemy-naznacheniya-i-proizvodstva-sudebnoy-ekspertizy (accessed: 31.01.2021).

5. Muzalev S. V., Brager D. K., Litvinov I. I., Novoselova Yu. V. Theoretical and methodological aspects of the development of modern research science: Monograph. Issue No. 4. Moscow: SIC MISI, 2019. 96 p.

6. Samuticheva E. Yu. Expert opinion and its assessment in the criminal process (comparative legal research): autoref. dis. ... cand. yurid. M., 2016. 32 p.

DOI 10.34660/INF.2021.71.47.009

THE ROLE OF SPEED-POWER READINESS OF CHILDREN INVOLVED IN ACROBATIC GYMNASTICS

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Abstract. *The results of the use of jumping exercises, borrowed from athletics, in the training process of sports acrobats are presented, and the effectiveness of their influence on the increase in speed-power abilities in children of 13-14 years old who are engaged in acrobatics is shown.*

Keywords: *acrobatics, physical training, jumping, jumping exercises, speed-power ability, efficiency.*

The kinds of sports differ according to the features of the subject basis of competitive activity, each of which contains only inherent ways of increasing physical, technical readiness and conducting competitive activity. The constant complication of acrobatic elements included in competitive programs is an urgent issue in the choice of means and methods for increasing the level of physical fitness of athletes.

Competitive combinations, as a rule, consist of elements with different rotations, from hands to feet and from feet to feet, performed at a high pace, subject to the technique of movements, demonstration of beauty and ease of their implementation.

The peculiarities of special physical training of those who go in for sports acrobatics are in the development of those muscle groups, which account for the power load during the performance of the competitive combination.

Due to the short duration of the acrobatic combination, it is not the maximum manifestation of strength that becomes important, but the speed of its implementation in a short time, while maintaining the amplitude of movements in the elements of the combination itself. Based on this, the level of speed-power abilities is of great importance for acrobats, therefore, in the training process of sports acrobatics, the dominant place is given to jumping elements from the arsenal of acrobatic exercises, i.e. work is underway to improve jumping ability. Under jumping ability Yu.V. Verkhoshansky noted the ability of an athlete to throw his body weight to the highest height by pushing off [2].

For a short in time and strong repulsion, it is necessary to show rapid muscle contraction with strong tension, which requires a powerful concentration of volitional efforts. The higher the level of combination of these indicators in the selected exercise, the faster you can achieve the expected results in increasing intramuscular and intermuscular coordination.

In this case, jumping exercises differ significantly from other means of developing physical qualities, including the development of speed-power abilities. They are available, do not require special equipment, make it easy to dose the load for athletes of various levels of fitness and help to master complex motor actions [2; 3].

In the process of analyzing materials from literary sources, we turned our attention to jumping exercises and the method of using them in the training process, in the jumping types of athletics - high and long jumps from a run, a triple jump from a run, as well as to the group of national Yakut jumps (Kylyy, Ystanga, Kuobakh). Achievements in these types of jumps, characterizing the levels of jumping ability of athletes, are also interesting.

So, in the high jump for men, the record result is - 245 cm, in the long jump from the run - 896 cm, in the triple jump from the run - 18.29 m, and in the Yakut jumps: Kalyy (jumps from foot to foot in 11 push-offs) - 48.34 cm; Ystanga ("leaps" on one leg in 11 jumps) - 46.50 m; Kuobach ("hare" jumps on two legs, i.e., pushing off 11 times with two legs sequentially) - 39.45 m. These figures are interesting in that they demonstrate the high level of jumping ability achieved by sportsman-athletes on the basis of special jumping exercises, and allow to suggest the possibility of using them in sports acrobatics to increase speed-power readiness.

Our research was aimed at studying the possibility of using jumping exercises from jumping types of athletics to increase speed-power abilities in children of 13-14 years of age, who go in for acrobatics.

In the process of conducting the research, we relied on the following methods: Analysis of materials of educational, methodological and scientific literature on the issue under study; Testing of physical readiness of boys aged 13-14 –, who go in for sports acrobatics; Pedagogical experiment; Mathematical processing of the received data; Analysis of the results of the experiment.

The experiment involved two groups of children involved in sports acrobatics: experimental ("E") and control ("C"), 8 people each. The experimental group consisted of 8 people, 5 people had the sports qualification of the CMS and 3 people had the 1st category, and in the control group 4 people had the fitness level of the CMS and 4 people had the 1st category.

Note. An explanation should be made that in sports acrobatics it is recommended to start classes from the age of 6, and in circus schools, at the Moscow

Circus School named after Rumyantsev (Karandash), it is recommended to start enrollment in preparatory groups from 4-5 – years of age. This approach to recruitment speaks of the early start of work with children on physical fitness, the formation of love for acrobatics, its genres. Therefore, children who have undergone directed training for acrobatics, at the age of 11–15, begin to work according to the CMS and MS programs, including more complex elements in their competitive combinations [1].

Our groups trained according to the general requirements set out in the work program for sports acrobatics, the differences during the training process were that in the experimental ("E") group, in order to increase speed-power abilities, in addition to the content of the program, they used jumping exercises, which are used in jumping athletics.

Testing was carried out according to the group of test exercises: Shuttle run 10x5m; Long jump from a place; Tenth long jump from the spot; Jumping up from a place (with a wave of hands); Hanging pull-ups on the bar; Push-ups from the support lying; Raising the body from the starting position lying on the floor. When performing test exercises, the generally accepted rules for performing and measuring results were observed.

Our experiment with the use of jumping exercises, selected from the jumping types of athletics, made it possible to conduct it at a high emotional level, because the used jumping exercises caused a competitive mood in children and stimulated them to competitive activity.

Each type of jumping used during the lessons was always visible in the distance of the jump, comparable between the practitioners, which made the children want to surpass themselves and others in the group.

Summing up at the end of the experiment, comparing the results of tests at the initial and final levels, we see a positive change in all tests in both groups, but in the "E" group they became higher. In the 10x5 m shuttle run, the time improvement in the "E" group was by 8.03%, from 16.28 seconds to 15.07 seconds, and in the "C" group by 2.35%, from 16.52 seconds to 16.14 seconds.

In the long jump from the spot, the boys of the "E" group improved their results from 207.24 cm to 228.00 cm, that is, by 21.08 cm (10.17%), and in the "C" group this increase was from 205.16cm to 214.17cm, at 9.01cm (4.39%). In this case, it should be noted that the results between the groups have a significant difference $P < 0.05$ in favor of the "E" group.

In the triple jump from the spot, the youths of the "E" group improved their performance by 75 cm (10.01%), and the "C" group by 35 cm (4.64%). As a result, in the "E" group, the result increased by 5.37% higher than the shifts in the "C" group, and the difference between them also has significant differences $P < 0.05$.

In the next jumping exercise, a tenfold jump from a spot, the final results of

the young men of the "E" -group turned out to be higher than the "C" -group by 4.35%, and this difference in results also significantly differs in favor of the "E" -group. The acrobats of the "E" -group improved their results by 1 m 59 cm, and in the "C" -group their height was 42 cm.

Considering the results of both groups in the fourth jumping exercise, jumping up from the spot, we see that in the boys of the "E" -group they increased from 41.75 cm to 49.46 cm by 7.71 cm (18.46%). In the "C" -group, the results changed from 42.27 cm to 47.34 cm by 5.07 cm (11.99%), and their difference with the "E" -group also significantly differs $P < 0.05$ in favor of this group.

Paying attention to the advancement of the young men of the experimental group, according to the results of testing in all four jumping tests, the participants of the control group, we can note that the use of jumping exercises borrowed from jumping types of athletics had a positive effect on the growth of the speed-power abilities of acrobats included in "E"-Group.

According to the state of strength abilities in three tests of strength orientation, the advantage of "E" results is noticeable. So, in pull-ups, the boys of the "E" -group increased the result from 11.65 to 17.29, which is 48.41% better than the initial result, and the boys in the control group respectively improved from 12.75 to 16.54 times, their gain was 4.29 times (35.02%). In push-ups in the "E" -group, the increase was 7.72 times (37.20%), and in the "C" -group by 5, 20 times (24.40%). In lifting the trunk from a prone position, the boys of the "E" -group increased their results from 20.71 times to 27.04, which is 6.33 times or 30.56% better than the initial one. During this period, the "C" -group increased its indicators from 20.04 to 25.25 times, by 5.21 times (25.99%), and yet yielded to the "E" -group by 4.57%.

As a result, according to strength tests, the results of the "E" -group are higher than the "C" -group, and this is confirmed by the significance of the differences $P < 0.05$ in favor of the "E" -group. Summing up the results of the experimental study, it can be noted that the use of jumping exercises contributed to an increase in motivation for active fulfillment of all jumping exercises, because the young men saw their effectiveness in each exercise, which set them up for competitive activity, namely, to jump further and higher.

The results obtained by us for the experimental period once again confirmed the correct approach to the choice of exercises for the training process, borrowed from the jumping types of athletics, which allowed the young men of the experimental group to increase the level of speed-power readiness, as evidenced by the growth of results in jumping tests. In addition, the boys' results in strength exercises improved, which is also important for children of this age.

The increased strength and speed-power readiness made it possible to improve the technique of performing the elements included in the combinations, and to

perform more successfully in competitions.

Taking into account the training efficiency of jumping exercises used in the types of athletics, introducing a variety of motor actions, contributing to an increase in emotional mood and influencing an increase in speed-power abilities among those who go in for sports acrobatics, we can recommend them for use.

References

1. Federal State educational standard of secondary vocational education in the specialty 52.02.03. Circus art. 27.10.2016. №1380.

2. Verkhoshanskiy Yu.V. Fundamentals of special strength training in sports. M.,1977.–275 P.

3. Strizhak A.P., Zagorulko E.P. High jump. The system of training highly qualified jumpers. M.2015. – 87 P.

DOI 10.34660/INF.2021.26.31.010

LETTERS AND THEIR COMBINATIONS REPRESENTING ENGLISH MONOPHTHONGS [Æ], [E] AND [Ə:] IN WRITING

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Abstract. *The article is devoted to the study of the problem of graphic spelling of monophthongs [æ], [e] and [ə:] in educational activities of pedagogical workers in English classes at educational institutions in the Russian Federation. The authors identify the main ways of graphic spelling of the phonemes, namely letters and combinations of letters used in the formation of the sounds in question. The study aims to define and describe the ways of graphic spelling of English sounds [æ], [e] and [ə:].*

Keywords: *educational activities, English, graphic spelling, monophthongs [æ], [e] and [ə:], pedagogical worker.*

First classes of English as a foreign language at the overwhelming majority of educational institutions in the Russian Federation make pedagogical workers solve a lot of vital issues while training their students within the main language as-

pects that are Auding/Listening, Speaking, Reading and Writing (such aspects as Interpretation and Translation are being omitted here since they are in the domain of a limited number of specialized Russian universities; for this reason, transliteration, being a way of rendering lexical units in writing, is not the subject of our research). Writing universally seems to be the most complicated aspect in its mastering due to the fact that it is directly connected with Grammar, Lexicology, Phonetics, Punctuation, Spelling and Stylistics. One complexity of writing is “Phonetics [12] vs Spelling” problem. In short, we mean a case when one letter or a group of letters contained in various lexical units [1] has several ways to be pronounced, e.g.:

- vowel letter *a* in the following lexical units: *plaque [a:], cradle [eɪ], adorn [ə], gall [o:], acrid [æ], Bologna [jə], vintage [ɪ], garish [ɛə], swab [ɔ]*;
- consonant letter *s*: *episode [s], fusion [ʒ], controversial [ʃ], liaison [z], Asia [ʃ]* or *[ʒ], CIS [es]* [5], [8]*;*
- double *oo*: *blood [ʌ], took [ʊ], tattoo [u:], door [o:], brooch [əʊ]*;
- a group of vowel and consonant letters *ough*: *through [u:], sought [o:], drought [aʊ], dough [əʊ], rough [ʌf], cough [ɔf], thorough [ə];*
- a combination of consonant letters *ch*: *avalanche [ʃ], chimney [tʃ], technology [k], Sandwich [dʒ]* [9], [10], [11].

To avoid bewildering in writing among students and to ensure that they will learn to write well is one of the primary tasks of the pedagogical workers in the initial and further stages of teaching English.

This publication is a humble attempt to unfold our experience in classifying the modes of graphical spelling of three monophthongs ([æ], [e], [ə:]) [2], [3], [4], temporarily omitting the other vowel and consonant sounds [6], [7].

The relevance of the research work arose in the light of insufficient coverage of the multiple ways of graphical spelling of vowel and consonant phonemes and their combinations in textbooks currently applied in the educational process.

Our research is based on the material of various extracts taken for our consideration from pieces of fiction, periodicals, textbooks, the Internet. We also dealt with corporate letters, movie subtitles, pieces of advertising; off-line and on-line dictionaries; reference books to contemporary English pronunciation [13]. We examined the parts of English speech and their transformations regarding case, degree, mood, number, tense and voice categories. It seemed natural for us to view abbreviations, acronyms, clipped words, interjections, loan words, etc, paying particular attention to such toponyms as geographic names, corporate names, days of the week, months, nationalities, people’s names, patronymics and sur-names, social networks, astronyms, types of drinks, meals and food, etc.

Paradoxically, some English consonant sounds can be rendered by vowel letters, e.g.:

- [f] can be rendered by vowel letter *u* (*lieutenant [lefˈtenənt]*);
- [j] can seldom be rendered by vowel letter *e (Eugene [ˈjuːdʒiːn], eureka [juəˈrɪkə]* or *[joːˈrɪkə], Europe [ˈjuərəp]* or *[ˈjoːrəp]);* by vowel letter *u* (*unique [juːˈniːk], use [juːz], usual [ˈjuːʒəl]* or *[ˈjuːʒl]*); by vowel letter *y (yacht [joːt], year[jɪə]* or *[jəː], youth [juːθ]*);
- [w] can sometimes be rendered by vowel letter *o* (*one [wʌn]*, *once [wʌns]*, *oneself [wʌnˈself];* by vowel letter *u* (*cuisine [kwɪˈziːn]*, *persuade [pəˈsweɪd]*, *quake [kweɪk]*.

We can observe a revearse process, when consonant letters render vowel sounds if they are pronounced under their names in the English Alphabet, e.g. letter *Pp* in *PPP* (that stands for *Power Point Presentation) [ˈpiːˈpiːˈpiː])*. To be more exact, consonant letters can render one (letter *Rr*), two (letters *Bb, Cc, Dd, Ff, Gg, Hh, Jj, Kk, Ll, Mm, Nn, Pp, Ss, Tt, Vv, Zz*, the latter in American variant of English), three (letters *Qq, Xx, Zz*) and six sounds (letter *Ww*):

- letter Rr rendered by one sound *[aː]*;
- letter Bb rendered by two sounds *[biː]*;
- letter *Qq* rendered by three sounds *[kjuː]*;
- letter *Ww* rendered by six sounds *[dʌbljuː]*.

Letters rendered by two (*Bb [biː], Hh [eɪtʃ], Nn [en]*), three (*Qq [kjuː], Xx [eks], Zz [zed]*) and six sounds (*Ww [dʌbljuː]*) involve both consonant and vowel sounds. This postulate says that if we pronounce the consonant letters in definite positions (in abbreviations and compound words, for instance), we have to use both consonant and vowel sounds to utter them, e.g. abbreviation *CIF [siːaɪˈef]* and compound word *X-ray [ˈeksreɪ]*:

- *CIF* is composed of letter *C – [siː]* rendered by two sounds, consonant *[s]* and vowel *[iː]*, letter *I [aɪ]* rendered by one vowel sound *[aɪ],* letter *F* rendered by two sounds, vowel *[e]* and consonant *[f]*;
- *X-ray* is composed of letter *X [eks]* and word *ray*.

Thus, a notable feature of this article is its inclusion of examples where consonant letters can take part in rendering vowel sounds.

In the pages that follow are to be found specimen letters and letter combinations depicting English monophthongs [æ], [e] and [əː].

Vowel sound [æ] can be represented by letters *a* (*acrid [ˈækrɪd]*), *i* (*meringue [məˈræŋ]*), by groups of letters *ai* (*plait [plæt]*), *ua* (*guarantee [gærənˈtiː]*), and by a combination of the apostrophe and vowel letter *a’a* (*ma’am [mæm]*).

Sound [æ] can be put in the opening (*act [ækt]*), central (*pad [pæd]*) and ending (*Nah* or *Nahh [næ]*) position of lexical units. One does not meet it in the neutral position. Monophthong [æ] is represented by two letters (*a*, *i*), two groups of vowel letters (*ai*, *ua*) and a combination of a vowel letter and the apostrophe (*a’a*).

Vowel sound [e] can be represented by letters *a* (*ate [et]* or *[eɪt]*), *e (per-*

il [ˈperəl]), u (bury [ˈberɪ]), f (FOB [efəʊˈbi:]), l (LTD [elti:ˈdi:]), m (BMW [bi:emˈdʌblju:]), n (NGO [endʒi:ˈəʊ:]), s (SOS [esəʊˈes]), x (x-ray *[ˈeksreɪ]*), *z* (ZT *[zed’ti:]*), by French letter *é* (*apéritif [əˈperəti:f]*) and by groups of letters *ai* (*said [sed]*), *ea* (*pleather [ˈpleðə]*), *eg* (*phlegm [flem]*), *ei* (*leisure [ˈleʒə]*), *eo* (*jeopardize [ˈdʒepədaɪz]*), *ie* (*friend [frend]*), *ue* (*baguette [bæˈget]*).

Sound [e] can be put in the opening (*embassy [ˈembəsɪ]*) and central (*twenty [ˈtwentɪ]*) position of words. One does not meet it in the neutral and ending position of lexical units. Monophthong [e] is represented by four vowel letters (*a, e, u, é*), seven consonant letters (*f, l, m, n, s, x, z*) and seven groups of letters (*ai, ea, eg, ei, eo, ie, ue*). In six cases, this phoneme is made in graphic spelling by groups of vowel letters (*ai, ea, ei, eo, ie, ue*) and in one case by a group of vowel and consonant letters (*eg*).

Table 1. *Ways of Graphical Spelling of Monophthongs [æ], [e] and [ə:]*

Spelling	**Monophthongs**					
	[æ]	**Example**	**[e]**	**Example**	**[ə:]**	**Example**
Vowel Letter	a	distract	a	ate	-	-
	i	meringue	e	peril		
			u	bury		
			é	apéritif		
Vowel Letters	ai	plaid	ai	said	ieu	milieu
	ua	guarantee	ea	jealous		
			ei	leisure		
			eo	leopard		
			ie	lieutenant		
			ue	guess		
Vowel and Consonant Letters	-	-	eg	phlegm	ear	search
					eor	George
					er	percent
					ere	were
					err	inferred
					eur	amateur
					ir	stir
					olo	colonel
					or	world
					our	journey
					ur	burden

Consonant Letter	-	-	f	FBI	-	-
			l	LLC		
			m	pm		
			n	NBC		
			s	NBS		
			x	XL		
			z	Z-axis		
Combination of the Apostrophe and Vowel Letter	a’a	ma’am	-	-	-	-

Vowel sound [ə:] can be represented by groups of letters *ieu* (*milieu [ˈmɪljə:]*), *ear* (*pearl [pə:l]*), *eor* (*George [dʒə:dʒ]*), *er* (*tertiary [ˈtə:ʃərɪ]*), *ere* (*were [wə:]*), *err (inferred [ɪnˈfə:d]), eur* (*amateur [ˈæmətə:]* or *[ˈæmətə]*), *ir* (*dirge [də:dʒ]*), *olo* (*colonel [ˈkə:nəl]*), *or* (*attorney [əˈtə:nɪ]*), *our* (*courtesy [ˈkə:təsɪ]*), *ur* (*nocturnal [nɔkˈtə:nəl]).*

Sound [ə:] can be put in the neutral (*Er [ə:]*), opening (*earnest [ˈə:nɪst]*), central (*hurt [ˈhə:t]*) and ending (*infer [ɪnˈfə:]*) position of lexical units. Monophthong [ə:] is represented by 12 groups of letters (*ear, eor, er, ere, erre, eur, ieu, ir, olo, or, our, ur*). In one case, this phoneme is made in graphic spelling by a group of vowel letters (*ieu*) and in 11 cases by groups of vowel and consonant letters (*ear, eor, er, ere, erre, eur, ir, olo, or, our, ur*).

Table 1 above displays particular cases of sounds [æ], [e] and [ə:] represented by single letters, groups of letters and the apostrophe in English lexical units.

To sum up, we must note that the solution to the problem of graphic spelling of monophthongs is still for the most part in its infancy. No single spelling rule can guarantee uniformed pronunciation of this or that vowel phoneme, that is why the best way to specify correct pronunciation of a lexical unit remains in looking it up in off-line and on-line dictionaries. However, the ways of graphic spelling of monophthongs [æ], [e] and [ə:] in particular described by us can simplify to some extent this process in the initial and further stages of teaching English at educational institutions in the Russian Federation.

Our brief outline of the modes of graphical spelling of the three vowel sound shows that further more careful and scrupulously detailed investigation is necessary to get the objective data by which we can more fully ascertain each method to render the vowel phonemes. Nevertheless, the research allowed us to work out and prepair for publishing a guide-book containing drills to consolidate the skills of spelling and pronunciation of lexical units. The logical outcome of our work permits to state that the data of the review can be helpful in the pedagogical reality of Russian schools, colleges, universities when teaching English phonological and

spelling nuances to students who master English as a foreign language. However, we cannot purport to have covered the entire range of variations of letters, groups of letters and their combinations with punctuation marks depicting monophthongs [æ], [e] and [ə:]. For this reason, we invite our fellow scholars to join us in further more thorough research of this issue.

References

1. Арнольд И.В. Лексикология современного английского языка. Пособие для студентов английских отделений педагогических вузов. – М.: Изд-во «Просвещение», 1966. – 342 с.

2. Васильев В.А., Катанская А.Р., Лукина Н.Д., Маслова Л.П., Торсуева Е.И. Фонетика английского языка. Учебник для институтов и факультетов иностранных языков. — 2-е изд., перераб. — М.: Высшая школа, 1980. — 256 с. (На английском языке).

3. Маншейнъ С.А. Иллюстрированный курс английского языка. Петроградъ. Типография Тренке и Фюсно, Максимиліановский пер., № 13. 1916. – 157 с.

4. Матюшкина-Герке Т.И., Балашова С.П., Броссе Н.Н и др. Учебник английского языка: для I курса филол. фак. ун-тов – 3-е изд., испр. и доп. – М.: Высш. школа, 1979. – 508 с., ил.

5. Мюллер В.К. Англо-русский словарь, 70 000 слов и выражений. Спб., «Академический проект», 1996.

6. Торсуев Г.П. Фонетика английского языка. 15-я типография «Искра революции» Главполитграфиздата при Совете Министров СССР. М: Изд-во литературы на иностранных языках, 1950. – 332 с.

7. Шах-Назарова В.С., Журавченко К.В. Английский язык для вас: в 2-х частях. 4-е изд., испр. – К. : Лумина, 1992. – 653 с.

8. Электронный словарь Abbyy Lingvo. https://www.lingvolive.com/en-us.

9. Электронный словарь Promt online. https://www.translate.ru/.

10. Электронный словарь Мультитран. ttps://www.multitran.ru/c/m.exe?l1=1&l2=2&s=effectual.

11. Macmillan English Dictionary, 2006. – 1693 p.

12. Paul Carley, Inger M. Mees and Beverley Collins. English phonetics and pronunciation practice. Taylor&Francis, 2017. – 328 p.

13. Roach Peter. English Phonetics and Phonology. Paperback with Audio CDs (2): A Practical Course. 4th Edition. Cambridge University Press, 2009. – 244 p.

DOI 10.34660/INF.2021.26.58.011

LINGUISTIC EDUCATION: PROBLEMS AND OUTLOOK

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Abstract. *The article is devoted to the problems of linguistic education at the University. The author emphasizes that the main task of a foreign language teacher is the development of a linguistic personality, capable of carrying out intercultural communication effectively in all its spheres. The chief aim of planning and organizing of the educational process at the University, according to the author, is the individualization of education, the training of a competitive specialist who speaks a foreign language not only within the framework of professional activity, but is also ready to carry out research work in a foreign language.*

Keywords: *individualization of education, competence-based approach, management of educational activities of students, multilevel tasks, research work of students.*

The political and socio-economic changes taking place in our country have led to a significant increase in interest in the study of foreign languages, and therefore to an increase in the role of linguistic education. Linguistic education plays a leading role in the process of personality development, since language, being the primary means of human communication, acts as a way for creating and interpreting the "image of the world", penetrating into world culture and realizing one's national and cultural identity, as an instrument of social interaction, formation and socialization of a personality. The country needs active, creative people with flexible thinking, developed abilities, able to solve new problems. Learning a foreign language has the necessary positive impact on the development of the human psyche, improving its various aspects. A person develops generalized abstract thinking. In communicative learning, the development of thinking is carried out not only by comparing with the native language, but by solving more complicated speech-and-thinking tasks that contain elements of problem-solving associated

with the semantic content of the communication process. Thus, the cognitive and communicative function of thinking is actively developing. The study of a foreign language contributes to the development of such mental operations as comparison, analysis, synthesis. Mastering a foreign language has a beneficial effect on the development of abilities and speech, motor apparatus. A person develops intonation and phonemic hearing, a "sense of language," or the ability to guess, the ability to allocate the main, all kinds of memory, voluntary and involuntary memorization. Modeling educational situations and situations of reality in the classroom, acting in anticipated circumstances, participating in speech games develop imagination and creativity. Mastering a foreign language is always mental and physical work, systematic and persistent. By accustoming a schoolchild or student to actively work in the lesson, regularly and conscientiously do their homework, we develop the habit of working in him. Developing a cognitive interest in educational work, we lay the foundations of a student's interested attitude to any future profession, the foundations of a creative attitude to work in general. A foreign language as an academic subject makes a significant contribution to the culture of mental work of students. They develop such specific educational skills as the ability to use a dictionary, grammar reference books, etc. All this teaches us to work independently, creates the prerequisites for the development of the need for self-education. Yes, "and that's all about him", about a foreign language! All the noted advantages of the process and result of teaching foreign languages lead to the fact that the role of the versatile training of future teachers as an integrating component in the vocational training system, including subsystems of special, ideological, psychological, pedagogical and cultural and aesthetic training, increases. Accordingly, the main goal in the field of teaching foreign languages is set before the teacher of a foreign language - the development of a linguistic personality capable of effectively carrying out intercultural communication in all its spheres. The formation of a new multicultural personality should contribute to the training of a new generation of highly qualified specialists in demand in the modern labor market.

The integration of the Russian education system into the world educational system has led to reforms in the field of educational space. In connection with the transition to a two-level system of higher education, the priority direction of the design and organization of the educational process at the university is the individualization of education, the training of a competitive specialist, the formation of future graduates' professional qualities and the ability to adapt to constantly changing socio-economic conditions. New educational standards presuppose not only and not so much the reproduction of acquired knowledge, abilities and skills, but the student's ability to apply them in specific practical activities. The intensive development of science and technology requires a specialist to constantly improve the level of professionalism in the chosen field, including the exchange of experi-

ence with foreign colleagues, the development of the ability to creatively process the constantly increasing flow of information and its application in practice.

At the present stage of social development, language education is becoming not just one of the components of the educational process, but a necessity dictated by globalization. That is why knowledge of a foreign language is considered by us as an integral part of the competence of a specialist of any profile. In this regard, the issues of effective teaching a foreign language, problems and prospects of foreign language education are of particular relevance.

The competence-based approach presupposes the presence in the new Federal State Educational Standards of general cultural and professional competencies, which should be formed in the student in the learning process. Thus, some educational standards stipulate that a graduate, in particular, must have such competence as the readiness to communicate in oral and written forms in Russian and foreign languages to solve the problems of professional activity (OPK-2) [6]. it can be concluded that the requirements for proficiency in a foreign language are quite high. In particular, the graduate must know the lexical minimum and special terminology sufficient for foreign language communication, including in the framework of professional activities. In addition, he should possess the methods of orientation in authentic sources of information on professional topics, the skills of writing his own point of view, as well as the experience of public speaking and conducting discussions in a foreign language.

The competence model assumes the expansion of students' independent work, the main condition of which is the competent formulation and specification of educational goals, as well as the creation of positive motivation for students to learn the language. In this regard, there is a need to redistribute the volume of educational material, taken out for independent work.

Analyzing the current situation in the education system, the work of researchers and methodologists in the field of organization and implementation of independent work [3; 5], it should be noted that the teaching staff is faced with the task of adjusting curricula and choosing adequate pedagogical technologies. For the successful implementation of this task, it is necessary to solve the following issues: the study of the initial level of knowledge and skills of students, planning and methodological aspects of independent work, optimization of the management of educational activities and the organization of educational and research work of students. G.P. Bukharina proposes to use a multilevel approach when designing a system of tasks aimed at developing students' practical skills in the field of professional activity, and identifies three levels of tasks according to the degree of complexity. Tasks of the first level provide for reproductive assimilation of material based on an algorithm; tasks of the second level are aimed at developing the analytical skills of students and are concentrated mainly in the framework of inde-

pendent work of students; tasks of the third level involve the use of infocommunication technologies and are aimed at developing the creative potential of the future graduate [1]. Based on this point of view and our own pedagogical experience, we can propose the following organization of such a hierarchy in teaching a foreign language, aimed at the formation of general professional competence (OPK-2) among students . The first level of assignments includes working with general and professional vocabulary, grammatical minimum, audio materials and educational texts (in particular, annotating and note-taking according to the proposed model). At this stage of studying the topic, special attention is paid to the development and improvement of the skills of monologue and dialogical speech and writing. For this purpose, we consider it expedient to use exercises , including their preparation of a thematic oral message according to a given algorithm, drawing up a dialogue and writing letters to Russian-language articles according to the model. Tasks of the second level allow to form analytical skills and are focused on classroom and extracurricular independent work of students, taking into account their individual characteristics, inclinations and interests. At this stage, it is proposed to write annotations, reviews, abstracts in a foreign language, as well as an analysis of English-language resources in the preparation of reports and presentations, followed by speaking at conferences and seminars. Tasks of the third level contribute to the implementation of interdisciplinary connections in teaching a foreign language in the format of a competency-based approach. At this stage, students develop and defend projects within the framework of professional interests, solve situational problems and participate in international activities. Research work of students as the highest form of organizing independent work involves writing articles and participating in seminars and conferences in a foreign language. In addition, this includes the protection of the portfolio, which allows you to assess the degree of formation of the student's competencies and the level of his readiness to carry out professional activities. Currently, in the context of globalization, the use of infocommunication technologies is an obligatory component of the educational process. However, the specificity of the use of information technology in the design of tasks at all stages of training and was previously considered in the works of domestic and foreign researchers [2; four; 7; 8]. Pedagogical practice shows that electronic testing not only gives the student the opportunity to work on complex aspects of the studied discipline and independently control the degree and completeness of mastering the educational material, but also allows the teacher to objectively evaluate the student's work. Active international cooperation in all spheres of human activity requires proficiency in a foreign language at a sufficiently high level. In this regard, language education in the context of globalization is undergoing complex changes and modernization, which implies the introduction of innovative technologies into educational activities and the development

of a qualitatively new educational concept. Consequently, a well-developed and applied system of tasks, combining the traditions and innovations of Russian and foreign education, the use of interdisciplinary relations and the introduction of new forms and methods of organizing the educational process in a foreign language, contribute to improving the quality of graduate training.

References

1. Bukharina G. P. Implementation of the competence-based approach in the organization of students' independent work (IWS) [Electronic resource]. URL: http://www.myshared.ru/slide/230002/ (date of access: 05/31/2016).

2. Efremova N. F. Test control of the quality of educational achievements in education: diss . ... D. Ped . n. Rostov-on-Don , 2003.458 p.

3. Kuprina OG Organization of independent work of students at the university in the study of foreign languages // Higher education today. 2011. No. 5. S. 78-80.

4. Nepomnyashchaya S., Khokhlova T., Abalikhina E. Computer testing: pros and cons (on the method of using in the educational process) // Alma mater . 2006. No. 6. S. 9-14.

5. Tyurnikova G., Filatova O., Proshkina I., Ilyina Yu., Semenova E. Organization of students' independent work is a condition for the implementation of the competence-based approach // Higher education in Russia. 2008. No. 10. S. 93-97.

6. Federal State Educational Standard of Higher Professional Education in the areas of bachelor's degree [Electronic resource]. URL: http://fgosvo.ru/fgosvpo/7/6/1 (date of access: 05/31/2016).

7. Bartram D., Hambleton RK Computer-based testing and the Internet: issues and advances. UK, Chichester, West Sussex, 2006.272 p.

8. Parshall CG, Spray JA, Kalohn JC, Davey TC Practical considerations in computer-based testing. NY, 2002.232 p

DOI 10.34660/INF.2021.35.42.012

EMPIRICAL RESEARCH OF STUDENTS’ TOLERANCE IN EXTRAMURAL AND DISTANCE EDUCATION

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Abstract. *The article substantiates the need for the development of tolerance among students at the university. The content of the key concepts "tolerance", "intolerance", "intercultural dialogue" is revealed on the basis of the theoretical analysis of psychological and pedagogical literature. The article considers the issues of tolerance in cross-cultural communication and summarises advanced experience in the field of fostering ethnic tolerance in students as a preventive measure. The article presents the statistical data of the empirical study on the method of determining the tolerant attitude to representatives of other cultures "Tolerance Index" (G. U. Soldatova, O. A. Krivtsova, etc.). The results revealed the average level of tolerance among the respondents.*

Keywords: *cross-cultural dialogue; tolerance; intolerance; methods of pedagogical research.*

Introduction

The relevance of the research topic is determined by the processes of globalization and international integration, which has exacerbated the problems of tolerance in intercultural communication in all spheres of human activity: socio-economic, political, cultural, religious, educational, which negatively affect the stability of the progressive development of the world as a whole.

The need for the formation of ethno-cultural competence and ethnic tolerance among students is caused by the processes of national and cultural self-determination of the peoples of Russia; migration flows to the Russian Federation from the CIS countries, with which local residents have conflicts on the basis of differences between ethnic groups. [7, c. 532-534].

The problems of tolerance are considered with the aim of educating young people in a culture of peace, legal and political culture in the context of multicultural education, which has a significant impact on the cultural self-determination

of students. [15, c. 96-110].

Purpose of the study – to establish the level of tolerance of students of extramural and distance education as an integral part of the intercultural competence of the individual, which is necessary for professional and interpersonal communication in the intercultural space of the modern information society. To achieve this goal, the following tasks were solved: 1) identify the content of the key concepts of the research topic: "tolerance", "intolerance", "intercultural dialogue"; 2) to measure the general level of tolerance of students and its aspects (ethnic, social and tolerance as a personality trait); 3) to draw the appropriate conclusions on the basis of the analysis of the conducted questionnaire.

Materials and methods

In the course of the research, methods of analysis and synthesis of scientific and methodological literature on the stated problem, psychological and pedagogical methods (survey, questionnaire), and statistical method were used.

The theoretical basis of the research was made up of works in the field of: 1) cross-cultural and ethnic psychology (G. U. Soldatova [13]); 2) dialogue of cultures (V. V. Safonova [11]); also works devoted to: 3) I-concepts in the theory of personality (k. Rogers [9]); 4) psychological aspects of personal development (G. Allport [1]); 5) concepts of spiritual and moral development and education of the individual (A. Danilyuk, A. Kondakov, V. Tishkov) [4]); and: 6) normative documents (Declaration of the Principles of Tolerance: approved by resolution 5.61 of the UNESCO General Conference of November 16, 1995 [5]).

In pedagogical science, there are methods of pedagogical research, including techniques, procedures, operations, with the help of which processes and phenomena are investigated in order to obtain scientific information. Empirical methods, such as testing, observation, conversation, and questioning, are used to identify judgments, assessments, and attitudes to a particular problem.

The oral survey is usually conducted in the form of a conversation, during which students ' communicative competencies are developed. With the development of electronic forms of communication, the method of questioning by e-mail or on the Moodle platform is used in educational activities, with the help of which it is possible to investigate various pedagogical phenomena: motivation for activity, research and creative activity; communication skills; to establish the attitude of students to the acute problems of modern society.

One of such problems is the problem of tolerance, the essence and types of which are widely considered by modern researchers in various humanities. The term "tolerance", which has become an international term, is directly related to the problems of the human world at all levels: family, inter-group, inter-ethnic, inter-confessional, and international relations.

The official document of the UNESCO Declaration of Principles of Tolerance

of 1995, in particular Article 4.2., refers to the adoption of urgent measures for education in the spirit of tolerance against violence and exclusion, the creation and implementation of programs in the education system aimed at the formation of a tolerant culture and promoting legal education, with special attention to proactive measures against racism, xenophobia, discrimination. [5].

The analysis of psychological and pedagogical works shows a wide range of different descriptions of the essence of tolerance, its structure, functions, types and different approaches to research. S. L. Bratchenko [3] considers tolerance from the point of view of a dialogical approach, K. Rogers [9] uses a humanistic approach, describing the specific features of self-actualization: tension, overcoming obstacles in the struggle, mobility, openness, independence, self-reliance, development in the direction of complexity, self-sufficiency, maturity, competence.

From the point of view of E. S. Sukhykh, tolerance is understood in many ways: as a resistance to uncertainty, stress, conflict situations, behavioral deviations. Its manifestations are observed in various forms and at different levels: from indifference and detachment from society or humility for the sake of peace to openness, curiosity, interest in dissimilarity, approval and respect for the rights of the other. [14, c. 66-77].

According to G. L. Bardier, nonviolent behavior in relation to religious, cultural, moral, political problems of people or social groups is tolerance. In a diverse world, tolerance in situations of dialogue of cultures means strong, sustainable and peaceful coexistence, reaching an agreement by non-violent methods in conditions of different views on the issues discussed, using a rational approach. [2, c. 3].

The concept of "tolerance" is often associated with the American psychologist G. W. Allport, who developed the theory of personality traits and generically characterized a tolerant and non-tolerant personality according to certain parameters.: ability to empathize, security, lack of need for certainty, sense of humor, self-knowledge, self-criticism, responsibility, desire for freedom and democracy. An intolerant person, in his opinion, is characterized by the desire to belong to a national group or organization where he feels safe [1].

The term intolerance is used to describe situations of violence, discrimination, violation of human rights, escalation of social instability, and the desire for strict uniformity. To more clearly explain the understanding of intolerance, A. P. Sadokhin identified the following forms of its manifestation: insults, ridicule, disdainful attitude; negative stereotypes, prejudices based on negative traits and qualities; discrimination on various grounds in the form of deprivation of social benefits, restrictions on human rights, artificial isolation in society; racism, nationalism, exploitation, fascism; desecration of religious and cultural monuments; religious persecution; ethnocentrism [10, p.242].

The debatable problem of tolerance in the context of globalization also con-

cerns intercultural communication, which requires the ability to establish a constructive intercultural dialogue based on digital technologies, including electronic communication; foreign language skills as a means of communication, which is facilitated by the use of the technology of cultural dialogue in the classroom [8, pp.21-24], on the basis of which a cultural picture of the world is formed, which helps to educate young people to be tolerant to other cultures [6, 114-120]. Interacting with each other, students gain an understanding of the rich diversity of cultures, the ways and forms of human individuality, the awareness of their abilities and their own destiny.

Zh. M. Utegenov offers an effective program for the education of ethnic tolerance of students, the structure of which includes ideological, emotional and activity components. During extracurricular time, on the basis of universal values (benevolence, peacefulness, empathy, openness) in the form of an intercultural dialogue, students master folk wisdom: proverbs and sayings, the content of which presents the best human qualities, developing young people's aspirations for patriotism, interethnic understanding, peacefulness. [13, c. 6].

To create a tolerant, constructive relationship between the subjects of the educational process of the university, a purposeful system of developing the skills of tolerance, correct behavior in conflict situations, possession of coping strategies for solving both professional and personal and interpersonal problems is necessary, believes O. A. Selivanova. As a preventive measure to correct intolerant and extremist tendencies, the education process focuses on humane values, social responsibility, and active citizenship. In order to avoid negative manifestations in relation to the main cultural and national groups of students in an educational institution, it is recommended to include national, religious, and cultural phenomena of reality with positive content [12].

Russian universities conduct social and educational work aimed at participating in cross-cultural communication and interaction based on a dialogue of cultures to prepare students for life in a multicultural society. Cross-cultural communication, in the understanding of V. V. Safonova, is a communicative interaction between people belonging to various geopolitical, continental, regional, religious, national, ethnic communities, social subcultures, differing in value orientations, lifestyle, models of speech and non-speech behavior. The key term in cross-cultural communication is "cultural dialogue". The basic principle of intercultural dialogue is mutual understanding and respect, an open exchange of views. [11, c. 123-138].

Results and discussion

As a result of studying the sources on the problem of tolerance of university students, it was revealed that teachers use modern pedagogical technologies, active methods of teaching and upbringing (conversations and discussions, interviews, game methods, trainings, various test methods).

Our study was conducted at the Financial University during the 2019-2020 academic year with the aim to forming tolerance as a personality quality, along with openness, curiosity, rejection of prejudices, which is part of the structure of students' intercultural competence, which is an important component of foreign-language professional communicative competence.

In our research was used widely known in higher education institutions questionnaire "Tolerance Index", created on the basis of domestic and foreign experience in the field of psychology (G. U. Soldatova, O. A. Kravtsova, O. E. Khukhlaeva, L. A. Shaigerova.). The questionnaire includes statements that reveal a tolerant or intolerant attitude of a person to the surrounding world and people, as well as social attitudes that manifest themselves in the process of interaction in various fields of activity.

Students of 1-2 courses of extramural and distance learning of 55 respondents aged 18 to 46 years from various ethnic groups: Russians (41 people); Armenians – 4 people); Koreans (3 people); Ukrainians (3 people); Kyrgyz (1 person); Georgians (1 person), Kabardin (1 person); Dagestani (1 person) took part in filling out the questionnaires.

Table 1. *Distribution of respondents by training profile and gender, as a percentage of the total number of respondents*

№	Direction of training	Gender. number		Total, %
		Female	Male.	
1.	Distance learning groups ("Economics", "Management", "Financial Management")	11	3	25,45%
2.	Extramural learning group(direction "Economics" of accelerated program)	5	4	16,36%
3.	Extramural learning group 1 (direction "Management")	17	-	30,909%
4.	Extramural learning group 2 (direction "Management")	10	5	27,27%
	Total: 55 respondents	43	12	100.0%

Students were offered a list of 22 direct and reverse statements. For direct statements, the points were distributed from 1 to 6 ("absolutely disagree" – 1 point, "completely agree" - 6 points). To reverse statements-reverse points ("absolutely disagree" - 6 points, "completely agree" - 1 point).

According to the received data of the questionnaire, a quantitative and qualitative analysis was carried out. Table 2 shows the overall results of the quantitative analysis without dividing the identified tolerance level into subscales of the groups that took part in the survey. The overall assessment of the level of tolerance was determined by three stages: low level of tolerance - from 22 to 60 points; average

level – 61-99; high level – 100 to 132.

Table 2. *Group assessment of the identified level of tolerance without division into subscales*

Groups / Tolerance Levels	Low level of tolerance (22-60)		Average level of tolerance (61-99)		High level of tolerance (100-132)	
	Number of participants	Percentage %	Number of participants	Percentage %	Number of participants	Percentage %
Distance learning groups	-	-	11	20%	3	5,45%
Accelerated Learning Group	-	-	7	12.72%	2	3,63%
Extramural Learning Group Management (1)	-	-	12	21,81%	5	5,45%
Extramural Learning Group Management (2)	-	-	10	18.18%	5	5.45%
Total: 55 (100%)	0	0	40	72,72%	15	19,98%

According to the creators of the questionnaire, a high level of tolerance (more than 115 points) can indicate a psychological infantilism of an individual, indifference or a desire to be friendly in social contacts. Among the respondents who scored more than 115 points – two people, which was 3.63% of the total number of participants in the survey. The results of the group assessment of the level of tolerance showed the average level of the majority of respondents-72.72%.

Then we conducted a diagnosis of the level of tolerance of students in three aspects: 1) ethnic tolerance – attitude to people of their own ethnic group, other race and ethnic group; 2) social tolerance-attitude to poor, mentally ill people and minorities; 3) tolerance as a personality trait – respect for a different point of view, readiness for constructive conflict resolution and fruitful cooperation.

Table 3 shows that the majority of students have a high (50.9%) and average (45.44%) level of tolerance towards representatives of other ethnic groups and positive attitudes in the field of intercultural communication. Two students have a low level (3.63%), which means that this category of respondents should be involved in interactive discussions on the development of empathy and tolerance, in university events dedicated to the issues of ethnographic literacy, harmonization of interethnic relations, and be motivated to get acquainted and study the cultures and traditions of other peoples, including those living in Russia.

Table 3. *Tolerance indicators for the Ethnic tolerance subscale»*

The aspect of tolerance / Groups	the Ethnic tolerance			Average mean
	Low Level – до 19 баллов	Average Level – 20-31 балл	High Level – 32 и более баллов	
Distance learning groups	Not fixed	9 (16,36%)	5 (9,09%)	31
Accelerated Learning Group	Not fixed	2 (3,63%)	7 (12,72%)	32,44
Extramural Learning Group (1)	Not fixed	10 (18,18%)	7 (12,72%)	30,23
Extramural Learning Group (2)	2 (3,63%)	4 (7,27%)	9 (16,36%)	26,66
njnal: 55 чел. (100%)	2 (3,63%)	25 (45,44%)	28 (50,9%)	120,33

Table 4 shows the results of the analysis of social tolerance, which allowed us to identify the average level (81.81%) of tolerant manifestations of students to various social groups (minorities, criminals, mentally ill people), as well as the attitudes of the individual in relation to certain social processes. The high level (14.54%) was shown by five and a half times less students than the average, and the intolerant manifestations were recorded in 3.63% of respondents.

Table 4. *Tolerance indicators for the "Social tolerance" subscale»*

The aspect of tolerance / Groups	Social tolerance			Average mean
	Low Level – до 22 баллов	Average Level – 23-36 баллов	High Level – 37 и более баллов	
Distance learning groups	Not fixed	12 (21,81%)	1 (1,81%)	32,14
Accelerated Learning Group	Not fixed	8 (14,54%)	2 (3,63%)	32
Extramural Learning Group (1)	Not fixed	13 (23,63%)	4 (7,27%)	31,52
Extramural Learning Group (2)	2 (3,63%)	12 (21,81%)	1 (1,81%)	26,33
Total: 55 resp-s. (100%)	2 (3,63%)	45 (81,81%)	8 (14,54%)	121,99

Table 5 shows the results of the diagnosis of tolerance as a personality trait: high indicators – in 29 respondents (52.72%), average – in 26 (47.27%). The low level was not recorded. The diagnosed personality traits largely determine a person's attitude to the world around him, his attitudes and beliefs.

Table 5. *Tolerance indicators for the subscale " Tolerance as a personality trait»*

The aspect of tolerance / Groups	Tolerance as a personality trait				
	Low Level – до 19 баллов	**Average Level – 20-31 балл**	**High Level – 32 и более баллов**	**Number of resp-s**	**Average mean**
Distance learning groups	Not fixed	9 (16,36%)	5 (9,09%)	14	32,71
Accelerated Learning Group	Not fixed	4 (7,27%)	5 (9,09%)	9	31,44
Extramural Learning Group (1)	Not fixed	6 (10,9%)	11 (20%)	17	32,76
Extramural Learning Group (2)	Not fixed	7 (12,72%)	8 (14,54%)	15	28,6
Total: 55 resp-s. (100%)	0	26 (47,27%)	29 (52,72%)	55	125,31

Conclusion

Based on the results of the study, the following conclusions were made. 1) According

to the quantitative analysis of the overall result without dividing by scales, respondents in all groups showed an average level of tolerance (72.72%), which means the manifestation of both tolerant and intolerant traits in various social situations. Intolerant manifestations were recorded in the group (2) of extramural learning (3.63%) on two scales (Social tolerance and Ethnic tolerance), in which additional conversations on the topic of culture, intercultural communication and discussion of the content of the concepts of "tolerance / intolerance" were not organized.

2) The analysis of scientific and pedagogical literature on the topic of the study allowed to learn various points of view, approaches of researchers to the content of the key concepts of "tolerance", "intolerance", and revealed the interdisciplinary status of the problem of tolerance. The debatable problem of tolerance in the context of intercultural communication requires a more detailed consideration on the basis of intercultural dialogue by electronic means of communication using digital technologies.

3) The practical significance of the research lies in the fact that as a result of the conducted analysis of the questionnaire and learning the experience of fostering tolerance in higher education, it is possible to develop methodological and didactic materials that will expand the opportunities of the English teacher in the formation of intercultural competence of students, including digital technologies (distance learning platforms, online learning, mixed learning with an interactive format of materials and synchronous and asynchronous interaction).

References

1. *Allport G. Tolerantnaya lichnost ' [Tolerant personality]. 2011. No. 2 (6). pp. 155-159.*

2. Bardier G. L. Social psychology of tolerance. Autoreferat diss. Ph. D. in Psychology. 2007. Saint-Petersburg. 45 p.

3. Bratchenko S. L. Interpersonal dialogue and its main attributes / / Psychology with a human face: a humanistic perspective in post-Soviet psychology / ed. D. A. Lentyev, V. G. Shchur. M.: Smysl, 1997. pp. 201-222.

4. Danilyuk A., Kondakov A., Tishkov V. The concept of spiritual and moral development and education of the individual citizen of Russia. Moscow: Prosveshchenie, 2010. 25 p.

5. Declaration of the principles of Tolerance [Electronic resource]: Approved by resolution 5.61 of the UNESCO General Conference of November 16, 1995. URL : https://06spb.edusite.ru/p94aa1.html]. [Electronic resource: URL: https:// www.un.org/ru/documents/decl_conv/declarations/toleranc.shtml

6. Karmova M. R., Maksimova O. I. Dialog kultury [Dialog Culture: from Conflict to Mutual Understanding: materials of the Second International Scientific and Practical Conference (Moscow, April 21-25, 2020)], edited by L. G. Vikulova, Moscow: Languages of the Peoples of the World, 2020, pp. 114-120.

7. Leontiev M. G. Multicultural education and the formation of ethno-cultural competence of university students // Bulletin of the Moscow State University of Civil Engineering. 2011. No. 6. C. 532-534.

8. Mashanova S. M., Kylyshpaeva M. Kh., Kylyshpaeva S. Kh. Development of students' tolerance by means of the English language in higher education institutions. Questions of theory and practice. 2019. Vol. 4.Issue. 2. pp. 21-24.

9. Rogers K. R. View on psychotherapy. The formation of man / trans. from the English by M. M. Isenina; general ed. and preface by E. I. Isenina. M.: Progress; Univers, 1994. 480 p.

10. Sadokhin A. P. Cross-cultural communication. Moscow: Alfa-M; INFRA-M, 2004. 310 p.

11. Safonova V. V. Co-study of languages and cultures in the mirror of world trends in the development of modern language education // Language and culture. 2014. No. 1 (25). pp. 123-141.

12. Selivanova O. A. Main directions of prevention of intolerance and extremism in the environment of a modern regional university / / Education and Science. 2012. No. 3. pp. 74-79. 24.

13. Soldatova G. U. Tolerance: psychological stability and moral imperative / / Practicum on psychodiagnostics and research of tolerance / ed. by G. U. Soldatova, L. A. Shaigerova. Moscow: Lomonosov Moscow State University, 2003. pp. 4-13.

14. Sukhykh E. S. Tolerance: psychological content and personal factors. Community. Management. 2005. No. 4. pp. 66-77.

15. Sysoyev P. V. Linguistic multicultural education in the XXI century // Language and culture. 2009. No. 2 (6). pp. 96-110.

16. Utegenov Zh. M. Education of ethnic tolerance of students in extracurricular time (based on the material of the Republic of Kazakhstan): autoref. diss. ... k. p. n. M., 2011. 22 p.

DOI 10.34660/INF.2021.72.34.027

EXPERIMENTAL APPROBATION OF NEURO DIDACTIC TECHNOLOGY OF DISTANCE LEARNING OF STUDENTS AT THE ASCERTAINING STAGE

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Annotation. *The article, which is offered to a wide range of the scientific community, describes an experimental study of the Neurodidactic technology of distance learning of students at the ascertaining stage. The experimental work included the development of its methodology, the formation of experimental and control groups, the collection and systematization of information about the participants of the experiment. When getting acquainted with their data, the following methods were used: A test method for diagnosing the properties of the nervous system of the Ego.Strelau, design of diagnostic sheets when using methods of observation, analysis of educational products, testing, and written survey.*

Experimental reflection at the ascertaining stage was expressed in the conclusion about the mixed type of lateral characteristics of the participants of the experiment and the feasibility of using mixed strategies for the presentation of educational material, the dialogic style of pedagogical communication, and intermediate diagnostics at the subsequent stages of the experiment. This type of lateral brain asymmetry is the most common in the academic environment, which

gives universality to the recommendations made.

Keywords: *experimental research, neuro-didactic technology, distance learning, students, ascertaining stage, methodology, experimental and control groups, diagnostic sheet*

The product of the author's project activity in the field of neurodidactics of students was the neurodidactic technology of their distance learning. The components of the technology are: 1) formation of motivation, 2) development of the training content, 3) creation of its program, 4) implementation of the program in the educational process, 5) control of the formed competencies.

The effectiveness of the technology developed by us was tested experimentally. The methodology of the experimental study is shown in table 1.

Table 1.

Experimental research methodology

The purpose of the experiment: to test the effectiveness of Neuropedagogic technology of teaching students.
Tasks: 1) organize the approbation of Neuropedagogical technology of teaching students; 2) prove the effectiveness of the technology.
Hypothesis: The neuropedagogic technology of distance learning of students will be effective if, when applying its main provisions, the final indicators in the experimental group are higher than in the control group.
The object of the experimental study: 110 students (55 students in the experimental group and 55 students in the control group). The object of the experimental study: 110 students (55 students in the experimental group and 55 students in the control group).
The subject of the experimental study: Neuro-didactic technologies of distance learning of students.
Criteria for the effectiveness of the technology: competencies formed during the experimental study period.
Training levels: zero, reproductive, heuristic, creative.
Forms of experimental research: group, study circles, electronic circles.
Methods of experimental research: testing, questionnaires, filling out diagnostic sheets of students, observation, study of products of activity, self-management, multimedia presentations, qualitative analysis, quantitative calculation of results.
Methods of information processing: mathematical calculation, analysis of written works and evaluation forms.

Stages

stating (2020)	*forming* (2021)	*control* (2022)
- development of the experimental research methodology; - formation of experimental and control groups; - collection and systematization of information about the participants of the experiment: familiarization with their data and filling in diagnostic sheets.	1. Teachers reflection on taking into account the lateral asymmetry of the brain in the process of teaching students. 2. Implementation of the main composite components of the technology. 3. Implementation of the author's neuro-didactic recommendations and provisions in the educational process. 4. Intermediate diagnostics of the formed competences of students.	Final diagnostics of the formed competences of students.

From the data placed in the table, it follows that the implementation of the experimental method involved three stages: the ascertaining, forming and control. At the ascertaining stage, the basis for conducting an experimental study was determined. It became FGBOU VO "Pyatigorsk State University" and FGBOU VO "Ingush State University".

As a form of experimental work, we chose distance learning under the additional professional program "Modern information and communication technologies and e-learning technologies in higher education" with a volume of 72 hours. It was logical to assume that the students had different lateral features. The training was conducted in April 2020.

At the first introductory lesson, the students were introduced to the experiment conducted on the basis of these universities. Everyone agreed to participate in the experiment. The subjects were divided into equal quantitative groups – experimental and control. As a result, the experimental and control experimental groups consisted of 55 people each.

Then we got acquainted with the content of the additional educational program that was studied in the groups we formed. The program "Modern information and Communication Technologies and e-learning technologies in higher education" was presented by the following modules: 1) information culture of the individual in the educational process of the university, 2) formation of communication skills by means of computer science, 3) modular training at the university, 4) rational methods of teaching communicative competence at the university, 5) formation of self-educational competence of students based on project technology, 6) organization of independent work of students based on Internet 2.0 in the information and learning environment.

The diagnostic sheets [1] of the experimental participants were filled in. This type of work according to the category of subjective experience (attitude to the educational material) reflected the following characteristics of the subjects. Their average age was 19 years. The conscious needs [2] and motivation of the majority of students consisted of professional and career growth, high wages. The subjects had no unconscious needs. The participants of the experiment associated the personal meaning of completing this additional educational program with professional mobility, the opportunity to change their profession or its profile. Students A. A. Kaisheva and L. A. Malsagov in the experimental group expressed a desire to get vacancies in the capital's universities. The male representatives in the control group (M. I. Gelogaev, I. I. Akiev, M. A. Mautiev) justified their choice of the program by their personal interest in computer science. All the students demonstrated their readiness to study.

The continuity of the content of additional educational programs with previous subjective experience and the formation of individual cognitive abilities were diagnosed during the formative stage of the experiment due to the expediency of using methods of observation and analysis of educational products to obtain reliable results. As a result of calculations and analysis of the results for the named categories of subjective experience, we concluded that the categories of subjective experience were expressed in the subjects of both groups.

Data on the activity of brain processes [3] of the subjects according to the second part of the diagnostic sheet of the student were obtained based on a series of independently performed tests for the diagnosis of perception, memorization, logical memory, logical thinking, understanding, voluntary attention, speech. The test results in their total expression for each participant of the experiment reflected approximately equal average and close to high indicators in both groups. We explain the rather high activity of brain processes in all subjects by the specifics of pedagogical activity associated with intellectual work.

The predominance of intuition or reasonableness according to the parameter "Activity of brain processes" we checked by a written survey. In the questionnaire, addressed to each subject, it was necessary to cross out the wrong answer from the two suggested answers.: intuition or reasonableness. As expected, about one-quarter of the girls in both groups left "intuition" as the correct answer, the other three – quarters of the girls - "reasonableness". All the young men of both groups preferred "reasonableness"as the correct answer. The results of the diagnostic survey are quite consistent with the neurodidactic data on the lateral features of the brain of male and female representatives.

The next two points of the diagnostic list of students were clarified by us in the course of their training in additional educational programs as part of the formative experiment. Following the systematic presentation of the material, we will put this

data here. The continuity of the content of additional educational programs with previous subjective experience according to the fourth category varied from the presence of knowledge and skills on the topics of individual classes in both groups to the lack of awareness of the material being studied. In the experimental group, A. I. Mamieva was sufficiently knowledgeable in the field of modular training at the university, which was explained by the experience of professional activity. In the control group, A. A. Sergeev demonstrated a fairly high level of awareness in the field of information design technologies. From interviews with students of both groups, we found out that the subjects have situations that are important for the formation of the competencies inherent in program training.

Data on the formation of individual cognitive abilities of the subjects according to subjective experience were obtained using questionnaires in both groups. The trainees were asked questions similar to the characteristics of these abilities contained in the diagnostic sheets. To obtain reliable data, the teachers of both groups confirmed or disagreed with the opinion of the respondents. If the teacher disagreed, the respondent's opinion was considered erroneous and was not taken into account when calculating and summing up the results. In quantitative terms, they are reflected in table 2.

Table 2.

Formation of individual cognitive abilities of the participants of the experiment

individual cognitive abilities of the subjects	**Experimental group (pers.)**	**Control group (pers.)**
transformational (independent use of previously studied educational material)	39	40
transfer (the ability to transfer past experience to new educational and professional situations)	37	36
analytical (the ability to organize, organize your past experience)	45	48
simulation (the ability to reproduce your past experience in new educational and professional situations)	48	50
ability to reflect on your experience	55	54

As a comment to the data placed in the table, we note the overall high rate of formation of individual cognitive abilities of the subjects. The minimum score is 37, and the maximum score is 54 out of 59. We believe that the diagnostic results for this category of subjective experience could be even higher with a purposeful and longer-term study of the subjects.

The ability to generalize, creativity, strength, mobility, balance, dynamism, lability, and activity of thinking were tested using a test method for diagnosing the properties of the nervous system of the Ego.I shoot. This task required time (45 minutes), and therefore it was addressed to the students of both groups as homework. The subjects were offered forms with questions and instructions. They counted the answers themselves. The result of the test method in both groups was the predominance of the pronounced strength of the processes of excitation and inhibition, mobility and balance of nervous processes. At the same time, there was a tendency to increase the strength of the inhibition process, as well as cases of unbalanced nervous processes (in the experimental group – 3 people, in the control group – 4 people).

The IQ value for all students was obtained from the introductory classes conducted with the permission and participation of teachers P. V. Ivanov, P. D. Chanieva. The average IQ of the subjects in the experimental group was 102%, in the control group – 104%.

The last item of the diagnostic sheets of the subjects – functional asymmetry of the brain-was detected by testing performed by students at home. Detailed instructions and a key to the answer allowed the subjects to determine their lateral organization with a high degree of probability. When checking the registration forms, it was found that in both groups (in the experimental group – 68%, in the control group – 71%), a mixed type of interhemispheric asymmetry of the brain prevails. 25% of the subjects (girls) in the experimental group and 20% (boys) in the control group referred themselves to the" right hemispheres". In the experimental group, 7% of the subjects (boys and girls) and 9% (boys and girls) in the control group referred themselves to" left hemispheres".

The analysis of the obtained data confirms the neuropsychological idea of correlation of the lateral characteristics of the student in the process of his distance learning at the university. In the modern society of rational, intellectual type, "right-hemispheres" adapt (adapt) to social requirements, foundations, value priorities, developing the left hemisphere of their brain through characteristic activities: intellectual activity, pragmatic decisions, concrete conclusions, reactivity, decisive actions, etc. It is noteworthy that the majority of girls (genetic owners of right-hemisphere brain asymmetry), who made up the bulk of the subjects in both groups, demonstrated an acquired mixed type.

However, according to the registration forms, in three cases in the experimental group and in two cases in the control group, a mixed type was detected among young men (the predominant owners of left-hemisphere brain asymmetry). We believe that it is also acquired due to the nature of the training activity.

A diagnostic study of the functional asymmetry of the students ' brains led us to the conclusion that the participants of the experiment live and carry out training

according to a mixed type of lateral characteristics that contributes to their development. Based on this, the teacher in such an audience should use a dialogic style of pedagogical communication, which involves mixed strategies for presenting educational material and reflection on their effectiveness.

References

1. Bloom F. Brain, mind and behavior. M.: Mir, 1998, 248p.
2. Vorobyov A. I. Training of intelligence. M.: Akademiya, 2009. P. 67.
3. Bespalko V. P. The components of pedagogical technology. M., 1989, 192p.

DOI 10.34660/INF.2021.95.53.013

THE PHENOMENON OF THE "INFORMATION PERSON" IN THE MODERN SOCIETY

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Abstract. *The relevance of the work is due to the change in the standard model of the generalized image of a person which in communication-related studies is characterized as Homo informaticus. The phenomenon of post-industrial society in the beginning of the XXI century, in which communication can perform various functions including mind control and behavior of society and the individual, "information person " very actively in contact with the media, has significant influence on media culture. But being immersed in a new, digital environment, a person is not only the object of its influence, but also the subject, the direct producer. Therefore, the model of a modern person is considered taking into account the significant role of the mass media in his professional and personal development.*

Keywords: *impact, information, information technology, mass media, media culture, society, digital environment.*

High research interest in problems directly or indirectly related to information and communication processes is quite natural and very relevant. The transition to a post-industrial information society with its global production of information and at the same time the wide spread of information technologies, marked the beginning of a new era. Accordingly in the first decade of the XXI century, the standard model of the generalized image of man, which is now characterized as Homo informaticus ("information person"), also changed.

"Today informatization has become part of reality"; < ... > information "plays the role of the technical basis of the new society" [1]. Considering the role of information in the life of society, it should be noted that at the beginning of the XXI century, information has become a huge resource both for production and consumption. Information becomes a factor that determines a person's social behavior, and information and technological achievements ensure the active and successful use of information technologies in the intensive process of professional and personal development.

According to the figurative definition of the foreign scientist-philosopher, theorist of mass media and mass communication Marshall McLuhan, who predicted the dominance of digital means of communication, we live in the era of the" information explosion " [2]. Today, without a doubt, the digital environment is one of the main prerequisites for the formation and functioning of the global information industry, which largely determines not only the development, but also the adaptation of the individual to the rapidly changing conditions of modern life.

Such concepts as" information"," information society"," information exchange" have firmly entered the scientific circulation of communication studies, philosophy, sociology, economics, linguistics and many other disciplines. The key term of the information age, in turn, contributed to the emergence of new concepts, which is an important indicator of the direction of the interests of scientists representing different areas of modern scientific knowledge. Among the most popular terms are "information management", "information pedagogy", "information security " and others.

A society in which almost all processes are governed by information flows is also a significant stage in the development of humanity from a socio-political point of view. The transmission through various media channels and the dissemination through a global network of information that is not only public, but also private, is considered as a powerful tool for solving various kinds of topical problems: political, ideological, socio-economic, cultural and others.

Indeed, information is increasingly being used as a lever to control mass audiences, social groups, and individuals. "We find this statement in many publications; in real life, the concept of "information" is increasingly used in relation to the sectors of the economy and management" [3]. Therefore, the person of the new, digital era becomes more vulnerable from the point of view of information security.

In a post - industrial society, information is an important component of mass and interpersonal communication, moreover, it is an integral part of the national and cultural heritage, a strategic resource, one can say, the leading strategy of a society that builds its priorities in accordance with new information technologies. Thus, an effective tool for the formation of a new type of personality - the "in-

formation person" is primarily information and / or communication technologies which are directly related to the entire system of production and consumption.

The new era of information, marked by the rapid growth of mass communication, as well as electronic media, certainly has both positive and negative sides. Unlimited technical capabilities, on the one hand, have a beneficial effect on the process of producing new knowledge, expanding the base of scientific research, increasing the efficiency of mass media, etc. "It is this – interactive convergent information transmitted from anywhere in the world and received instantly, without restrictions in time and space-that is of particular value to the audience" [4: 36]. At the same time, information continues to act as a necessary tool for establishing various types of contacts, developing international cooperation, etc.

But the negative consequences caused by the increased influence of the mass media on a person also attract increased attention. Speaking about the ideology of post-industrial society, which exerts an unprecedented influence on the consciousness and behavior of the individual, one of the famous philosophers of the XX century, Herbert Marcuse, wrote that "the apparatus of production and the goods and services produced by it "sell" or impose the social system as a whole.

The vehicles and the mass communication system, the inexhaustible choice of entertainment, and the information industry carry with them prescribed attitudes and habits, sustained intellectual and emotional responses that bind consumers to producers and, through them, to the whole. Products have a suggestive and manipulative power. As a result, a model of behavior arises" [5; 14-15].

In a society with a leading strategy for the production and dissemination of information, there is a threat of uncontrolled growth of information exchange, in other words, an information "flood". The "information person" regularly interacts with the received information, and here it should be taken into account that the information perceived by him can have a negative, even destructive effect on him.

The process of informatization, which has covered all socially significant areas of life, has recently increased its influence so much that scientists, based on the fact that the social and individual existence of a person is largely determined by the activities of the mass media, use the concepts of "information person"/ "media person" as equivalent.

It is the mass media that selects, systematizes, structures and broadcasts information flows, the volume of which is constantly increasing due to the use of new technologies. Hence the close connection of the terms "media person" / "information person", the content of which should be considered in their interdependence.

Dependence on technical communication channels and mass media increases the role of mass media in the life and activities of the individual, and information, being the basis of knowledge, creates an "information person", a consumer of information and at the same time its producer. "Today, a media person," writes

E. L. Vartanova, "is not only a passive consumer of ready-made media products, but also an active participant in the processes of their distribution and production, on the one hand, involved in the process of mediatization, and on the other hand - forming it himself" [4: 37]. Therefore, information, as well as the very model of the personality "information person", should be considered within the framework of both media production and media consumption.

It is obvious that the study of information problems of modern society quite naturally has access to a new discipline - media ecology, which develops the basics of rational and safe interaction with the media space.

References

1. Ibragimova L. A. Chelovek v informatsionnom obshchestve [Man in the information society]. - 2016. - No. 5. - pp. 492-494.

2. McLuhan M. Understanding the media: the external expansion of man. - M., 2003. - 464 pp.

3. Pronina L. A. Informatsiya, informatsionnoe obshchestvo i chelovek [Information, information society and man]. - 2008. - No. 11. - Pp. 251-257

4. Vartanova E. L. Media man - a new stage of evolution or an application to a gadget [Electronic resource]. - Access mode: https://www.nkj.ru/open/27523

5. Marcuse G. One-dimensional man. - M.: AST, 2003.

DOI 10.34660/INF.2021.16.69.014

STRUCTURE PARALLELISM AS THE MAIN PROPERTY OF THE STRUCTURE OF DISJUNCTIVE SENTENCES WITH THE CONJUNCTION *ИЛИ*

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Abstract. *The article presents an analysis of the structural organization of dividing structures with a conjunction* ***или****: considered the ratio of modal and temporal plans of predictive units, as well as modeling their components; a quantitative method of studying the linguistic material was carried out, which made it possible to draw conclusions regarding the features of the construction of the analyzed sentences.*

Keywords: *parallelism of structure, dividing construction, view-time plan, modal plan, predicative unit, conjunction* ***или****.*

The term "structure parallelism" is ambiguous. In some cases, structural parallelism is understood as the similarity in the construction of the predicative parts of a complex sentence, manifested in the same arrangement of their members, in the use of the same words, phrases, in the repetition of conjunctions or particles, in the ratio of demonstrative and relational pronouns, in other cases parallelism is considered, firstly, as the formalization of all predicative units according to one structural scheme, and secondly, as the identity of modal-type-temporal plans of predicative units (parallelism of the morphological characteristics of predicates).

The article adopted a broad understanding of the term "structural parallelism", including:

1) modeling predicative units according to one structural scheme (the same arrangement of the main members);

2) the identity of the type-time plans of predicative units;

3) identity of modal designs of predicative units.

Purpose of the study: to characterize the predicative units of a compound dividing sentence in terms of their type-temporal and modal relationships and to establish whether structural parallelism is a defining property of the analyzed structures.

The material of the study is a card index of polypredicative constructions with conjunction ***или*** (***ли… или***) with a volume of about three thousand examples, extracted by continuous sampling from the texts of oral folk art (epics), from works of classical, Soviet and modern fiction, from articles of modern periodicals, as well as from scientific texts.

The work uses those **research methods** that, in our opinion, give the maximum efficiency and ensure the reliability of the conclusions:

1) descriptive-analytical method, which involves the description of the facts of the language, subjected to observation, analysis, comparison and typological generalization;

2) the method of linguistic experiment with methods of transformational modeling (exclusion, addition of any elements);

3) method of quantitative analysis.

The same arrangement of the main members in the predicative units of dividing structures with conjunction ***или*** is typical for 80% of the structures from the total number of illustrative material we have collected (mono-subject dividing structures were not analyzed in this case): *Только иногда, вглядываясь пристально в нее, он вздрогнет страстно*, ***или*** *она взглянет на него мимоходом и улыбнется* <…> (Goncharov); *А не удастся, он оседлает своего любимого коня, фантазию,* ***или*** *конь оседлает его и мчится он в пространстве, среди своих миров и образов* (Goncharov); <…> *зашевелится кисейная занавеска в окошке и из-за герани выглянет чиновница,* ***или*** *вдруг над забором, в саду, мгновенно выскочит и в ту же минуту спрячется свежее лицо девушки* (Goncharov); <…> *вот откуда-то доносится отрывистый, тревожный крик неуснувшей птицы,* ***или*** *раздается неопределенный звук, похожий на чей-то голос, вроде удивленного «а-а!»* (Chekhov).

However, the same structure of the parts of a sentence connected by conjunction ***или***, is not always observed.

1. The structure of predicative units in constructions with conjunction ***или*** can be characterized by an unequal arrangement of the principal members in predicative units: *И изредка разве покажется неуклюжая сеноплавка* <…>, ***или*** *каторжный бредет по колена в воде и тащит за собою на веревке бревно, – вот и все картины* (Chekhov); <…> *и изредка лишь фыркали сытые кони* ***или*** *охотник произносил во сне бессвязные слова, поворачиваясь на соломе под теплым полушубком* (Lermontov); *Выпадали среди зимы и теплые дни, когда снег таял* ***или*** *шли проливные дожди, но Марии не было от этого легче* (Zakrutkin).

2. Multiple predicative units constructed according to the schemes of one-part and two-part sentences can also be combined into a single construction: *Пока, думаю, опасности нет. Вероятно, грипп* ***или*** *выявится воспаление легких, –*

сказала Вера (Babenko); *Познакомились на бегах. Он – деньги потерял* ***или*** *– выкрали* (Gorky); *Но вот приходит Андрюша* ***или*** *его приведут* (Goncharov).

As you can see, parallelism in the meaning of the same composition and order of the main members within the framework of constructions with conjunction ***или*** is not their absolute structural feature: 20% of constructions are characterized by a non-parallel structure of predicative parts.

Type-time plans of predicative units connected by conjunction ***или***, can be either the same (predicates have the same form of time and type) (I), or different (II).

I) 1. *Видишь, например, как стоит бутылка,* ***или*** *идет дождь,* ***или*** *едет мужик на телеге, но для чего эта бутылка, или дождь, или мужик, какой в них смысл, сказать не можешь* (Chekhov); 2) *Когда-то он (город – О.П.) играл значительную роль в местной истории; не раз его осаждали, как саранча, загоны татар, посылавших через стены тучи своих стрел, порой пестрые отряды поляков отчаянно лезли на стены* ***или****, наоборот, казаки бурно кидались на приступ* (Korolenko); 3) *Старый доктор схоластики попросил слова и, когда ему дали его, заметил, что спор ведется неправильно; ибо одно из двух:* ***или*** *вопрос об ископаемых животных принадлежит низшему знанию, чуждому метафизике,* ***или*** *же относится к истинному высшему знанию – к диалектике* (Merezhkovsky).

In sentences (1-3), the predicates of both components are represented by the imperfective forms of the present (1, 3) and past (2) tense verbs. It is well known that imperfective verbs are used to express the simultaneity of events ("long series"). However, this provision needs to be clarified when it comes to dividing structures: the phenomena described in the components of these structures are carried out either alternately, at different time intervals (1, 2), or the implementation of one of them actually excludes, in the speaker's opinion, all the rest (3). In the first sentence, the parallel structure of predicates (***или*** *идет,* ***или*** *едет*) contributes to the creation of a general verbal picture of possible events, which are based on procedural features with an internal dynamic structure of the course of each of them in time. Predicates of this type, according to AV Bondarko, express the process value [1, p. 383]. In the second sentence, predicates (*осаждали, лезли* ***или*** *кидались на приступ*) represent different-temporal, alternately performed in the past, but regularly repeated actions of the same nature, also not limited by a limit. In the third sentence, imperfective verbs in the generalized present tense (***или*** *принадлежит,* ***или*** *относится*) serve as a means for expressing scientific laws that reflect active connections and relationships. But these connections are recognized by the subject of speech as mutually exclusive: if the question belongs to the lower knowledge, then it does not belong to the higher, and vice versa.

Perfect predicates denote completed actions bounded by a limit: 1) *Может, у него жена померла,* ***или*** *еще какое горе случилось, а я ржу* (Astafiev);

2) *Марианна чуть-чуть свихнулась, сдвинулась. Ей казалось, что нянька утопит ребенка в ванне, выронит в окно, нечаянно, конечно.* ***Или*** *ребенок сам захлебнется во сне* (Tokareva).

The symmetry of the perfect type of predicates in components 1 and 2 of sentences indicates that the events characterizing the situation as a whole are perceived by the speaker as supposedly accomplished facts in the past (1), or as possible in the future, equally unpleasant and terrifying for the subject of speech (2). The verbalized processes are of a complete nature, they represent holistic actions, limited by the limit, not divided into phases. The difference lies in the timing of their implementation: in the first construction potential events that have occurred in the past are verbalized, and in the second - possible in the future. The use of perfect predicate verbs in these sentences makes it possible to describe a situation with completed, time-limited actions, which, however, represent not a "chain" of consistently realizable events, but a number of potential phenomena, any of which can be real.

The function of the grammatical categories of predicate verbs, subject to their symmetry (92.4% of the number of examples of the entire sample) in the structure of the construction, is to create equivalence of the listed phenomena, which are perceived as alternative to each other. All the above propositions, characterizing any one denotative situation, reflect the speaker's general idea of a given situation located in a certain time plane and having certain boundaries for the flow of potential actions, correlated, as a rule, both in appearance and in time.

II) Cases of "non-parallel" type or type-temporal semantics of predicates are much less common (7.6% of the number of examples of the entire sample).

The discrepancy between the type-temporal characteristics of predicates in predicative units is explained by a number of factors.

1. The reason for the "non-parallelism" of predicates in the type plan may be the absence of a perfect form in one of the verbs: *Если я долго не приезжал в город, то, значит, я был болен* ***или*** *что-нибудь случилось со мной, и они оба сильно беспокоились* (Chekhov).

2. The choice of "non-parallel" forms may be associated with the "competition" of type meanings, in which it is possible to replace one type form with another without prejudice to the meaning of the statement [1, p. 59]: *Но неумышленно, когда он не делал никаких любовных прелюдий, а просто брал ее за руку, она давала ему руку, брала сама его руку, опиралась ему доверчиво на плечо, позволяла переносить себя через лужи и даже, шаля, ерошила ему волосы* ***или****, напротив, возьмет (mid. брала) гребенку, щетку, близко подойдет (mid. подходила) к нему, сделает (mid. делала) пробор и, пожалуй, напомадит (mid. помадила) голову* (Goncharov). The first part of the structure (before conjunction ***или***) conveys the measured course of events; it uses imperfect verbs with the

meaning of repeated use of actions in reality. In the second part, information is introduced that is opposite to the previous one in semantic fullness (mid. *ерошила волосы – возьмет гребенку*, etc), which is supported by the introductory word "напротив" and a change in the view-time plan. The future simple tense of perfective verbs, presented in predicates after the separative conjunction, denotes actions related to the past tense, and indicates the brevity and completeness of episodically repeated actions. The designation of repetitive actions, atypical for the perfect form of verbs, brings them closer, makes them synonymous with the verbs of the past imperfect form.

3. The reason for the discrepancy between the type values of the predicates may be the need to convey differences in the way actions occur in the real space-time world: *Он писал о Даше в Москву, ее сестре Екатерине Дмитриевне, но письма не доходили,* ***или*** *с ней приключилось тоже что-нибудь недоброе* (A. Tolstoy). In this sentence, the predicate of the first component (писал) indicates the repeatability of the described writing process. Accordingly, it is natural to formulate the predicate of the next part, which informs about the possible fact that the addressee did not receive all letters sent to him, in the form of an imperfect verb (*не доходили*). The third predicate (*приключилось*) has the form of a perfect form, its choice is conditioned by the speaker's ideas: the supposed "unkind" is perceived by him as something one-time, already accomplished, having a limit. For comparison, an example can be given, which also lists the hypothetical reasons for the silence of the addressee, which, however, are verbalized by the addressee using verbs of the same kind: *Ни на одно он ответа не получил.* ***Или*** *товарищ Киров не считает нужным отвечать,* ***или*** *письма до товарища Кирова не доходят* (Rybakov).

Modal plans for separating sentences with conjunction ***или*** find their expression in the mood forms of predicate verbs. The modal meaning of reality is based on the forms of the indicative mood (hereinafter IM), the meaning of unreality is based on the forms of the subjunctive (SM), conditional mood (CM). The general meaning of unreality, presented in more specific meanings of potential modality (will, desirability, necessity) is expressed in the forms of incentive (hereinafter IM), desirable (DM) and obligatory (OM) moods.

Components of dividing structures with conjunction ***или*** are characterized by both real (r.) and irreal (ir.) modality. Within the same construction, predicates can have either the same or different modal characteristics.

Наш материал позволил выявить следующие соотношения модальных планов предикативных единиц: I) [r./r.], II) [ir./ir.], III) [ir./r.], IV) [r./ir.], which in this work, taking into account its tasks, we will consider rather quickly, since a more deep and detailed analysis is presented by us in the article "Modal designs of predicative units of dividing sentences with conjunction ***или***" [2, p. 191-193].

I) **[r. / r.]:** 1) <…> *ее (дудки – О.П.) переливы так нераздельно сливались с тихими вздохами степи, что порой Петрусь сам не мог отдать себе отчета, ветер* ***ли*** *навевает издалека смутные думы,* ***или*** *это он сам извлекает их из своей свирели* (Korolenko); 2) *Хлипнула вода –* ***или*** *лопнул плававший с вечера пузырек,* ***или*** *содрогнулась, умирая, рыба: по траве пробежала и убежала узкой полоской незнакомая рябь* (Rasputin); 3) *Я посидел на террасе, поджидая, что вот-вот за цветником на площадке или на одной из аллей покажется Женя или донесется ее голос из комнат* (Chekhov). In the above sentences, in each of the predicative parts, there is a modal plane of reality, represented by the forms of the indicative mood of the present (1), past (2) and future (3) tense, forming a syntactic indicative.

II) model **[ir. / ir.]** is less common than the correlation of real ones, and finds its expression in a limited range of syntactic mood combinations.

A. **[ir. IM / ir. IM]**: 1) *Мне надоела эта длинная церемония. – Послушайте, – сказал я, –* ***Или*** *застрелитесь,* ***или*** *повесьте пистолет на прежнее место, и пойдемте спать* (Lermontov); B. **[ir. CM / ir. CM]**: *Если б нам отдали детей! Если б она отдала их, если б у нас хватило жестокости отнять у нее* ***или*** *если бы они сами оставили ее ради нас… три “если”, и ни одно из них не осуществимо* (Nikolaeva); C. **[ir. SM / ir. SM]**: 1) *Соня, она (Наташа – О.П) знала, со своим строгим и цельным взглядом,* ***или*** *ничего бы не поняла,* ***или*** *ужаснулась бы ее признанию* (Tolstoy); D. **[ir. DM / ir. DM]**: 1) ***Хоть бы*** *что-нибудь новое!* ***Хоть бы*** *французы пришли и разорили Милан,* ***или*** *пономарь выудил рыбу,* ***или*** *дядя нашел золото…Боже мой, какая скука!* (Merezhkovsky); E. **[ir. OM / ir. OM]**: *Ситуация должна измениться к лучшему. Ты* ***или*** *помоги ей по дому,* ***или*** *своди ребенка в парк*. Constructions with the obligatory mood of predicative units, the content of which "incorporates the obligation, the compulsion, the prescription of the implementation of something with the help of the forms of the incentive mood of the verbs" [3, p. 116], are extremely rare and typical only for colloquial speech.

III) The ratio of various modalities – **[ir. / r.]** – is observed in constructions with conjunction ***или***, in the prepositive part of which the predicate is used in the form of the impulsive mood, and in the postpositive part - in the form of the future indicative mood: *И я закричал: – Отвечай,* ***или*** *я убью тебя! (Andreev); Ты сходи меду возьми,* ***или*** *я немую пошлю* (Tolstoy).

In these constructions, when considering the modality of the related parts, one cannot ignore the implicit logical link that has its own modality. A non-verbalized semantic link manifests itself during transformation: 1) *Отвечай, если не ответишь, то я тебя убью*;2) *Сходи меду возьми, если не пойдешь, я немую пошлю* – [ir. IM / r. IM / r. IM].

IV) The collision of two different-modal plans – **[r. / ir.]** – is observed in

constructions with an interrogative second part attached by a conjunction particle ***или***: *Как меняется человек! Отяжелел подбородок, а лоб словно убавился, – **или** это костер играет тенями? (Andreev); Ведь они же никаких молитв христианских, чай, не знали, **или** вы их выучили?* (Leskov).

Asymmetry of the structure of components in terms of modal characteristics of predicates [ir. / r.], [r. / ir.] is typical for an insignificant amount (3.75%) of proposals collected by us, ie. most of the constructions (96.25%) have a unidirectional modality of predicative units: either real or surreal. Moreover, the number of constructions with a parallel ratio of real modal plans in general is 85.6%, and with a ratio of unreal plans - 10.65% of the analyzed language material.

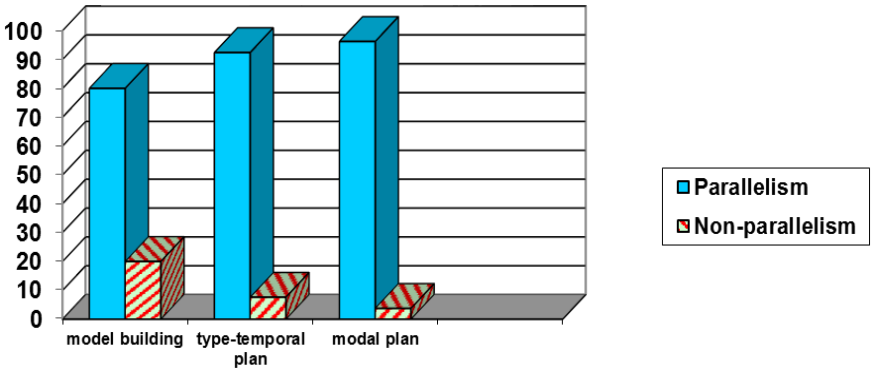
Table

Parallel modal plans for PE		**Non-parallel modal plans for PE**
[r. / r.]	[ir. / ir.]	[ir. / r.], [r. / ir.]
85.6 %	10.65 %	3.75 %

Due to the fact that the overwhelming number of predicates in the components of sentences with conjunction ***или*** are represented by indicative forms representing the real modality, the predominant structural feature of the named structures is the identity of modal plans of predicative units.

Taking into account the results of the study regarding the parallel (identical) / non-parallel (different) structure of the predicative units of the analyzed structures at the level of the ratios of their components, temporal and modal plans, we will clearly present what has been said in the form of the following diagram:

The diagram of the ratio of the frequency of manifestation parallelism in the structure of constructions with conjunction ***или***



So, the results of the study indicate that parallelism, as the uniformity of the components of the dividing sentence connected by conjunction ***или***, is not all-encompassing: in 20% of structures there is an asymmetric arrangement of the main members, in 7.6% of structures we record cases of "non-parallel" type or temporal semantics, 3.75% of constructions are characterized by a different ratio of modal plans. However, as we can see, the dominant formal feature of the organization of sentences with conjunction ***или*** is still the symmetry of the structure, which determines the grammatical equality of the components.

The structural parallelism of predicative units serves as an additional confirmation of their close interaction and determines the semantic equality of the content of the parts: the reflected events are presented as equiprobable, potential in a certain case, which are alternatives to a real denotative situation.

References

1. Bondarko, A.V., Bulanin, L.L. Russian verb: A guide for students and teachers / Ed. prof. Yu.S. Maslov. – L.: Enlightenment (Leningrad department), 1967. – 192 P.

2. Pochinyaeva O.A. Modal Predicative Units Designs for Separating Clauses with conjunction или // Science and Culture of Russia: Materials of the VI International Scientific and Practical Conference dedicated to the Day of Slavic Written Language and Culture of the Memory of Saints Equal-to-the-Apostles Cyril and Methodius (May 25-27, 2009). – V. 1. – SamSSTU, 2009. – P. 191 – 193.

3. Russian grammar. Syntax. – M.: Science, 1980.

DOI 10.34660/INF.2021.78.64.015

HOW THE FACE OF A MODERN PRIEST IS BEING CHANGED (TO THE PROBLEM STATEMENT)

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Abstract. *The article is dedicated to the aspect of modern religious problem: what is and being changed in church, in the relationship to it, who and how interpret these changes, which were caused by the multiple factors of society. The role and place of a priest (clergyman) is dependent on many social, political, cultural, religious reasons. The technological and processing burst of social development, certainly, transform and alter the modern image of church.*

Keywords: *priest, clergyman, the Roman Catholic Church, church, flock, society, social changes, social religious development.*

Imagine a modern priest. Of course, everybody presented "their own" priest, depending on whether the person attends church services, communicates with the priest or is just a regular viewer (reader) of mass media. But regardless of which priest you imagine, his face and "image" are undergoing changesunder the influence of the rapidly changing realities of our time.

Even if we take a time interval of 15-20 years, so over the past two decades, there have been tangible changes in the image of the priest of our time. What is the reason for this? You have clearly thought about the development and availability of computer technology, communications and the Internet. How many different opportunities exist to spread the news, to talk about upcoming changes, and all this in just a few seconds. What a variety of social networks and news feeds we have, and in addition, what an amount of various compact devices helps us in this. Start-up firms, large companies, and even large corporations use all these tools to spread information about themselves and what they want to show.

The modern church, as a social institution of the state and an integral part of society, does not stand aside, using the possibilities of the Internet, television, social networks, etc. But can we say that it changes the face of the modern clergyman? Rather, it changes its appearance, speed, and reach of information dissemination. Of course, this also has an impact on a person as a parishioner and on a person as a

clergyman. It also affects the speed of world globalization, which connects cities, regions, countries and continents with each other, thereby enabling and forcing people to move more often and further. The frequent movement of people and the rapid penetration of information makes it possible for many other people to come to the faith, who live in completely different places, far from the historical and cultural center of the development of the Church.

Under the influence of these processes, the sphere of influence and spread of the Church is being increased and goes beyond state borders, ethnic territory and linguistic space. "The Church, as a God-human organism, has not only a mysterious essence that is not subject to the elements of the world, but also a historical component that comes into contact and interaction with the outside world, including the state. The state, which exists for the organization of secular life, also contacts and interacts with the Church"[1]. This interaction is especially intensified in the context of the development of modern economic, political, cultural, and social events in the world.

Future clergymen go to study in different countries, write research at universities (theological academies) in different cities and countries. But, unfortunately, the number of priests in some countries is declining, as is the number of parishioners, so the head of the church and supreme administration is forced to expel priests from other regions and even countries. For example, in Germany, in its southern part, historically Catholic Bavaria and Swabia, the number of local German priests has fallen sharply in recent years. This may be due to the modern atheistic,"agnostic" lifestyle. "In terms of the frequency of church attendance and involvement in the life of the church, Russia ranks in 15th place out of a number of observed countries. In Germany, Slovakia, and Bulgaria, 20% are not involved in the activities of the church, in the United States, Sweden – 30%, in France – 40%, in the United Kingdom and Poland-45%" [2, 22-23]. In addition, in particular, according to statistics in the district of Murnau (Upper Bavaria), only about 10% of local residents attend churches for religious service [3].

Many parishes in villages and small towns are still in useand functionate, there are not enough priests to hold mass, to feed the flock. Catholic bishops are forced to appoint new priests from other countries and continents. More and more often you can find priests from Africa (Nigeria) or Asia (Indonesia, India) in a remote Bavarian village. As practice shows, it happens that newly appointed clergymen do not speak German or in a language of country where they come. These circumstances create difficulties in understanding the pastor and his flock. They are forced to learn the local language in the process of their new place of residence. Otherwise, this circumstance causes some dissatisfaction with the local parishioners. Of course, there are more radical solutions to the absence of a large number of parishioners. One of the most striking examples is England. Photos of the author

of the article of the church in the city of Newcastle-upon-Tyne (Newcastle-upon-Tyne, England) clearly express a completely different purpose, which changed the church itself. If we interpret the situation, then we have a thought with the question: what does a modern person identify with in the West and how to adapt to the existing realities with the assistance of the church. After all, the natural attempt to think about the meaning of life has not gone away. And whether the new clergymen from a different ethnic culture will help to adapt to the new circumstances and do the best.

Observation shows that this is only at the beginning. The enthusiasm of the new priests, who came from another part of the world, does not leave the population indifferent, and most importantly, indifferent to the population. They become a kind of new catalyst for stagnant and empty parishes. Their different way of thinking makes people look at routine things in a new way, it is like second wind. Priests who come, for example, from Africa or India, begin to conduct the service as they conducted it in their own countries.

Identifying with something has become more difficult, but the need has persisted. In addition to the above-mentioned component, there is the simplest factor of the modern practice of exchanging international experience. We can agree with this assessment: "And it is important that this demonstrative belonging to the state whole-in contrast to everyday life and disillusionment with the help of the state - does not traumatize, does not infringe, does not stigmatize" [2,23].

Our world is so rich and diverse. In its individual parts, intra-church communication undergoes noticeable changes which can’tbe unnoticed. This is due to the traditions and culture of the ethnic group, the laws of the state, as well as the natural and climatic factor. In this context, the change in the face of the modern clergyman acts "not as a real institution, but as a kind of imaginary construction", which allows the new pastor and flock to rise above the traditional reality and switch their assessments to objective and qualitative changes in the world as a whole. How to make a person understanding the value of the world around her/him and lead her/him to a new rethinking of the values of life? Modern religion has not lost its great role in influencing the minds and consciousness of people, despite the dominance of various technologies and materialism in our time. The Church remains an important foundation for the cultural development of mankind, the educator of human individuality. After all, whatever a person is, she/he is a Person. The people of different origins, faiths, and races have one thing in common – the actions of each of them depend on their upbringing, the values of life embedded in them, and to which they should strive. Then she/he will be truly Human, and perhaps then we will be able to overcome many crises and gain an understanding of the innermost truths of life.

Bibliography

1. Clergyman K. Parchomenko. Church and politics: the relationships of church and state in modern documents of the Russian Orthodox Church. -https://azbyka.ru/forum/xfa-blog-entry/cerkov-i-politika-3.935/

2. Boris Dubin (Levada-centre). The relationship to a faith is analogously to the relationship to a state. – RBC magazine, the August of 2012. – P. 22-23.

3. „…für die Pfarreiengemeinschaft Murnau. 8030 Katholiken, von ihnen gehen ungefähr 800 zu den Messen. Das bedeutet, dass 7230 Christen nicht in die Kirche gehen. Oder nur an besonderen Feiertagen.“ Süddeutsche Zeitung Nr. 135, Mittwoch/Donnerstag, 14./15. Juni 2017.


NEWCASTLE CLIMBING CENTRE
GET INTO CLIMBING
BIRTHDAY PARTIES
HOLIDAY SESSIONS

DOI 10.34660/INF.2021.21.21.016

ENERGY SECURITY POLICY IN THE CONTEXT OF COOPERATION OF AZERBAIJAN AND TURKEY

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The history of relations between Azerbaijan and Turkey is ancient and rich. It is well known that common roots, language, religious unity, similar cultures, customs and traditions are among the factors that determine the interaction. On the other hand, Turkey is one of the three regional states that play an important role in the fate of the Caucasus, including Russia and Iran.

Fundamentals of Azerbaijan's energy security policy, principles of its provision and other issues are reflected in the "National Security Concept", the new oil strategy, many official state documents adopted in 2003-2014 (Law of the Republic of Azerbaijan "On Energy", "Alternative" and the State Program on the Use of Renewable Energy Sources ", the State Program" Development of the Fuel and Energy Complex of the Country in 2005-2015 ", the Shah Deniz-2 Natural Gas Project, etc.).

Among the threats to the national security of the Republic of Azerbaijan, the Concept on National Security specifically mentions "action against the energy infrastructure of the Republic of Azerbaijan (3.6.)". It states that "Revenues from the development and transit of energy resources are the basis of the economy of the Republic of Azerbaijan. In light of this, attempts to destabilize the industry through political means or physical damage to infrastructure are among the possible threats" [1].

The document emphasizes that the Memorandum of Understanding on Strategic Energy Partnership signed between the Republic of Azerbaijan and the European Union in 2006 will contribute to the diversification of energy sources and transport routes of EU member states, development and modernization of energy infrastructure in the Republic of Azerbaijan, efficient use of energy resources and their use of inexhaustible energy sources [1].

The concept includes "Energy Security Policy" in a separate paragraph (4.3.8). Development, operation of existing oil and gas fields in the sector of the Caspian Basin belonging to the Republic of Azerbaijan, as well as promising structures,

construction and installation of modern oil and gas foundations, detection, assessment and adequate measures of threats to major export oil and gas pipelines and terminals are highlighted as one of the most important activities to ensure the national security of the Republic of Azerbaijan [1].

The analysis of the provisions of the paragraph (4.1.5.1.) On “Cooperation with the countries of the region” in the document shows its importance for both countries. It states with confidence that “the trilateral strategic partnership and expanding cooperation between Azerbaijan, Georgia and Turkey has become a factor of stability in the region. This cooperation has been successful as the Baku-Tbilisi-Ceyhan export oil pipeline named after Heydar Aliyev and the South Caucasus Gas Pipeline (Baku-Tbilisi-Erzurum), which increase the importance of the Black Sea and Caspian Sea regions and contribute to European and global energy security. It has laid the foundation for a new vital and safe source of energy for Europe through its energy infrastructure project” [1].

Energy security can be achieved in three ways: security, demand and transit security. In terms of countries capable of “providing adequate quality and environmentally friendly energy that is necessary for the development of a country at reasonable prices and without deficits” [2], the Republic of Azerbaijan “Turkey can be cited as an example of countries where demand and energy security are at the forefront” [3].

In this sense, we consider it important to look at the specific facts about both countries. First of all, let’s look at the measures taken to ensure energy security in Azerbaijan.

Some sources say that the rich energy resources discovered in the Caspian region in the early 2000s have the potential to become the third largest in the world. For this reason, the idea that the Caspian region could become a second Persian Gulf in the XXI century has emerged [4, p.9]. In this sense, the Caspian region, which occupies a key place in the architecture of regional and international energy security, has become a field of geo-political and geo-economic competition after the collapse of the USSR. Therefore, the countries of the Caspian Basin also had to start “games” in international political goals, which are: a) the real geoeconomic values of the Caspian Sea; b) Caspian pipeline route area; c) Legal status and division of the Caspian Sea; d) It is connected with alternative pipelines, etc [5, p.14].

Azerbaijan's reserves of about 5 billion tons of oil and 5-6 trillion m3 of gas in the Caspian region account for about 4% of world energy reserves [6, p.655]. BP estimates that Azerbaijan's total oil reserves in 2009 were estimated at 7 billion barrels and natural gas reserves at 1.20 trillion m3 [7], resulting in one of the world's ten largest reserves [4, p.26]. Therefore, the country’s oil and gas reserves have always been in the spotlight of the world, and one of the most

important directions of the foreign policy of the Republic of Azerbaijan has been energy policy.

In particular, offshore oil production in Azerbaijan showed the dynamics of development in 1948-1991, underwent a deep decline in 1991-1994, and in the period after 1994 entered a new stage of development. Significant events took place in Azerbaijan’s energy diplomacy and oil and gas sector before and after the “Agreement of the Century” signed in September 1994 [8, p.759].

Speaking at a conference on “Investment Opportunities in Azerbaijan” in London in 1995, President Heydar Aliyev said: “For centuries, Azerbaijan’s energy potential has served to develop the Russian economy and the Soviet Union for the last 70 years. Now this potential can be an effective stimulus for a new economic leap around the world. The West and Azerbaijan need each other. Global cooperation facilitates the entry of one of the parties into the world market, and saves the other party from a possible expected energy crisis” [9, p.5-7].

Research shows that Azerbaijan is not only able to ensure its energy security, but also plays a key role in the energy security of some other countries. At present, the important role of Azerbaijan and Turkey in Europe’s energy security is unequivocally recognized by the developed countries and leading international organizations. It is impossible to disagree with the following conclusion of a researcher studying Azerbaijan’s energy policy:

Azerbaijan's policy of diversification of oil and gas pipelines not only serves the country’s specific energy security, but also has a significant impact on more efficient and targeted organization of transnational energy exports in the region and strengthening regional cooperation, ensuring mutually beneficial interests of energy producers, consumers and transit countries.

At present, Azerbaijan receives serious energy, transport and communications, etc. from any country in the region. It acts as a country without geopolitical dependence and able to meet its needs completely independently. Both the countries of the region and the superpowers are already skeptical of “the possibility of implementing any transnational energy, corridor and transport and communication project in the region without the participation of Azerbaijan”. With his participation, the number of regional and international initiatives aimed at implementing new energy projects is growing [10, p.157-158].

Thus, the collapse of the Soviet Union, the export of the rich energy resources of the Caspian Basin to the world market, the search for alternative energy sources in Europe, the serious interest of foreign countries and multinational companies in the region, and so on. As a result, a new geopolitical and geoeconomic situation has emerged in the region. Turkey has played and continues to play an important role in the implementation of the international energy policy of the Republic of Azerbaijan. The Republic of Azerbaijan has played and continues to play an im-

portant role in the energy security of Turkey, a consumer of natural oil and gas. It should be noted that at the present stage, the Azerbaijani-Turkish energy cooperation, founded by Heydar Aliyev, is developing at a higher pace. This successful policy, along with Azerbaijan and Turkey, makes an invaluable contribution to both the countries of the region and global energy security. According to President Ilham Aliyev, this has also created stability, predictability and very sincere cooperation in our region [11].

References

1. Azərbaycan Respublikasının Milli Təhlükəsizlik Konsepsiyası // http://www.e-qanun.az/framework/13373

2. Ediger V. Ş. Yeni Yüzyılın Enerji Güvenliğinde Karşılıklı Bağımlılık Bir Zaruret. Doğal Gaz Dergisi. 2007.: http://www.dogalgaz.com.tr/magazine/default

3. Kibar A. Enerji Ticaretinde Türkiye'nin Yeri ve Önemi. Türkiye Dış Ticaret Derneği Durum Dergisi. Enerji Özel Sayısı. Türkiye Dış Ticaret Derneği, 2010.: http://www.turktrade.org.tr/tr/magazine/019595b5-8fac-48f3-80e8-edc6f3cbe656/aralik-2010.aspx

4. Şenyurt Y. Hazar ve Basra körfezi havzalarinin enerji kaynaklari üzerinde stratejiler ve Türkiye. Ankara, 2010, 199 s.

5. Qonaqov R.R Xəzər hövzəsinin enerji ehtiyatları və onun Avropanin enerji təhlükəsizliyində rolu: Siy. elm. üzrə fəl. dok...disser. Avtoreferatı. Bakı, 2018, 26 s.

6. Həsənov Ə.M. Müasir beynəlxalq münasibətlər və Azərbaycanın xarici siyasəti. Dərslik. Bakı, "Azərbaycan" nəşriyyatı, 2005. 631 s.

7. BP Statical Review of World Energy December 2009, 'Erişim': http://www.bp.com/ sectiongenericarticle.do

8. Azərbaycan Respublikasının xarici siyasətinin əsas istiqamətləri (1991-2016) / məqalələr toplusu. Bakı: "Poliart" MMC, 2017, 904 s.

9. Алиев И. Каспийская нефть Азербайджана. Москва: Известия, 2003, 712 с.

10. Həsənov Ə.M. Xəzər – Qara dəniz hövzəsi və Cənubi Qafqazın geoiqtisadiyyatı: Azərbaycanın enerji siyasəti. Bakı, "Zərdabi LTD" MMC, 2016, 296 s.

11. Azərbaycan Prezidenti İlham Əliyev XXIII Beynəlxalq "Xəzər neft və Qaz – 2016" sərgi və konfransının açılışında iştirak edib. /06.06.2016/ - http/hague.mfa.gov.az/news/4/3155

DOI 10.34660/INF.2021.15.48.017

MULTIVARIATE ANALYSIS OF THE ARTERIOVENOUS FISTULA FOR HEMODIALYSIS COMPLICATIONS

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Abstract. *The main method for diagnosing arteriovenous fistula for hemodialysis dysfunction is duplex ultrasound. Research objective – to study the structure of complications and changes in hemodynamics in the vascular access for hemodialysis and to determine the risk factors contributing to its development. Ultrasonography, clinical and laboratory examination was performed in 550 patients undergoing program hemodialysis, 517 (94.0%) of them had arteriovenous fistula, 33 (6.0%) patients had arteriovenous graft. Vascular access complications occurred in 26.7% (147 patients), there was no significant difference in the detection rate of thrombosis (26.5%), stenosis (23.8%), and aneurysm (21.1%), a combination of two complications was observed in 20.4%, the syndrome – in 8.2%. A correlation was established between the presence of significant stenosis, aneurysm of the outflow vein and the thrombosis development, between the presence of concomitant diseases of the peripheral arteries and the development of steal syndrome and the inflow artery stenosis and the anastomosis zone stenosis. Duplex ultrasound allows to diagnose complications of vascular access for hemodialysis and determine its causes.*

Keywords: *vascular access, arteriovenous fistula, arteriovenous graft, ultrasound examination, stenosis, thrombosis, aneurysm, hand ischemia.*

Introduction. Carrying out hemodialysis is associated with the need for multiple punctures to ensure the collection and return of the patient's blood. The superficial veins of the upper extremities are suitable for repeated punctures, but they are not suitable for connecting the patient to the dialyzer due to the low blood flow. In the arteries, the blood flow is higher than in the veins, but it is also insufficient. The arteries are located deeper, so their puncture is technically difficult, and when

the needle is removed, bleeding is often observed [1]. Central venous catheters are unsuitable due to frequent thrombotic complications. It is necessary to form such an access that would provide the possibility of multiple punctures, blood sampling, passing it through the dialyzer at the required speed and returning to the patient's bloodstream [1,2].

The maximum duration of the vascular access for hemodialysis functioning rarely exceeds 4 years. In this case, the duration of a patient's stay on hemodialysis therapy can reach 20 years or more [3]. Effective long-term treatment is highly dependent on the successful maturation and functioning of the arteriovenous fistula (AVF). The main method for diagnosing AVF dysfunction is duplex scanning [4, 5, 6,7].

Purpose – to study the structure of complications and changes in hemodynamics in an arteriovenous fistula for hemodialysis, to determine the risk factors that contribute to their development.

Materials and methods. Ultrasound examination was performed in 550 patients undergoing hemodialysis, of which 52.4% (288 people) were men, 47.6% (262 patients) were women. Arteriovenous fistula was observed in 517 (94.0%) patients, arteriovenous graft - in 33 (6.0%) patients. The age of the patients ranged from 20 to 88 years, the average age was 56.7±14.5 years. The duration of hemodialysis therapy ranged from 1 month to 20 years (on average, 74.5±20.1 months). The average duration of vascular access functioning was 41.3±15.7 months (from 1 month to 16 years).

All patients underwent an ultrasound examination of the vascular access for hemodialysis using a Vivid E9 ultrasound scanner with a 7–10 MHz linear transducer. The research algorithm included the study of the inflow artery, anastomosis, outflow vein or prosthesis, cephalic and basilic veins on the shoulder (with the formation of AVF on the forearm), subclavian vein. Determined the diameters of the inflow artery, anastomosis, vein or prosthesis; peak systolic velocity in the anastomotic zone; blood flow in the outflow vein or in the prosthesis, in the inflow artery. During ultrasound examination, the state of the compensatory mechanisms of autoregulation of blood flow in the hand was assessed using a test with physical exertion (clenching and unclenching the hand into a fist for 2 min) and a test of postocclusive reactive hyperemia [3, 8].

We collected complaints, anamnesis of the disease, analyzed the surgical interventions performed to reconstruct the fistula, performed laboratory studies, echocardiography and consult of the vascular surgeon if necessary.

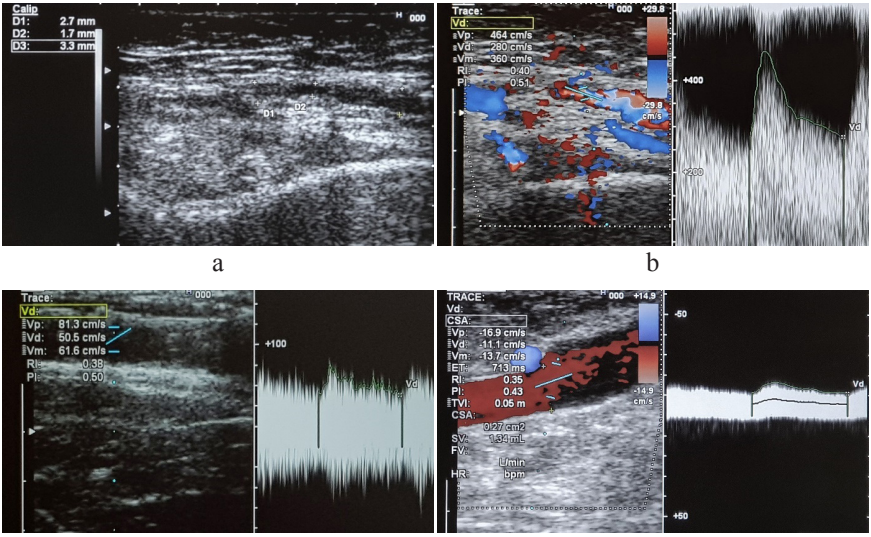
Results and discussion. Complications of vascular access for hemodialysis occurred in 26.7% (147 patients), of whom thrombosis (26.5% - 39 patients), stenosis (23.8% - 35 patients) and aneurysm (21.1 % - 31 patients), there were no significant differences in the frequency of their detection. The combination of two

complications of vascular access was noted in 20.4% (30 patients), less often the hand steal syndrome was observed - 8.2% (12 patients).

Vascular access stenosis was detected in 48 (8.7%) patients, of which 26 (54.2%) were diagnosed with hemodynamically significant stenosis. Stenosis of the outflow vein was more common (72.9% - 35 people), less often - stenosis of the inflow artery (14.6% - 7 patients) and the anastomotic zone (10.4% - 5 patients), stenosis of the ipsilateral subclavian vein was detected in 1 (2.1%) patient. Stenosis was significantly more frequent in patients with arteriovenous graft (18.2% - 6 out of 33 people) than in patients with fistula (6.2% - 32 out of 517 people). In 2 (6.1%) patients with a prosthesis, stenosis of the distal anastomosis of the prosthesis and the outflow vein was noted, in 4 (12.1%) patients - stenosis of the outflow vein. Significant stenosis developed more often in patients with distal access than with proximal one ($p = 0.01$), which is probably due to the larger diameter of the vessels on the shoulder. Significant stenosis of the inflow artery was diagnosed only in patients with radiocephalic AVF.

Stenosis developed at different times from the moment the vascular access was formed: from 3 months to 12 years (on average, 45.9±19.3 months). Its development did not depend on gender ($p = 0.54$) and age of the patient ($p = 0.06$), the underlying disease that caused end-stage renal failure ($p>0.05$). In all patients with stenosis of the inflow artery and the proximal anastomosis zone (of the artery and veins or artery and graft), concomitant peripheral arterial diseases (diabetes mellitus and generalized atherosclerosis) were noted, which is consistent with the literature data on the causes of AVF stenosis for hemodialysis [2]. No correlation with the presence of concomitant peripheral vascular diseases ($p>0.05$) was found in those examined with stenosis of the outflow vein and the area of the distal anastomosis of the arteriovenous graft (between the prosthesis and the vein). The causes of stenosis of the outflow vein and the anastomotic zone in most patients were high blood flow, multiple punctures in the local zone, turbulent blood flow, constantly traumatizing the vein wall and causing intimal hyperplasia, which is also noted by other authors [1, 2, 9]. Subclavian vein stenosis in 1 patient was associated with previous vein thrombosis after its catheterization [2, 3].

As a result of the study, the criteria for significant stenosis of the inflow artery and outflow vein were determined (fig. 1): the diameter of the vessel in the stenosis zone is less than 2 mm, the ratio of peak systolic velocities in the pathology zone and in the proximal section is more than 2 for stenosis of the inflow artery and more for stenosis of the outflow vein, the blood flow in the outflow vein is less than 300 ml/min [10].



a b

c d

Fig. 1. *Echograms of significant stenosis of the outflow vein: stenotic area in B-mode is 1,7 mm (a), peak systolic velocity in the stenotic area is 464 cm/s (b), peak systolic velocity in proximal to the narrowing area is 81.3 cm/s (c), access flow in the outflow vein distal to the stenotic zone is 134 ml/min (d)*

Thrombosis of the vascular access for hemodialysis was detected in 66 (12.0%) patients, of whom non-occlusive thrombosis was observed in 60.6% (40 patients), occlusive thrombosis - in 39.4% (26 patients). Thrombosis significantly more often developed in women (15.7% - 40 out of 262 people) than in men (9.0% - 26 out of 288 people), p = 0.025. In patients with proximal access, thrombosis was more common (22.1% - 27 people out of 122) than in distal AVFs (9.0% - 38 out of 424 people), p = 0.025. Of 4 patients with a hip prosthesis, 1 (25.0%) had non-occlusive access thrombosis. In patients with prostheses, thrombosis was observed more often (24.2% - 8 out of 33 people) than in those examined with a fistula (11.2% - 58 out of 517 people), which corresponds to the literature data [3].

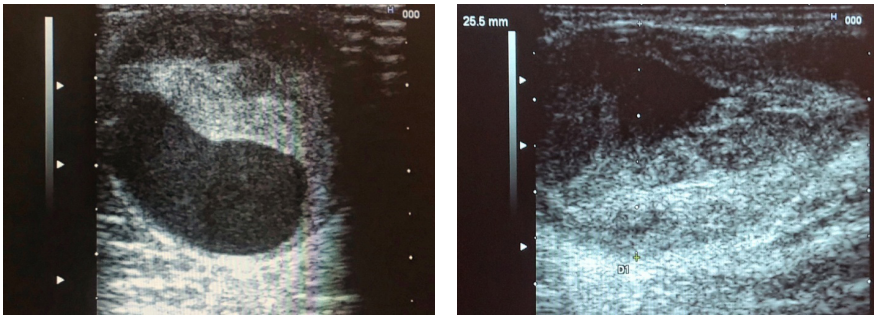
There was no significant relationship between the development of thrombosis and the patient's age, the underlying disease that caused chronic renal failure (p>0.05). Thrombosis developed on average after 20.6±11.2 months. after access formation (from 1 month to 12 years). There were no significant differences between the diameter of the inflow artery (p = 0.72) and the diameter of the anastomosis (p = 0.36) in patients with and without thrombosis.

The reasons for the development of thrombosis were: a decrease in the blood

flow in the access due to stenosis or low systemic arterial pressure, disturbances in the homeostasis system, damage to the vessel wall, especially during punctures in the local zone [3, 11]. The access flow rate in patients with thrombosis ranged from 100 ml/min to 2400 ml/min (average 860.6±575.1 ml/min).

In 10 (15.2%) patients with thrombosis, significant stenosis of the outflow vein and a decrease in access flow to 300 ml/min or less were noted. A correlation was established between the presence of significant stenosis of the vascular access and the development of thrombosis ($p = 0.02$), which corresponds to the literature data on the main cause of AVF thrombosis [5, 11, 12]. A number of authors claim that the risk of thrombosis is significantly reduced with a minimum access flow rate of more than 500–600 ml/min in a fistula and more than 800 ml/min in a prosthesis [2, 4, 12].

In patients with thrombosis, aneurysm of the outflow vein was detected in 14 (21.2%) people (fig. 2) and aneurysmal dilatation of the prosthesis - in 3 (37.5%). A correlation was found between the presence of an aneurysm of the outflow vein or prosthesis and the development of thrombosis ($p < 0.01$).



a *b*

Fig. 2. *Echograms of outflow vein aneurism, B-flow mode: non-occlusive (a) and occlusive (b) thrombosis*

The outflow vein aneurysm was detected in 45 (8.7%) patients with AVF, aneurysmal dilatation of the prosthesis - in 3 (9.1%) patients. In our study, the development of aneurysm did not depend on the diameter of the inflow artery and the anastomosis ($p>0.05$). The formation of aneurysms was facilitated by numerous punctures of a vein in a small area, localization was noted in the area of confluence with the tributary veins, in the area of the valve apparatus, as well as in rigid areas formed as a result of previous surgical interventions or catheterizations. The turbulent nature of the blood flow in the aneurysm leads to the deposition of platelets on the endothelium in places with a low blood flow rate, their subsequent agglutination and activation of the fibrin coagulation

process [2, 9].

Steal syndrome was detected in 2.7% (15 patients). Steel syndrome appeared at different times from the moment of vascular access formation: from several weeks to 8 months (on average 3.5±1.3 months) in patients with a prosthesis and from 1 month to 15 years (on average 32.7±10.7 months) with AVF. Among patients with a proximal access, it occurred significantly more often (4.4%) than in patients with radio-cephalic fistulas (2.3%).

In ultrasound examination, the diameter of the anastomosis in patients with the steal syndrome was significantly greater (5.9±0.9 mm) than in the group of patients without hand ischemia (4.1±1.5 mm). In the case of hand steal syndrome, the blood flow in the inflow artery in the case of the formation of the brachial AVF was on average 1802.6±147.5 ml/min, with a radio-cephalic fistula - 753.3±117.6 ml/min; in the outflow vein with brachial AVF - 1607.5±126.2 ml/min and with distal fistula - 1008±115 ml/min. There were no significant differences in mean values of access flow in patients with and without steal syndrome ($p = 0.06$).

Ultrasound examination revealed the main reasons for the development of steal syndrome: stenosis of the inflow artery in patients with atherosclerosis and diabetes mellitus, which do not allow increasing the access flow in the artery (20.0% - 3 patients); large diameter of the anastomosis, leading to significant shunting of blood, dilatation of the vein and an increase in the access flow (13.3% - 2 people); insufficient blood flow through the ulnar, anterior interosseous arteries and the absence of collateral branches, which did not compensate for the retrograde blood flow from the radial artery distal to the anastomosis into the fistula (40.0% - 6 patients); violation of the mechanisms of regulation of the tone of resistive vessels and pathological changes in the microvasculature of the hand (26.7% - 4 patients).

Conclusion. Complications of vascular access for hemodialysis were found in 26.7% (147 patients), there were no significant differences in the frequency of detection of thrombosis (26.5%), stenosis (23.8%) and aneurysm (21.1%), the steal syndrome (8.2%) was less common. The combination of two complications was found in 20.4%. The presence of concomitant diseases of the peripheral arteries was a risk factor for the development of the inflow artery stenosis ($p = 0.024$) and the anastomotic zone stenosis ($p = 0.037$). A significant relationship was established between the presence of the vascular access significant stenosis ($p = 0.02$), the outflow vein aneurysm or prosthesis aneurysm ($p < 0.01$) and the development of vascular access thrombosis. Thrombosis was more common in patients with a proximal access than with a distal one ($p = 0.025$), as well as with an arteriovenous prosthesis than with the AVF ($p = 0.026$). Pathological changes in the arteries of the forearm, which do not compensate for the deficit of blood flow in the hand, and the state of the microvasculature of the hand, are of major importance in the development of the steal syndrome. Dynamic ultrasound examination of the vascular access allows timely identification of complications and their correction.

References

1. Vasil'ev A.N., Miheeva J.S., Smirnov A.V. Pathophysiology of arteriovenous fistula. Nefrologija. 2015; 19 (66): 61–72. In Russian.

2. Vascular Access Work Group. KDOQI Clinical Practice Guideline for vascular access: 2019 Update. AJDK. 2020; 66 (5): 1–194.

3. Grinev K.M., Karpov S.A., Alferov S. Non-thrombotic complications of vascular access in dialysis cases and techniques for their surgical correction. Vestnik SPbGU. Medicina. 2017; 12 (4): 340–353. In Russian.

4. Pietrryga J.A., Little M.D., Robbin M.L. Sonography of Arteriovenous Fistulas and Grafts. Seminars in dialysis. 2017; 30 (4): 309–318.

5. Quencer K.B., Kidd K., Kinney T. Preprocedure Evaluation of a Dysfunctional Dialysis Access. Elsevier. 2017; 20 (1): 20–30.

6. Richards J., Hossain M., Summers D. et al. Surveillance arteriovenous fistulas using ultrasound (SONAR) trial in hemodialysis patients: a study protocol for a multicentre observational study. BMJ Open. 2019; 9 (3): e031210.

7. Strokov A.G., Gurevich K.Ya., Il'in A.P.et al. National guidelines «Treatment of patient with terminal kidney insufficiency by hemodialysis and hemofiltration». 2016. 31 p. In Russian.

8. Lobov G.I., Gurkov A.S. Regulation of microcirculatory blood flow in the hand in patients with radiocephalic arteriovenous fistula for hemodialysis. Vestnik nauki Sibiri. 2014; 14 (4): 291–296. In Russian.

9. Shol'c H. Vascular access for hemodialysis. Per. s angl. pod red. Gurkova A.S. Moscow: Prakticheskaja medicina, 2019. 280 p. In Russian.

10. Koen V.S., Zahmatova T.V., Holin A.V., Sebelev K.I. Method for access flow measurement in arteriovenous fistula for hemodialysis. Patent on the application No 2020107070, 14.02.2020. In Russian.

11. Mudoni A., Caccetta F., Caroppo M. et al. Echo color Doppler ultrasound: a valuable diagnostic tool in the assessment of arteriovenous fistula in hemodialysis patients. J. Vasc. Surg. 2016; 7 (5): 446–452.

12. Ishii T., Suzuki Y., Nakayama T. et al. Duplex ultrasound for the prediction of vascular events associated with arteriovenous fistulas in hemodialysis patients. JVA. 2016; 17 (6): 499–505.

DOI 10.34660/INF.2021.17.81.018

PROGNOSTIC SIGNIFICANCE OF NEUTROPHIL-TO-LYMPHOCYTE RATIO IN THE DEVELOPMENT OF POST-STROKE COGNITIVE IMPAIRMENT

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Abstract. *The inflammatory process is involved in the development of cognitive impairment after hemorrhagic stroke. The neutrophil-lymphocyte ratio (NLR) is an indicator reflecting systemic inflammation and a reliable marker of the severity and adverse outcomes of stroke. The aim of the study was to evaluate the predictive value of NLR for the first time 24 hours of stroke in the development of post-stroke cognitive impairment after intracerebral hemorrhage.*

Materials and methods: *115 patients with previous supratentorial intracerebral hemorrhage were included in this case-control study. 58 patients were included in the main group with a total of ≤17 MoCA points, ≤19 MMSE points, and GDR stages 2-7; 57 patients in the control group - with ≥ 26 MoCA points, with ≥ 27 MMSE points and stage 1 GDR. The NLR was analyzed as a continuous variable with a cut-off level> 3.53.*

Results: *In the main group, the NLR range was 1.2378-19.2, the median value was 4.3583. In the control group, the NLR was within 0.2881-21, the median was 2.6667. Patients with PSCI were more likely to have an elevated NLR than patients without PSCI (p=0.002). An increase in NLR of more than 3.53 was determined in 62.07% of patients with PSCI (95% CI: 49.33-74.81), in patients without PSCI - in 33.33% (95% CI: 20.85-45.82). An increase in NLR> 3.53 increased the*

incidence of PSCI by 1.78 times (RR - 1.785, 95% CI: 1.216-2.621). An increase in NLR> 3.53 is associated with a high chance of developing post-stroke cognitive dysfunction at 6 months after ICH (OR - 3.273, 95% CI: 1.524-7.030).

Conclusion: *An increase in NLR> 3.53 for the first time 24 hours of intracerebral hemorrhage is associated with the development of post-stroke cognitive impairment. NLR can be used as a prognostic marker in the development of post-stroke cognitive impairment.*

Keywords: *neutrophil-lymphocyte ratio, inflammatory marker, inflammation, post-stroke cognitive impairment, stroke.*

Introduction

Post-stroke cognitive impairment (PSCI) is a serious disabling disorder due to stroke. Cognitive impairment develops in more than 30% of stroke patients, reaching the degree of dementia and leads to disability [1, 2] Currently, about 50 million people suffer from dementia, in 2030 the number of patients with dementia will reach 82 million [3].

According to experimental and clinical studies, the inflammatory process has an important role in the development of PSCI [4-7]. Several previous studies have examined the association of markers of inflammation with PSCI, but the results for certain biomarkers have been mixed. In a study by K. Narasimhalu et al. in patients after ischemic stroke, C-reactive protein (CRP), interleukin-1β (IL-1β), interleukin-6 (IL-6), interleukin-10 (IL-10) did not confirm the relationship with PSCI [8]. However, the results were different for CRP in the L.S. Rothenburg et al. The results showed that a high level of CRP is associated with a deterioration in cognitive functions 1 month after stroke, with respect to IL-6, no relationship was found [9]. In other studies, an association between CRP and PSCI has also been found [10, 11]. Regarding IL-1β, IL-6, IL-10, according to the results of the study by V.G. Cherkasova et al., Patients with PSCI had a high concentration of IL-1β and IL-10 in the cerebrospinal fluid and IL-6 in the blood serum, in comparison with patients with normal cognitive ability [12].

One of the inflammatory markers reflecting systemic inflammation is the neutrophil-lymphocyte ratio (NLR). Compared to the above markers, NLR is readily available with a complete blood count, which is usually done for all inpatients, without additional financial costs. Several meta-analyzes have shown that an increase in NLR is a predictor of acute ischemic and hemorrhagic strokes [13-15]. In addition, NLR is a reliable marker for predicting the severity [16] and adverse outcomes of stroke [17-19], such as infectious complications, increased hematoma volume after intracerebral hemorrhage (ICH) [20,21] and post-stroke disability [16,22,23, 24].

Based on the results of previous studies and the role of inflammation in the de-

velopment of post-stroke cognitive impairment, NLR may be a prognostic marker of the occurrence of post-stroke cognitive impairment in intracerebral hemorrhage.

Purpose of the study – to evaluate the predictive value of NLR for the first time 24 hours of stroke in the development of post-stroke cognitive impairment after ICH.

Materials and methods

This retrospective case-control study included 115 patients with previous supratentorial intracerebral hemorrhage. Inclusion criteria were: age from 18 years, established diagnosis of supratentorial intracerebral hemorrhage, a complete blood count was performed on the analyzer for the first time 24 hours ICH, early recovery period. Patients with aphasia, pathology of the organs of vision and/or hearing, with acute infectious, mental illnesses and taking sedatives, glucocorticosteroid, immunosuppressive drugs or other therapy affecting the immune and cognitive status were excluded.

In order to identify pre-stroke cognitive impairments in the subjects of the study, close relatives were questioned using the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE). According to the results of IQCODE, 32 patients were excluded, the results of which were more than 78 points. Cognitive status was assessed 6 months after stroke according to the American Psychiatric Association's Diagnostic and Statistical Manual using the Montreal Cognitive Assessment Scale (MoCA), Mental Status Assessment Summary (MMSE), and General Deterioration Scale (GDR). In order to exclude false results and taking into account the sensitivity of the scales, patients with mild cognitive impairment according to the results of MoCA and with mild dementia according to the MMSE were not included [25, 26]. In the categorical table of the General Impairment Scale (GDR), patients were classified into 7 stages of cognitive impairment [27]. Based on the test results, the main group included patients with a total of ≤17 MoCA points, ≤19 MMSE points, and GDR stages 2-7; in the control group - with ≥ 26 MoCA points, with ≥ 27 MMSE points and stage 1 GDR.

Absolute Neutrophil Count (NEUT #), Absolute Lymphocyte Count (LYM #) were recorded through the Integrated Medical Information System case history data. The NLR analysis was performed as a continuous variable with a range within the normal range from 0.78 to 3.53 [28].

According to the results of computed tomography (CT) of the brain, the affected hemisphere, localization and volume of the hematoma were recorded. The volume of hematoma was measured using the ABC/2 method by means of non-contrast CT of the brain [29], the indicator of which was entered as a continuous variable. Localization of ICH was classified as lobar, medial, lateral and mixed intracerebral hematomas [30]. The degree of neurological deficit on admission was assessed using the National Institutes of Health Stroke Scale (NIHSS). Statistical

processing of the results was carried out using Microsoft Excel 14.0.4760.1000 and Statistica 6.0 software. The distribution of features was assessed using the Shapiro-Wilk test. Quantitative characteristics were compared using the non-parametric Kruskal-Wallis test (H-test). Comparison of the proportions between groups was carried out using the Z-test. Correlation was assessed using Spearman's correlation coefficient. To assess the risk, the relative risk (RR) was determined. The strength of association between NLR and PSCI was assessed using odds ratio (OR). The significance level of the data was α=0.05.

The scientific research was approved by the Bioethics Committee of the NJSC "Medical University of Karaganda" (protocol №8 of 10.11.20). The study was conducted with the voluntary consent of the participants and the legal representative with the receipt of written informed consent.

Results and discussion

The groups were matched by sex and age (p> 0.05). In the main and control groups, the average age was 55.1897 and 55.193 years, the proportion of men was 46.55% (95% CI: 33.45-59.65) and 45.61% (95% CI: 32.42-58.81), respectively (Table 1).

Table 1. *Characteristics of patients in the test groups*

Indicator	Main group n=58	Control group n=57	p - value
Age, Me, (Q25; Q75)	56.5 (49; 63)	57 (48; 62)	0.984
Male, %	46.55	45.61	0.920
Left hemisphere,%	48.28	57.89	0.301
ICH localization:			
Lobar,%	1.72	12.28	**0.026**
Medial,%	1.72	3.51	0.548
Lateral,%	37.93	45.61	0.404
Mixed,%	58.62	38.60	**0.032**
Hematoma volume (ml^3), Me,(Q25; Q75)	16.4 (9.5; 30)	5 (3.5; 8)	**<0.001**
NIHSS score (points), Me, (Q25; Q75)	14.5 (13; 16)	8 (5; 11)	**<0.001**
Laboratory indicators:			
The absolute number of neutrophils ($x10^9/l$), Me, (Q25; Q75)	6.6 (4.3; 9.5)	4.85 (3.4; 7)	**0.014**
Absolute lymphocyte count ($x10^9/l$), Me, (Q25; Q75)	1.4 (1.1;1.9)	1.7 (1.38; 2.4)	**0.009**
NLR, Me, (Q25; Q75)	4.35 (2.59; 7.15)	2.67 (1.76; 3.73)	1
NLR>3,53, %	62.07	33.33	**0.002**
Cognitive status assessment:			

MoCA (points), Me, (Q25; Q75)	15 (14; 16)	26 (26; 27)	**<0.001**
MMSE (points), Me,(Q25; Q75)	16 (15; 17)	28 (28; 28)	**<0.001**
GDR:			
Stage 1, %	-	100	**<0.001**
Stages 2-3, %	32.76	-	**<0.001**
Stages 4-7, %	67.24	-	<0.001

According to Spearman's correlation analysis, the level of cognitive impairment on the MoCA, MMSE, and GDR scales strongly positively correlated with the NIHSS score, moderately positively correlated with the volume of the hematoma, and a weak direct relationship with the localization of the hematoma was found. Consequently, cognitive dysfunction is associated with stroke severity and damage to the critical site of stroke [31,32]. In addition, MMSE and GDR had a weak positive association with ICH treatment. No correlation was found between MoCA, MMSE, GDR and age, gender, affected hemisphere (p> 0.05, Table 1).

In the main group, the NLR ranged from 1.2378-19.2, in 62.07% (95% CI: 49.33-74.81) the NLR was more than 3.53. In the control group, NLR was in the range of 0.2881-21, NLR over 3.53 was found in 33.33% (95% CI: 20.85-45.82). When comparing the proportions using the Z-test, it was revealed that in the acute period of ICH, more patients had cognitive dysfunction with an NLR level> 3.53, in comparison with the control (p = 0.002) (Table 1).

Spearman's correlation analysis revealed that NLR had a weak direct relationship with the NIHSS score at admission, localization, hematoma volume (p <0.05, Table 2). There was no statistically significant correlation between NLR and the affected hemisphere (p> 0.05, Table 2). According to Jie Qin et al. NLR was moderately positively correlated with hematoma volume assessed by NIHSS, but was not associated with ICH localization [33]. These results indicate that neutrophils and lymphocytes associated with stroke severity are involved in brain tissue damage in ICH.

Table 2. *Spearman's correlation analysis between NLR and stroke severity*

Indicator	Spearman	t(N-2)	p-level
Affected hemisphere	-0.16638	-1.7937	0.075537
Localization of hematoma	0.26214	2.8875	**0.004654**
Hematoma volume	0.28928	3.2125	**0.001715**
NIHSS score	0.25251	2.7741	0.006478

As a result of the risk assessment, an increase in NLR> 3.53 increases the incidence of PSCI by 1.78 times (RR-1.785, 95% CI: 1.216-2.621). An increase in

NLR> 3.53 for the first time 24 hours of stroke is associated with a high chance of developing post-stroke cognitive dysfunction at 6 months after ICH (OR - 3.273, 95% CI: 1.524-7.030). This is due to the fact that in acute ICH, intraparenchymal blood and local aseptic necrosis trigger inflammation [34]. Through the highly permeable blood-brain barrier, neutrophils infiltrate the hematoma area from 30 minutes to several hours, reaching a peak of 1–3 days [35]. Unlike neutrophils, T-lymphocytes are recruited later, approximately 3-4 days after hemorrhagic stroke [36]. Despite the fact that neutrophils are involved in recovery, they also have a damaging effect [37,38]. Localized brain damage leads to neuronal death and loss of synapses, contributing to the development of cognitive dysfunction [39].

There are several limitations to this study. First, the study was retrospective with a limited number of samples, which led to hematomas varying in volume and location. Second, due to the complex nature of ICH, it was not possible to exclude possible factors influencing the patient's baseline cognitive level. Nevertheless, our results will serve to improve the prediction of post-stroke cognitive impairment in patients with intracerebral hemorrhage for early cognitive rehabilitation.

Conclusion. Based on the results obtained, an increase in NLR> 3.53 for the first time 24 hours ICH is associated with the development of post-stroke cognitive impairment at 6 months after stroke. Thus, NLR can be used as a marker for the first time 24 hours of spontaneous intracerebral hemorrhage for early prediction of the development of post-stroke cognitive impairment.

References

1. Rist P. M., Chalmers J., Arima H., Anderson C., Macmahon S., Woodward M., Kurth T., Tzourio C. Baseline cognitive function, recurrent stroke, and risk of dementia in patients with stroke. Stroke. 2013; 44(7), 1790–1795. https://doi.org/10.1161/STROKEAHA.111.680728

2. Park JH, Kim BJ, Bae HJ, Lee J, Lee J, Han MK, et al. Impact of post-stroke cognitive impairment with no dementia on health-related quality of life. J Stroke 2013;15:49-56.

3. World Health Organization, 2020 https://www.who.int/ru/news-room/fact-sheets/detail/dementia

4. Gorelick P.B. Role of inflammation in cognitive impairment: results of observational epidemiological studies and clinical trials. Annals of the New York Academy of Sciences. 2010; 1207: 155-162. https://doi.org/10.1111/j.1749-6632.2010.05726.x

5. Gary A. R. Extracellular matrix inflammation in vascular cognitive impairment and dementia. Clin Sci (Lond) 1 March 2017; 131 (6): 425–437. https://doi.org/10.1042/cs20160604

6. Alam A, Hana Z, Jin Z, Suen K.C. Surgery, neuroinflammation and cognitive impairment. EBioMedicine. 2018;37:547–556. https://doi.org/10.1016/j.ebiom.2018.10.021

7. Van Harten, A. E., Scheeren, T. W., Absalom A. R. A review of postoperative cognitive dysfunction and neuroinflammation associated with cardiac surgery and anaesthesia. Anaesthesia. 2012; 67: 280-293. https://doi.org/10.1111/j.1365-2044.2011.07008.x

8. Narasimhalu K, Lee J, Leong YL, Ma L, De Silva DA, Wong MC, Chang HM, Chen C. Inflammatory markers and their association with post stroke cognitive decline. Int J Stroke. 2015 Jun;10(4):513-8.https://doi.org/10.1111/ijs.12001

9. Rothenburg LS, Herrmann N, Swardfager W, Black SE, Tennen G, Kiss A, Gladstone DJ, Ween J, Snaiderman A, Lanctôt KL. The relationship between inflammatory markers and post stroke cognitive impairment. J Geriatr Psychiatry Neurol. 2010;23(3):199-205.https://doi.org/10.1177/0891988710373598

10. Kliper E, Bashat DB, Bornstein NM, Shenhar-Tsarfaty S, Hallevi H, Auriel E, Shopin L, Bloch S, Berliner S, Giladi N, Goldbourt U, Shapira I, Korczyn AD, Assayag EB. Cognitive decline after stroke: relation to inflammatory biomarkers and hippocampal volume. Stroke. 2013 May;44(5):1433-5. https://doi.org/10.1161/strokeaha.111.000536

11. Alexandrova ML, Danovska MP. Cognitive impairment one year after ischemic stroke: predictorsand dynamics of significant determinants. Turk J Med Sci. 2016 Nov 17;46(5):1366-1373. https://doi.org/10.3906/sag-1403-29

12. Kulesh A, Drobakha V, Kuklina E, Nekrasova I, Shestakov V. Cytokine Response, Tract-Specific Fractional Anisotropy, and Brain Morphometry in Post-Stroke Cognitive Impairment. J Stroke Cerebrovasc Dis. 2018 Jul;27(7):1752-1759. https://doi.org/10.18019/1028-4427-2019-25-3-413-423

13. Zhang J, Ren Q, Song Y, He M, Zeng Y, Liu Z, Xu J. Prognostic role of neutrophil-lymphocyte ratio in patients with acute ischemic stroke. Medicine (Baltimore). 2017 Nov;96(45):e8624. https://doi.org/10.1097/MD.0000000000008624

14. Zhang J, Cai L, Song Y, Shan B, He M, Ren Q, Chen C, Liu Z, Zeng Y, Xu J. Prognostic role of neutrophil lymphocyte ratio in patients with spontaneous intracerebral hemorrhage. Oncotarget. 2017 Sep 8;8(44):77752-77760. https://doi.org/10.18632/oncotarget.20776

15. Ye Z, Ai X, Fang F, Hu X, Faramand A, You C. The use of neutrophil to lymphocyte ratio as a predictor for clinical outcomes in spontaneous intracerebral hemorrhage. Oncotarget. 2017 Aug 10;8(52):90380-90389. https://doi.org/10.18632/oncotarget.20120

16. Brooks SD, Spears C, Cummings C, VanGilder RL, Stinehart KR, Gutmann L, Domico J, Culp S, Carpenter J, Rai A, Barr TL. Admission neutrophil-lymphocyte ratio predicts 90 day outcome after endovascular stroke therapy. J Neurointerv Surg. 2014 Oct;6(8):578-83. https://doi.org/10.1136/neurintsurg-2013-010780

17. Lattanzi S, Brigo F, Trinka E, Cagnetti C, Di Napoli M, Silvestrini M. Neutrophil-to-Lymphocyte Ratio in Acute Cerebral Hemorrhage: a System Review. Transl Stroke Res. 2019 Apr;10(2):137-145. https://doi.org/10.1007/s12975-018-0649-4

18. Tao C, Hu X, Wang J, Ma J, Li H, You C. Admission neutrophil count and neutrophil to lymphocyte ratio predict 90-day outcome in intracerebral hemorrhage. Biomark Med. 2017 Jan;11(1):33-42. https://doi.org/10.2217/bmm-2016-0187

19. Yu S, Arima H, Bertmar C, Clarke S, Herkes G, Krause M. Neutrophil to lymphocyte ratio and early clinical outcomes in patients with acute ischemic stroke. J Neurol Sci. 2018 Apr 15;387:115-118. https://doi.org/10.1016/j.jns.2018.02.002

20. Lattanzi S, Cagnetti C, Provinciali L, Silvestrini M. Neutrophil-to-Lymphocyte Ratio Predicts the Outcome of Acute Intracerebral Hemorrhage. Stroke. 2016 Jun;47(6):1654-7. https://doi.org/10.1161/STROKEAHA.116.013627

21. Wang F, Hu S, Ding Y, Ju X, Wang L, Lu Q, Wu X. Neutrophil-to-Lymphocyte Ratio and 30-Day Mortality in Patients with Acute Intracerebral Hemorrhage. J Stroke Cerebrovasc Dis. 2016 Jan;25(1):182-7. https://doi.org/10.1016/j.jstrokecerebrovasdis.2015.09.013

22. Altun, I., F. Akın and M. Biteker. The Role of Epicardial Fat Thickness and Neutrophil-to-Lymphocyte Ratio Are Needed to Be Studied in Real-World Stroke Patients. Journal of stroke and cerebrovascular diseases: the official journal of National Stroke Association 24 5 (2015): 1100. https://doi.org/10.1016/j.jstrokecerebrovasdis.2014.10.023

23. Nardi K, Milia P, Eusebi P, Paciaroni M, Caso V, Agnelli G. Admission leukocytosis in acute cerebral ischemia: influence on early outcome. J Stroke Cerebrovasc Dis. 2012 Nov;21(8):819-24. https://doi.org/10.1016/j.jstrokecerebrovasdis.2011.04.015

24. Wafeek M Elsheik, Ibrahim E Alahmar, Gelan M M. Ali, Eman S Matar Neutrophils-to-lymphocyte ratio in acute ischemic stroke patients Menoufia Medical Journal 2020 Volume : 33 Issue : 3: 1067-1071 https://doi.org/10.4103/mmj.mmj_371_18

25. Hoops S, Nazem S, Siderowf AD, Duda JE, Xie SX, Stern MB, Weintraub D. Validity of the MoCA and MMSE in the detection of MCI and dementia in Parkinson disease. Neurology. 2009 Nov 24;73(21):1738-45. https://doi.org/10.1212/WNL.0b013e3181c34b47

26. Mitchell AJ. A meta-analysis of the accuracy of the mini-mental state examination in the detection of dementia and mild cognitive impairment. J Psychiatr Res. 2009 Jan;43(4):411-31. https://doi.org/10.1016/j.jpsychires.2008.04.014

27. Hardcastle, Cheshire & Taylor, Brad & Price, Catherine. (2019). Global Deterioration Scale. https://doi.org/10.1007/978-3-319-69892-2_697-1

28. Forget P, Khalifa C, Defour JP, Latinne D, Van Pel MC, De Kock M. What is the normal value of the neutrophil-to-lymphocyte ratio? BMC Res Notes. 2017 Jan 3;10(1):12. https://doi.org/10.1186/s13104-016-2335-5

29. Haley MD, Gregson BA, Mould WA, Hanley DF, Mendelow AD. Retrospective Methods Analysis of Semiautomated Intracerebral Hemorrhage Volume Quantification From a Selection of the STICH II Cohort (Early Surgery Versus Initial Conservative Treatment in Patients With Spontaneous Supratentorial Lobar Intracerebral Haematomas). Stroke. 2018 Feb;49(2):325-332. https://doi.org/10.1161/STROKEAHA.117.016677

30. Clinical protocol № 23 of the Ministry of Health of the Republic of Kazakhstan "Intracerebral hemorrhage" dated May 25, 2017

31. Kandiah N, Wiryasaputra L, Narasimhalu K, Karandikar A, Marmin M, Chua EV, Sitoh YY. Frontal subcortical ischemia is crucial for post stroke cognitive impairment. J Neurol Sci. 2011 Oct 15;309(1-2):92-5. https://doi.org/110.1016/j.jns.2011.07.013

32. Stephens S, Kenny RA, Rowan E, Allan L, Kalaria RN, Bradbury M, Ballard CG. Neuropsychological characteristics of mild vascular cognitive impairment and dementia after stroke. Int J Geriatr Psychiatry. 2004 Nov;19(11):1053-7. https://doi.org/10.1002/gps.1209

33. Qin J, Li Z, Gong G, Li H, Chen L, Song B, Liu X, Shi C, Yang J, Yang T, Xu Y. Early increased neutrophil-to-lymphocyte ratio is associated with poor 3-month outcomes in spontaneous intracerebral hemorrhage. PLoS One. 2019 Feb 7;14(2):e0211833. https://doi.org/10.1371/journal.pone.0211833

34. Zhou Y, Wang Y, Wang J, Anne Stetler R, Yang QW. Inflammation in intracerebral hemorrhage: from mechanisms to clinical translation. Prog Neurobiol. 2014 Apr;115:25-44. https://doi.org/10.1016/j.pneurobio.2013.11.003

35. Jickling GC, Liu D, Ander BP, Stamova B, Zhan X, Sharp FR. Targeting neutrophils in ischemic stroke: translational insights from experimental studies. J Cereb Blood Flow Metab. 2015 Jun;35(6):888-901. https://doi.org/10.1038/jcbfm.2015.45

36. Loftspring MC, McDole J, Lu A, Clark JF, Johnson AJ. Intracerebral hemorrhage leads to infiltration of several leukocyte populations with concomitant pathophysiological changes. J Cereb Blood Flow Metab. 2009 Jan;29(1):137-43. https://doi.org/10.1038/jcbfm.2008.114

37. Hermann DM, Gunzer M. Contribution of polymorphonuclear neutrophils in the blood periphery to ischemic brain injury. Neurol Neuroimmunol Neuroinflamm. 2019;6:e570. https://doi.org/10.1212/nxi.0000000000000570

38. Perez-de-Puig I, Miró-Mur F, Ferrer-Ferrer M, Gelpi E, Pedragosa J, Justicia C, Urra X, Chamorro A, Planas AM. Neutrophil recruitment to the brain in mouse and human ischemic stroke. Acta Neuropathol. 2015;129:239–57. https://doi.org/10.1007/s00401-014-1381-0

39. Stanimirovic DB, Friedman A. Pathophysiology of the neurovascular unit: disease cause or consequence? J Cereb Blood Flow Metab. 2012 Jul;32(7):1207-21. https://doi.org/10.1038/jcbfm.2012.25

DOI 10.34660/INF.2021.95.82.019

STRESS-INDUCED HYPERGLYCEMIA AS A PREDICTOR OF THE DEVELOPMENT OF POST-STROKE SEIZURES

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Abstract. *Stress-induced hyperglycemia is a controversial risk factor for the development of seizures after a stroke. Stress-induced hyperglycemia leads to increased mortality and complications in critically ill patients. The aim of the study was to evaluate the effect of stress-induced hyperglycemia on the development of post-stroke seizures.*

Materials and methods*: 489 patients were included in the case-control study. In patients, the level of stress-induced hyperglycemia was assessed by retrospective data of biochemical analysis. Statistical methods were used to determine the relationship between the level of stress-induced hyperglycemia and the development of post-stroke seizures.*

Results: *according to the results of the study, in 260 cases in the group, the outcome of which was the development of post-stroke seizures was stress-induced hyperglycemia. Stress-induced hyperglycemia was observed 1.193 times more often than normoglycemia. The chance of developing post-stroke seizures in the study group was 1.468. The relationship between the traits was found to be statistically significant.*

Conclusion: *Stress-induced hyperglycemia is associated with the development of post-stroke seizures. Our study confirmed that stress-induced hyperglycemia is one of the predictors of the development of post-stroke seizures.*

Keywords: *stress-induced hyperglycemia, post-stroke seizures, predictor, ischemic stroke*

Introduction

Currently, there is a consistent increase and prevalence of seizures [1]. This is due to an increase in the population of persons of older age groups, as well as an increase in the incidence of cerebrovascular pathology [2]. About 10% of epilepsies and 55% of newly diagnosed seizures develop after a stroke [3].

Seizures worsen morbidity and mortality rates, prevent active recovery from stroke, and increase the length of hospital stay [4,5]. It has been proven that mortality in patients with post-stroke seizures is at a higher level than in all patients with ischemic stroke [6]. In addition, patients with seizure syndrome have a more pronounced neurological functional deficit in the outcome of stroke than patients without seizures [7].

The management of patients with post-stroke seizures is challenging due to the lack of proven effective treatment guidelines and recommendations. In their practice, neurologists are faced with such problems in treatment as the optimal time to start treatment and an adequate choice of antiepileptic drugs [8].

In the course of a meta-analysis, it is known that hemorrhagic stroke, stroke in the left carotid system, atherothrombotic ischemic stroke, severe neurological deficit according to the NIHSS scale, age over 65 years are the most frequent risk factors for seizures after stroke [9].

In the course of the literature review, there is a single number of studies and ambiguous conclusions about stress-induced hyperglycemia as a risk factor for the development of post-stroke seizures [10,11].

Stress-induced hyperglycemia occurs in up to 50% of stroke cases [12]. Stress hyperglycemia is an independent predictor of disease severity. Practice has shown that stress-induced hyperglycemia in patients with cerebral stroke is associated with an increase in the area of ischemic brain damage and a worsening prognosis [13, 14]. The risk of hospital complications also correlates with the degree of hyperglycemia, with a higher one observed in patients without a history of diabetes mellitus, and improved glycemic control reduces the incidence of complications and mortality [15].

Thus, the growth and prevalence of convulsive seizures against the background of a stroke necessitates a more detailed study. Better knowledge of the risk factors for post-stroke seizures, as well as the possible prediction of seizures after stroke, may have an impact on improving the prevention and treatment of seizures after stroke.

Purpose

The purpose of the study was to evaluate the effect of stress-induced hyperglycemia on the development of post-stroke seizures in patients with ischemic stroke.

Materials and methods

The case-control study was carried out on the basis of a neurological hospital. We retrospectively analyzed 260 case histories of patients with post-stroke seizures in 2015-2020. The study included patients aged 50-79 years, who were divided into two groups. The main group consisted of 260 patients aged 50 to 77 years (141 men and 123 women) with seizures, the control group - 229 patients (119 men and 106 women) 50–73 years old without seizures. Patients of the two groups were comparable in clinical characteristics (blood pressure of 2-3 degrees, points on the NIHSS assessment scale not more than 22), pathogenetic subtype of stroke (atherothrombotic ischemic). The level of stress-induced hyperglycemia was assessed by the results of biochemical analysis in patients upon admission to the hospital, on an empty stomach the next morning, and also during the entire stay of the patient in the hospital. The exclusion criteria were type 1 and type 2 diabetes mellitus and a history of epilepsy, clinically and neuroimaging hematomas with a volume of more than 30-40 ml, accompanied by severe neurological deficit, and patients with intracerebral and subarachnoid hemorrhages. The criterion for confirming stress-induced hyperglycemia was the consultation of respective specialists, exclusion of the diagnosis of diabetes mellitus, blood test for glycated hemoglobin (HbA1c) - less than 6.0%. Statistical processing was carried out using the software package Microsoft Excel, Statistica 6.0., The statistical programming language R version v3.2.0. Spearman's correlation coefficient was used to assess the relationship between the level of stress-induced hyperlycemia and the development of post-stroke seizures. The strength of associations of the analyzed features was determined using the value of the odds ratio and relative risk. The study was approved by the local ethics committee of the medical university.

Results and its discussion

In the course of the study, we found that in patients with post-stroke seizures, an increase in the level of blood pressure to the 3rd degree was more often observed, in percentage terms - 53.85% in the main group. In the control group, patients with grade 2 slightly prevailed - 50.22%. We concluded that no significant differences in blood pressure were found in the two groups. According to the clinical examination, patients with seizures did not have a gross neurological deficit; in the control group, severe neurological disorders were observed (121 cases - 52.84%). As in previous studies, the association of the severity of stroke with the development of seizures was not confirmed [16,17,18]. In our study, seizures developed in the atherothrombotic variant. However, according to the literature, a higher incidence of epileptic seizures after cardioembolic stroke was found in comparison with other subtypes of ischemic stroke [19, 20, 21]. In 115 (44.23%) patients of the main group and 116 (50.66%) of the control group, ischemic stroke developed in the carotid system, in 145 (55.77%) patients of the main group and

113 (49.34%) of the control group - in the vertebrobasilar pool. Thus, convulsions developed in patients with ischemic stroke in the vertebro-basilar basin. When analyzing and assessing the level of stress-induced hyperglycemia, we divided the patients into 3 groups according to the level of glycemia. The first group, which had normal blood glucose levels, the second group with a stress-glycemic level of 7.8-11.1 mmol/l, and the third group, whose indicators exceeded 11.1 mmol/l. It was revealed that the level of stress-hyperglycemia up to 7.8-11.1 mmol/l was more often observed in two groups, the proportion of patients in the main group was 49.23% and 45.41% in the other group. In the main group, 153 cases of an increase in the level of glycemia were observed, of which, at a level of glycemia of 7.8-11.1 mmol/l, -128 cases, 25 cases with a level of glycemia of more than 11.1 mmol/l. In the control group, there were 116 cases of normoglycemia and 113 cases of hyperglycemia without outcome. According to the results obtained, in stress-induced hyperlycemia, the greatest number of post-stroke convulsive seizures was observed. When analyzing the relationship, it was revealed that in patients with post-stroke seizures, stress-induced hyperglycemia is observed 1.193 times more often than normoglycemia (RR=1.193). The odds ratio was 1.468, thus, the chance of developing post-stroke convulsive seizures in the main group is 1.5 times greater than in the control group (OR=1.468). The correlation coefficient of Spearman's ranks was 0.1. The connection between the signs is assessed as a direct weak one. The relationship was recognized as statistically significant, since the obtained p level (p=0.010617) did not exceed the permissible value (p=0.05). According to clinical phenomenology, 40% developed focal seizures, 34.15% developed simple partial seizures, 21.15% of patients suffered from complex partial seizures, generalized seizures were recorded in 7.69%. According to the results of the study, focal seizures were more often recorded in patients with the development of post-stroke seizures (104 cases). Also, analyzing our own data, we observed that convulsions were more often noted on 3-4 days of hospitalization. As a percentage, on day 3 at 21.92%, on day 4 at 42.31%. According to the classification of G.Barolin and E. Sherzer (1962), seizures that developed 7 days after an acute cerebrovascular accident are early seizures [22].

Conclusion

Based on the results obtained, we came to the conclusion that stress-induced hyperglycemia can be attributed to a predictor of the development of post-stroke seizures. Timely control of the level of stress-induced hyperglycemia and proper patient management will reduce the risk of developing post-stroke seizures.

References

1. Hasan T.F., Rabinstein A.A., Middlebrooks E.H. Diagnosis and management of acute ischemic stroke. Mayo Clinic Proceedings. 2018;93: 523–538.

2. Krueger H., Koot J., Hall R.E., O’Callaghan C., Bayley M., Corbett D. Prevalence of individuals experiencing the effects of stroke in Canada: trends and projections. Stroke. 2015; 46: 2226–2231.

3.Fisher R.S., Acevedo C., Arzimanoglou A., et al. ILAE official report: a practical clinical definition of epilepsy. Epilepsia. 2014; 55: 475– 482.

4.Pezzini A., Grassi M., Del Zotto E., et al. Complications of acute stroke and the occurrence of early seizures. Cerebrovascular Diseases. 2013; 35: 444–450.

5.Burneo J.G., Fang J., Saposnik G., Investigators of the Registry of the Canadian Stroke Network Impact of seizures on morbidity and mortality after stroke: a Canadian multi-centre cohort study. European Journal of Neurology.2010;17(1):52–58.

6.Alberti A., Paciaroni M., Caso V. et al. Early seizures in patients with acute stroke: Frequency, predictive factors, and effect on clinical outcome. Vascular Health and Risk Management. 2008;4(3):715—20.

7. Rossi C., De Herdt V,Dequatre-Ponchelle N,Hénon H.,Leys D., Cordonnier C. Incidence and predictors of late seizures in intracerebral hemorrhages. Stroke. 2013;44(6): 1723-1725.

8.Xu MY. Poststroke seizure: optimising its management. Stroke and Vascular Neurology.2019;4

9.Gilad R., Boaz M., Dabby R., Sadeh M. and Lampl Y. (2011) Are post intracerebral hemorrhage seizures prevented by anti-epileptic treatment? Epilepsy Research - Journal.95: 227–231.

10.Ahangar A.A., Hosseini S., Saghebi R. Clinical features of post stroke seizure in Babol, northern Iran. Neurosciences. 2008;13(1):88–90.

11.Zelano J., Lundberg R.G., Baars L., Hedegärd E., Kumlien E. Clinical course of poststroke epilepsy: a retrospective nested case-control study. Brain and Behavior. 2015;5(9)

12. Danilova T.V. Clinical features of post-stroke epileptic seizures. Neurology, neuropsychiatry, psychosomatics. 2015; (special issue 1):47–53.

13.Capes S.E., Hunt D., Malmerg K. et al. Stress hyperglycemia and increased risk of death after infarction with and without diabetes: a systematic overview. Lancet. 2000; 355: 773-8.

14.Egi M., Bellomo R., Stachowski E., French C.J., et al. Blood glucose concentration and outcome of critical illness: the impact of diabetes. Critical Care Medicine. 2008; 36 (8): 2249–55.

15.Inzucchi S.E. Clinical practice. Management of hyperglycemia in the hospital setting. The New England Journal of Medicine. 2006; 355 (18): 1903–11.

16. Noebels J. Pathway-driven discovery of epilepsy genes. Nature neuroscience. 2015;18(3):344–350.

17. Procaccianti G., Zaniboni A., Rondelli F., Crisci M., Sacquegna T. Seizures in acute stroke: incidence, risk factors and prognosis. Neuroepidemiology. 2012; 39(1):45-50.

18. McCrimmon R.J., Ryan C.M., Frier B.M. Diabetes and cognitive dysfunction. Lancet. 2012;379(9833):2291–2299. https://doi.org/10.1016/s0140-6736(12)60360-2

19. Umpierrez G.E., Isaacs S.D., Bazargan N. Hyperglycemia: an independent marker of in-hospital mortality in patients with undiagnosed diabetes. The Journal of clinical endocrinology and metabolism. 2002;87(3):978–982.

20. Pittas A.G., Siegel R.D., Lau J. Insulin therapy and in-hospital mortality in critically ill patients: systematic review and meta-analysis of randomized controlled trials. Journal of parenteral and enteral nutrition. 2006;30(2):164–172.

21. McGinn J.T., Shariff M.A., Bhat T.M., et al. Prevalence of Dysglycemia Among Coronary Artery Bypass Surgery Patients with No Previous Diabetic History.Journal of Cardiothoracic Surgery. 2011;6:104.

22. Burn J.,Dennis M., Bamford J., Sandercock P.,Wade D., Warlow C. Epileptic seizures after a first stroke: the Oxfordshire Community Stroke Project. BMJ.1997;315(7122): 1582-1587.

DOI 10.34660/INF.2021.93.53.020

THE FREQUENCY OF DETECTING ANTI-DRUG ANTIBODIES IN NON-HODGKIN'S LYMPHOMA

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Abstract. *Therapeutic antibodies are known could occasionally elicit an antibody response in patients, which can result in loss of response or adverse effects. But sometimes these antibodies are found in pre-treatment serum samples, The purpose of this study was to determine the incidence of anti-drug antibodies (ADA) in patients with non-Hodgkin's lymphoma (nHL). Serum levels of anti-rituximab antibodies was determined in blood samples of patients with nHL (newly diagnosed and resistant / recurrent forms, previously treated by rituximab) and healthy controls. Results: none of the patients with newly diagnosed disease have antibodies to rituximab. Positive results were recorded in 7 (33%) patients who received rituximab earlier and 2 healthy controls.*

Keywords: *rituximab, anti-drug antibodies, non-Hodgkin's lymphoma*

Introduction

Monoclonal therapeutic antibodies are widely used to treat lymphoproliferative and rheumatologic disorders [1,2]. Because of their higher target specificity, monoclonal antibodies treatments are generally considered to pose a lower risk of adverse reactions than chemical drugs [3]. Rituximab, a chimeric monoclonal antibody targeted against the pan-B-cell marker CD20, was the first monoclonal antibody to be approved for therapeutic use [2]. It is usually used in combination with chemotherapy. Treatment with rituximab at standard weekly dosing is effective in more than 50% of patients with relapsed or refractory CD20-positive follicular non-Hodgkin's lymphoma, but is not curative. It is less effective in other subtypes of CD20-positive lymphoma and for retreatment, even with CD20 still expressed [4]. Thus, binding of rituximab to CD20 is not sufficient to kill many lymphoma cells, indicating that there are mechanisms of resistance.

There are quite a lot of data in the literature that therapeutic antibodies occasionally elicit an antibody response in patients, which can result in loss of response

or adverse effects [5-8]. However, antibodies that bind a drug are sometimes found in pre-treatment serum samples, with the amount depending on drug, assay, and patient population. The accurate prediction and assessment of (clinically relevant) immunogenicity remains a challenging endeavor [5].

Purpose of the study - to determine the incidence of anti-drug antibodies (ADA) in patients with non-Hodgkin's lymphoma (nHL) treated by rituximab.

Materials and methods

The study involved 32 patients with nHL (11 newly diagnosed, 21 - resistant / recurrent form), aged from 36 to 70 years (average age 49,5 years), of witch 18 women and 14 men and and 13 practically healthy individuals, matched by age and sex.

In 55% of patients, stage 2 of the disease was detected, in 45% of patients - stages 3 and 4. Patients with refractory / relapsing forms have previously received 4-6 courses of R-FC therapy. Determination of anti-rituximab antibodies in peripheral blood serum was performed by enzyme-linked immunoassay using a test system manufactured by Bender Medsystems (Austria) (semi-quantitative analysis).

Results and discussion

The data are shown in the table below.

Table 1. *The presence of antibodies to rituximab in the blood serum of patients with nHL and healthy controls.*

Group	Result (conventional unit) *
Newly diagnosed nHL (n=11)	1,4
	0,65
	1,74
	1,1
	1,3
	1,54
	1,2
	1,53
	2,12
	1,33
	1,59
Resistant/recurrent nHL (n=21)	2,32
	2,78
	2,6
	2,8
	10,7
	1,3
	1,14

Resistant/recurrent nHL (n=21)	**127**
	74,6
	2,4
	2,27
	9,7
	6,0
	9,3
	6,9
	1,16
	0,95
	1,43
	1,15
	0,79
	0,88
Controls (n=13)	1,77
	3.4
	0,95
	0,94
	0,81
	1,13
	0,59
	2,22
	5,18
	0,86
	1,72
	1,0
	0,77

*Note: positive results are shown in bold

As follows from the table, none of the patients with newly diagnosed disease have antibodies to rituximab. Positive results were recorded in 7 (33%) patients who received rituximab earlier. Of particular note is a patient with a very high antibody level (74,7 c.u.) who received 6 courses of combination therapy and showed pronounced progression of the disease. At the same, in the group of practically healthy persons, positive results were obtained in 2 (15,4%) cases, in particular, with a procedural nurse who regularly contacts the drug.

Conclusion.

Most recombinant engineered therapeutic proteins are administered to patients as repeated doses, over their lifetime. Generation of ADA is a potential outcome to almost all such therapeutics. The results of the study demonstrated that ADA are

revealed in 1/3 patients with resistant forms of the disease treated by rituximab. Moreover, pre-existing ADA were detected in several healthy controls. Of course, it should be borne in mind that the effect of ADA on the therapeutic efficacy of the drug can be different: it could be targeting predominantly the idiotype and thus clinically relevant, or due to pre-dose antibodies that can bind the therapeutic antibody, but are often irrelevant. If we suppose that immunogenicity is an important factor that should be considered in the overall treatment strategy, we should take actions to reduce antidrug antibodies formation: modifying drug administration; increasing dose; decreasing immunogenicity by adding immunosuppressive agents to the regimen or using new drugs which are supposed to be less immunogenic such as humanized or fully human monoclonal antibodies.

References

1. *Chan A.C., Carter R.T. Therapeutic antibodies for autoimmunity and inflammation. Nat. Rev. Immunol. 2009. Vol.10. P.301-316. Doi:10.1038/nri2761/*

2. Smith M.R. Rituximab (monoclonal anti-CD20 antibody): mechanisms of action and resistance. Oncogene. 2003. Vol.22(47). p.7359-7368. Doi 10.1038/sjonc120639.

3. Moskalets O.V. Late-onset hypogammaglobulinemia after rituximab therapy. Kazan Medical Journal. 2019. Vol.100(2). P.288-294. Doi: 10.17816/KMJ2019-288.

4. Maloney D.R. Anti-CD20 antibody therapy for B-cell lymphomas. N Engl. J. Med. 2012.Vol.316. P.2008-2018 DoI:10/1056/NEJMct1114348.

5. Rosenberg A.S., Sauna Z.E.Immunogenecity assesment during the development of protein therapeutics. J. Pharm. Pharmacol. 2018. Vol.70(5). P.584-594. Doi:10.1111/jphp12810.

6. Krishna M., Nadler S.G. Immunogenecity to biotherapeutics – the role of anti-drug immune complexes. Front. Immunol. 2016; 7:21 Doi: 10.3389/fimmu.2016.00021.

7. Tada M., Ishii-Watabe A., Suzuki T., Kawasaki N. Development and characterisationof an anti-rituximab monoclonal antibodies. Mabs. 201`8. Vol.10(3). P.370-379. Doi: 10.1080/19420862.2018.1424610.

8. vanSchi K.A., Wolbink G.J., Respens T. Cross-reactive and pre-existing antibodies to therapeutic antibodies – Effects on treatmentand immunogenecity. Mabs. 2015. Vol.7. 662-671. DoI:10.1080/19420862.2015.10481111.

DOI 10.34660/INF.2021.80.28.021

THE TRANSGENIC CHICKENS OBTAINED BY MICROINJECTION OF DNA IN THE OVARIAN FOLLICLES

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Abstract. *The technology of the transgenesis applied is based upon a surgery providing external access to the ovary and subsequent natural deposition of membranes resulting in eggs suitable for incubation. The microinjection of foreign DNA directly into the blastodiscs of large pre-ovulated follicles within the ovarian hierarchy improved the operation rate in compare to microinjections of ovulated follicles through the wall of the infundibulum. Though the access to ovary is more difficult than to infundibulum, and follicular membrane is harder and thicker than infundibular wall, this technique has certain important advantages including the lack of necessity in the determination of ovulatory cycle timing and ovulation times for every follicle to be injected. The technique gives 2-3 injected follicles per surgery per hen without possible problems related to the irregular deposition of tertiary membranes. The trials were performed on White Leghorn chicken; the injected construct was linearized plasmid pSMTHG9 containing metallothionein promoter and gene of growth hormone (GH). 45 chickens were operated; 120 follicles were injected; 56 whole injected eggs were obtained and incubated; 40 day-old chicks were hatched and studied for the transgenicity. GH was found in the blood of 10 chicks in concentrations of 0.5-1.0 ng/ml; in 2 chicks the nucleotide sequences of GH were found in the DNA of whole blood. It can result from the mosaicism of the obtained transgenic birds.*

Key words*: transgenesis, microinjection of DNA, chicken.*

Introduction

Transgenesis is one of the possible approaches to the genetic modification of poultry. The research related to different methods of induction of transgenesis in poultry is continuing since the emergence of transgenic mouse in 1980s. First ma-

nipulations with chicken zygote have been ineffective for the routine application; however, these studies paved the way for modern more effective technologies of the transgenesis [1-4].

Microinjections of foreign DNA into the zygote is still a classic technology of non-viral avian transgenesis. The technology of the transgenesis applied in our study is based upon a surgery providing external access to the ovary and subsequent natural deposition of membranes resulting in eggs suitable for incubation [5, 6].

Purpose of the study – to develop a technique for microinjecting DNA into chicken ovarian follicles in order to create transgenic individuals.

Materials and methods

The trials were performed on White Leghorn chicken (180-300 days of age) kept in individual cages in the Institute's vivarium and inseminated artificially. The introduction of foreign gene was performed in two replicates. The laparotomy was performed with local anesthesia (Novocain) of abdominal area above the left thigh to get an open access to the ovary (since only left ovary and left oviduct are well developed in chicken).

Microinjections into ovarian follicles were made with a micropipette of Pyrex glass with a tip of 2-4 microns, made of a glass blank with a diameter of 1 mm. The volume of injected DNA in various experiments varied from 200 to 1000×10^{-12} L. The injected construct was linearized plasmid pSMTHG9 containing metallothionein promoter and gene of growth hormone (GH).

The samples of comb, skin, skeletal muscles, liver, and blood were biopsied from the hatched chicks. The samples of other tissues were obtained at the post mortem examination of naturally dead birds. DNA was isolated by phenol-chloroform deproteinization after the treatment of the homogenates of tissues by pronase E. The analysis of DNA by blot hybridization was performed with Zet-Probe (Bio-Rad, USA) membranes according to the protocol recommended by the producer.

Results and discussion

At the first step of the trial a preliminary test was performed to be sure that injected follicles really can form an oocyte and egg suitable for incubation. The stain (methylene blue or ink) was injected into the follicle's yolk; then eggs from the hens with injected follicles were collected for 12 days and broken to determine the presence of the stain. The main results of this preliminary test are presented in Table 1.

Table 1. *The presence of stain in eggs laid by hens with stain-injected follicles*

Number of stain-injected follicles	Time after the surgery, days						
	1	2	3	4	5	6	7
3		○	●		○	●	○
4		●	○	●		○	○

5		○	●	●	●	
3	●		○	●	○	●
4		○	●	●		○
4	○	○	●	○	●	○

○ – egg without stain; ● – egg with stain

Since 8 days after the surgery the stains disappeared from the eggs. It should be noted that the surgery can disturb the follicular hierarchy where the largest follicle should ovulate first. The stains often were nor found in the first and largest follicles and appear later, although three largest follicles were always stained during the surgery. The post mortem examination of hens revealed that certain follicles can dissolve before the ovulation. In some eggs only the traces of the stains were found indicating the intense clearance of the stains from the maturating follicles. Certain eggs where the stains were nor found resulted from the stained follicles. The results of the preliminary test are therefore insufficiently clear and unambiguous to make strict conclusions on the effects of injections on the follicular hierarchy, the order of ovulations, etc. However, a solid conclusion can be made that not less than 50% of eggs laid by operated hens during the subsequent 7 days are originated from the injected follicles.

The next step of the trial was the injection of gene constructs into the follicular blastodiscs. During the surgery 3-4 follicles in average were injected in each operated hen. Then the eggs from the operated hens were collected for 7 days excluding the eggs laid next day after the surgery since these eggs were already in the oviduct at the moment of the surgery and were not injected. Then the eggs were incubated.

45 chickens were operated; 120 follicles were injected; 56 whole injected eggs were obtained and incubated (**Table 2**); 40 chicks were studied for the transgenicity. GH was found in the blood of 10 chicks in concentrations of 0.5-1.0 ng/ml; in 2 chicks the nucleotide sequences of GH were found in the DNA of whole blood (**Table 3**).

Table 2. *Injection of DNA into the follicular blastodiscs*

Experiment	Hens operated	Follicles injected	Eggs laid		Grown chickens
			total	standard	
1	11	33	19	19	8
2	34	87	39	37	32

Table 3. *Analysis of the transgenicity in chicks developed from injected follicles*

Chick No	Sex	hGH in blood serum		hGH in DNA from blood
		1	2	
3108	♀	–	+	–
5897	♀	–	+	+
5899	♂	+	+	–
5900	♂	–	+	–
5958	♀	+	+	–
5968	♀	–	+	–
5969	♀	+	–	–
5970	♀	+	–	–
5972	♀	+	–	–
5975	♀	+	+	+

The analysis of DNA in hatched chicks by blot hybridization revealed the nucleotide sequences of the injected plasmid. The radioautograph of the analysis of samples of different tissues of chick No 5975 is presented on **Fig. 1**. Together with fragments sized 2800 and 2500 base pairs (bp) expectable for the gene construct used (marked with arrows on **Fig. 1**) there was a fragment sized 1600 bp (the most intense strip) that can be formed in the tandem transgene integration, typical of the transgenic animals obtained by DNA microinjections into the ovicells. The fragments sized 850 and 3000-3500 bp are apparently the flanking sequences for the tandem transgene sequence. The size of 850 bp fragment indicates that the integration took place in 3'-end position near the Rst I of site of the genomic DNA. Since flanking sequences are well seen and are close in the intensity to the internal fragments of the tandem the latter contains only several repeats. The lesser intensity of large restrictive fragments of the transgene compared to small fragments is supposedly related to the incomplete transfer of large fragments from the gel onto the membrane.

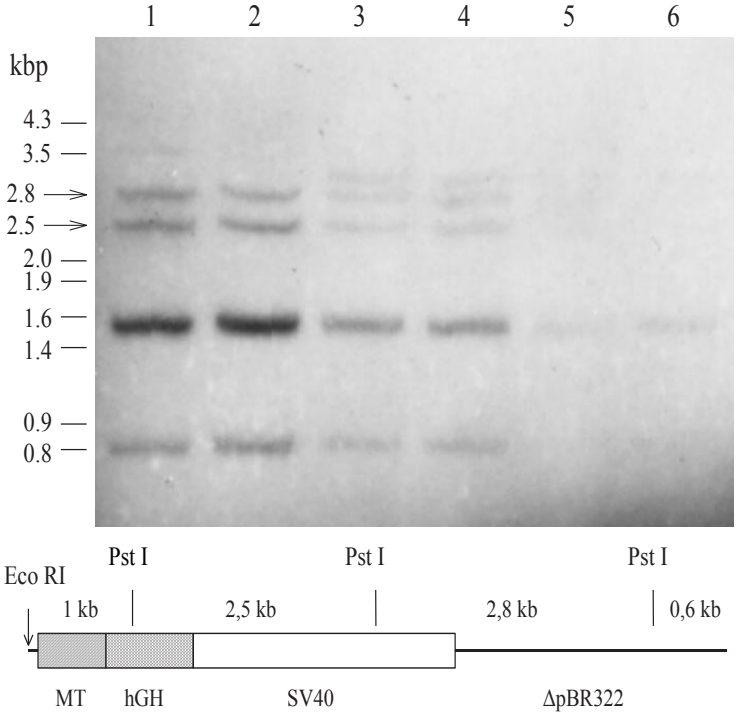

Figure 1. *Hybdridization analysis of the integration of human somatotropin gene into the DNA of chick No 5975 isolated from the intestine (1,2), lungs (3,4), gizzard (5,6); restriction Pst I.*
At the left: approximate position of marker fragments of lambda phag DNA (EcoR I + Hind III) and their sizes in kbp.

The hens (F0) grown from the transgenic chicks were crossed with the intact cockerels to obtain the first generation F1 (**Table 4**).

Table 4. *The analysis of the heritability of the transgenicity in chicks injected with human GH gene*

Chick No	Number of offsprings studied	Nos. of transgenic offspring	Sex	hGH in blood serum	hGH in DNA from blood
F0		**F1**			
5897	39	301407	♀	+	+
		1512	♂	–	+

5975	23	1591	♀	+	+
		2608	♂	+	+
		3905	♀	–	+
F1		**F2**			
1591	21	0418	♂	+	+
		0818	♀	–	+
		3006	♀	–	+
		3011	♂	–	+
		3014	♀	–	+
2608	29	1518	♂	–	+
		2808	♀	+	+

The transgenic F1 birds were, in their turn, crossed with intact cockerels. The yield of transgenic birds in F1 (62 birds totally) was 5 birds (or 8%). In F2 the frequency of the transgenesis was 14%. This fact can be explained by low livability of the embryos from the transgenic hens. The hatchability of eggs from these hens was 20% vs. 90% in non-operated control; the embryonic deaths occurred predominantly at the early stages of development, apparently as a result of non-controlled expression of the transgene in the embryonic tissues resulting in the lethal disturbances of embryogenesis.

Conclusions

The microinjection of foreign DNA directly into the blastodiscs of large pre-ovulated follicles within the ovarian hierarchy improved the operation rate in compare to microinjections of ovulated follicles through the wall of the infundibulum. Though the access to ovary is more difficult than to infundibulum, and follicular membrane is harder and thicker than infundibular wall, this technique has certain important advantages including the lack of necessity in the determination of ovulatory cycle timing and ovulation times for every follicle to be injected. The technique gives 2-3 injected follicles per surgery per hen without possible problems related to the irregular deposition of tertiary membranes.

References

1. Sang H. Prospects for transgenesis in the chick // Mechanisms of Development. – 2004. – V. 121. – N 9. – P. 1179-1186. doi:10.1016/j.mod.2004.05.012

2. Park T.S., Han J.Y. piggyBac transposition into primordial germ cells is an efficient tool for transgenesis in chickens // Proc. Natl. Acad. Sci. USA. – 2012. – V. 109. – N 24. – P. 9337-9341. doi:10.1073/pnas.1203823109

3. Han J.Y., Lee B.R. Isolation and Characterization of Chicken Primordial Germ Cells and Their Application in Transgenesis // Meth. Mol. Biol. – 2017. – V. 1650. – P. 229-242. doi:10.1007/978-1-4939-7216-6_15

4. Trefil P., Aumann D., Koslova A., Mucksova J., Benesova B., Kalina J., Wurmser C., Fries R., Elleder D., Schusser B., Hejnar J. Male fertility restored by transplanting primordial germ cells into testes: a new way towards efficient transgenesis in chicken // Sci. Rep. – 2017. – V. 7. – N 1. – P. 14246. doi:10.1038/s41598-017-14475-w

5. Korshunova L.G., Karapetyan R.V., Fisinin V.I. Methods for genetic modification in poultry // Agricultural bioloby. – 2013. – № 6. – P. 3-15.

6. Korshunova L.G., Karapetyan R.V., Ziadinova O.F. Modification of chicken genome by interferon gene // Russian Agricultural Sciences. – 2014. – V. 40. – N 5. – P. 379-381. doi:10.3103/s1068367414050140

DOI 10.34660/INF.2021.30.70.022

THE LEVEL OF REPRODUCTION SYNCHRONIZATION IN EARLY AND LATE COLONIES GULL BIRDS (ON THE EXAMPLE OF THE WHITE-WINGED BLACK TERN)

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Abstract. *Based on many years of research (1972-82) in the Selenga river delta (Lake Baikal, Eastern Siberia) the level of synchronization of bird reproduction in white-winged black tern colonies is considered. This region is distinguished by an extremely dynamic mountain-floodplain water regime, which determines the high mortality of nests from flooding. For such an analysis, we used a specially developed multiplication synchronization index, I_{sr}. Its use makes it possible to compare, on this basis, dense nesting clusters of any species of birds, as well as their breeding seasons, which differ in nesting conditions. It has been shown that the synchronization of reproduction is most pronounced in small colonies that form at the beginning of the nesting season. In some cases, all birds of a small colony (up to 15, and extremely rarely 20 birds) can start breeding in one day. By the end of the nesting season, this index in the colonies decreases. The high mortality of nests and the massive repeated (compensatory) nesting of birds determine the high variability of the breeding synchronization index. Nevertheless, its use makes it possible to quite clearly determine the level of breeding synchronization in any dense flocks of birds. It can be one of the criteria for distinguishing between colonial and non-colonial bird species in certain situations that form dense nesting concentrations.*

Keywords: *Eastern Siberia, Selenga river delta, White-winged Black Tern, colonial nesting, breeding synchronization index.*

Introduction

The ecology of colonial birds of many species is understood not fully, which hinders the solution of many practical issues related to determining their role in coastal ecosystems. The special questions of the biology of their reproduction are also poorly known. This does not allow the development of clear criteria for the separation of colonial and non-colonial bird species, many of which often form

local dense nesting aggregations. The level of nesting density in such aggregations often reaches values characteristic of optional and sometimes obligatory colonial species [4, 13], although they clearly do not belong to colonial birds.

At the same time, it is well known that colonies of gull birds are often characterized by a well-pronounced synchronization of reproduction [6]. It can change depending on the size of the colonies. As a rule, with an increase in colony size, the synchronization of bird reproduction greatly decreases, although there are exceptions to this rule [6, 7]. In addition, it is known that the level of synchronization can be associated with the timing of colony formation; at the end of the bird breeding season, it can decrease [2-3, 9. 11]. The particular significance of this parameter is due to the fact that reproductive success in birds is often associated with it [3, 9, 11]. However, this issue is still very poorly studied. The main reason for this is due to the need to collect and analyze a very large field material. In this regard, the solution of this problem requires a very large investment of time and is distinguished by high labor intensity. Despite this, we have undertaken special work to study this phenomenon, the results of which are presented in this communication.

Purpose of the study

The main purpose of this publication is, on the basis of long-term research (1972-82), to analyze the features of changes in the level of synchronization of bird reproduction in gull colonies (using the example of the white-winged tern) during the full nesting season. Show the features of the dynamics of this parameter depending on the size of the colonies and the timing of their formation. Despite the fact that this work was carried out a very long time ago, its results, for a number of objective reasons, have not yet been published. At the same time, despite the rather intensive study of birds of this group, this issue remains very poorly studied and the materials we have collected have not lost their relevance.

Materials and methods

The work was done in the Selenga river delta (Lake Baikal, Eastern Siberia) (1972-82) during the full 11-year climatic cycle, characterized by abnormally high and low water levels at the beginning and end of its formation. For all mountain basins of rivers in Eastern Siberia, one common feature is characteristic - an extremely unstable mountain-floodplain water regime. Its main signs are short-term, but very strong spring floods and several summer floods (from 2 to 7, extremely rarely up to 11), sometimes reaching the force of catastrophic floods. Constant and often very strong rises in the water level cause a large death of nests and, along with other limiting factors (early spring burning of last year's vegetation, predation of birds and mammals, grazing, haymaking and intrapopulation factors), greatly reduce the success of bird reproduction.

Our field work covered the entire nesting period, which made it possible to obtain acceptable estimates of the main parameters of their reproduction, incl. and phenological periods, especially egg-laying, using the flotation method [7-8]. Annually, within a key site with an area of 150 km^2 in the central part of the Selenga river delta., covering all the main habitats of birds, a survey of colonies of all species of gull birds was carried out. In this case, we consider the peculiarities of the synchronization of reproduction in the colonies of the White-winged Black Tern *Chlidonias leucopterus.* Due to its very high number, it was possible to collect a large amount of material that allows a full analysis of the considered issues of the ecology of this species. Within the colonies selected for continuous study, all found nests were marked with numbered pegs. The eggs were marked with indelible paint (KTs-52) with stripes (gulls and waders) or Roman numerals (rails and ducks) at the narrow end of the egg, the number or value of which corresponded to the order of laying determined by the flotation method [6-8]. The control of nests was carried out after 2 days, but in the case of a long period of unfavorable weather after 3-4 days, up to a specific final state: the death of clutches for various reasons or hatching and rearing of chicks.

The work during the full field season made it possible to collect massive and high-quality material on the timing of egg-laying, incubation of clutches and the peculiarities of egg incubation, which are necessary to develop methodological approaches associated with the use of the flotation method [1, 7-8, 12]. It should be noted that the flotation method for determining the date of appearance of the first egg in clutches, the timing of the formation of which is unknown, is standard and generally accepted in studies of the biology of bird reproduction. Based on our data, it was possible to refine the scoring system for the degree of incubation of white-winged tern eggs by their position in the water [5]. Comparison of the course of the water level, the death of nests from various factors and the appearance of repeated clutches leaves no doubt that the graphs of the course of egg-laying, built on the basis of the flotation method, reflect these processes well.

In the general series of studies of various stages of the nesting cycle of birds, it is very important to accurately identify the mass periods of egg-laying, which is always associated with certain difficulties. They are minimal with a unimodal distribution of the dates of appearance of the first eggs in clutches. However, for most breeding seasons of birds, under conditions of an unstable hydrological regime, bimodal distributions of the dates of their formation are more characteristic. With a large mortality of nests occurring at different periods of egg-laying, due to massive repeated, and sometimes even third attempts to restore them, polymodal distributions are formed. Isolation of mass periods in them is often a very difficult task. Its solution is possible on the basis of the graphical method used in our work [7].

The total duration of egg-laying, as well as the proportion of birds that nested during the period of mass formation of clutches, can vary greatly in different seasons [6-8]. Mass death of nests as a result of strong fluctuations in the water level - up to 70.0% and more - has a particularly large effect on these parameters of the nesting cycle of birds [7]. In such situations, only the nests of birds nesting on high islands and terraces above the floodplain remain. The proportion of birds that started breeding during mass egg-laying is often determined by weather factors in a particular nesting season, causing a significant lengthening or, conversely, a reduction in the breeding season. Most often, there is a shift in the period of mass egg-laying to the beginning or end of the nesting season, forming a well-pronounced asymmetry in the distribution of the timing of formation of clutches. An accurate assessment of such changes is impossible without special approaches, one of which is to determine the level of synchronization of bird reproduction.

A large number of compensatory clutches greatly extends the breeding season of birds (Table 1). They also make it very difficult to determine the period of mass nesting of birds in different colonies. In large colonies, which are most characterized by a polymodal distribution of the timing of the formation of clutches, the first mass peak of bird reproduction is taken as the time of the beginning of the formation of a colony, since there may be several such peaks. It often does not coincide with the period of the entire mass nesting of birds in the colony, which can combine several peaks of bird reproduction. In small colonies, most often this problem is absent - all birds start nesting in 5-10 days.

Table 1

The total duration of the White-winged Black Tern breeding season and the boundaries of the identified decades in the Selenga river delta (Lake Baikal, Eastern Siberia)

N o/p	**The boundaries of the decade**	**Decade number**
1	2	3
1	May 26 – June 4	I
2	June 5 – June 14	II
3	June 15 – June 24	III
4	June 25 июня – July 4	IY
5	July 5 – July 14	Y
6	July 15 – July 24	YI
7	July 25 – August 3	YII
8	August 4 – August 13	YIII

Source: compiled by the author.

The complex combination of various parameters makes it very difficult to quantify this phenomenon, which requires the use of special methods. In this case, the best option is to develop a complex index that includes several parameters that determine the characteristics of bird reproduction. As a result of long-term studies, we have developed an index of bird reproduction synchronization, which allows us to solve this problem [6-7]:

$$I_{sr} = \sqrt[2]{(n/l)/N}, \qquad 0 < I_{sr} < 1$$

where: n is the number of clutches started during the mass egg-laying period, in pieces, *l* is the duration of the mass egg-laying, in days up to tenths, N is the size of the colony, accumulation, aggregation or the total sample size from the population (number nests or pairs).

During the work, 143 White-winged Black Tern colonies were under constant control. All graphs are based on the date of laying of the first egg in each nest detected and monitored. A preliminary check was made of the correspondence of the distribution of egg-laying dates by day on the basis of actual and calculated information obtained by the flotation method. A comparison of these samples was carried out on the basis of the most stringent Kolmogorov-Smirnov homogeneity criterion [10]. It includes checking all kinds of distribution differences, scattering, skewness and kurtosis. The collected materials were analyzed using standard statistical methods [10]. Data processing and construction of tables and graphs were performed in Excel2016 and CorelDRAW2018 programs.

Results

Analysis of the collected materials shows that the synchronization of reproduction is clearly higher in small colonies and can in some cases 1.0 reach. With an increase in the colony size, the bird index reproduction synchronization decreases (Fig. 1). However, this pattern does not reach a high level, although it is reliable - $P < 0.05$. The coefficient of determination (R^2), showing what proportion of the relationship falls on these signs is only 13.0%. Indeed, this regularity is violated often and there are small colonies with a low level of synchronization of bird reproduction and rather large colonies with a high level (at the level of the average value typical for the population of this region). The highest index of bird reproduction synchronization is in colonies of up to 40-45 nests observed. At the same time, in colonies of this size, there are often cases of very low synchronization of bird reproduction. In this regard, it makes sense to analyze the relationship between the synchronization index of bird reproduction in colonies and the timing of their formation.

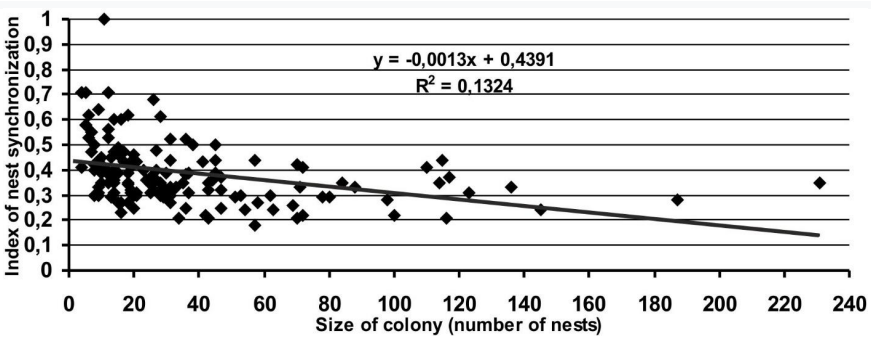

Fig. 1. *The level of relationship between the index of reproduction synchronization and the colony size of the White-winged Black Tern in the dynamic conditions of the mountain-floodplain water regime of the Selenga river delta.*

Source: Compiled by the author.

The relationship between the synchronization index of bird reproduction in colonies and the timing of their formation does exist, but it is very low and does not reach reliable values. The coefficient of determination of features (R^2) reaches only 2.0% (Fig. 2). At the same time, it is clearly seen that at the end of the breeding season, colonies with average values of the synchronization index prevail. The general period of the nesting season is very extended and covers 8 decades, which is a very rare phenomenon for the main part of waterfowl and waterfowl in Eastern Siberia. However, most of the colonies are formed in the first half of the nesting season (Fig. 2). At the same time, there is clearly a higher average index of synchronization of bird reproduction in colonies in the second half of the nesting season. Its variability at this time (IY-YIII decades) is clearly less than in the first half of the nesting period. The main reason for this is undoubtedly the high nest loss observed already in the first half of the nesting season (predation of large gulls and mammals, cattle grazing, herding dogs). Death from these factors in the first half of the breeding season is not very high. Therefore, birds that have lost their clutches at this time do not form independent colonies, but settle in already existing colonies. As a result, due to such single clutches, the total breeding period of birds in the colony increases sharply, and the level of their reproduction synchronization, even in small colonies, sharply decreases. This leads to a large variability of the index reproduction synchronization birds in the first half of the nesting season.

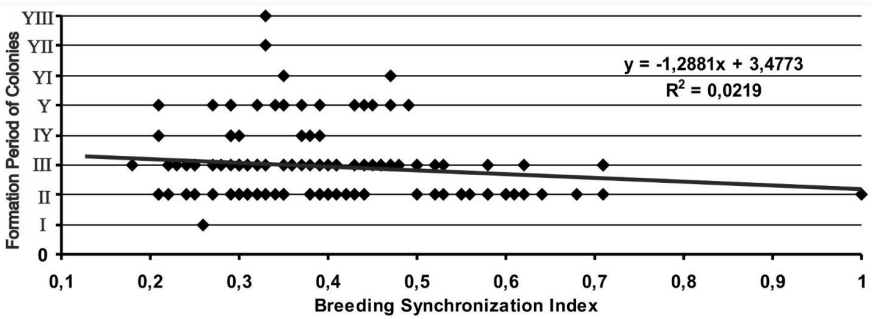

Fig. 2. *The level of correlation between the synchronization index of bird reproduction in colonies and the duration of the period of their formation on the White-winged Black Tern in the dynamic conditions of the mountain-floodplain water regime of the Selenga river delta.*
The ordinate shows decades in which the formation of new colonies is marked.
Source: Compiled by the author.

At the same time, the relationship between the size of colonies and the total duration of the nesting season remains unclear, which requires additional consideration (Fig. 3). The connection between these features, as well as in other cases considered by us, is small. The coefficient of determination (R^2) selects only 7.0% of the total variability of these factors (Fig. 3). First of all, it should be noted that the main part of the later colonies is formed by birds that have lost the first and sometimes second clutches. Often, such birds settle in already existing colonies, the size and general breeding time in which sharply increase. In some cases, very large colonies (for a given species) can form, the breeding season in which covers almost the entire nesting period of birds. The proportion of colonies formed in the first half of the nesting season is also quite large, the size of which, subsequently, is determined by the number of birds that have settled in that have lost their first clutches. In some cases, they can reach sizes of 200-300 pairs, which is a rather rare event for this species (Fig. 3). However, it is clearly seen that in the first half of the nesting season, small colonies (up to 50 nests) predominate. The formation of large colonies at this time is a rather rare event.

In this case, it should be noted that usually the period of mass reproduction of birds in a colony is within one decade. However, in very large colonies, due to the repeated introduction of new groups of birds (small colonies), the total breeding period increases dramatically. As a result, the general appearance of the laying period in such colonies takes the form of a polymodal distribution. In such cases, it is very difficult to identify the period of mass nesting of birds (it is determined by

the graphical method) [7], and the first peak of mass egg-laying is taken as the time of formation of such a colony. That is why the formation of the main part of large colonies occurs at the beginning of the nesting season. In fact, their total size is determined by the number and size of the populated groups of birds. Often, with a high mortality rate of nests in the middle or second half of the nesting season, new groups of birds settle in colonies in which mass hatching of chicks is observed, and quite often some of the young birds have already “risen on the wing”.

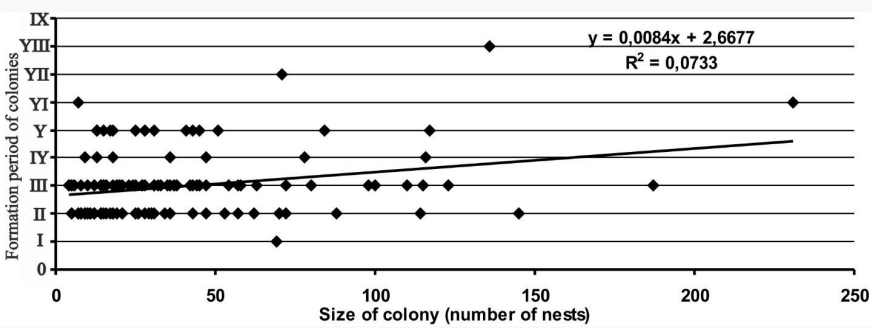

Fig. 3. *The level of relationship between colony size and the time of its formation on the White-winged Black Tern in the dynamic conditions of the mountain-floodplain water regime of the Selenga river delta.*
Source: Compiled by the author

Analysis of the graphs does not give a clear answer to the question of whether the early and late colonies differ in the level of the bird reproduction synchronization index. Therefore, we conducted a correlation analysis between these factors (Table 2). He showed that the index of synchronization of bird reproduction in early small colonies is reliably and significantly higher than in other colonies differing in size and timing of formation. There are significant high-level differences ($P < 0.001$) between early and late small colonies. These differences persist up to the size class of colonies of 41-60 nests, but the level of significance of differences decreases ($P < 0.05$) (Table 2). The lack of significant differences between these characters in the largest colonies (61-80 and more than 81 nests) is clearly due to the insufficient sample size of colonies of these size classes. Consequently, differences in the index of synchronization of bird reproduction in early and late colonies do exist, but in larger colonies these differences are clearly smoothed out (Table 2). Undoubtedly, the main reason for this is the complex nature of their formation, which is also confirmed by the polymodal distributions of the egg-laying course in large colonies. In small colonies, the course of egglaying, in most cases,

is characterized by positive excess and positive asymmetry caused by a high level of synchronization of bird reproduction [6].

During the analysis of the distribution features of the reproduction synchronization index in colonies of different size classes, first of all, its high variation attracts attention. In all size classes in colonies formed at different times, there are both high and very low indices. The coefficient of variation of the average value of this index in different size classes of colonies is gradually increasing (from 4.08% to 9.82%), and the average value of the synchronization index is constantly decreasing (Table 2). The increased variability of this trait is also well traced in the late colonies (in the early ones from 4.08% to 9.82%, and in the later from 5.71% to 6.62%). Consequently, there is still a certain pattern in its changes, but it is strongly veiled by random manifestations of various factors.

Table 2

The level of synchronization of reproduction in colonies of the White-winged Black Tern Chlidonias leucopterus formed at different periods of the nesting season

Colony size, nests	Colony formation time*	Number colonies	Index of Breeding Synchronization	
			Middle	Limit
Up to 20	I-III	48	**0,49±0,02*** **	0,27-1,0
	IY-XIII	17	**0,35±0,02*** **	0,23-0,49
21-40	I-III	25	**0,39±0,02** **	0,27-0,68
	IY-XIII	9	**0,32-0,02** **	0,21-0,44
41-60	I-III	8	**0,39±0,04** **	0,22-0,52
	IY-XIII	12	**0,3±0,02** **	0,18-0,43
61-80	I-III	5	0,31±0,03	0,26-0,41
	IY-XIII	6	0,29±0,03	0,21-0,42
81 and more	I-III	6	0,34±0,03	0,22-0,44
	IY-XIII	8	0,31±0,02	0,21-0,37

Note: *Decads, which account for the peak of the mass egglaying of the species in colonies of this size (see Table 1). The level of significance of differences in the synchronization index of bird reproduction in colonies differing in terms of formation: **P <0.05, ***P <0.001. Significant differences in the reproductive synchronization index between early and late colonies are in bold highlighted. *Source: compiled by the author.*

The synchronization of reproduction is clearly reduced in later colonies, which are formed mainly by birds, which compensate for the death of the first clutches by repeated reproduction. By settling in other colonies, even as part of a group with synchronous breeding (small colonies), such birds sharply reduce the synchronization index of their reproduction. At the same time, at the beginning of the nesting

season, large colonies with synchronous reproduction can sometimes form, which, in general, is not typical for this species. This situation is observed when several small colonies, which do not differ in terms of formation, occupy one small area for nesting, forming a very large nesting accumulation (colony) of birds.

Discussion

The most interesting question in the analysis of the peculiarities of the synchronization of bird reproduction is to find out the reasons for the appearance of large colonies. Why do birds choose only certain colonies and do not settle in others that are found in the neighborhood? This issue was not considered in this context in any known work on the synchronization of bird reproduction [2-3, 9, 11]. In unstable environmental conditions, birds prefer to nest in small colonies characterized by a high synchronization of reproduction. This is confirmed by observations of all species of gull birds in the Selenga river delta [6] and only Black-headed Gull *Larus ridibundus* is an exception. It forms large colonies in this region in the areas of an extensive network of small channels and extensive silt shoals. There is a high abundance of small molluscs, which the birds use to feed their chicks. All large colonies of white-winged tern formed in the lower delta among vast shallow waters occupied by thickets of horsetails and reed beds. The highest abundance of aquatic insects with which they feed their chicks is here observed. Undoubtedly, the migrating birds choose areas with an increased abundance of forages, which leads to the formation of very large colonies.

During periods of mass death of clutches, part of the colonies often perishes completely. When embarking on re-nesting, birds usually choose the remaining colonies, increasing their chances of successful breeding. They increase sharply under conditions when the first flood is higher than all subsequent ones. Such floods can no longer have a significant impact on the survival rate of birds. At the same time, the proportion of large colonies in the population is growing, despite the fact that they are based on small colonies. Consequently, a large number of small colonies at the beginning of the breeding season allows us to occupy as many areas as possible, which, according to feeding conditions, allow them to grow chicks normally. The high synchronism of bird reproduction in the colony increases the chances of successfully completing the nesting season as soon as possible.

The high mortality of nests includes the following mechanism for increasing the success of bird nesting - compensatory breeding. Occupying areas with preserved colonies or colonies with a low proportion of dead clutches, birds reduce the synchronization of reproduction of, in fact, a new colony. However, in the new site, the chances of successful breeding of birds increase, compensating for the losses associated with a decrease in its synchronicity. It should be noted that these are ter-

ritories with an increased abundance of forages, which increases the reproductive success of birds. The complex and multifaceted formation of colonies in extremely unstable environmental conditions dramatically increases the chances of birds to raise offspring, in fact, in critical situations. The important thing here is that the reproductive success of the entire population is ensured by special adaptations based on the "trial and error" method.

Conclusion

Long-term studies of the ecology of the white-winged tern show that one of the main features of this species is a very high synchronization of bird reproduction in small colonies. However, a large number of strongly acting limiting factors and, above all, an extremely unstable hydrological regime, lead to a large death of nests during the breeding season. Massive compensatory reproduction significantly increases the total duration of the bird nesting season. It also, in most cases, sharply reduces the general synchronization of bird reproduction in early colonies, which is well reflected by the index of bird reproduction synchronization. In addition, co-nesting of several small colonies with very different breeding times, even at normal times typical for the population, can also significantly reduce the synchronization of bird reproduction in a common larger colony. A decrease in the reproduction synchronization index in late colonies is determined by a high proportion of compensatory clutches. As a result, the general nesting rhythm in colonies of any size is disrupted and the reproductive synchronization index decreases.

References

1. Beintema A.J., Müskens G.J.D.M. Nesting success of birds breeding in Dutch agricultural grasslands // Journal of Applied Ecology, 1987. Vol. 24. P. 743-758.

2. Darling F.F. Bird flocks and the breeding cycle. - Cambridge: Cambridge University Publ., 1938. - 124 p.

3. Nelson J.B. The breeding behavior of the white booby Sula dactylatra // Ibis, 1967. Vol. 109. P. 194-231.

4. Mel’nikov Yu.I. Nesting aggregations of non-colonial bird species and the main patterns of their formation // Protection and rational use of animal and plant resources. Irkutsk: Irkutsk Agricultural State Academy Publ., 2000. Part 2. P. 249-259.

5. Mel’nikov Yu.I. The Defining of the date of laying of the first egg in the nests of White-Winged Black Terns Chlidonias leucopterus (Temminck, 1815) basing on flotation method // Baikal. Zool. Journ., 2013. № 2(13). P. 60-69.

6. Mel’nikov Yu.I. Colonial bird species of the family Laridae (Charadriiformes): synchronization of reproduction and determination of its level // Bull. Irkutsk. State University. Ser. Biology. Ecology. 2020. Vol. 33. P. 3-25.

7. Mel’nikov Yu.I. New approaches to the assessment of phenological parameters of breeding of Shorebirds and Waterfowl of Eastern Siberia // Higher school: scientific research. Materials Interuniversity scientific Congress (April 16, 2020 Moscow, Russia). M.: Infinity Publ., 2020. - P. 92-103.

8 .Mel’nikov Yu.I. Egglaying and features of its formation in non-colonial species of coastal birds // Journal of science. Lyon, 2020. Vol. 1. № 14. P. 3-11.

9. Parsons J. Seasonal variation in the breeding success of the Herring Gull. An experimental approach to pre-fledging success // J. Animal. Ecol., 1975. Vol. 44. P. 553-573.

10. Sachs L. Statistische Auswertungsmethoden. Moscow: Statistische Publ., 1976.598 s.

11. Viksne J., Janaus M. Breeding success of the black-headed gull Larus ridibundus in relation to the nesting time // Ornis Fenn., 1980. Vol. 57. P. 1-10.

12. Westerskov K. Method for determining the age of game bird eggs // J. Wildlife Management, 1950. Vol. 14, № 1. P. 56-57.

13. Zubakin V.A. The index of nesting density of some species of gull birds and the method of its calculation // Zool. zhurn., 1975. Vol. 54. № 9. P. 1386-1389.

DOI 10.34660/INF.2021.29.74.023
UDC 619:616.9:615.371

EFFICACY OF INACTIVATED BIVALENT FORMOL-HYDROXIDE ALUMINUM VACCINE IN STREPTOCOCCUS OF PIGS

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Abstract. *An inactivated bivalent formol-aluminum hydroxide vaccine (IBFAHAO) against swine streptococcosis has been developed on the basis of strains of two serogroups (D and C). It has been established that it is harmless, creates tense immunity in white mice and piglets, and prevents streptococcosis in conditions of a dysfunctional economy. Immunological restructuring of the piglets' body is accompanied by the activation of cell-humoral resistance indicators and the synthesis of specific antibodies, which persist for at least 6 months after vaccination.*

Keywords: *antibodies, vaccine, immunity, prevention, pigs, streptococci, streptococcosis.*

Pig breeding occupies a large share in the meat balance of the Russian Federation [1,2,10,11,16, 17]. Despite the high rates in industrial and small-scale pig breeding, viral and bacterial infections are still recorded, causing great damage to pig breeding [3,4,5]. Most often, infections are recorded in the pathology of young animals, in the etiology of which opportunistic microorganisms play an important role [6,7]. Among them, a significant place is occupied by streptococcosis, which occur in various forms, affecting different sex and age groups of pigs and pose a threat to human health [8, 9].

Due to the fact that in some pig farms streptococcosis are massive, affecting the broodstock and piglets, against the background of violations of the conditions

of feeding and maintenance, there is a need for vaccination. However, the available vaccines do not always create intense immunity due to the circulation of a wide range of streptococcal serovars, as well as the lack of toxigenic components of the corresponding streptococcal serogroups in their composition.

The aim of the research was the design and assessment of the activity and immunogenic properties of the inactivated bivalent formol-aluminum hydroxide vaccine IBFAHAO we created.

Materials and methods. For the manufacture of IBFAHAO vaccine, we used strains of Streptococcus suis, serovars D and C, isolated from dead newborn piglets with a septic form of streptococcosis.

The biomass of streptococci was obtained by cultivation in Hottinger's broth with 0.4% glucose with amine nitrogen 200 mg% at a temperature of 37-38°C for 18-20 hours. Cultivation was carried out at the beginning in incubation (within 3-4 hours), stationary "rest" mode. Then on a rocking chair and at the end again at rest. Grown cultures of streptococci containing a bacterial mass with a concentration of 4 billion m.k. in cm^3, toxins and capsule components were inactivated with formalin at a final concentration of 0.3% and sorbed on aluminum hydroxide (10%), pH was stabilized at 7.2 ... 7.4. The culture inactivation time and sorbent were selected empirically.

To determine the completeness of inactivation of streptococci and the quality of the vaccine preparation, inoculations were made on nutrient media. The safety and immunogenicity of samples of inactivated bivalent formol-aluminum hydroxide vaccine was tested on white mice weighing 18 ... 20 g. Experiments were carried out with one of the experimental vaccine samples on 14-day-old piglets, which were immunized with an experimental batch of IBFAHAO vaccine against swine streptococcosis, obtained according to our laboratory regulations. The vaccine was injected intramuscularly twice with an interval of 10 days at doses of 2 and 3 cm^3. One month after the second vaccination, three vaccinated and two similar non-immunized piglets were infected with a culture of streptococci of the LSP strain at a dose of 2 billion m.k. intraperitoneally. In the future, the effectiveness of the vaccine was assessed in the conditions of the farm on piglets.

To assess the resistance of pigs and the state of the immune response of vaccinated pigs, hematological studies were carried out and individual cell-humoral indicators of the organism's resistance were determined according to the methods described in the relevant sources [12,13,14,15].

The digital material was subjected to statistical processing using Microsoft Excel 10 programs with the derivation of the Student's t-test.

Research results. The vaccine produced according to the IBFAHAO regulation developed by us was sterile. After administration to white mice, it turned out to be harmless, did not cause deviations in their physiological status. When

challenged with a virulent culture of streptococci, all twice vaccinated white mice were resistant (immunogenicity 100%).

To determine the immunogenicity of the IBFAHAO vaccine, experiments were carried out on 3 piglets at the age of 14 days. Post-vaccination complications were not observed, except for the appearance of a small swelling at the injection site, 5-8 mm in diameter, which disappeared completely after 7-10 days. All vaccinated piglets after infection remained without visible clinical changes during the observation period (1.5 months). Unvaccinated piglets (2 animals) fell ill and died on the 8th and 12th days after infection. During bacteriological studies of the pathological material obtained from them, streptococci were isolated. The results of the experiment with the control infection with streptococci testify to the high immunogenicity of the tested drug.

Subsequently, experiments were carried out in a pig farm, unfavorable for streptococcosis. In the conditions of the farm, 14-18 day old piglets were vaccinated with an experimental series of IBFAHAO vaccine.

The research results are summarized in table 1.

Table 1 – *Antibodygenesis and safety of vaccinated piglets*

№	Number of pigs in a group	Vaccine dose, cm^3	Safety		Antibody titers	
			%	death (animals)	60 days	180 days
1	70	2,0 3,0	97,1	2	1:32 -1:64 (av.51)	1:16-1:32 (av. 25)
2	10	5,0 5,0	70	3	1:16-1:32 (av. 25)	1:8 - 1:16 (av. 14)

Immunological restructuring in vaccinated piglets was accompanied by the production of specific antibodies, titers of which after 2 months were 1:32 ... 1:64 (51 on average). Antibodies remained at a fairly high level for 180 days after vaccination at an average of 1:25. In piglets vaccinated with a commercial vaccine (associated polyvalent against salmonellosis, pasteurellosis and streptococcosis), antibody titers were on average 2 times lower.

The death of piglets in both groups was not due to streptococcosis, which was confirmed by laboratory tests.

The results of hematological studies are presented in table 2. The content of erythrocytes, hemoglobin, total protein after vaccination did not undergo significant changes.

Table 2 – *Piglet hematological parameters (n=3)*

Indicators	Before and after (14 days) vaccination	
Erythrocytes(10^{12}/l)	7.2±0.22	7.7±0.21
Hemoglobin(g/l)	104.6±2.32	108.8±2.51
Leukocytes(10^9/l)	27.1±1.41	28.6±1.13
Total protein (g/l)	55.1±0.31	56.1±0.25
Albumin(g/l)	21.8±1.34	22.3±1.41
Globulins(g/l)	73.7±1.23	79.2±1.12

The total number of leukocytes increased by 5.5% and globulins - by 7.4%. 14 days after vaccination, certain changes were noted in the piglet leukoformula (table 3). After vaccination, the number of stab neutrophils increased 1.4 times, against the background of a decrease in segmented neutrophils and monocytes by 2.8 and 2.5%, respectively. The content of lymphocytes after vaccination increased by 6.6%.

Table 3 - *Piglet blood leukoformula*

Indicators	Units	Before and after (14 days) vaccination	
Neutrophils: stab	%	3.4±1.12	4.8±1.12
segmented		8.1±0.72	5.3±0.66
Eosinophils	%	6.3±0.81	5.1±1.08
Basophils	%	0.1±0.02	0.11±0.01
Monocytes	%	7.1±0.81	4.6±0.07
Lymphocytes	%	75.1±4.13	80.1±3.15

Certain changes were observed in piglets in terms of natural resistance, characteristic of the immune response (table 4).

Table 4 – *Indices of natural resistance of piglets before and after two-fold immunization with IBFAHAO vaccine.*

Indicators	Units	Before and after vaccination	
Lysozyme activity	%	12.3±0.67	14.6±0.78
Phagocytic activity	%	47.3±1.65	55.3±1.83
Phagocytic number	c.u.	4.1±0.3	5.1±0.3
HCT test (CB)	%	7.8±0.4	10.2±0.6
HCT test (AB)	%	62.8±2.36	66.8±2.13

In particular, after vaccination there was an increase in lysozyme activity of blood serum (by 1.8%), phagocytic activity (FA) and phagocytic number (FP) by 17 and 24%, respectively. An increase in the functional activity of blood neutrophils was observed in spontaneous (SV) (by 30%) and stimulated (AB) (10%) variants of reactions.

Conclusion. As a result of the studies, it was established that the inactivated formol-aluminum hydroxide (IBFAHAO) vaccine prepared against swine streptococcosis is harmless and creates intense immunity in laboratory animals and piglets. Immunological restructuring of the piglets' organism after double vaccination is accompanied by antitelogenesis and a certain restructuring of the cellular-humoral parameters of the organism's resistance, characteristic of the vaccine process. The vaccine produced according to the developed regulations can be recommended for use in dysfunctional farms for the prevention of swine streptococcosis.

References

1. Tikhomirov, A.I. Marketing analysis of the effectiveness of the development of animal husbandry in modern conditions / A.I. Tikhomirov // Bulletin of Agrarian Science– 2017. №5(68) – P.113-115.

2. Tsoi, L.M. Prospects for the development of pig breeding in the Russian Federation / L.M. Tsoi // Mechanization, automation and machine technologies in animal husbandry – 2019. – №1(29). – P.25-28.

3. Shakhov, A.G. Etiology and prevention of gastrointestinal and respiratory diseases of calves and pigs / AG. Shakhov / Actual problems of young animals in modern conditions // Materials of the International Scientific Conference – Voronezh- 2002-P.3-8

4. Gaffarov, Kh.Z. Mono- and mixed infectious diarrhea of newborn calves and piglets / Kh.Z. Gaffarov, A.V. Ivanov, E.A. Nepoklonov, et al. – Kazan: Publishing house "Feng", 2002.-592P.

5. Sidorov, M.A. Immune status and infectious diseases of newborn calves and piglets / M.A. Sidorov, Yu.N. Fedorov, O. M. Savich // Veterinary Medicine. – 2006 – №11. – P.3-5.

6. Simonov, I.I. Analysis of the incidence of young animals in the farms of the Volgograd Oblast / I. I. Simonov // Veterinarian.-2005-P. 19-23.

7. Lamarin, A.A. Pig diseases: textbook / A. A. Lamarin, I. A. Bolotskiy, A. I. Baraikov. – SPb.: Doe, 2008. – 640P.

8. Bolotsky I. A. Streptococcosis of pigs / I. A. Bolotsky, A. K. Vasiliev, S. V. Prutsakov, V. I. Sementsov / Veterinary Medicine of the Kuban -2010. – №1. – P. 8-9.

9. Abramov, S.V. Solution to the problem of streptococcosis – maymoxy 10 microgranulates / S.V. Abramov // Pig breeding.-2016.-№7-P.26-30.

10. Kostikov, M.P. Vaccine prophylaxis of pneumococcal infection and influenza in autoimmune diseases / M.P. Kostikov, A.A. Tarasova- M.: Publishing and Printing Group MDV – 2009.- 249 P.

11. Mayansky, N.A. Serotypic diversity and resistance of pneumococci / N.A. Mayansky, N.M. Alyabyeva, A.V. Lazarev et al. // Bulletin of the RAMS-2014. – №7-8. – P. 38-45.

12. Labinskaya, A.S. Microbiology with the technique of microbiological research / A.S. Labinskaya M. Medicine- 1986.-394P.

13. Antonov, B.I. Laboratory research in veterinary medicine. Bacterial infections / B.I. Antonov. – M. – 1986. – 352P.

14. Alimov, A.M. Investigation of the NBT test to determine the immunological restructuring of the body during vaccination and brucellosis infection / A.M. Alimov // Problems of ecological, radioactive and epizootic monitoring. Materials of the scientific-practical conference dedicated to the 45th anniversary of the FGNU VNIVI, Kazan – 2005.- P. 233-236.

15. Workshop on biochemistry with the basics of physical colloidal chemistry / Edited by A.M. Alimova // Kazan, FSBEI HPE «Kazan State Academy of Veterinary Medicine named after N.E. Bauman." – 2012. – 236P.

16. Pigs and science make a great couple [electronic resource]- Available at: https://www.positiveaction.info/pollfs/stars/AB%20Neo-YPT.1-8-2015

17. FAO - on the perspective of the world meat market [Electronic resource] Access: https://www.meat-info.ev/bo/articles/meat/item

DOI 10.34660/INF.2021.93.51.024

STUDYING OF VECTOR OPTIMIZATION PROBLEM UNDER CONDITION OF TOLERANCE

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Annotation. *In the given work the problem of decision-making under condition of tolerance, which is one of many problems in the filed of mathematical optimization and decision making theory has been considered. Also, the relevance of this work has been shown, as the conditions under which optimization under condition of tolerance can be applied. After that, the definitions of tolerant spaces and of conditions of tolerance has been given. Then, a scalar model of optimization under condition of tolerance has been considered. And, finally a two vector models of interest intersection - the one with artificial tolerance and the one with natural tolerance has been shown.*

Keywords: *mathematical optimization, decision-making, vector optimization, decision-making under condition of tolerance .*

1. Introduction

Recently, models of vector optimization received a lot of attention, as its formalism allows to substantially increase a level of adequacy in the real cases of decision-making. There are a lot of reasons for switching from scalar to vector criteria of optimization. It could be plurality of criteria (goals), also it could be plurality of subsystems of the integral system, or it might be dynamics of processes and different kinds of quality uncertainties [1, 8].

The investigator of the problem of vector optimization mostly agreed, that the number one natural step in this case must be selection of the Pareto set [4,5]:

$$X \backslash X^S = S^P, \tag{1}$$

where X^S - is defined as a set of agreement, in which any solution can be improved without any losses, X^P - the Pareto set, and X - a set of alternatives.

Often, solution of the problem is limited by equation (1), and the Pareto set is presented as the optimal solution of the formal problem [5].

It should be noted, that in real cases, it's frequently required either to find the only one optimal solution x^0, or to determine quite narrow optimal subset X^0. But till now, there is no a unified approach for solving this problem. We need to note, that it was proposed to use a zoning method for some cases [8].

This paper discusses another approach based on the ideas of a tolerant space. In addition, the introduction of conditions of tolerance puts forward a number of fundamentally new methods of choice.

2. Tolerant spaces and conditions of tolerance

"*Tolerance*" is a word, which can be understood widely. Literally it means "*patience*". In modern discourse, it can be interpreted as "indifference, indistinguishability in different spheres of human activity." In decision-making problems, and especially in vector optimization problems, tolerance plays a very important role. Here it comes to light in the process of formalizing specific tasks. Let's introduce some definitions.

Definition 2.1. Let X be some random set, elements of which $x,x' \in X$ are so close to each other, so it is impossible to distinguish them. Hence, we will say, that x and x' are related with an relation of tolerance or are within a relationship of tolerance: $x \sim x'$.

Definition 2.2. Let X be some random set, elements of which $x,x' \in X$ are quite different, so they can be easily distinguished. Hence we will say, that x and x' are not tolerant and they are are outside the relation of tolerance, which means: $x \not\sim x'$.

Consequently, we can define the relation of tolerance as follows.

Definition 2.3. Tolerance τ is a binary relation of indistinguishability, which is given on a set of pairs. Then any set or space X, on which the relation of tolerance is determined τ, shall be called as tolerant space (X,τ).

Now, the intuitive idea behind the concept of tolerant spaces is clear enough. We can move in such a space within the limits of tolerance without noticing the difference.

Definition 2.4. The situation when the tolerance relation is defined in the formalized selection problem will be called the tolerance conditions, and, accordingly, the model is the optimization model under the tolerance conditions.

It should be noted, that the tolerance relation is not transitive. If $a \sim b$ and $b \sim c$, it does not necessarily result in $a \sim c$. The introduction of tolerance leads to a change in the structure of space, distorts the nature and properties of other relations, including transitivity.

Tolerance in vector optimization problems allows you to create a number of fundamentally new methods of solutions based on the ideas of nonindistinguish-

ability, transform the known solution methods and remove the uncertainty of choosing the principle of optimality. In this case, both natural tolerance, determined from the conditions of the problem, and artificial, specially introduced for the implementation of specific principles of optimality in models, can be used.

To begin with, consider the simplest scalar model of choice in terms of tolerance.

3. Scalar optimization model under tolerance conditions

Let x be a solution, which is defined on set X. The quality of solution is rated by criteria $x \to y(x) \in R'$. There is a tolerance relation τ defined on R'. Then we have a model:

$$X^0 = X \cap \{x^0 | y(x^0) \geq \max_{x \in X} y(x) - \tau\}. \quad (2)$$

Thus, instead of a single optimal solution, we obtain an optimal subset of X^0 solutions that are equivalent under tolerance conditions τ:

$$x_1^0, x_2^0 \in X \Rightarrow x_1^0 \sim x_2^0 \Rightarrow |y(x_1^0) - y(x_2^0)| \leq \tau. \quad (3)$$

The composition of the order relation $\succ$ and the tolerance relation τ led to a new relation (the principle of optimality):

$$x^0 \succ x \Rightarrow y(x^0) \geq y(x) - \tau. \quad (4)$$

Often the tolerant approach is mixed with approximate methods for solving mathematical programming problems, when, in order to simplify the calculation procedure, a solution is searched for close to the optimal one. In this case, there is a ”*coarsening*” of the models and a departure from the exact optimum on the basis of the tolerance conditions corresponding to the statement of problems.

After we have considered scalar models in terms of tolerance, let’s move on to vector models.

4. Vector optimization models under conditions of tolerance

Let the quality of solutions $x \in X$ be rated by vector criteria:

$$x \to y(x) = \{y_j\}_{j \in J} \in R^m. \quad (5)$$

Also let the criteria space define the priority relation:

$$\lambda = \{\lambda j\} j \in J \in Rm, \quad (6)$$

and tolerance relation:

$$\tau = \{\tau j\} j \in J \in Rm, \quad (7)$$

where τ_j is the measure by j coordinate R. Thus, we get:

$$(X = \{x\}; y = \{x \to y_j(x)\}; \lambda = \{\lambda_j\}; \tau = \{\tau_j\}; j \in 1,...,m). \quad (8)$$

The model (8) is a vector optimization model with priority under tolerance conditions and covers almost the entire class of vector optimization models.

Now let us consider the methods of searching for X^0, which are fundamentally possible only in conditions of tolerance.

4.1 Model of intersection of interests with artificial tolerance

For each j local criterion $y_j(x)$ and tolerance τ_j defined on it, local optimal subsets X_j^0 are determined and the interests of all criteria are matched by the intersection method:

$$X^0 = \cap X_j^0(y_j;\tau_j), \tag{9}$$

where $X_j^0 = X \cap \{x^0 | y(x^0) \geq \max_{x \in X} y_j(x) - \tau_j\}$.

The idea behind this model is quite simple. Since each of the subsets X_j^0 consists of tolerant solutions that are optimal with respect to the j criterion, and we do not care which particular solution on X_j^0 will be chosen, then, naturally, the intersection of all X_j^0 gives the general consensus solution.

4.2 Model of intersection of interests with natural tolerance

Unfortunately, this method often does not work within the framework of the natural tolerance generated by the problem conditions, since the intersection $\cap X_j^0$ turns out to be empty. In this case, a model with artificial tolerance is applied, i.e. an increase in the level of tolerance is carried out, exceeding the natural level until the matching condition $\cap X_j^0 \models \varnothing$ is satisfied, in this case we will have:

$$\begin{gathered} X \supset X_1^0 \supset X_2^0 \supset \ldots \supset X_m^0 \equiv X^0,\ X_1^0 = X \cap \{x^0 | y_1(x) \geq \max y_1(x) - \tau_1\},\ x \in X \\ Xj0 = Xj0{-}1 \cap \{x0 | yj(x0) \geq \max y1(x) - \tau 1\}, \\ X^0 \equiv X_m^0 = X_{m-1}^0 \cap \{x^0 | y_m(x^0) \geq \max y_m(x) - \tau_m\}. \end{gathered} \tag{10}$$

Thus, at each j stage of the search due to tolerance, a local subset of tolerant solutions by the j criterion is determined - X_j^0, which is returned as an admissible set for the next most important criterion y_{j+1}. As a result, there is a sequential narrowing of the admissible set X to the optimal subset of X^0, taking into account the interests of all criteria, but subject to the principle of strict priority.

The model 10 can be used in the case of flexible priority of criteria, by transforming natural tolerance or by introducing artificial tolerance, taking into account the priority vector λ. However, in this situation, the difficult task of arguing the transformation arises $(\tau,\lambda) \rightarrow \tau^*$ according to the chosen compromise scheme.

References

1. Kolbin V. V. Stochastic Programming. Springer Netherlands, 1977. 196 p.

2. Kolbin V. V. Macromodels of the National Economy of the USSR. Methodological aspects. Holland, Dordrecht: D. Reidel Publishing Co., 1985. 465 p.

3. Kolbin V. V. Decision Making and Programming. Singapore: World Scientific Publishing Co., 2003. 745 p.

4. Kolbin V. V. Systems Optimization Methodology. Part 2. Singapore: World Scientific Publishing Co., 2001. 380 p.

5. Kolbin V. V. Systems Optimization Methodology. Part 1. Singapore: World Scientific Publishing Co., 2000. 485 p.

6. Petrov M. M, Kolbin V. V. One approach to the problem of multiobjective optimization solutions improvement // Proc. Int. Conf. “Process Management and Scientific Developments”, Birmingham, UK, 2020. P. 45–48.

7. Petrov M. M, Kolbin V. V. One approach to researching the priority problem in the tasks of multi-object optimization // Proc. Int. Conf. “Process Management and Scientific Developments”, Birmingham, UK, 2020. P. 49–53.

8. Yudin D. B. Computational methods in decision theory, M.: Nauka, 1989.

9. Petrov M. M, Kolbin V. V. / Effective and Self-ffective Solutions for Multi-objective optimization. International Conference“Process Management and Scientific Developments”, Birmingham, United Kingdom (Novotel Birmingham Centre, December 19, 2020). 2020.

DOI 10.34660/INF.2021.67.91.025

RUSSIAN FAR EAST: DEMOGRAPHIC PROCESSES IN THE FORMATION OF LABOR POTENTIAL

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Abstract. *The socio-demographic situation in the Russian Far East for three decades has been characterized by a steady downward trend in the resident population, which negatively affects the formation and use of the region's labor resources. The main reason for this situation is interregional migration outflow. The priority of state policy in the Far East is to regulate labor potential, rationalize the structure of employment and population by influencing migration flows.*

Keywords: *labor potential, population, employment, unemployment, migration, the Far East.*

Introduction

The Russian Far East has become a strategic area at the national level and "a national priority for the entire XXI century." In modern conditions, sustainable economic growth is ensured not only by economic and natural resource potential, but above all, by the population living in a given territory, the structure and dynamics of demographic indicators, and the quality of the workforce capable of implementing large-scale projects.

The main problems hindering the economic development of the region are the unfavorable demographic situation, the long-term large-scale outflow of the population and the associated shortage of labor resources.

Purpose of the study – to assess the possibilities of forming the labor potential of the Russian Far East at the expense of its own demographic resources.

Materials and methods

To assess the formation of the labor potential of the Russian Far East, the data contained in the information and statistical materials prepared by the Federal State Statistics Service were used. To assess the demographic resources of the region, the features of changes in the natural and migration movement and their impact on the process of formation of labor potential are analyzed.

Results and discussion

Despite the introduction of a number of institutional decisions, there have been no changes in the demographic sphere. The process of reducing the resident population in the Far Eastern Federal District (FEFD) continues. As of January 1, 2020, the population was 8,169.2 thousand people (taking into account the Republic of Buryatia and the Zabaykalsky Krai, which became part of the district at the end of 2018), compared with the beginning of 2019, decreased by 19.4 thousand people. The largest losses in the resident population were incurred by the southern regions located in more favorable natural and climatic conditions with a more diversified economy - Primorsky Krai (6,850 people), Khabarovsk Krai (5,830 people), Amur Oblast (3,150 people). In the Far East North, the population decreased by 4,173 people. The Republic of Sakha (Yakutia), the Republic of Buryatia are the subjects where the population increased by 4,987 and 2,664, respectively, due to the excess of natural growth over the migration outflow.

The continuing decline in the demographic potential of the region is mainly a consequence of the migration outflow of the population, which in 2018-2019 exceeded the natural population decline by 4.5 times. In 2019, the negative balance of migration decreased (minus 10,539 people) compared to 2018 (minus 33,145 people), due to a decrease in the ratio of the number of departures to arrivals in the FEFD: in 2018 there were more departures by 10.1%, in 2019 - by 3.2%. A negative migration balance is typical for most of the Far Eastern regions (except for the Republic of Buryatia, Chukotka Autonomous Okrug of Primorsky Krai, Amur Oblast) and it is formed due to the interregional migration flow, and migration with the countries of the near and far abroad slightly compensates for it.

The factor of population decline, along with the migration outflow, is the natural decline, which has been observed in the FEFD since 2017 (in 2012-2016, the decline in the population was compensated by natural population growth). In 2019, the population of the region, as a result of natural decline, decreased by 8,881 people (2018 - 883 people, 2017 - 142 people). The reason for the natural decline in the population is the continuing decline in the birth rate of the population against the background of an increase in the death rate of the population. Due to the younger age structure of the population and ethnic composition, the birth rate in the region (11.9 $^{o}/_{oo}$, 2019) exceeds the national average (10.9 $^{o}/_{oo}$, 2019) [1]. All Far Eastern subjects are characterized by a decrease in the number of births as a result of a decrease in the number of women of reproductive age due to low fertility in the 1990s. This trend will continue in the near future. Natural growth was preserved in the Republic of Sakha (Yakutia), the Republic of Buryatia, Chukotka Autonomous Okrug.

Despite the population loss, the age structure of the FEFD differs from the national one. Intensive migration processes of the previous decades have formed a

population here with a predominance of young ages. The share of the population under the working age in 2018 was 20.9% (tab. 1), yielding in this indicator to the Southern Federal District (18.2%), the Siberian Federal District (20.3%), and the Urals (20.5%). In the Far Eastern regions, there is a low proportion of people over working age - 22.3% (RF - 25.9%), lower only in the North Caucasus (18.4%) and a high proportion of people of working age - 56.8% (RF– 55.4 %). But in recent years, there has been a tendency not only for a quantitative decrease in the working-age population, but also for its qualitative deterioration - the aging of the economically active part of the population. This is due to the exhaustion of the possibilities for its growth, due to the transition of the part of the population born to the population that is well-off from the demographic point of view, to the category older than the working age, but most importantly, by the migration outflow.

Predictive estimates indicate a worsening of the situation with the age structure of the population, a limitation of the needs of the economic complex in labor resources, an increase in the demographic burden of the elderly on citizens of working age [3]. Therefore, despite the fact that the FEFD has a low and declining level of general unemployment in recent years (7.4% in 2011 and 6.3% in 2018), the region is interested in attracting labor resources, since employers feel the need for labor resources. The lack of personnel in a number of industries in certain specialties, the discrepancy between the need for labor and the availability of labor resources in the territorial and sectoral sections leads to the attraction of foreign labor migrants. Large consumers of foreign labor are Primorsky and Khabarovsky Krai, Sakhalin Oblast (tab. 2). In recent years, thanks to measures taken at the federal and regional levels, the scale of the registered number of foreign labor migrants in the FEFD has begun to decline. In the period 2011-2018, the number of foreign citizens who had a valid work permit decreased by 3.8 times, and the number of labor migrants who had a patent for employment decreased from 78.1 thousand to 66.7 thousand people. The bulk of labor migrants are in the shadows, shaping the processes of illegal migration and latent employment of foreign labor.

It would be expedient to satisfy the need for workers by increasing labor mobility and attracting people to the region from other Russian territories. But FEFD itself is a donor of other subjects of the Russian Federation, which lack labor resources.

Table 1

Change in the age structure of the population in FEFD subjects, % [5]

	younger than working age		**working age**		**over working age**	
	2011	**2018**	**2011**	**2018**	**2011**	**2018**
The Russian Federation	16.5	18.7	60.9	55.4	22.6	25.9
Far Eastern Federal District	18.6	20.9	62.3	56.9	19.1	22.2

The Republic of Buryatia	21.7	24.6	61.0	54.8	17.3	20.6
The Republic of Sakha (Yakutia)	23.5	24.8	63.1	57.6	13.4	17.6
Zabaykalsky Krai	21.0	22.8	61.4	56.3	17.6	20.9
Kamchatka Krai	17.4	18.8	64.7	60.2	17.9	21.0
Primorsky Krai	15.6	17.9	62.4	57.0	22.0	25.1
Khabarovsk Krai	16.0	19.1	62.9	57.7	21.1	23.2
Amur Oblast	18.5	20.5	61.3	56.2	20.2	23.3
Magadan Oblast	17.1	18.9	65.3	59.1	17.6	22.0
Sakhalin Oblast	17.0	19.7	62.7	56.6	20.3	23.7
JAO	18.9	21.1	61.1	55.6	20.0	23.0
CAO	22.2	23.1	67.0	61.7	10.8	15.2

Therefore. "by means of migration policy that relies on attracting migrants from other regions of the country. this problem cannot be solved" [4].

In 2018. the number of unemployed in the FEFD amounted to 272 thousand people, a decrease in comparison with 2011 by 83 thousand people (tab. 3). The unemployment rate was 6.3%. which is the lowest value for 2000-2018. A decrease in the unemployment rate was typical for all (except for the Republic of Buryatia, Magadan Oblast) FEFD subjects. Regional differences also persist: low unemployment rates in recent years have been recorded in Chukotka Autonomous Okrug (3.1%), the highest in Zabaykalsky Krai (10.2%), the Republic of Buryatia (9.3%). Problems in the regional labor market are associated with the predominance of single-industry settlements, limited mobility of the population due to large distances between local labor markets [2].

Table 2

The need for workers, declared by employers to the bodies of the employment service, and the number of foreign citizens, with a valid work permit in the FEFD [5]

	The need for workers declared by employers to the employment service, people		**Foreign citizens with a valid work permit, people**	
	2011	**2018**	**2011**	**2018**
Far Eastern Federal District	10 8534	20 2615	90 774	23 830
The Republic of Buryatia	6 594	10 194	2 269	558
The Republic of Sakha (Yakutia)	8 696	9 312	9 668	637
Zabaykalsky Krai	2 431	15 248	8 647	3 244
Kamchatka Krai	4 359	6 016	5 003	16
Primorsky Krai	49 475	65 044	30 624	5 837
Khabarovsk Krai	15 317	16 650	12 073	4 879

Amur Oblast	8 588	55 714	7 386	4 677
Magadan Oblast	3 185	2 770	586	300
Sakhalin Oblast	6 425	12 508	10 843	1 700
JAO	2 807	7 979	3 363	1 948
CAO	657	1 180	672	34

In 2018, the employment rate in the FEFD was 61% (2011 - 62.8%. 2015 - 64.2%). Among the Far Eastern territories, a high level of employment is observed in Chukotka Autonomous Okrug (75.4%). the smallest is in the Republic of Buryatia (54.6%).

According to the Agency for the Development of Human Capital in the Far East, in accordance with the implementation of measures to increase the indicators of socio-economic development of the FEFD, significant growth in employment is expected in such industries, as the extraction and processing of oil and gas; coal mining, ore and gold; fishing and aquaculture; timber industry.

Table 3

Workforce in FEFD, thousand people [5]

	Labor force		**including**				**Unemployment rate. %**	
			employed		**unemployed**			
	2011	**2018**	**2011**	**2018**	**2011**	**2018**	**2011**	**2018**
Russian Federation	75 779	76 190	70 857	72 532	4 922	3 658	6.5	4.8
Far Eastern Federal District	4 456	4 319	4 101	4 047	355	272	7.9	6.3
The Republic of Buryatia	464	456	422	415	42	41	9.0	9.3
The Republic of Sakha (Yakutia)	492	500	448	465	44	35	9.0	6.9
Zabaykalsky Krai	535	532	478	477	57	55	10.6	10.2
Kamchatka Krai	192	179	180	170	12	9	6.1	4.9
Primorsky Krai	1 062	1 040	977	984	85	56	8.0	5.4
Khabarovsk Krai	751	728	701	701	50	27	6.6	3.8
Amur Oblast	450	410	423	387	27	23	6.0	5.6
Magadan Oblast	102	88	97	84	5	4	4.5	5.0
Sakhalin Oblast	288	277	265	262	23	15	7.9	5.3
JAO	87	79	79	73	8	6	8.5	7.0
CAO	33	30	31	29	2	1	5.6	3.1

According to the order of the Government of the Russian Federation № 1234-r dated June 7, 2019, at present, in all Far Eastern regions, the attraction of labor resources is a priority. Inclusion in this list of the Republic of Buryatia, Republic of

Sakha (Yakutia), Zabaykalsky Krai and Jewish Autonomous Oblast are aimed at meeting the needs of employers in qualified personnel due to the lack of specialists in the regional labor markets with the necessary qualifications. The decision will contribute to the employment of more than 400 people in 2020-2022, as well as attracting labor resources to FEFD territories strategically important for the state.

According to analysts' estimates [6], the main trends in the labor market in the FEFD are: high demand for specialists in working specialties; the popularity of shift work; higher average wages for a number of vacancies due to a shortage of qualified personnel.

Conclusions

Thus, the most important tasks for solving the demographic problems of the Far Eastern Federal District is the migration outflow of the population, and among the priorities, both in scientific research and in practical actions, it should take first place. The next in importance is the solution of the problem of creating attractive conditions for migrants from outside, on the one hand, in order to ensure the growth of the demographic potential of the territory, and on the other hand, additional labor resources to build up the social and infrastructural complex. At the same time, a differentiated approach to the components of this flow and expectations from the participation of certain groups of migrants in the life of the region is important. And the third task in this series is to assess the possibilities for increasing the intensity of reproduction processes.

The research results presented in the article were obtained within the framework of the state assignment of the Ministry of Education and Science of the Russian Federation (the topic "Geographic and geopolitical factors in the inertia, dynamics and development of various ranks of territorial structures of the economy and settlement of the population of Pacific Russia", № AAAA-A16-116110810013-5. Section 2).

References

1. Natural movement of the population of the Russian Federation in 2019 URL: https: //gks.ru/bgd/regl/b19_106/Main.htm (appeal date: June 2020).

2. Zubarevich N.V., Burdyak A.Ya., Hasanova R.R., Mkrtchyan N.V. Social Development and Demography of Russian Regions: Autumn Trends in 2018 // Economic Development of Russia. 2019. V. 26. № 2. P. 76-90.

3. Lisitsyn Yu.P. Public health and health care: textbook. 2nd ed. M.: GEOTAR – media, 2010. 512 P.

4. Mkrtchyan N. Far Eastern Migration: How to Manage? URL:https:// eastrussia.ru/material/dalnevostochnaya-migratsiya-like.../ (appeal date: July 2020).

5. Regions of Russia. The main characteristics of the constituent entities of the Russian Federation. 2019: Stat. Coll. /Rosstat. – M., 2019. – 766 P.

6. Labor market of the Far East: salaries, trends, prospects // Agency for the Development of Human Capital in the Far East.2019. 27 P. URL: https:// hcfe.ru/ uplpad/iblock/516/rinok. pdf (appeal date: July 2020).

7. The size and migration of the population of the Russian Federation in 2018 URL: https: //gks.ru/bgd/regl/b19_107/Main.htm (appeal date: June 2020).

8. The size and migration of the population of the Russian Federation in 2019 URL: https: //gks.ru/bgd/regl/b20_107/Main.htm (appeal date: June 2020).

DOI 10.34660/INF.2021.21.35.026

INVESTIGATION OF THE STRESS-STRAIN STATE OF THE FROZEN MASS, LEADING TO A CHANGE IN THE CYLINDRICAL SHAPE OF THE ICE WALL

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Abstract. *Among the specific features of modern underground construction is an increase in the depth of deposits and, as a consequence, the complexity of mining and geological conditions, which, in turn, is connected with increasing the depth of unstable watered rocks, which require special construction methods, in particular, the artificial freezing of rocks. These conditions include high rock and hydrostatic pressures, heat flows and other factors that complicate the sinking process. Under such conditions, the existing calculation models, which consider the ice wall as a homogeneous isotropic body of a regular circular shape, distort the actual picture of the frozen mass stress-strain state. The paper substantiates the need to develop new ice wall calculating models and methods, taking into account the unfavorable combination of geological and technological factors.*

Keywords: *ice wall, stress-strain state, calculating models, safe design solutions*

New mineral deposits are characterized by complex geological and hydrogeological conditions. Construction of barrels in such conditions is possible only with the use of special methods.

As the world experience in underground construction shows, one of the most versatile and reliable special methods is the method of freezing rocks. In mining practice, using the method of freezing rocks, 70-75% of all vertical shafts are constructed in difficult conditions.

Today, deposits are being developed at depths that have passed the 1000 m mark.

Today, there are several groups of methods for calculating the parameters of an

ice wall, based on analytical design schemes. In calculations, the shape of the ice wall is assumed to be cylindrical with uniform surfaces.

However, these design schemes do not take into account that with an increase in the depth of the fields being developed and, consequently, the depth of the shafts, traversed by the method of artificial freezing, the load on the ice wall increases significantly. In addition, the stress-strain state of the ice wall is significantly influenced by mining and technical factors, such as the effect of lining, temperature fields, which in total affects the shape of the outer contour of the ice wall, its reliability, strength and stability.

Unfortunately, due to the deviation of the shape and dimensions of the ice wall from the design, its surfaces are uneven, which causes an incorrect setting of the external load on the surface of the ice wall, thereby leading to a difference in the stress-strain state of the ice wall from the calculated one.

In addition, the reliability of the ice wall is often negatively affected by the rigidity of the ice wall. It was found from practical experience that the higher the stiffness index of the ice wall system, the higher the stress concentration around the ice wall itself. Excessive rigidity of the ice wall leads to the formation of asymmetric stress-strain state of the frozen rock mass, which increases with the depth of the shaft.

In such fields as Gremyachenskoye in the Volgograd Oblast, Nivenskoye, in the Kaliningrad Oblast, the thickness of the aquifers also increases, which often leads to an increase in the temperature of the rocks, an increase in stress and the development of plastic deformations during shaft sinking, to deformation and destruction of freezing columns, violation of the stability of ice wall and water breakthrough into the trunk. At the same time, as the quantity and thickness of clay layers increases, the thickness and strength of the ice wall decreases, which leads to a large displacement of the ice wall and the bottom.

At high loads on the outer contour of the ice wall, the latter works like a pipe that loses its stability, which corresponds to a critical loss of stability with deformation of the ring into an ellipse. In addition, as stated in [2], along with the main forms of buckling, there are also transitional forms of critical buckling, and the deformation in the transitional form can be deeper than in the basic one.

During the formation of the ice wall, as already noted, its shape and dimensions deviate significantly from the design ones, as a result of which the mechanical characteristics of the frozen rocks and, therefore, the stress-strain state in the ice wall walls will differ from the calculated ones. The thickness of the ice wall especially influences the acting stresses.

It should be noted that in the calculation of the ice wall, its shape is taken to be cylindrical with uniform surfaces. However, due to the unevenness of the processes taking place, in some cases the shape of the ice-rock cylinder may be oval. The

deviation of the shape and dimensions of the ice wall from the design ones causes an incorrect setting of the external load on the surface of the ice wall, thereby leading to a difference in the stress-strain state of the ice wall from the calculated one.

It is known that the strength of frozen rocks largely depends on the magnitude of their negative temperature [3]. In this regard, the question of the distribution of temperatures in the ice-soil wall becomes of great importance (Table 1).

Table 1. *Compressive strength of frozen soil*

Soils saturated with water	Compressive strength (in MPa) at temperature, C°				
	From-1 to-5	From-5 to -10	From-10 to -15	From-15 to-20	From-20 to -25
Sand	2.5-8.5	8.5-12.7	12.7-14.4	14.4-15.2	15.2-18.0
Sandy loam	2.0-6.5	6.5-8.8	8.8-10.5	10.5-12.2	12.2-14.0
Clayey	1.5-4.5	4.5-6.0	6.0-7.5	7.5-9.5	9.5-10.0
Dusty	1.0-1.5	1.5-3.5	3.5-4.5	4.5-6.5	6.5-7.0

Consequently, the determination of the strength of the developed frozen rocks in the face at the design stage is of great importance. For this, the values of the strength of the frozen rocks at various points of the ice wall must be determined. Since it is almost impossible to measure the strength value in a frozen massif, we will use the relationship between the strength of rocks and temperature at each point.

To determine the average temperature of the ice wall, it is necessary to know the temperature distribution in three characteristic planes: axial, passing through the axes of two adjacent freezing columns, the main one passing through the axes of the freezing columns perpendicular to the line of their location, and the interlocking one, passing through the key line parallel to the axes of the freezing columns and perpendicular to the line of their location. In each of these planes, the temperature distribution has specific features and is described by various equations, while the temperature value at the point of intersection of the axial and locking planes is of greatest practical interest.

In the main plane, the temperature is calculated by the formula:

$$t_r = t_{cn} \frac{\ln \frac{\xi}{y}}{\ln \frac{\xi}{r_0}} \qquad (1.1)$$

In the locking plane, the temperature

$$t_{зм} = t_{cm} \frac{\ln \frac{2\xi}{\sqrt{4y^2 + S^2}}}{\ln \frac{\xi}{r_0}} \quad (1.2)$$

where $t_г$- temperature in the main plane,°C ;

$t_з$- temperature in the locking plane,°C ;

y- distance of the considered point from the axial plane, m;

S- distance between adjacent freezing columns, m

Since the process of formation of the ice wall is long in time, then, as follows from equation (1.2), the temperature distribution does not depend on the properties of the frozen rocks.

To simplify the calculations, the following temperature distribution assumptions are accepted;

1) in the main plane - the lowest temperature near the "soldered into the array" freezing column. Hence, the greatest strength of the frozen rock should also be in this plane.

2) in the locking plane, between the two freezing columns, the temperature in the initial period of the ice wall closing is 0.3-0.4 $t^0_{см}$, then, with an increase in the design thickness, the temperature in the locking plane may drop to 0.7 – 0.8 $t^0_{см}$.

Thus, it is assumed that the locking plane is the most reliable (Fig. 1).

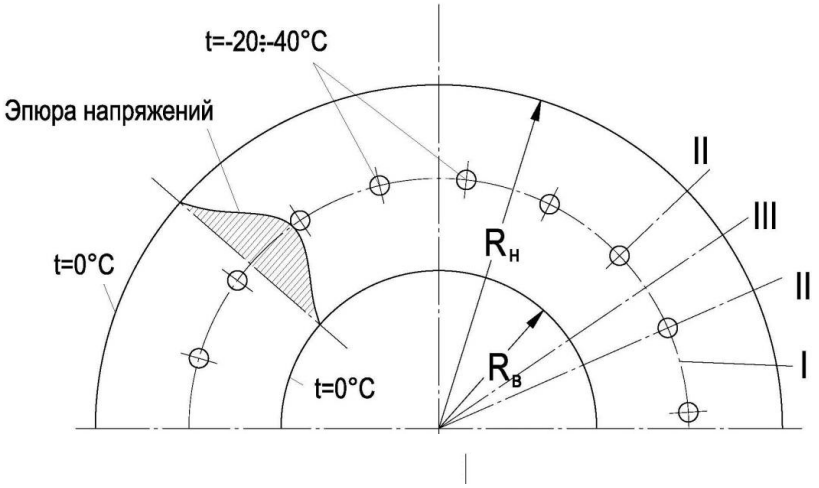

Fig.1 - *Scheme for determining the average temperature of the ice wall. $R_в$- inner radius of the ice wall; $R_н$- outer radius of the ice wall, $t=0^0$ the boundary of the ice wall*

However, in practice, the weakening of the rock mass during the drilling of freezing wells has been repeatedly recorded, therefore, the metal column is separated by the drilling fluid from the mass. At temperatures down to -10°C, ice strength is not taken into account at all [BCH189-78], and at temperatures of -20°C (normal freezing), ice strength does not exceed 1.8 MPa. For comparison, the strength of sand in similar conditions is 14 MPa, and that of clay is 7 MPa. If we consider the compressive stresses in the frozen cylinder depending on the external radial load, then in the locking plane they will be calculated, and on the annular weakening contour by the borehole in the main plane, the stress concentration coefficient near the hole should be taken into account equal to 2. Therefore, the ice wall is not a monolithic cylinder what must be taken into account in the calculations.

The deformation characteristics of the ice wall change in such a way that the ice wall begins to work in the elastic-plastic stage, which leads to the formation of a plastic zone in the ice wall. The parameters of the plastic zone are determined by the geometrical parameters of the support, and do not depend on the external load on the ice wall.

References

1. Palankoev I.M. A.V. Korchak, A.V. Kuzina Improving the efficiency of ground-freezing shaft sinking method. Sofia. – P. 85-89

2. Volmir A.S. Stability of deformable systems. – 2nd ed, rev. and add. – M.:Science: Main editorial office of physical and mathematical literature,1967

3. Baklashov I.V., Kartozia B.A. Mechanics of underground structures and support structures.– M.:Bowels, 1965.

4. HuXiangdong. Prediction of the safe state of the ice wall during shaft sinking / Materials of the round table "Scientific and technical problems of the development of environmentally friendly technologies for the construction and operation of underground structures in difficult mining and geological conditions" sci.-pract. conf. Miner's Week-97. – M.: MSUH, 1997, – P. 85-88.

5. Kuzina A. V. Systematization of the causes of damage to freezing columns during the construction of deep vertical shafts using the method of artificial freezing // GIAB. – 2006. –№11. – P.396-420.

6. Lieberman Yu.M. Method for calculating the wall thickness of an ice-bearing cylinder. Freezing of rocks during shaft sinking. –M. Publishing house of the AS of the USSR, 1962. – 24 P.

Scientific publication

International Scintific Conference
"Science and innovations 2021:
development directions and priorities"

Melbourne, Australia
March 14, 2021

Signed in print 21.03.2021 г. 60x84/16.
Ed. No. 2. Circulation of 500 copies.
AUSPUBLISHERS, 2021.
Infinity publishing, 2021


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