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# BIOLOGICAL SCIENCES

## SPECIES DIVERSITY AND PATHOGENIC FEATURES OF MICROMYCETES IN RESIDENCES

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**Abstract**

The presented work is dedicated to determining the status of sick buildings in residential complexes. It was determined that 52 species of micromycetes belonging to 18 genera are spread in residential buildings. It is known that micromycetes spread in the interior of residential buildings can be found in various forms such as cells, propagules, mycelial fragments, mycelial segments, etc. Therefore, the status of sick building can be applied to buildings that seriously violate mycological safety principes.

**Keywords:** residential complexes, micromycet, adhension, invasion, dissemination, micotic infection, micologial safety.

Although the recent rapid population grouth and intensive urbanization have led to the further expansion and architectural renewal of the central settlements, on the other hand. They have also exacerbated the environmental situation. Therefore, the modern city is characterired as a special ecosystem, fundamentally different from the medical biocenoses. It should be noted that the urban ecosystem, which includes the majority of the world's population, sccounts for 1,5% of the total area of the Earth [1;2]. In addition, the recent influx of people to the central cities and the increase in the number of modern residential complexes due to social problems has led to aggravation of not only the ecological but also the mycological situation. Thus, if we take into account the negative impact of the mycocomplex inside the building on human health, then it becomes clear how important it is to study these fungi. In this regard micro-organisms living inside the building are considered a risk factor for the development of a number of diseases of mycotic origin in the body and are therefore called. " The Source of disease of civilization" . Although research in this area began in the $1930_s$ , some problematic issues remain unresolved. In this regard, the study of biological ecology of micromycetes that make up the mycobiota of residential complexes is considered very relevant for the prevention, diagnosis and therapy of mycogenic sensitization [3;5;6].

Construction work is also being carried out on a large scale in Baku capital of the republic. It should be noted that the misuse of residential buildings by the residents of the building creates a real basis for the emergence of potential sources of infection in these facilities, which leads to an increase in risk factors for human health and emergence of various mycotic diseases.

The purpose of the presented work was to assess the sanitary-mycological condition in such residential buildings as one of the main principles of mycological safety.

The object of research was registered rooms of different status in 47 apartments of 25 residential buildings built in different years in Baku, including kitchen, bathroom, caridor, living room and bedroom. The area of these apartments has varied between 5-35 $m^3$. As the main criteria for the selection of mycological analysis, residents have long been living in the building and the observation of how many members of a family area observed 18 residential apartments are located on the IX-XII floors of the residential buildings and 18 on the III-VIII 18th floor and 18. Micological samples from residential buildings were taken from various status rooms from the atmosphere and the dust mass. Sedimentation and applications were used during the removal of samples. The patterns are decorated in Chapex, Chapk-Doks and Saburo nutritious environments.Clinical strains were used determine the pathogenous-ness of studied microments. For this purpose, clinical materials were obtained from the serious patients with allergis and michaosis. At the same time, the number of micromplets was calculated based on the Omelyanski formula. Experiments were repeated 4-6- times [4;7].

25 multi – storey residential buildings constructed in different areas of Baku were studied from the mycological point of view. It was found that 52 species micromycetes of 18 genera were distributed in the residential buildings registered for the study (Table 1). As can be seen from the table, the species Aspergillus and Penicillium make up half of the total mycobiota with in the mycocomplex formed in residential buildings, Characterized by a fairly wide range of species. Cladosporium and Mucor species each represent 15 species and account for 15,4% of mycobiota, Acremonium, Alternaria, Rhiropus and Ulocladium species

each consist of 2 species, 15,2% of mycobiota and representatives of the remaining lo genera account for 19,2% of the total mycobiota constitute. Among the fungi have a superior position. However, in the interior of residential buildings, dark-colored fungi, opportunistic fungi, including allergens, conventional pathogens, etc are found.

It should be noted that the number of opportunistic fungi within the mycobiota formed in residential buildings operated by humans for a long time reaches such a level that they even have the opportunity to become permanent members of the dominant nucleus. It has been established that the structural composition of the dominant care of the mycobiota formed in residential building is quite rich and consists of the following fungi: Acremonium charticola Gams; Aspergillus clavatus

Table 1.

**Structural organization of mycocomplex and species diversity for malired in residential buildings**

| S № | Fungal genera | Fungal species |
|---|---|---|
| 1 | Acremonium (1/2) | *Acremonium Strictum W.Gams;A. charticola Gams* |
| 2 | Alternaria (1/2) | *Alternaria alternata Keissl; A.tenkissima (Kunze: Fr) Wilt* |
| 3 | Aspergillus (1/14) | *Aspergillus candidus Link: A.clavatus Desm; A.flavus Link:Fr;A.fumigatus Fresen; A.glaucus Link; A.niger Tiegh; A.nidulans Winter; A.sydowii Church; A.ochraceus K.Wilh; A.repens Fischer; A.terreus Thom; A.ustus Bainier; A.versicolor (Vuill) Tirab* |
| 4 | Aureobasidium (1/1) | *Aureobasidium pullulans (de Bary) Arnaud* |
| 5 | Botrytis (1/1) | *Botrytis cinerea Pers* |
| 6 | Chaetomium (1/1) | *Chaetomium globosum Kunze:Fr* |
| 7 | Cladosporium (1/4) | *Cladosporium Cladosporioides de Vries; C.elatum (Harz) Nannf; C.herbarum (Pers;Fr) Link: C.sphaerospermum Pens* |
| 8 | Mucor (1/4) | *Mucor circinelloides Tiegh; M.hiemalis Wehmer; M.plumbeus Bonard; M.racemosus Fresen* |
| 9 | Paecilomyces (1/1) | *Paecilomyces variotii Bainier* |
| 10 | Penicillium (1/12) | *Penicillium Brevi-compactum Dierckx; P.canescens Sopp; P.chryogenum Thom; P.citrinum Thom; P.claviforme Bainier; P.funiculosum Thom; P.fraquentas West; P.decumbens Thom; P.purpurogenum Stoll; P.terlikowski Zaleski; P.janthinellum Biourge; P.verrucosum Stolk et Hedlok* |
| 11 | Rhizomucor (1/1) | *Rhizomucor pusillus (Lindt) Schipper* |
| 12 | Rhizopus (1/2) | *Rhizopus arrhizus Fiseher; Rh.nigricans Ehrenb* |
| 13 | Scopulariopsis (1/1) | *Scopulariopsis brevicaulis (Abbut) Sacc* |
| 14 | Stachybotrys (1/1) | *Stachybotrys artra Corda* |
| 15 | Stemphyllium (1/1) | *Stemphyllium botryosum Wall* |
| 16 | Sporotrichum (1/1) | *Sporotrichum Pruinosum Gilman* |
| 17 | Trichoderma (1/1) | *Trichoderma viride pers* |
| 18 | Uliclodaium (1/2) | *Ulocladium consortiale Simmons; U.chartarum Simmons* |

Desm A. fumigatus Fresen; Alternaria alternate Keissl; Cladosporium cladosporioides de Vries, Mucor plumbeus Bonard; Penicillium chrysogenum Phom; Scopulariopis brevicaulis Sacc; Stachybotrys atra Corda; Ulocladium chartarum Simmons. As can be seen, 9 genera of micromycete species participated in the structural organization of the domiant core of the mycobiota formed in the studied residential buildings. Considering that more than 60% of the clominant core consists of opportunistic fungi, then the mycological situation in such buildings is considered unsatisfactory. As a result of this, 35-40% of building residents had allergic rhinitis, 30-35% of atopic dermatitis, 20-25% of bronchial asthma and general depression.

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# PATHOGENICITY CHARACTERISTICS OF CLINICAL STRAINS BELONGING TO THE GENUS ASPERGILLUS

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**Abstract**
The presented work is devoted to the study of the characteristic features of the clinical strains of the genus Aspergillus. It was found that A. fumigatus mushroom is one of the most active representatives of conventional pathogens spreading in healthcare facilities. At the same time, it was determined that clinical strains of this fungus are the pathological agents of both allergic and invasive forms of aspergillosis.

**Keywords:** health facility, clinical strain, conditional pathogen, aspergillosis, pathological agent.

The increasing dynamics of mycotic diseases caused by conditionally pathogenic micromycetes has already been confirmed in world practice. It should be noted that the use of antibacterial and antifungal drugs during the treatment of people in various healthcare facilities, the use of a wide range of cytostatic and steroid hormones, the rescue of patients from the clutches of death by special surgical neonatological and resuscitation methods, on the one hand serve to bring people back to life, on the other on the other hand, it leads to zero or loss of their immunity. The skin, mucous membrane, and operated internal organs of such patients are easily infected with aspergillosis, candidiasis, etc. mycoses, which, as a secondary pathology, aggravates the general condition of the patient [5; 7; 8]. If it is taken into account that a large number of people lose their health in the construction and construction works, which are widespread in our republic, as well as almost every day, as a result of traffic accidents, and their treatment and rehabilitation are carried out using the same methods and in the same place, then. It becomes clear how complex the pathological condition is. At the same time, improper living conditions in modern megacities create the basis for people to be infected with mycotic diseases [1; 2; 3].

The purpose of the work was the study of clinical fungi, including various strains belonging to the genus *Aspergillus*, which become a potential source of infection in patients receiving treatment in various healthcare facilities.

Clinical strains belonging to the genus *Aspergillus* were obtained from the surgical, gynecological, dental and X-ray rooms, wards and dressing rooms of the central health facilities of our republic. The collected samples were cultured and identified using available markers [4; 6; 9].

As a result of the conducted research, it was determined that clinical fungal strains are widespread in the air space of operating rooms. In particular, the number of spores per unit volume of fungi belonging to the genus Aspergillus is expressed by higher quantitative indicators compared to others. At the same time, the number of spores of clinical strains belonging to the genus of fungi is significantly higher on the internal organs separated from the human body by special surgical methods. This characterizes Aspergillosis as a secondary pathology as a potential source of infection. Comparative mycological analyzes prove that clinical strains of Aspergillus fumigatus are involved in the etiology of Aspergillosis in healthcare facilities as the most active pathological agent. It is known that Aspergillosis is an infectious-allergic disease caused by fungi belonging to the genus *Aspergillus, including A.fumigatus, A.flavus, A.nidulans, A.niger, A.terreus, A.clavatus, A.amstelodami,* etc is committed. By the way, it should be noted that clinical studies prove that A.*fumigatus* fungus is the pathological agent of both allergic and invasive forms of aspergillosis. At the same time, if we take into account that this fungus is conditionally pathogenic, the type of secondary pathology that will be caused depends on the immune level of the body. A comparative study of the pathogenicity characteristics of fungi belonging to the *Aspergillus* genus shows that in all cases, spores of the A. fumigatus fungus are noted as the primary cause of aspergillosis as a secondary pathology in patients. In other words, the air space density of spores belonging to the *A. fumigatus* fungus in operating rooms increases extremely and the virulence ability increases.

The conducted mycological examinations show that the clinical strains of *A.fumigatus* fungus, which are dislocated on the internal organs, which gradually lose their viability, increase their biological activity even more. If we take into account that the chemical composition of the internal organs is composed mainly of substances of protein origin, then there is no doubt that the *A. fumigatus* fungus synthesizes proteolytic enzymes. Studies conducted on 27 clinical strains of *A. fumigatus* prove that these fungi invade muscle tissue without any difficulty. Because the proteases secreted by the clinical strains more easily destroy the protein compounds that form the basis of the cell membrane, creating favorable conditions for the unhindered entry

of fungal hyphae into "in vivo". This plays an extremely important role in the pathogenetic activity of clinical strains *of A. fumigatus* (table 1).

However, since clinical strains that synthesize proteolytic enzymes poorly cannot invade tissues and cells, their level of virulence is extremely low. Thus, the conducted studies show that there are

Table 1.

**Physiological and biochemical characteristics of different strains of Aspergillus fumigatus isolated from operating rooms.**

| № | Types of fungi | Proteolytic activity | Growth process at 37 $^0$C | Fungi species status |
|---|---|---|---|---|
| 1 | Aspergillus fumigatus (1) | + | + | K |
| 2 | A.fumigatus (2) | + | + | K |
| 3 | A.fumigatus (3) | + | + | K |
| 4 | A.fumigatus (4) | + | + | K |
| 5 | A.fumigatus (5) | + | + | K |
| 6 | A.fumigatus (6) | + | + | K |
| 7 | A.fumigatus (7) | + | + | K |
| 8 | A.fumigatus (8) | - | + | S |
| 9 | A.fumigatus (9) | - | + | S |
| 10 | A.fumigatus (10) | + | + | K |
| 11 | A.fumigatus (11) | + | + | K |
| 12 | A.fumigatus (12) | + | + | K |
| 13 | A.fumigatus (13) | - | + | S |
| 14 | A.fumigatus (14) | - | + | S |
| 15 | A.fumigatus (15) | - | + | S |
| 16 | A.fumigatus (16) | + | + | K |
| 17 | A.fumigatus (17) | + | + | K |
| 18 | A.fumigatus (18) | - | + | S |
| 19 | A.fumigatus (19) | + | + | K |
| 20 | A.fumigatus (20) | + | + | K |
| 21 | A.fumigatus (21) | + | + | K |
| 22 | A.fumigatus (22) | - | + | S |
| 23 | A.fumigatus (23) | - | + | S |
| 24 | A.fumigatus (24) | + | + | K |
| 25 | A.fumigatus (25) | + | + | K |
| 26 | A.fumigatus (26) | + | + | K |
| 27 | A.fumigatus (27) | + | + | K |

correlative relationships between the enzymatic activity (proteases) of the clinical strains of the *A. fumigatus* fungus and their ability to invade the substrate. In other words, the proteolytic activity of the fungus is the main argument determining its pathogenicity.

The conducted mycological examinations show that the clinical strains of *A.fumigatus* fungus, which are dislocated on the internal organs, which gradually lose their viability, increase their biological activity even more.

The researches conducted that the clinical strains of this fungi manifest in the organism as secondary pathology with clinical symptoms. In our opinion the cultural-morphological, biochemical and molecular-genetic changes that occur in the fungal cell depending on the composition of the food environment and environmental parameters are the clinical forms of the genus Aspergillus.

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# EARTH SCIENCES

## COMPARATIVE ASSESSMENT OF INFORMATIVENESS OF ATMOSPHERIC ARIDITY INDICES

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**Abstract**

Prediction of drought, a dangerous hydrometeorological phenomenon, is based on meteorological data (temperature, precipitation, air pressure, dew point, evaporation), combined into a single formula – an index describing the qualitative state of aridity depending on the quantitative value of the index in a given climatic region. Due to the lack of a universal definition of drought, different aridity indices provide an effective assessment of aridity in different climatic regions of the world in different ways. In order to adapt methods for assessing aridity in a specific climatic region accounting for both the physical mechanism of the occurrence and evolution of drought and the influence of geographical and climatic features of the region under study, it is necessary to investigate the informativeness of a particular aridity index in relation to that region. This paper provides a solution for prediction of drought for the Central Asian region.

**Keywords:** aridity indices, reanalysis, precipitation, temperature, gamma function, cumulative probability, informativeness, amount of information.

**Introduction.** Atmospheric aridity, a natural component of the climate, can occur in its extreme manifestation, called drought, in any part of the planet [9]. On a global scale, atmospheric drought occurs annually in a particular geographical area and inherently belongs to the category of natural hazards, having a negative impact on various economic sectors and environment.

Various indices are used in scientific research and practical work of meteorological organizations in order to quantify the degree of aridity of a certain period of the year (monthly, seasonal, semi-annual, annual). An overview of their use in meteorological research and practical work is given in [10].

McKee et al. [14] pioneered agrometeorological research for drought monitoring. The Standardized precipitation index (SPI) recommended by the World Meteorological Organization (WMO) is then widely used, supplementing the previously widely used Normalized Normalized precipitation index (NPI) . The Hydrometeorological Service of the Russian Federation uses the index of Pedya [5], Selyaninov [8], moisture coefficient of Ivanov [2]. Petrov's aridity index was widely used in the studies of various Uzbek scientists [6]. The Palmer index is widely used in non-CIS countries [12].

**Purpose of the work** is to investigate the informativeness of the aridity indices, namely, the standardized precipitation index SPI, the normalized NIP index, the Pedy index Si, the aridity index K developed by Petrov, applied to the Central Asian region.

In this work, time series of reanalysis ERA5 [15] of average monthly precipitation, air temperature, relative humidity and dew point with a grid step of 2.5x2.5° from 1948 to 2019 for the territory bounded by latitudes 37.5–47.5° N and longitudes 55–75° E, was used.

**Aridity indices.** To adapt the methods of assessing aridity for the Central Asian region, we will consider the above listed indices in more detail.

**The SPI index.** The idea of presenting the aridity index in a standardized form leads to the expression of a transformed cumulative probability [13,14]

$$H(p) = q + (1-q)\cdot G(p), \qquad (1)$$

where $q$- is the probability of zero precipitation, and

$$G(p) = \int_0^p g(p)dp = \frac{1}{\beta^a \Gamma(a)} \int_0^p p^a \exp\left(-\frac{p}{\beta}\right)dp. \qquad (2)$$

In G(p) is the cumulative probability distribution function, G(a) is the gamma function– □, □ are the scale and shape parameters. In [1] it is shown that the gamma function approximating the empirical distribution can be replaced without loss of accuracy by a polynomial of the *n*th degree, which, firstly, greatly simplifies the computational process, and, secondly, eliminates mathematical incorrectness, because at zero values the gamma function is not defined.

Taking into account (2), the CPI index itself is calculated based on the ratio [14]

$$SPI = \mathrm{m}\left[\frac{1}{(k - H(p)^2} \times \frac{c_0 + c_1 t + c_2 t^2}{1 + d_1 t + d_2 t^2 + d_3 t^3}\right] \qquad (3)$$

In (3) $t = 1/[(k-H(p)]^2$ , the sign "-" for $0 < H(p) \leq 0{,}5$; the sign "+" for $0.5 < H(p) < 1$; $k=0$ for $0 < H(p) \leq 0{,}5$ and $k=1$ at $0.5 < H(p) < 1$; $c_i$, $d_j$ = const –even coefficients.

Table 1 shows the classification of the SPI index and the qualitative category by the values of its values.

Table 1

**Dryness classification by SPI values**

| Code | **SPI** value | Category |
|---|---|---|
| | **Dryness** | |
| **–4** | SPI<–2,00 | Extreme |
| **–3** | –2,00≤SPI<–1,50 | Serious |
| **–2** | –1,50≤SPI<–0,99 | Moderate |
| **–1** | –0,99≤SPI<–0,00 | Weak |
| **Code** | **Humidity** | |
| **+1** | 0,00≤SPI<+0,50 | Soft |
| **+2** | 0,50≤SPI<+1,50 | Moderate |
| **+3** | 1,50≤SPI<+2,00 | Strong |
| **+4** | SPI≥+2,00 | Extreme |

**Index of Si.** This index, developed by D. A. Pedem in the 50-ies of the last century, characterizes the arid (moist) at the degree of the deviation of the values of temperature $\Delta T = T_i - \overline{T}$ and precipitation $\Delta P = P_i - \overline{P}$ from the climate of Korea norms, standardized by the corresponding variance $\sigma(T)$, $\sigma(P)$:

$$Si = \frac{\Delta T}{\sigma(T)} - \frac{\Delta P}{\sigma(P)}. \quad (5)$$

The ranges of gradations of Si index values corresponding to the qualitative categories of the SPI index are given in Table 2.

**Index NIP.** The normalized precipitation index was used in hydrometeorological services before the introduction of the SPI index into widespread practice, which represents a deviation from the norm of precipitation Pi, normalized to the climatic norm:

$$NIP = \frac{P_i - \overline{P}}{\overline{P}} \quad (6)$$

Table 2

**Aridity classification by *Si* values**

| Code | *Si* value | Category |
|---|---|---|
| | **Humidity** | |
| **+4** | $S_i > 4,5$ | Soft |
| **+3** | $4,5 \geq S_i \geq 3,1$ | Moderate |
| **+2** | $2,1 < S_i \leq 3,0$ | Strong |
| **+1** | $1,1 < S_i \leq -2,0$ | Extreme |
| **Code** | **Dryness** | |
| **–1** | $-1.0 < S_i \leq +1,0$ | Extreme |
| **–2** | $-2,0 \leq S_i \leq -1,1$ | Serious |
| **–3** | $-3,0 \leq S_i < -2,1$ | Moderate |
| **–4** | $S_i \leq -3,1$ | Weak |

The ranges of aridity (Humidity) of the NIP index corresponding to the qualitative categories of aridity (humidity) of the SPI index are given in Table 3,

Table 3

**Aridity classification by *NIP* values**

| Code | **SPI value** | Category |
|---|---|---|
| | **Dryness** | |
| **–4** | NIП – < 4,00 | Extreme |
| **–3** | –4,00≤NIП<–1,80 | Serious |
| **–2** | –1,80≤NIП <–0,80 | Moderate |
| **–1** | –0,80≤ NIП <–0,00 | Weak |
| **Code** | **Humidity** | |
| **+1** | 0,00≤ NIП <+2,00 | Soft |
| **+2** | 2,00≤ NIП <+4,00 | Moderate |
| **+3** | 4,00≤ NIП I<+5,00 | Strong |
| **+4** | NIП ≥+5,00 | Extreme |

**Index K.** The thermohydrometric coefficient K of air dryness with constant moisture retention developed by Uzbek scientist Petrov, describes a tendency to increase dryness with increasing air temperature, and with constant temperature and an increase in moisture content - a tendency to decrease dryness (Fig. 1). The index is calculated by the following formula:

$$K = \frac{T - \tau}{T} \text{‰}, \quad (6)$$

where T is the air temperature (*K*), τ is the dew point (K).

Table 4 shows the classification of the K index according to the degree of aridity (hymidity).

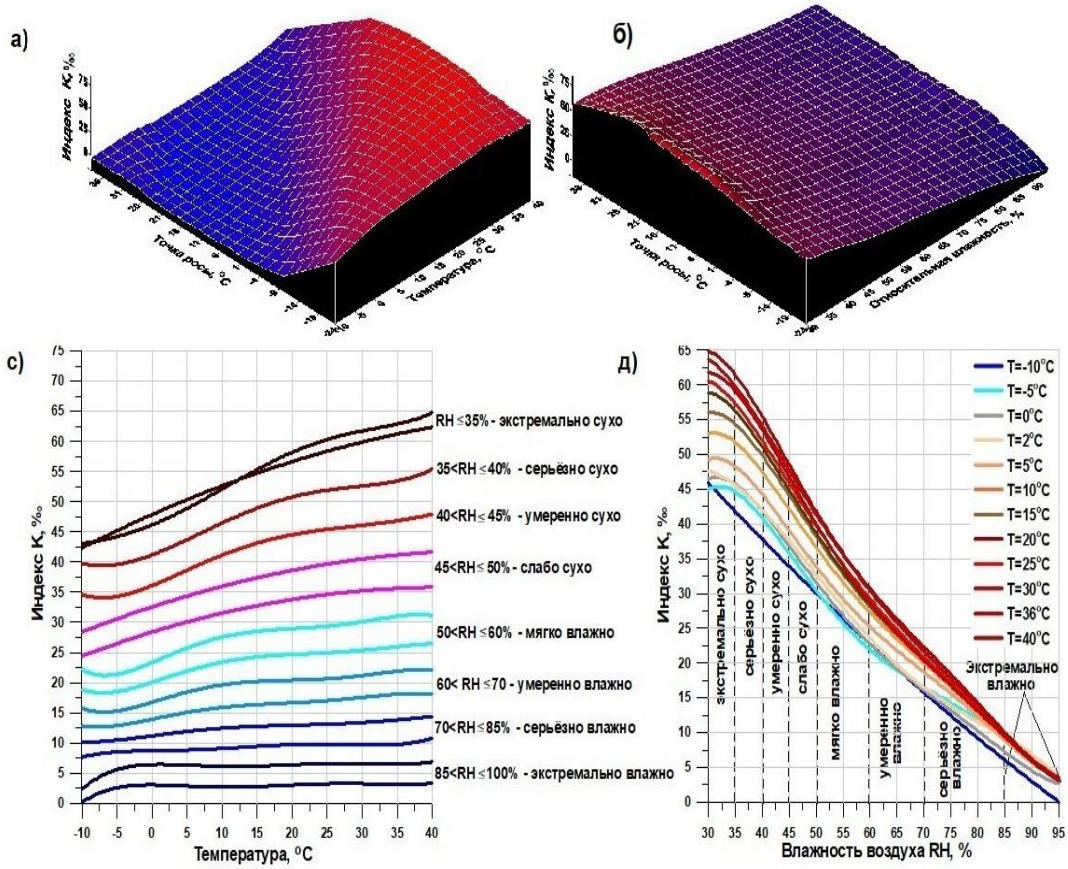


*Fig. 1. a) – Surface index K as a function of dew point and temperature; б) – as a function of dew point and relative humidity; c) – K-index curves as a function of temperature at constant relative humidity; д) – as a function of relative humidity at constant temperature.*

**Research methodology.** The absolute and relative informativeness of the aridity indices is considered from the standpoint of the information theory described in [4]. For a random variable X having a finite number of values with probabilities $p(X_i) = p_i$, $p_i \geq 0$, $\sum_i p_i = 1$, the intrinsic information $I_X = -p_X log_2 p_X$ is itself a random variable other than its average value – the Shannon information entropy $H(X_i) = -\sum p_i log_2 p_i$. In this case, $H_{max} = log_2 N$ (if the probabilities of the outcomes of events are equal; *N* is the total number of implementations of a random variable). The smaller the entropy value, the less additional information is required for an adequate assessment of the state of the system. The information has the property of additivity, i.e. for independent variables $x_1, x_2, \ldots, x_n$ the equality $I(x_1, x_2, \ldots, x_n) = \sum_{i=1}^{n} I_i$.

Table 4

**Aridity classification by *K* values**

| Code | Category | Humidity RH, % | Index *K*, ‰ |
|---|---|---|---|
| | **Aridity** | | |
| **–4** | Extreme | RH ≤30 | K>65 |
| **–3** | Serious | 30<RH ≤40 | 65≥K>45 |
| **–2** | Moderate | 40<RH ≤45 | 45≥K >35 |
| **–1** | Weak | 45<RH≤50 | 35≥K>30 |
| **Code** | **Humidity** | | |
| **+1** | Soft | 50<RH≤60 | 30≥ K >20 |
| **+2** | Moderate | 60<RH ≤70 | 20≥ K >15 |
| **+3** | Strong | 70<RH ≤85 | 15≥K>5 |
| **+4** | Extreme | 85<RH ≤100 | K ≤5 |

We introduce into consideration two systems *X* and *Y*, the states of which $x_1, x_2, \ldots, x_N$ и $y_1, y_2, \ldots, y_N$ are determined by the values of the aridity indices, respectively. The absolute amount of $I_A$, information contained in each of the systems is

$$I_A = \frac{\sum_{i=1}^{n} p_i log_2 p_i}{H_{max}} \quad (7)$$

where $p_i$ is the verticality of the *i* state of the system (i = 1, 2, ..., n).

The relative informativeness of $I_O$ system *Y* in relation to system *X* is estimated by the following formula

$$I_O = \frac{\sum_{i=1}^{n} p_i(X_i) \sum_{j=1}^{m} p_j^i(X_i) log_2 p_j^i(X_i) - \sum_{k=1}^{n} p_k(Y_k) \sum_{j=1}^{m} p_j^k(Y_k|X_i) log_2 p_j^k(Y_k|X_i)}{H_{max}}. \quad (8)$$

In expression (8), $p_j^k(Y_k|X_i)$ is the conditional probability of the *k*-th gradation of system *Y*, provided that system *X* gave the *i*-th gradation.

Taking into account the widespread use of the SPI index based on the recommendation of the WMO in studies of drought processes in various geographical areas worldwide, the informativeness of the *Si, NIP, K* indices in this work is estimated relative to the *SPI* index (relative informativeness). For this purpose, absolute and relative informativity were calculated according to formulas (7), (8) and taking the implementation of the *SPI* index as a system *X* and the implementation of the *NPI, Si, K* indices sequentially as a system *Y* . The pre-calculated time series of indices were attributed to one school scale with a code for each category of aridity (humidity), as shown in Table 6.

**Calculation results.** Each of the considered dryness indices is closely correlated with the other. Table 5 shows the mutual correlation matrix of their interrelation, calculated from the original and reduced to the same scale data. Thus, each of the listed indices can be used for the regionof Uzbekistanto diagnose the state of aridity. This is confirmed by the assessment of their informativeness shown in Table 6, which presents the probabilities of the pi categories of the indices under consideration and their absolute $I_A$ and relative $I_O$ amount of information calculated from samples of ERA5 reanalysis of temperature, precipitation and dew point over a 70-year period for all months of the year in the above-mentioned territory. As follows from the table, the quantitative estimates of the informativeness of all indices given to the same scale are very close. At the same time, however, the SPI index is the most informative, which confirms the decision of the WMO to use it in the work of hydrometeorological services.

Table 5

**Correlation matrix of aridity indices**

| Index | **SPI** | **Si** | **NPI** | **K** |
|---|---|---|---|---|
| **According to the initial data** | | | | |
| **SPI** | 1,00 | 0,95 | 0,99 | 0,92 |
| **Si** | | 1,00 | 0,98 | 0,78 |
| **NIP** | | | 1,00 | 0,88 |
| **K** | | | | 1,00 |
| **According to the data provided** | | | | |
| **SPI** | 1,00 | 0,86 | 0,86 | 0,87 |
| **Si** | | 1,00 | 0,92 | 0,73 |
| **NIP** | | | 1,00 | 0,82 |
| **K** | | | | 1,00 |

Table 6

**Probabilities of aridity indices categories and their absolute amount of information (AAI)**

| **Type** | **Category** | **Code** | **Unconditional probabilities** | | | |
|---|---|---|---|---|---|---|
| | | | **SPI** | **Si** | **NIP** | **K** |
| **Fordrynes s** | **Extreme** | **-4** | 0,079 | 0,008 | 0,002 | 0,356 |
| | **Serious** | **-3** | 0,313 | 0,020 | 0,006 | 0,077 |
| | **Moderate** | **-2** | 0,424 | 0,040 | 0,014 | 0,081 |
| | **Weak** | **-1** | 0,184 | 0,072 | 0,050 | 0,071 |
| **Норма Standard** | | 0 | 0,000 | 0,141 | 0,165 | 0,078 |
| Humidity | **Soft** | **1** | 0,000 | 0,459 | 0,368 | 0,075 |
| | **Moderate** | **2** | 0,000 | 0,248 | 0,318 | 0,089 |
| | **Strong** | **3** | 0,000 | 0,012 | 0,074 | 0,106 |
| | **Extreme** | **4** | 0,000 | 0,000 | 0,003 | 0,067 |
| **АКИ** | | | 0,564 | 0,669 | 0,678 | 0,904 |
| **ОКИ** | | | | 0,564 | 0,669 | 0,678 |

Potentially dangerous factors contributing to the occurrence of atmospheric drought, against the background of synoptic processes, are determined by the local features of the geographical area, which is characterized by a variability of landscapes. The characteristic landscapes of the territory of Uzbekistan are represented by deserts, steppes, mountain ranges. There are four distinct landscapes [11]: deserts and plains (chul), foothills and hills (adyr), mountains (tau), highlands (jailau). In turn, these landscapes are subdivided into 12 agro-climatic districts on the basis of agro-climatic zoning (Fig. 1) [7]. In general, this diversity can be generalized as lowland and sub-mountain regions, which, with established circulation processes, determine the degree of risk of potentially dangerous factors for the occurrence of drought.

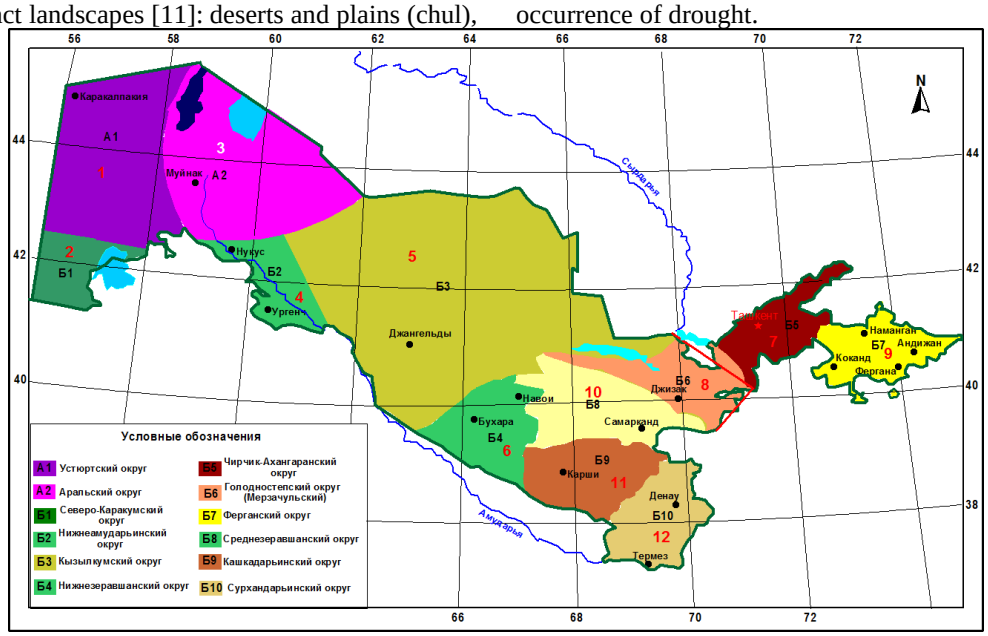


*Fig. 1. Agro-climatic zoning of the territory of Uzbekistan.*

Figure 2 shows the spatial climatic distribution of the average monthly values of the aridity index SPI, and Figure 3 shows seasonal, semi-annual, annual and during the growing season on the territory of Uzbekistan and neighboring countries. As follows from Fig. 2, 3, the driest months in climatic terms fall on June-October and the summer season, which is fully consistent with long-term observations [3]. At the same time, in the autumn season and the second half of the year, areas of aridity are distinguished, capturing the Nizhneamudarya and Aral agro-climatic districts with a negative maximum *SPI* in the Nizhneamudarya (*SPI* = -0.25). Relative to other districts, the greatest aridity is characteristic of the agro-climatic district of Ustyurt in March, and in the summer season there is increased humidity relative to other districts. This feature of the spatial distribution of the SPI index is a consequence of the isolation of the synoptic processes and the terrain landscape of the western part of the territory of Uzbekistan, manifested in the fact that during the hot period of the year, the western and north-western intrusions are eroded when passing through the territory to the east.

As follows from the obtained distributions of *SPI* and agro-climatic zoning of the territory of Uzbekistan, in general, their good agreement can be noted, which implies its sufficient informativeness in relation to the assessment of the risk of aridity in a particular geographical area. The latter indicates that SPI can be successfully used in the task of monitoring aridity.

**Conclusions.** The indices of aridity (humidification) considered in this work, almost equally well describe the state of dryness on the territory of Uzbekistan and neighboring countries. The most informative of them is the *SPI* index, which once again indicates the correctness of the WMO recommendation for its use in scientific and practical work.

Modification of the cumulative probability into the expression of the aridity index SPI by replacing the gamma function with a polynomial of the nth degree greatly simplifies the computational process and establishes the mathematical correctness of the expression.

The above-mentioned aridity indices, due to their high informativeness, can be used in solving the problem of monitoring aridity on the territory of Uzbekistan and neighboring countries. The creation of a system for monitoring fluctuations in humidity and dry periods makes it possible to correctly approach the problem of forecasting monthly, seasonal, semi-annual, annual and for the growing season of drought.

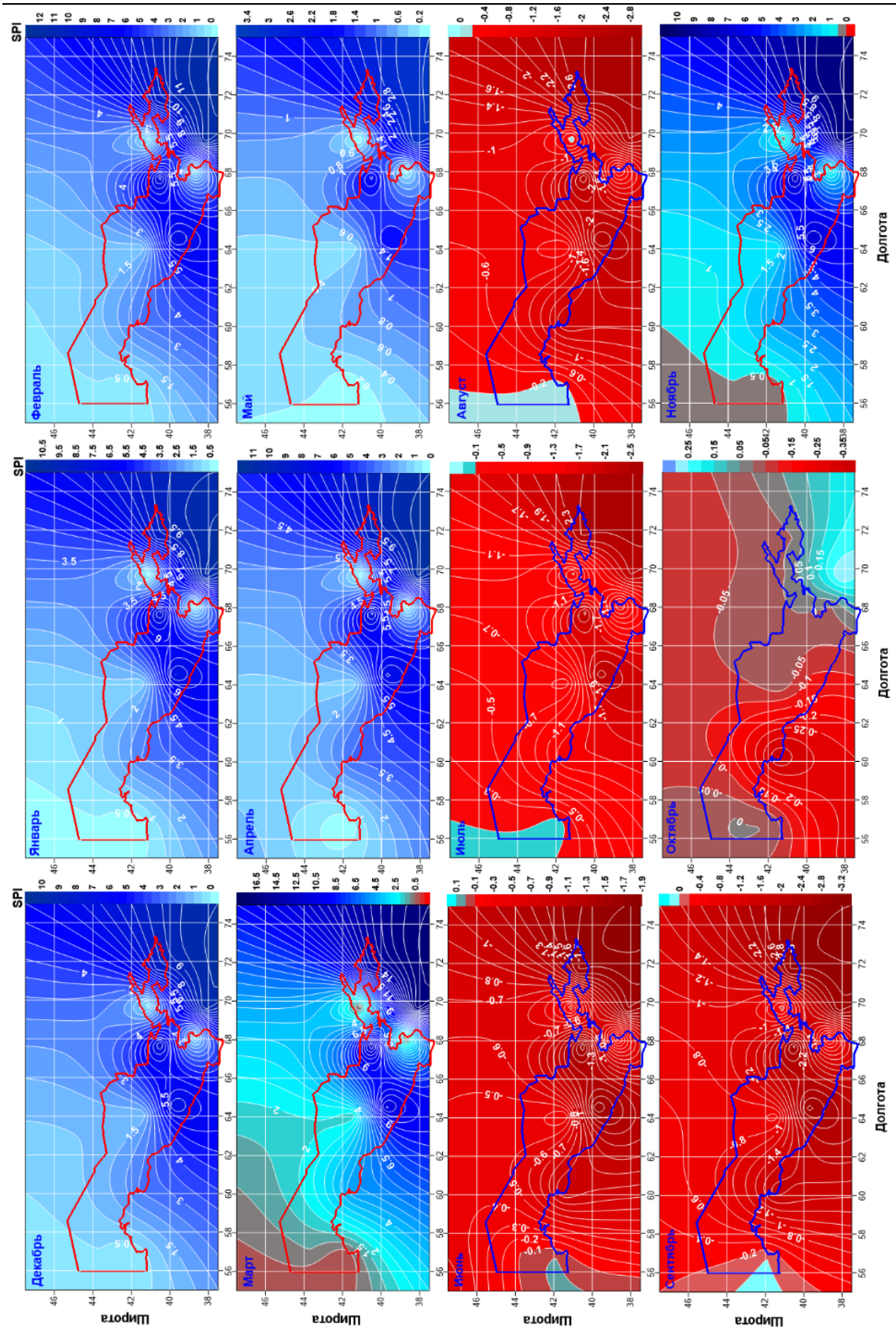


*Fig. 2. Climatic spatial distribution of average monthly values of the SPI index.*

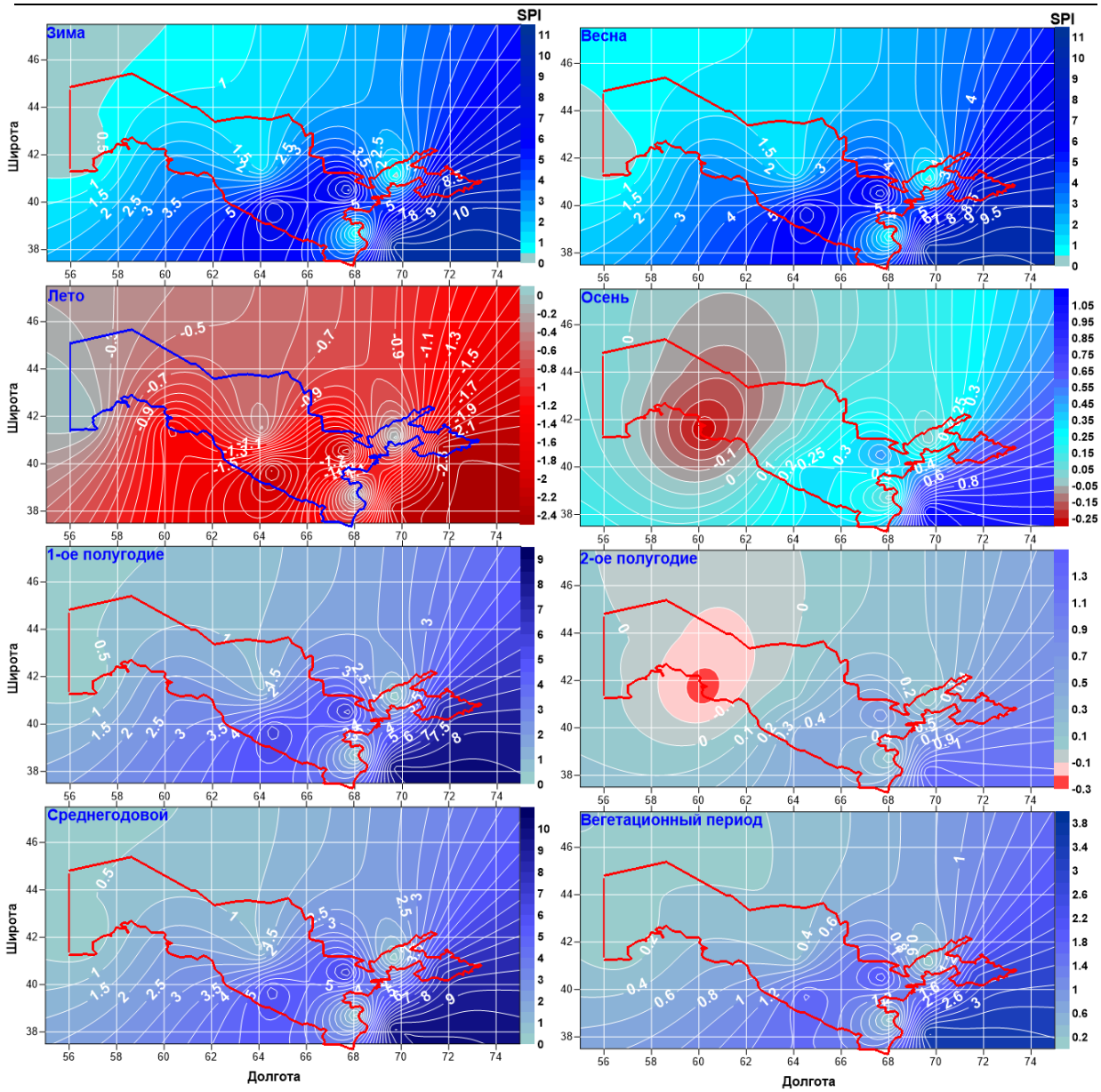


*Fig. 3.*
*Climatic spatial distribution of seasonal, semi-annual, annual and vegetation period values of the SPI index.*

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# ECONOMIC SCIENCES

## THEORETICAL BASICS OF ACCOUNTING SUPPORT FOR FINANCIAL PLANNING OF ENTERPRISE ACTIVITIES

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**Abstract**

The theoretical foundations of financial planning of enterprise activity as an element of management process are presented. The functions of financial planning are allocated. The characteristic features of individual components of the system of functional budgets at the enterprise are grouped. The stages of financial planning and their content for the purpose of effective management are given.

**Keywords:** Accounting, financial planning, budgeting, financial flows.

Financial planning is considered the basis of the organization of the enterprise's finances, because it provides for an economic substantiation of the volume of revenues and directions of spending funds, as well as the volume of formation of monetary assets necessary for the continuous functioning of the enterprise. Business entities are interested in a real assessment of their financial situation today and in the near future, not only to succeed in their entrepreneurial activities, but also to timely fulfill their obligations to the budget, social funds, banks and other creditors. Therefore, it is important to calculate income and expenses in advance, take into account the consequences of inflation, changes in the market situation, violations of contractual obligations by partners. This is especially important in wartime.

Financial planning is an element of the overall planning process, and is also the basis and responsible component of the functional management system. It allows you to identify bottlenecks in the enterprise's economic activity.

As a type of activity, financial planning is such an activity that is aimed at maximizing the efficiency of the functioning of enterprises, as well as solving the tasks set. The definition of financial planning as a document has a double content due to the presence of several groups of financing objects: Resources, i.e. assets and liabilities, and transactions that form the system of financial relations[2].

The goal of financial planning in practice should be to justify the need for capital to ensure the forecasted volumes of operating and investment activities, coordination with the capital that can actually be attracted, resource support for the circulation of production funds on the basis of financial stability, solvency, creation of prerequisites for obtaining profit in the amount , sufficient for economic and social development[3].

In the process of financial planning, the business entity evaluates the state of its finances from various points of view, the possibility of growth of financial resources and the efficiency of their use. In most cases, the managers of the enterprise make management decisions during planning based on the analysis of financial information. According to this, scientists distinguish the following main functions of financial planning: reduction of complexity; motivation; prognostication; security; optimization; coordination and integration; ordering; control; documentation; training[4].

It is known that the main goal of the enterprise is to maximize profits while simultaneously reducing costs. Since effective distribution of financial resources can contribute to achieving this, it is necessary for financial planning[3]:

- to determine the amount of necessary and realistically possible monetary resources according to the sources of their formation and directions of use for the implementation of operational, investment and other types of activities;
- to optimize the capital structure by sources and directions of placement;
- to determine the projected profitability of the capital advanced for the formation of the company's assets;
- to develop alternative or preventive measures in case of deviations from the predicted indicators;
- monitor and respond promptly to the progress of the implementation of the financial plan.

This process should also be carried out in stages, namely in terms of: income, expenses, profit from operating, investment, financial and other types of activities, net profit and directions of its use; working capital needs by sources and directions of use; sources of investment resources for the implementation of the capital investment plan; amount and directions of use of social funds; balance of assets and liabilities at the end of the planned period[5].

Accordingly, five stages of financial planning are distinguished. The first is to develop a plan of income, expenses and profit in order to make sure that the net profit is sufficient for self-sufficiency.

The second stage is special because here it is necessary to ensure an uninterrupted cycle of production and circulation funds with the help of a sufficient amount of money resources, which is appropriate to make up the balance of money resources.

The third stage is related to the determination of sources of funding for capital investments in order to avoid deficits in financing objects and to prevent unplanned withdrawal of own funds from circulation for capital investments[2].

The social policy of the financial planning process should also not be forgotten, which is why the next stage belongs. After all, in order to ensure the successful implementation of the indicators of the financial plan, it is necessary to pay due attention to the company's personnel and its social security, since material incentives are an important motivation for work and innovation, which corresponds to the Sustainable Development Goals.

As for the final stage, it is necessary not only to draw up a forecast balance of assets and liabilities of the enterprise, but also to determine what kind of structural changes will take place under the conditions of the implementation of the financial plan. It is also necessary to assess their impact on the financial condition of the enterprise based on forecast calculations of expected indicators, which are used to assess financial stability. And, of course, for an adequate assessment of the effectiveness of financial planning, it is necessary to conduct a comparative analysis of indicators for periods from three to five years in order to prevent a possible deterioration of the company's financial condition.

The financial plan will contain background information on the actual indicators of the past year and the planned indicators of the current year. The business entity has the opportunity to draw up a financial plan and prepare an explanatory note using the recommendations for drawing up the enterprise's financial plan and a report on its implementation. In addition to regulatory legal acts, the enterprise can also independently develop various internal instructions, methodological recommendations for regulation and improvement of the financial planning process.

The system of financial plans (budgets) of Western corporations includes: a forecast of the balance of assets and liabilities; profit and loss statement forecast; cash flow statement forecast; forecast of key financial indicators (sales volume, production and circulation costs, profit, return on assets and equity, share price, etc.); long-term budget of capital investments and assessment of investment projects; the long-term financing strategy of the corporation[6].

The experience of the countries with market economy shows that with the growth of the level of financial planning, the efficiency of enterprise management increases. Foreign economic entities carry out financial planning, usually within the framework of various management systems: budgeting, controlling and balanced scorecard.

In order to organize the budget planning of the activity of structural units of the enterprise, it is advisable to create an end-to-end system of budgets at the enterprise, consisting of several functional budgets (Table 1.). This system of budgets includes the entire base of financial calculations.

Table 1.

**Characteristics of the system of functional budgets in the enterprise**

| Type of functional budget | Characteristics |
|---|---|
| The budget of the wage fund | With the budget of the wage fund, related to payments to extrabudgetary funds (pension, social insurance, employment) and parts of tax deductions. |
| Budget of material costs | Budgets of material costs and energy consumption reflect the main part of third-party payments of the enterprise |
| Energy consumption budget | |
| Amortization budget | The depreciation budget is largely for the purpose of the enterprise's investment policy, in addition, depreciation deductions can be used as working capital of the enterprise |
| Budget of other expenses | The budget of other expenses will allow you to save on the least important financial expenses. |
| Loan repayment budget | The loan repayment budget and the position to make loan and loan repayment operations in strict accordance with the payment schedule plan |
| Tax budget | The additional budget includes all taxes and mandatory payments to the state budget and budgets of other levels, as well as to extrabudgetary funds (pension fund, social insurance fund, health insurance, employment, etc.). This budget is planned only for the enterprise as a whole. |

At the same time, foreign enterprises, when creating budgets of structural divisions and relevant services, always ensure that each lower-level budget is a detail of a higher-level budget, that is, production budgets specify a consolidated (complex) budget .

In order to determine which accounting procedures the accountant performs at each of the stages of financial planning, we will list the stages that this multistage process includes: analysis of financial indicators for past periods; development of financial strategy and financial policy; drawing up current financial plans; coordination of financial plans with production, commercial, investment and other plans and programs of the enterprise; operational financial planning; analysis and control of execution of plans.

At the first stage, financial indicators of the company's activity for the previous period are analyzed. The source of information support for this process is financial reporting and accounting registers. On the basis of the conducted analysis, the enterprise can assess the financial results of its activities and the placement of the problems that arise before it.

At the second stage of financial planning, a financial strategy is developed and the foundations of financial policy are laid[2]. The development of a financial strategy has a certain sequence of actions: analysis of the factors of the external and internal environment of the enterprise; development of a system of strategic goals; determination of possible options for the company's financial strategy; formation of a financial strategy; financial strategy implementation; financial strategy monitoring; detection of deviations, correction of the chosen strategy or activity of the enterprise itself[4].

As for the third stage, here the main indicators of the forecast financial documents are specified and specified with the help of drawing up current financial plans. The current financial plan is a plan of income and expenses for the current year, which ensures a certain level of profitability of the enterprise, as well as sources of formation and directions of receiving funds.

Current financial plans are developed in terms of such financial plans as: income and expenses from operational, financial and investment activities; receipts and expenditures of funds; balance of monetary resources; cash resources plan for financing current assets; investment plan.

The purpose of the first plan is to determine the amount of net profit from the economic activity of the enterprise by means of forecasting the indicators of income and expenses (Fig. 1.).

The cash receipts and disbursements plan is a plan, the main task of which is to determine the amount and need for cash of various forms for the implementation of planned operating expenses and investment programs, as well as to ensure the receipt of these resources in the process of carrying out economic activities by the economic entity.

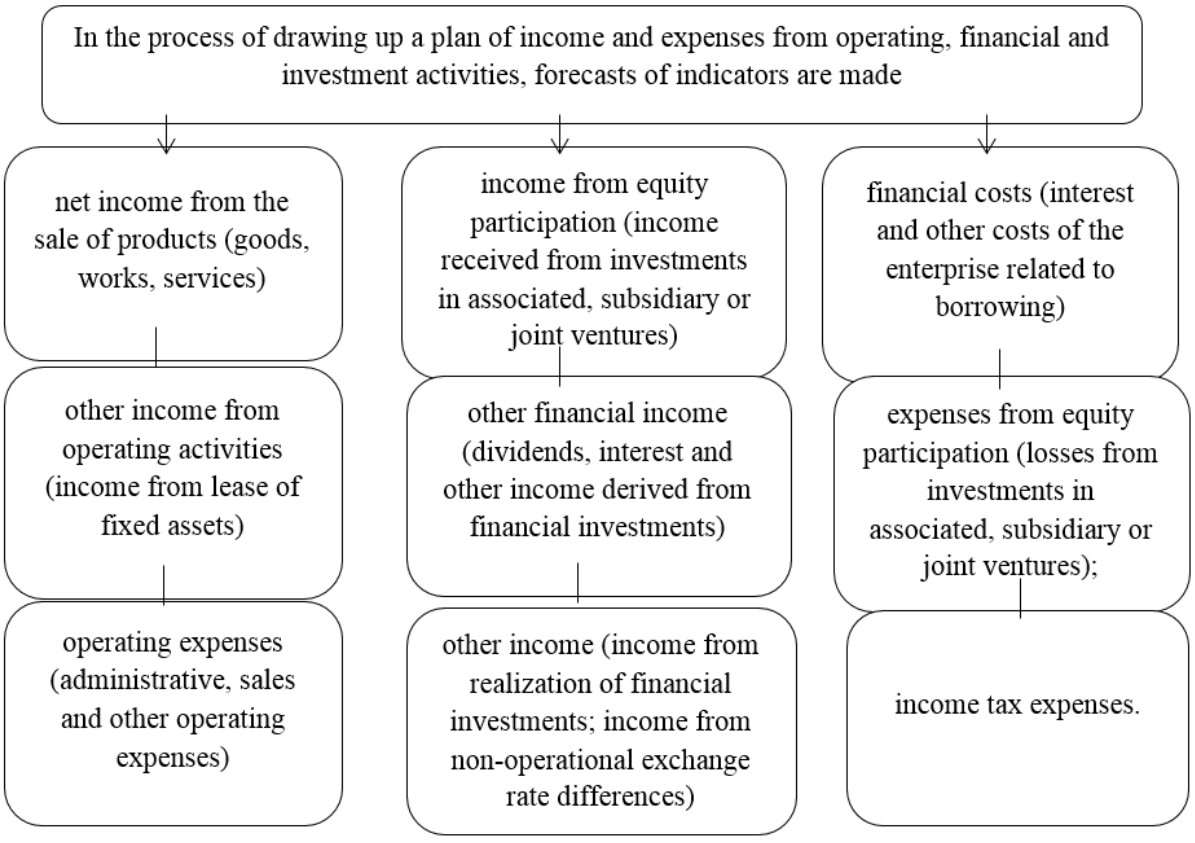


*Fig. 1. Forecast indicators of the income and expenditure plan from operational, financial and investment activities*

Drawing up such a current plan will allow to control the ensuring of permanent solvency of the enterprise at all stages of the planned period and provides for the implementation of concretization of the carrying out (planning) of the relevant indicators of receipts and expenditures of funds

An important problem of financial planning is to ensure the validity of the financial plan, its reality. By paying more attention to financial planning, it is possible to strengthen the financial stability of the enterprise, provided that the volumes of operating and investment activities predicted by the business plan are fulfilled on the basis of financial stability, and the creation of prerequisites for obtaining a net profit sufficient for self-sufficiency and self-financing of the enterprise.

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# HISTORICAL SCIENCES

## SCIENTIFIC ACTIVITY OF ROMAN LUTSYK (1900-1974): BIBLIOGRAPHIC AND BIBLIOLOGICAL ASPECTS

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## НАУКОВА ДІЯЛЬНІСТЬ РОМАНА ЛУЦИКА (1900–1974): БІБЛІОГРАФІЧНИЙ ТА КНИГОЗНАВЧИЙ АСПЕКТИ

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**Abstract**

The article deals with the scientific heritage of Roman Lutsyk, a librarian, bibliographer, book critic, and long-term head of the Rare Book Department of the Vasyl Stefanyk National Scientific Library of Ukraine in Lviv. The basis of the Department's collection was made up of old prints and rare publications of the nineteenth and twentieth centuries, accumulated from the libraries of national institutions in Lviv – Ukrainian, Polish, Jewish, etc.– that were liquidated by Soviet authorities in 1939. It is confirmed that catalogs, thematic files, historical, bibliographic, and book studies articles written by Roman Lutsyk, his popular science publications in periodicals, and bibliographic indexes contributed to the disclosure of information about a unique collection of old prints and rare books of the nineteenth and twentieth centuries. It is emphasized that the scientific, bibliographic, and book studies works of Roman Lutsyk are worth being updated, further carefully read, and introduced into scientific circulation.

**Анотація**

У статті розглянуто особливості наукової спадщини бібліотекаря, бібліографа, книгознавця Романа Луцика, багатолітнього завідувача відділу рідкісної книги Львівської національної наукової бібліотеки України імені В. Стефаника. Основу фонду відділу становили стародруки, а також рідкісні видання XIX–XX ст., акумульовані з бібліотек ліквідованих радянською владою у 1939 р. національних інституцій Львова – українських, польських, єврейських та ін. Підтверджено, що каталоги, тематичні картотеки, історико-бібліографічні та книгознавчі статті його авторства, науково-популярні публікації в пресі, бібліографічні покажчики сприяли розкриттю унікального фонду стародрукованих видань та рідкісної книги XIX–XX ст. Наголошено, що науково-бібліографічний та книгознавчий доробок Р. Луцика потребує актуалізації, подальшого уважного дослідницького прочитання та запровадження до наукового обігу.

**Keywords:** Roman Lutsyk, Vasyl Stefanyk National Scientific Library of Ukraine in Lviv, book studies, catalogue, bibliographic index

**Ключові слова:** Роман Луцик, Львівська національна наукова бібліотека України імені В. Стефаника, книгознавчі дослідження, каталог, бібліографічний покажчик

Бібліотекар, бібліограф, книгознавець Роман Луцик залишив важливу наукову спадщину в царині наук із соціальних комунікацій, актуалізація і осмислення якої розпочалися лише в перші роки XXI ст. Народився діяч на Тернопільщині (с. Лука) у сім'ї священика, навчався в реальній гімназії з польською мовою викладання (м. Борщів). Як відзначав у своїй біографії Р. Луцик, «наслідком Першої всесвітньої війни – наступила довга перерва в моєму навчанні. У 1918 р. відбув, як рядовий солдат, військову службу в австрійській армії» [1]. Тільки у 1925 р. Р. Луцик закінчив гімназію у Львові, здавши екстерном іспити на атестат зрілості, що дало йому можливість вступити на гуманітарний факультет Львівського університету імені Яна Казимира.

Крім історичних студій у 1926–1932 рр., він удосконалював знання іноземних мов: латинської, польської, німецької, французької. В університетські роки він також співпрацював з низкою культурно-освітніх, наукових товариств москвофільського спрямування, зокрема був активним діячем студентського товариства «Друг». 1932 р. у ювілейному збірнику «Вешнія воды», виданому з нагоди 60-ліття товариства «Друг», було опубліковано його першу історико-бібліографічну працю «Журналы галицко-русского студенчества», над якою він

працював понад п'ять років, вивчаючи зміст студентської преси 1870–1920-х рр. та опрацьовуючи архівні джерела.

Після завершення вищих студій Р. Луцик працював керівником центральної бібліотеки та архіву культурно-освітнього Товариства ім. М. Качковського, поєднуючи з роботою бібліотекаря науково-літературного товариства «Галицько-руська матиця» [9, с. 152]. Згодом він очолив інструкторський відділ Товариства ім. М. Качковського, відповідаючи за роботу понад 300 читалень і бібліотек цього товариства. У цей час він також активно співпрацював із галицькою спеціалізованою пресою, висвітлюючи передовсім бібліотечну проблематику. Особливу увагу він приділяв читальняно-бібліотечному часопису «Листок» (1936–1938), який зініціював і провадив для цільової аудиторії.

Ліквідація радянською владою у 1939 р. усіх національних товариств, зокрема й тих, де працював Р. Луцик, спричинила перерву у науковій і бібліотечній діяльності Р. Луцика. Тільки навесні 1942 р. він влаштувався до Державної бібліотеки у м. Львові (Staatsbibliothek Lemberg) науковим працівником третього відділу (Народний Дім), де набув вишкіл науково-бібліографічної роботи, співпрацюючи з визначним вченим, бібліографом та книгознавцем Володимиром Дорошенком.

Упродовж 1944–1974 рр. Р. Луцик працював у Львівській бібліотеці Академії наук УРСР (від серпня 1944 р.), яка в ці роки тричі змінювала назву: від липня 1963 р. – Львівська державна наукова бібліотека Міністерства культури УРСР, від квітня 1969 р. – Львівська державна наукова бібліотека АН УРСР, від травня 1971 р. – Львівська наукова бібліотека ім. В. Стефаника АН УРСР, нині – Львівська національна наукова бібліотека України НАН України. У час своєї професійної діяльності в установі Р. Луцик понад 20 років перебував на посаді завідувача відділу рідкісної книги, значним чином причинившись до становлення, функціонування і розвитку цього важливого підрозділу книгозбірні. Основу фонду відділу головним чином становили стародруки та рідкісні видання XIX–XX ст., акумульовані з бібліотек ліквідованих національних інституцій Львова – українських, польських, єврейських та ін. Серед них відзначимо найбільші передвоєнні бібліотеки Галичини: Оссолінеум разом з книгозбірнею Фундації ім. Віктора Баворовського, бібліотеки Народного Дому у Львові, Наукового товариства імені Шевченка, «Студіону», низки монастирських бібліотек.

Очоливши відділ на початку 1950-х рр., Р. Луцик зіткнувся зі значними викликами у роботі, зокрема з великою кількістю неопрацьованих стародруків, більшість з яких потребувала ідентифікації, а також з необхідністю впорядкування фонду та укладання науково-довідкового апарату, якого не могло бути з огляду на звезені з різних інституцій книжки. Усі ці складні бібліотечні процеси довелося виконувати керівникові одноосібно. Однак висока професійна культура завідувача відділу, його особисті (перфекціонізм, відповідальність, відданість фаху, критичне мислення, креативність) та професійні (вузькоспеціалізовані, набуті ще в міжвоєнне двадцятиліття) якості сприяли досягненню чималих результатів. Відзначимо, наприклад, сформовані особисто ним колекції кириличних та латинських стародруків, а також рідкісної книги XIX–XX століття. Їх укладання припадає на кінець 1950-х рр. – час, коли, як відзначають українські вчені Л. Дубровіна та О. Онищенко, «наукова діяльність бібліотек характеризується поступовою переорієнтацією на конкретну діяльність, пов'язану з організацією, вивченням та використанням інформаційного потенціалу фондів» [8, с. 28].

Нині у відділі рідкісної книги ЛННБ України імені В. Стефаника зберігається низка картотек, які слугували читачам як необхідні їхній дослідницькій праці бази джерел, що суттєво полегшувало їхні наукові пошуки. Особливою увагою користувалися спеціалізовані картотеки «Galiciana», «1848», «Альбоми. Власники книжок», «Портрети», «Оформлення книжок. Ілюстрації до тексту» та ін. Серед користувачів цих інформаційно-бібліографічних продуктів відзначимо таких відомих науковців, як от М. Жовтобрюх, І. Крип'якевич, Я. Дашкевич, Я. Ісаєвич, Я. Запаско, Р. Кирчів, Ф. Максименко, М. Мороз, І. Свєнціцький, А. Ярошенко. Ці носії інформації Р. Луцика активно використовували також і закордонні дослідники. Зокрема, у звіті роботи відділу за 1966 р. [10] відзначено, що з картотеками працювали В. Вітковський – викладач Краківського університету (Польща); Ю. Гальвадіс – літературознавець (Литва); З. Геник-Березовська – доцентка Празького університету (Чехія); В. Гривна – доцент Братиславського університету (Словаччина); Е. Лауцевічус – історик (Литва); Р. Лужний – науковець (Польща); С. Янушоніс (Литва).

У Книзі відгуків відділу рідкісної книги зберігся запис від 25 грудня 1976 р., радше прохання-пропозиція до працівників відділу відомого книгознавця Я. Запаска, який наполягав на продовженні започаткованої й ретельно проваджуваної Р. Луциком картотеки художників та ілюстраторів. Він, зокрема, відзначав: «Хотів би подати одну пораду. Впродовж кількох років колишній завідуючий відділом Р. Луцик складав картотеку художньо-оформлених книг за прізвищами художників. Як видно з картотеки, ця робота припинена: кращих за оздобленням книг останніх років в ній немає. Тим часом працю треба обов'язково продовжити, наукову вартість її важко переоцінити» [2].

Звісно, з огляду на інноваційні процеси в інформаційно-бібліотечній діяльності низка картотек, укладених у 1950–1970-х рр., слугує нині радше історико-бібліографічною пам'яткою, як, наприклад укладена Р. Луциком картотека: «Виставки», що складається із 1240 карток. Тут зафіксовано відомості, розділені за такими рубриками: «Книги з автографами», «Галицькі українські друки першої половини XIX ст.», «Видання друкарень, заснованих Іваном Федоровим», «Книгодрукування на Україні XVI–XVIII ст.», «Історія оформлення книги до початку XX ст.». Ці результати копіткої науково-бібліографічної роботи Р. Луцика,

дозволяли й дозволятимуть наступним поколінням користувачів орієнтуватися в унікальному фонді відділу рідкісної книги.

Важливо відзначити, що основним дослідницьким зацікавленням Р. Луцика були кириличні та латинські стародруки. 1951 року у виданні «Бюлетень: Досвід роботи» було опубліковано його статтю «Слов'янські стародруки XV–XVII ст. у фондах Львівської бібліотеки Академії наук УРСР» [5], в якій автор здійснив загальний огляд кириличних стародруків, що зберігаються у фонді відділу рідкісної книги, охарактеризувавши їх за такими групами: дофедорівські друки; друки Івана Федорова; післяфедоровські друки XVI–XVII ст. Науковець докладно проаналізував стародруки, які видавали Швайпольт Фіоль, Франциск Скорина, Божидар Вукович, Іван Федоров, Гедеон Балабан.

У науково-бібліографічному доробку Р. Луцика важливе місце посідає ретельно укладена ним анотована картотека «Львівські слов'янські друки XVI–XVIII ст.», матеріали якої лягли в основу каталогу «Львівські видання XVI–XVIII ст.». Укладач цієї праці Я. Ісаєвич відзначив у вступному слові, що «вважає приємним обов'язком висловити подяку керівникові відділу Р. Я. Луцикові за сприяння в роботі над каталогом [6, с. 8]. Каталог побачив світ у 1970 р., однак уже в 1972 р. відомий вчений Ф. Максименко в одній із рецензій на праці завідувача відділу рідкісної книги висловив побажання про якнайшвидше видання каталогу кириличних стародруків XVI–XVIII ст. Р. Луцика, оскільки високо оцінював цю працю науковця, неодноразово користуючись матеріалами його картотеки «Львівські слов'янські друки XVI–XVIII ст.» [7].

Особливу увагу Р. Луцик приділяв вивченню інкунабул. У 1974 р. вийшла в світ його науково-бібліографічна праця – «Інкунабули Львівської наукової бібліотеки ім. В. Стефаника Академії наук УРСР», яку автор присвятив 400-річчю книгодрукування в Україні. У передмові науковець відзначав, що в описі інкунабул подано такі відомості: автор, назва книги, місце видання, видавець, дата видання, формат, кількість листів, відомості про фізичний стан примірника: «дефекти, наявність ініціалів, рубрик та гравюр, оправа та її стан, рукописні помітки на полях книги, шифр книги» [3, с. 4]. У розділі «Алфавітний каталог інкунабул» подано інормацію про 39 «колискових друків». Розділ «Ілюстрації» містить вісім фотокопій «перших і останніх листів низки інкунабул, листи з ініціалами, ілюстраціями і т. д.». Видання споряджено двома допоміжними покажчиками: «Покажчик друкарів та видавців за місцевостями», «Покажчик років виходу в світ інкунабул», «Конкорданції». Відзначимо, що рецензент цієї праці книгознавець Я. Ісаєвич, високо оцінивши наукові зусилля Р. Луцика, наголошував, що видання «дуже своєчасне», оскільки «у зв'язку з відсутністю друкованого каталогу інформації про львівські примірники до цього часу не наводились в «Зведеному каталогу» інкунабул, що не сприяло їх науковому використанню» [4].

Вважаємо, що науковий доробок Р. Луцика – каталоги, тематичні картотеки, історико-бібліографічні та книгознавчі статті, науково-популярні публікації в пресі, бібліографічні покажчики, що розкривали унікальний фонд стародрукованих видань та рідкісної книги XIX–XX ст. відділу рідкісної книги Львівської національної наукової бібліотеки України імені В. Стефаника, потребує актуалізації, подальшого уважного дослідницького прочитання та запровадження до наукового обігу.

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# MEDICAL SCIENCES

## ANALYSIS OF THE EFFECTIVENESS OF SURGICAL TREATMENT OF PATIENTS WITH TYMPANOSCLEROSIS

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**Abstract**

The aim of this study was to comparative analysis of the auditory function of the ear before and after surgical treatment of tympanosclerosis. Study of the clinical and audiological conditions of patients with tympanosclerosis. During the examination from December 2021 to May 2022 (6 months), 27 patients with tympanosclerosis were examined. The patients underwent the following examinations: general ENT examination (otoendoscopy, otomicroscopy), audiometry, multislice computed tomography of the temporal bones.

According to the results of the above studies, all examined patients were conditionally divided into 3 groups. Due to the absence of perforation of the tympanic membrane and hearing loss in patients of I group, dynamic monitoring of patients was proposed. Patients of II group were offered surgical treatment. During the operation, the tympanic cavity of the patients was cleaned from tympanosclerotic plaques, the handle of the malleus and the rest of the tympanic membrane. The mobility of the auditory ossicles after the removal of the plaques was completely restored. Patients of III group were also recommended surgical treatment. During the operation, tympanosclerotic plaques were removed from the tympanic cavity and around the auditory ossicles. Except the tympanoplasty to the patients who had non-restoration of movements of ossicles were used prosthesis PORP or TORP. If in such cases fixation of the malleus and anvil of the bones is observed, it is necessary to remove the head of the malleus and incus, if the movement of the stirrup is not restored in these patients, it is indicated to prepare for the operation a secondary total ossiculoplasty.

**Keywords:** tympanosclerosis, ossiculoplasty, tympanoplasty

**Introduction.** Tympanosclerosis is a non-purulent disease of the middle ear, characterized by the formation in the mucous membrane of peculiar foci (tympanosclerotic plaques) that limit the mobility of the tympanic membrane and / or auditory ossicles. Nowadays, surgical treatment is considered the only effective way to rehabilitate hearing in patients with tympanosclerosis. The tactics of surgical treatment of patients with tympanosclerosis is determined by the form of the disease, the prevalence and localization of tympanosclerotic foci, as well as the nature of intraoperative findings: the safety of the superstructures of the stirrup, the condition of the tendon of the stapedius muscle, the features of the ingrowth of the epidermis into the tympanic cavity, the condition of the tympanic foramen-auditory tube.

**Aim.** Comparative analysis of the auditory function of the ear before and after surgical treatment of tympanosclerosis.

**Research objectives.** Study of the clinical and audiological conditions of patients with tympanosclerosis.

**Methods and materials.** During the examination from December 2021 to May 2022 (6 months), 27 patients with tympanosclerosis were examined. The patients underwent the following examinations: general ENT examination (otoendoscopy, otomicroscopy), audiometry, multislice computed tomography of the temporal bones.

According to the results of the above studies, all examined patients were conditionally divided into 3 groups:

I group - 3 patients (11%) without tympanic perforation with tympanosclerotic plaques in the tympanic membrane. On audiometric examination hearing was preserved in these patients;

II group - 18 patients (67%) with perforation of various sizes in the stretched part of the tympanic membrane. Tympanosclerotic plaques were found in the remaining parts of the tympanic membrane and on the malleus handle. When examining patients by audiometry, it was found that conductive and mixed hearing loss with an air-bone interval was up to an average of 20 dB;

III group - 6 patients (22%), with perforations of various sizes, tympanosclerotic plaques in the remaining parts of the tympanic membrane, on the medial wall of the tympanic cavity, around the malleus, anvil and stirrup. An audiometric examination of these patients revealed conductive and mixed hearing loss with a bone-air interval of 20 dB or more.

**Results:**

Due to the absence of perforation of the tympanic membrane and hearing loss in patients of I group, dynamic monitoring of patients was proposed.

Patients of II group were offered surgical treatment. During the operation, the tympanic cavity of the patients was cleaned from tympanosclerotic plaques, the handle of the malleus and the rest of the tympanic membrane. The mobility of the auditory ossicles after the removal of the plaques was completely restored. The fascia of the temporal muscle was established by the UNDERLAY method (type I according to Woolstein). After 2 months, with repeated audiometric examination of these patients, the hearing increased by an average of 10 dB, after 3 months by an average of 17.8 dB compared to the initial value.

Patients of III group were also recommended surgical treatment. During the operation, tympanosclerotic plaques were removed from the tympanic cavity and around the auditory ossicles. In 1 patient, in connection with the restoration of bone mobility, type I tympanoplasty (according to Woolstein) was performed (the prepared fascia from the temporal muscle was laid using the UNDERLAY method). In 3 patients, due to non-restoration of movements, the head of the malleus and the incus were removed, and a prosthesis PORP was placed on the head of the stirrup. In the remaining 2 patients, the spread of the tempanosclerotic process into the oval window with fixation of the base of the stirrup was found, which could not be completely restored by removing the tympasclerotic plaques. In these patients, the integrity of the tympanic membrane was restored, and ossiculoplasty was postponed to the second stage in order to prevent infection of the labyrinth and its consequences. With the exception of those preparing for the second stage of the operation, hearing increased by an average of 20 dB after 2 months and by an average of 2.5 dB after 3 months.

**Conclusions.** The study showed that the maximum audiological recovery of hearing after the surgical period occurs after 2 months, which explains the feasibility of a complete hearing examination 2 months after complete rehabilitation. Restoring the integrity of the tympanic membrane may not always allow full restoration of hearing, since the immobility of the auditory ossicles can adversely affect the result of the operation. But the restoration of the mobility of the auditory ossicles in the second stage allows to restore hearing. This fact shows us that it is necessary to introduce patients to the course before the operation, that the operation can be performed at the second stage, since the operation at the first stage is fraught with complications.

Since it is impossible to predict the outcome of the operation by 100% before the operation, the surgeon must be prepared for any outcome and preferably have all types of prostheses at hand, which allows avoiding unnecessary surgical interventions.

Based on the results of the observations, the following conclusion was made.

If patients with tympanosclerosis have hearing loss, perforation of the tympanic membrane and conductive hearing loss, treatment of these patients with surgery and restoration of the integrity of the tympanic membrane is indicated. After the restoration of the tympanic membrane, it is not always possible to restore hearing if there are tympanosclerotic plaques in the tympanic cavity. To restore hearing, it is necessary to remove tympanosclerotic plaques and restore the movement of the bones. Sometimes the mobility of the bones may not be restored. If in such cases fixation of the malleus and anvil of the bones is observed, it is necessary to remove the head of the malleus and incus, it is necessary to install a PORP prosthesis on the head of the stirrup. If the movement of the stirrup is not restored in these patients, it is indicated to prepare for the operation a secondary total ossiculoplasty.

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# CLINICAL AND IMMUNOLOGICAL STUDY OF THE EFFECTIVENESS OF THE MEDICATIONS, LAZOLEX AND TRADTIONAL TREATMENT, DURING THE COMPLEX TREATMENT OF CHRONIC RECURRENT APHTHOUS STOMATITIS (RAS)

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**Abstract**

The purpose of this study was to study the immunomodulatory and clinical properties of the drug in patients with RAS. In order to assess the effect of the LAZOLEX on the clinical course of RAS, 2 groups of patients were formed (In total 50 patients): 1) The first group (control), which included 20 patients, who received a traditional treatment (application of A and E vitamins, cedar oil, Solcoseryl dental adhesive paste); 2) The second group (main), which included 30 patients, who were treated with LAZOLEX. (5% gel was applied to the damaged areas of the lips and oral mucosa, daily for 10 days).

Examination of patients with RAS revealed noticeable changes in the immune system, affecting all its factors, which largely depended on the severity of the process, i.e., the most severe immunosuppression was recorded in patients with severe stomatitis. Therefore, the obtained fact was a sufficient justification for the use of immunomodulatory agents as adjuvant therapy, in a particular case - LAZOLEX. We note that this drug significantly increases the effectiveness of traditional treatment, and from an immunological point of view, we can reasonably assert that it contributes to the immunorehabilitation of patients.

Conducted clinical, laboratory and immunological studies allow us to recommend LAZOLEX for active use in dental practice for RAS.

**Keywords:** RAS, LAZOLEX, Extract of the pericarpium, Juglone herbal extract, Aphthae

***Introduction:***

The Greek term “Aphthae” was initially used in relation to disorders of the mouth and was first mentioned by Hippocrates (460-370 BC) [12]. Today, recurrent aphthous ulcération, or recurrent aphthous stomatitis (RAS), is recognized as the most common oral mucosal disease known to human beings. According to WHO, it affects up to 20% of the population. The onset of RAS seems to peak between the ages of 10 and 19 years before becoming less frequent with advancing age [14].

The most characteristic symptom of the disease is the recurrent onset of single or multiple painful small, round or ovoid erosions and ulcers with circumscribed margins, erythematous haloes, and yellow or gray floors, covered with fibrous coating, with a development cycle of 7-10 days. They appear mainly on unattached oral mucosa of the lips, cheeks and tongue. Occasionally the lesions may also be observed on strongly keratinized palatal and gingival mucosa [2].

Patients complain of burning sensation and pain, which is sharply increased when eating, talking. Often the general condition of the patient worsens, manifesting headaches, insomnia, possible addition of subfebrile temperature. It can be considered not only as an independent local process, but also as a manifestation of some disease of the body. Up to now, the etiopathogenesis of this condition remains unclear; it is, however, considered to be multifactorial. The potential trigger factors, that modify the immunologic response in RAS and provoke relapses of the disease include: trauma of the oral mucosa, stress, gastrointestinal disorders and hormonal level fluctuations, hypothermia, genetic predisposition, systemic diseases, vitamin and microelement deficiencies, food allergies, viral and bacterial infections, HIV. There are many different theories about the origin of RAS, such as viral, immune, infectious, allergic, neurogenic [15, 13].

As the etiopathogenesis of the condition has not been clearly defined, the treatment is mainly symptomatic and not very effective. Discovering the direct etiopathogenetic factors in RAS may in future help to predict the risk of the disease occurrence and to develop the effective, causative management.

Intensive research is continuing in our country to find and implement new natural medicinal preparations produced from ecologically pure endemic plants of Georgia, according to traditional medicine recipes, using the latest biotechnological approaches. An example of such studies is a local drug - LAZOLEX (extract of the pericarpium of an unripe walnut), produced by the “Iveria-Pharma” company. LAZOLEX passed the necessary preclinical tests and was successfully used in the

clinic as an antiviral agent [1, 4, 9]. This time, we studied its clinical effects in patients with recurrent aphthous stomatitis (RAS) [4].

Results of In vitro tests in cell cultures, as well as in laboratory animals, have shown that the extract for the production of LAZOLEX has the protective properties against the herpes simplex virus. In addition, under the same experimental conditions, as well as on healthy volunteers, positive immunotropic effects of LAZOLEX were also found [1].

The purpose of this study was to study the immunomodulatory and clinical properties of the drug in patients with RAS.

***Methods:***

In order to assess the effect of the LAZOLEX on the clinical course of RAS, 2 groups of patients were formed (In total 50 patients):

1) The first group (control), which included 20 patients, who received a traditional treatment (application of A and E vitamins, cedar oil, Solcoseryl dental adhesive paste);

2) The second group (main), which included 30 patients, who were treated with LAZOLEX. (5% gel was applied to the damaged areas of the lips and oral mucosa, daily for 10 days), **(Figure 1).**

In addition, depending on disease form, each group was divided into 3 subgroups - Fibrinous (a) – 12 patients (24%), Necrotic (b) – 32 (64%) and Glandular (c) – 6 (12%). Depending on the severity of the disease – mild (A) – 20 (40%), moderate – 20 (40%), severe – 10 (20%).

The therapeutic effect was assessed on the basis of the timing of the disappearance of subjective and objective signs of RAS, time of epithelialization and remission.

Clinical symptoms were assessed daily. Clinical research methods included taking anamnesis, examining the oral cavity for the presence of RAS aphids, palpation of the oral mucosa to assess the pain of the rash, time of epithelialization.

To assess the immune status of the organism, we used the following adequately responding indicators of the T- and B-lymphocyte system, phagocytosis, interferon in the blood, secretory immunoglobulin A and lysozyme in saliva (in total, about 15 parameters). Since some of them were comparatively less informative, in our discussion we stopped at 6 parameters, which were the most dynamic, informative and reliable: interferon system - αIFN and γIFN, index of immunoregulation (Ii), phagocytic index (PhI), sIgA and lysozyme [11].

The state of immune homeostasis of patients was assessed in dynamics, i.e., at the first visit to the clinic, as well as on the 10-13th day of treatment **(Table 1).** (first visit) combines data from all 50 patients, depending on the severity of stomatitis. In the second table, the immunological aspects of the two treatment approaches (Traditional/LAZOLEX), depending on the severity of RAS and the results of treatment, were assessed separately and comprehensively, and a generalizing analysis of the data obtained was made.

Imunological studies were being conducted at V.Baxutashvili Institute of Medical Biotechnology, Tbilisi, Georgia.

Statistical analysis of the experimental data was conducted using Student's t-test. A significance level of $p \leq 0.05$ was considered statistically significant [10].

***Results and its discussion:***

Examination of patients with RAS revealed noticeable changes in the immune system, affecting all its factors, which largely depended on the severity of the process, i.e., the most severe immunosuppression was recorded in patients with severe stomatitis.

Table 1.

**Immunological parameters in patients with RAS (admission to the clinic)**

| **Parameters** | **Severity of the disease (A –** mild; **B –** moderate; **C –** severe**).** | | | | **Control (n=30)** |
|---|---|---|---|---|---|
| | **Total (n=50)** | **A (n=20)** | **B (n=20)** | **C (n=10)** | |
| αIFN **(U/ml)** | *25.05 | *28.1 | *26.7 | *20.2 | **41.3** |
| γIFN **(U/ml)** | *13.3 | *17.6 | *13.5 | *8.8 | **28.6** |
| **Ii** | *1.7 | 2.1 | *1.76 | *1.24 | **2.28** |
| **PhI** | *3.88 | 4.75 | *3.8 | *3.1 | **4.9** |
| **sIgA (g/l)** | 0.27 | *0.39 | 0.27 | *0.14 | **0.28** |
| **Lyz (%)** | *33.6 | 40.6 | 34.5 | *25.7 | **41.9** |

Note: * indicates a significant difference with the control - Practically healthy volunteers.
Source: own editions

As can be seen from the table 1, mild RAS proceeded against the background of the compensatory reaction of the body, due to the humoral link. Important is a significant increase in the digestive capacity of blood leukocytes (4.75) and an increase in the concentration of secretory IgA (0.39g/l) and lysozyme (40.6%) in saliva, the most important factors of local protection of the oral cavity. The interferon system turned out to be especially sensitive (decrease, αIFN to 28.1 units/ml, - γIFN to 17.6 units/ml). However, with the deterioration of the clinical condition of patients, there was a depletion of compensatory capabilities and a cascade inhibition of almost all the factors studied.

With moderate severity of RAS, almost all parameters undergo further suppression: phagocytic index - 3.8; αIFN - 26.7 U/ml; γIFN - 13.5 U/ml. It should be emphasized that with this form of stomatitis, the content of lysozyme in saliva significantly decreased -

34.5%, and slightly below the norm - the amount of sIgA (0.27 g/l). In other words, with a moderate degree, we can no longer talk about compensatory mechanisms on the part of the immune system, which was characteristic of mild stomatitis.

A serious immunodeficiency state is formed with a severe degree, all the studied parameters turned out to be significantly lower than normal. Thus, these studies, which were, as it were, preliminary, indicate a serious immuno-pathological state of the body, which accompanies moderate and severe forms of stomatitis.

Therefore, the obtained fact was a sufficient justification for the use of immunomodulatory agents as adjuvant therapy, in a particular case - LAZOLEX. We note that this drug significantly increases the effectiveness of traditional treatment, and from an immunological point of view, we can reasonably assert that it contributes to the immunorehabilitation of patients **(Table 2).**

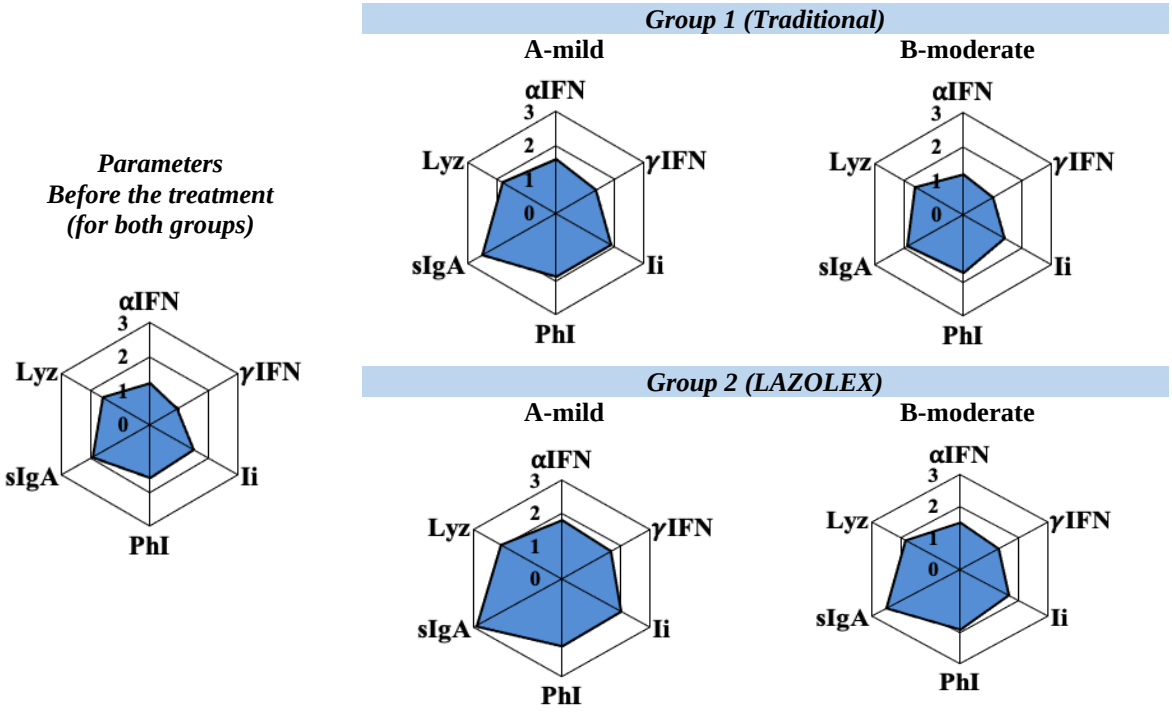
For a better perception of this data, we used immunograms, in which the control information is presented in the form of a regular hexagon. The shaded (irregular) polygon reflects the dynamics of immunological indicators from different groups (for example, different severity of the disease, treatment, units of measurement).

Table 2.

**Immunological parameters in patients with RAS (10-13 days after treatment)**

| Parameters | Before treatment (n=50) | | Severity of the disease (**A** – mild; **B** – moderate; **C** – severe). A (n=20) | | B (n=20) | | C (n=10) | | Control (n=30) |
|---|---|---|---|---|---|---|---|---|---|
| | Group 1 n=20 | Group 2 n=30 | Gr 1 n=7 | Gr 2 n=13 | Gr 1 n=8 | Gr 2 n=12 | Gr 1 n=5 | Gr 2 n=5 | |
| **αIFN (U/ml)** | *24.7 | *25.4 | *32.5 | 36.9 | *24.8 | *30.7 | *22.1 | *26.1 | **41.3** |
| **γIFN (U/ml)** | *13.7 | *12.9 | *19.6 | 24.4 | *14.8 | *18.8 | *9.3 | *9.9 | **28.6** |
| **Ii** | *1.68 | *1.72 | 2.17 | 2.31 | *1.6 | *1.9 | *1.31 | *1.34 | **2.28** |
| **PhI** | *3.85 | *3.9 | 4.65 | 5.1 | *4.2 | *4.7 | *3.9 | *4.4 | **4.9** |
| **sIgA (g/l)** | 0.28 | 0.25 | *0.35 | *0.41 | 0.26 | *0.35 | *0.16 | *0.19 | **0.28** |
| **Lyz (%)** | *33.5 | *33.7 | 38.05 | 43.2 | *34.1 | 38.6 | *28.1 | *29.3 | **41.9** |

Note: * indicates a significant difference with the control - Practically healthy volunteers.
Source: own editions




***Immunograms**. Immune status of patients with RAS after treatment in Group 1 and 2 (comparison with control - line 2).*

Source: own editions

Thus, the determination of the state of different links of immunity in patients with RAS is of great practical importance, since it allows predicting the course and outcome of an infection of the oral cavity. It is known that timely and pathogenetically justified therapy can achieve almost complete compensation for violations of homeostatic mechanisms [6, 9, 8]. In case of irrational treatment of patients, the indices of the body's immunocompetence may remain altered for a long time, which increases the likelihood of a torpid course of the disease and the occurrence of complications as a result of the activation of other pathogenic factors. Therefore, along with specific treatment, complex therapy is of decisive importance, including means aimed at restoring immune homeostasis (LAZOLEX).

Clinical efficacy was assessed according to the following criteria: [I] Time of epithelialization; [II] Duration of remission.

The results of a study showed that the use of LAZOLEX (Group 2) was accompanied by a significant improvement: Time of epithelization – depending on a disease form - Fibrinous (a) – 3-6 days, Necrotic (b) – 7-14 days and Glandular (c) – 9-14 days, compared to traditional treatment (Group 1) - (a) – 7-14 days, (b) – 10-21 days and (c) – 14-20 days **(Figure 2, Figure 3).**

Period of remission in group 2 was also improved: Fibrinous (a) – 6-9 months, Necrotic (b) – 4-6-7 months and Glandular (c) – 3-5 months, compared to traditional treatment (Group 1) - (a) – 3-4 months, (b) – 2-4 months and (c) – 1-2 months.

Specifically speaking about LAZOLEX, which was previously used by us for herpetic stomatitis as an adjuvant agent, and now for treatment of RAS, we can talk about the double action of the drug, it significantly increases the effectiveness of direct antiviral treatment, and from the immunological point of view, it contributes to the immunorehabilitation of patients. This opinion is based on the fact of a clear correlation between the clinical state of patients and the dynamics of immunological parameters [3, 7]. The drug is especially effective in showing it is immunomodulatory properties in case of mild disease, when almost all parameters approach the control level. The action of LAZOLEX with an moderate form of stomatitis is quite reliable.

***Conclusion:***

Our studies have convincingly shown that LAZOLEX can be successfully used to selectively neutralize the immunosuppressive effect of the herpes virus. We can talk about the various mechanisms of the indicated abilities of the drug, but the following seems to be the most acceptable to us with herpes, a hormonal imbalance is formed in the body, general and cellular hypoxia develops, destructive processes lead to intoxication. All these phenomena arise either against the background of an already existing immunopathology, or lead to it. In other words, with herpes, and also with RAS at least all four of these factors are present - hormonal imbalance, hypoxia, intoxication, immunopathology, with mutually reinforcing effects. In our opinion, these effects are realized due to physiologically active substances contained in the extract (antibiotic Juglon and flavonoids; trace elements; complex of vitamins C, E, PP), which enhance functional activity of immunocompetent cells. Therefore, the Juglone herbal extract tested by us (for the production of LAZOLEX) can be classified as active natural remedies that can be successfully used for the prevention and treatment of viral and bacterial infections, purulent-inflammatory diseases, as well as other pathological conditions that require an improvement in metabolic and adaptation processes [5, 16], **(Figure 4).**

Conducted clinical, laboratory and immunological studies allow us to recommend LAZOLEX for active use in dental practice for RAS.

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Data Availability: All of the data are included in the content of the paper.

*Figure1. Female, 45 yrs. Fibrinous form. First day of treatmantwith a LAZOLEX gel (mild form).*

*Figure 2. Female, 45 yrs. Fibrinous form. The fourth day of treatmantwith a LAZOLEX gel (mild form).*

*Figure 3. Female, 45 yrs. Fibrinous form. The sixth day of treatmantwith a LAZOLEX gel (mild form).*

*Figure 4. LAZOLEX 5% GEL*

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# PEDAGOGICAL SCIENCES

## INDIVIDUAL CHARACTERISTICS OF STUDENTS IN THE PROCESS OF LEARNING FOREIGN LANGUAGES

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**Abstract**
The issue of age and individual characteristics in the preparation of foreign languages remains insufficiently studied. Although foreign language training continues throughout school life, in some cases from kindergarten through high school, the level of foreign language training is generally insufficient for practical use in human life. One of the reasons for this situation, in our opinion, is the insufficient consideration of the age and individual characteristics of students in the process of learning foreign languages.

**Keywords:** individual characteristics, high school students, foreign languages, learning, cognitive process, development, holistic thinking, perception.

One of the main issues of the theory of individual human development is the question of the relationship between age, typological and individual characteristics of a person, about the contradictory and changing relationships between them. Their unique combination will become the basis for the development of the psyche in specific areas, thereby contributing to the manifestation and development of the ability to master academic disciplines, especially a foreign language. With the change of age, in the school period, the value of verbal memory, memorization of figurative meanings increases, creative thinking starts to play an important role, the ability to establish cause-and-effect relationships is revealed, also speech and mental activity become more differentiated. The success of learning foreign languages at different ages is determined by the predominance of different components in the structure of language skills. At the initial stage of training, the successful mastery of foreign languages is mainly related to the superiority of personal parameters; at higher stages of training, cognitive and psychophysiological indicators are mainly determined. At the same time, personal factors are not sufficiently used in high school [1, p. 6].

Psychologists attribute the age of high school students (15-18) to early adolescence. Early adolescence exists between childhood and adulthood. This age is characterized by a number of psychological features. Currently, the age specificity of this period of development is almost certainly different, which is reflected in all aspects of learning and school life of high school students. A modern high school student is a product of modern life, complex, interesting and contradictory at the same time. A person's physical maturation is completed in high school age. The physical development of modern 17-year-old students corresponds to the development of 22-year-old students in the 1930s [1, p. 7].

In early adolescence, qualitative changes occur in all aspects of mental activity. Perception becomes arbitrary, manifests itself in perceptual acts of systematic observation of certain objects, one's own actions, behavior, experiences and thoughts. The memory of high school students undergoes significant changes: long-term verbal and logical memory prevails in them, the arbitrariness of memory increases, the productivity of logical memorization increases, and the means of memorization are improved. Productivity of involuntary memory also depends on the organization of mental activity, the role of which does not diminish. We involuntarily remember, first of all, what is connected with the interests and needs of high school students, with their plans for the future. Let us consider in more detail the components of the cognitive processes of high school students and their influence on learning foreign languages [2]. One of the important aspects of the intellectual development of high school students is intensive intellectual maturation, in which developmental thinking plays a leading role. The center of cognitive development of high school students is the formation of verbal and logical thinking. There is a transition to higher levels of abstract and generalizing thinking. Scientific concepts become not only a subject of research, but also a tool of knowledge.

Students of this age are able to consciously master logical operations (analysis, synthesis, comparison, reflection, abstraction, concretization, and generalization). They form an individual cognitive style of solving cognitive and practical tasks, develop individual features of thinking, including: depth, flexibility, breadth, awareness, independence, criticality, etc. The thinking of different students of the same age differs in the ratio of visual-figurative and verbal-logical components, as well as the level of productivity. Especially in the process of learning a foreign language, the specificity of students' thinking affects the speed of forming verbal connections and functional language generalizations, the flexibility of transformational processes, etc. Depending on the level of development of the student's productive thinking and the nature of the educational

goal, the teacher should direct his thinking from concrete to abstract and vice versa. Thus, the presence of individual differences in thinking requires different methods of teaching foreign languages. Since high school students are characterized by synthesis in relation to a high abstract-logical form of thinking, this (synthesis) causes the appearance of critical features in their analytical activity, the desire to discuss issues that concern them. It follows from this that the structure of the communication content of foreign language lessons should be problematic [3, p. 34].

With the development of abstract and holistic thinking, high school students reach higher levels of language proficiency. As the thinking of young boys and girls develops, the content and structure of their speech becomes more complex. Active and passive vocabulary expands. Oral and written expression improves. There is a transition from an expanded internal language to a shortened (concise) internal one, which becomes the basis of mental action. High school students are characterized by significantly higher communicative development than elementary school students.

They have a more perfect command of morphological and syntactic aspects of speech, coherence, logic and sequence of utterances. The statement demonstrates the ability to analyze, compare, generalize, draw conclusions, and predict. All this implies, on the one hand, the need to have adequate linguistic material, as well as the use of authentic written and acoustic texts in the educational process. On the other hand, there is a need for new, undeveloped language skills at previous levels of education, which ensure the implementation of a normative and generalizing function, for example, the ability to communicate in an organizational form of discussion. Since the unit of teaching foreign languages today is not a word or a sentence, but a text, during the teaching of foreign languages, an analogy with the process of learning a native language is allowed and the circle of interests and cognitive needs is expanded [5, p. 95].

Memory plays an equally important role in the acquisition of foreign languages, as does speech. In early adolescence, students develop a desire to master their memory and manage it, to increase productivity. It should be noted that memorization is not reduced to understanding, but requires specific methods of memorization and reproduction and consolidation of consciously learned information. Learning material first enters short-term memory and then must be transferred to long-term memory through exercises. Both types of memory are of great importance for language activity. The main trend in the development of the memory of a high school student is characterized by its increase and strengthening of willpower. As psychologists note, random memorization prevails among high school students, which is effective when they realize the necessity and expediency of memorizing this or that material, as well as the effectiveness of the final result [4, p. 28]. Memorizing the material will help to understand the characteristic features of this material, to recognize the relationship and meaningful grouping of the objects of memorization and to focus on intensive work.

It is characteristic that boys and girls of this age are more self-critical than teenagers. This circumstance makes it possible to better organize work on the elimination of defects according to individual tasks. At a higher level, the combination of forms of individual, pair and team work (the latter predominates), where the teacher acts as a partner, organizer, animator, director, screenwriter, director, etc., becomes more and more important. At the same time, the group is given a general cognitive task, and the teacher organizes and stimulates joint research, where everyone performs their work task. It is necessary to deal with the understanding and calculation of the phenomenon characteristic of this age - the desire of the schoolboy to attract more attention from others. A foreign language teacher can use it when organizing discussions, setting tasks in role-playing games or project work, when developing individual tasks and organizing self-help, when setting individual tasks for organizing extracurricular work [6, p. 29].

In high school age, involuntary memory acquires a specific character, the role of which cannot be underestimated. The productivity of this memory also depends on the mental work of students during the learning process. In particular, they remember learning material better if it is part of the goal of their intellectual activity. High school students better involuntarily remember what is an obstacle and difficulties in their success. In addition, the involuntary recall of what is related to the needs, desires and interests of students, their plans for the future, causes a strong emotional reaction in them. For this type of memory, reflective methods and methods of working with educational materials in foreign language classes are especially relevant (reference outline, algorithm, sync-way, intelligence map, cluster, etc.) [5, p. 51].

The development of the cognitive sphere of high school students also consists in improving the ability to direct attention to specific subjects and phenomena, overcoming the influence of distracting factors. All this indicates the development of concentration. The volume, stability, degree of focus, speed of attention switching increase. The development of these qualities of attention is connected with the development of logical thinking. But the selectivity of attention also increases, its dependence on the direction of interest, the role of post-voluntary attention increases. Although involuntary attention, which is usually dictated by the student's immediate interest, cannot be forgotten, it requires special attention when teaching foreign languages [5, p. 52].

The development of the imagination of high school students is marked by the disclosure of their inner world. The assimilation of the material becomes much more difficult and requires the activation of reproductive and creative imagination. Students observe a more critical attitude towards the creations of their own imagination; they strengthen self-control over the work being performed. The development of senior schoolchildren’s perception is manifested by the predominance of its arbitrary form, the assimilation of perceptual actions, the deliberate observation of certain objects, the identification of the essence in objects,

events and phenomena. This is especially characteristic for the perception of complex materials, grammatical phenomena and regularities.

There is a development of integrity, meaningfulness, objectivity, selectivity, and especially perception. A holistic image is created on the basis of a conscious generalization of data about individual properties, features and functions of the object, as a result of the integration of experiences of different modalities. The given psychological characteristics of high school students are of a general nature. Ignoring them can lead to negative consequences. The general is always realized in a special way in the individual and therefore has a peculiarity in the individual case. Recognition and acceptance of this uniqueness is no less important than the development of general rules and norms. This applies, in particular, to a foreign language, which belongs to a group of active educational disciplines, the purpose of which is primarily the development of specific skills and abilities.

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# ROLE OF TECHNOLOGY IN LEARNING AND TEACHING ENGLISH FOR SPECIFIC PURPOSES STUDENT'S PERSPECTIVE

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**Abstract**

Technology has definitely become the headline of the century. Every field of life, starting up with medicine, science, engineering, etc., and ending with education, goes hand in hand with technology and its development. It is undeniable that information and communication technology (ICT) has a significant impact on people's lives and the way they communicate.

But what is technology's impact on education?

Previously, there were only 4 main elements during the learning process: the student, the teacher, the book, and the blackboard. Learning was explained only through books, papers, notebooks, and pencils.

However, the last century has undergone tremendous changes due to technology, which has now become an integral and essential part of the teaching and learning process. The technological infrastructure in the learning process is translated into devices that serve to exchange information, process it, analyze it, etc.

The main purpose of technology in education is to increase the student's ability to concentrate, to be more creative, and to facilitate the learning and teaching process while increasing its efficiency. Students have grown responsible for their own learning through searching and finding (at least) information on the Internet and other technological tools, communicating and collaborating with each other, by encouraging independent learning among students.

Regarding learning a foreign language for specific reasons, and the impact of technology on it, a study was conducted in the Faculty of Mechanical Engineering where the familiarity of students with ESP and with technology during the ESP course was revealed.

The research concluded that students of Mechanical Engineering deal with technology in the classroom and take the best out of it, however, there is a lack of tools limiting them just to laptops or students' own personal smartphones, and rarely video projectors.

Students make use mostly of online dictionaries and mobile phone learning technology by using WhatsApp and other social media applications.

**Keywords:** ESP, technology, Mechanical Engineering, teaching, learning

## Introduction

With technology revolutionizing our life in all its dimensions, it has become a target of endless studies.

*Previous work*

Countless number of studies have been conducted on technology and its role in education worldwide. As Albanian is concerned, there have been conducted studies related to Language for Specific Purposes, ESP in Mechanical Engineering, especially papers related to mechanical terminology, but there are no studies conducted dealing with the impact of technology on ESP learning and teaching in the Faculty of Mechanical Engineering, PUT.

This paper has two main parts. The theoretical part is where data pertaining to ESP and technology, is collected and analyzed. The descriptive part: the term descriptive research refers to research questions, the design of the study, and data analysis conducted on that topic. We call it an observational research method because none of the research study variables are influenced in any capacity.

The paper attempts to:

1. Gather, describe and analyze data concerning ESP and Technology in general, mainly of the last years
2. Better target and evaluate our ESP Mechanical Engineering students 'familiarity with ESP, their needs and requirements and to reveal what technological tools are actually used and which of digital technologies serve the common purpose of teachers which, in this context, is employing and applying effective teaching strategies involving technology by promoting effective learning.

## 1. Literature Review.

*1.1 Technology and its impact on our life*

Technology has become an inseparable part of our everyday life by walking hand in hand with us in our countless everyday activities, by undoubtedly revolutionizing our lives.

Almost, each of us starts the day by strongly embracing technology. We wake up and if not, mobile

phones or the so-called smartphones are “the first person to give the morning kiss “, and move on with the television, computer, etc. There are high-tech tools that actually monitor everything, starting with the daily steps one makes, measurement of blood pressure, or even home robots.

Then you move on to work, go out with friends, play with your kids…technology is there, everywhere. Beyond the shadow of a doubt, inventors that belong to the digital space and technology are actually scrambling to find ways to promote their platforms or tools to each member of society, be it kids or elderly people.

Technology was meant to help people, to make our lives easier, it was meant to serve us, right? But, when people fail to use technology and take the best out of it, what happens? What happens is that technology, manages to make us its servants and “it” the master.

In my opinion, somehow, sometimes we have come to be manipulated by technology, which is actually directing our lives. When people get addicted to smartphones, video games, YouTube videos, etc., it means that it is technology that is setting the priorities of each of us, it is technology that dominates our lives and our time.

But, in spite of what we mentioned earlier, no one ever can deny that technology has really enhanced our way of living and experiencing life.

It affects in many different fields of life, such as the healthcare industry, science, communication, and many others by ending up, with what concerns our work, and education. The healthcare industry of course has undergone substantial changes, which no one could have ever foreseen. Many chronic diagnoses such as hypertension, before would be considered life-threatening, nowadays with the big impact of technology, modern medicine has created the right tools to manage these health conditions, by improving life and increasing the lifespan of human beings.

Communication has changed a lot due to technology’s advancement. We all know that initially, it was the telegraph the first technological tool of communication which then paved the way for the telephone, but know it is the internet cell phones and emails which are at the summit of most preferred methods of communication.

***1.1.2*** *Technology in education and its role in this area of life.*

There are three main components of technology in education (Burgin. M 1999)[12]: 1) organization and management of some educational system (from a school to the system of education of the whole country); 2) satisfaction of some supplementary needs of education systems and educators (e.g., information supply, communication facilities, word processing, etc.); 3) realization of a teaching/learning process. The latter type is called educational technology. It has three aspects. First, the most obvious one is technology as a discipline for teaching and learning. The second aspect is the technology of learning, and the third one is the technology of teaching. Technologies of both latter types are called instructional or pedagogical technologies.

*1.1.3 Definitions of Technology*

Technology is the social phenomenon of the last 21st century, and no one can deny it, that being the case, as far as education is concerned, in order to have a very efficient usage of technology in this field, we have to really understand what technology stand for as a social phenomenon. But first, let us give some definitions regarding technology:

1. Technology is any systematized practical knowledge, based on experimentation and/or scientific theory, that enhances the capacity of society to produce goods and services, and which is embodied in productive skills, organization, or machinery.[3]

2. Technology is :

- a technical language;
- the science of the application of knowledge to practical purposes
- application of scientific knowledge to practical purposes. [4]

Apart from the above-mentioned, we put an emphasis on the influence it has on almost every aspect of life.

*1.1.4 Technological approach to education*

When it comes to the technological approach in education, the first thing that goes through one’s head is, the presence of technological tools in the classroom, such as computers, video-projectors, internet connection, and why not smartphones. But of course, even advanced technological tools in different laboratories according to the study programs. All these means, serve the purpose of having a high diversity of methodologies and techniques being used during the teaching and learning process as well. It has facilitated the whole process of teaching and learning. Teachers have endless methods and techniques to implement in the classroom, and out of it. Students on the other side, have options on how to deepen their knowledge or understanding of a specific subject. There is always room for more wisdom in people’s brains, and technology offers enormous sources where one can always learn something new. But, what I want to emphasize is the fact that technology should not act as a means that causes a metamorphosis in the teachers’ role, by making it the main instrument and fading the role of the teacher which is, well teaching itself.

*1.4.1 What is teaching?*

As for what does teaching mean, many scholars have given their own definitions of what teaching is. ‘Teaching is intimate contact between a more mature personality and a less mature one which designed to further the education of the latter”. [5] Morrison (1934), Dewey (1934) expressed this concept of teaching by an

1.[1] Technology in Education Mark Burgin

2. [3]Pacey, A., "The Culture of Technology", 1983

3. [4] McGraw-Hill Concise Encyclopedia of Science and Technology. - New York - London - Tokyo, 1989

4. [5] H C Morrison (1934), retrieved from https://worldcat.org/identities/lccn-no96056165/

equation. “Teaching is learning as selling is to buying”.[6] According to John Brubacher (1939), “Teaching is arrangement and manipulation of a situation in which there are gaps or obstructions which an individual will seek to overcome and from which he will learn in the course of doing so”. [7] B.O. Smith defined teaching as “Teaching is a system of actions intended to induce learning”[8]. In the words of Gage (1963), “Teaching is a form of interpersonal influence aimed at changing the behavior potential of another person”.[9] Edmund Amidon (1967) defined teaching as “an interactive process, primarily involving classroom talk which takes place between teacher and pupil and occurs during certain definable activities”[10]. Many confuse teaching with training or indoctrination, well there’s merely some resemblance among them. Teaching is not just meant only to teach and therefore has an effect on students’ learning, it is also about face-to-face communication. Understanding student’s needs and trying to find a way to fulfill them. It is not just as Smith in 1963 who gave an extended definition of teaching said, ‘Teaching is a system of actions involving an agent, an end in view and a situation including two sets of factors those over which the agent has no control (class size, characteristics of pupils, physical facilities, etc.) and those which he can modify (such as techniques and strategies of teaching. As I mentioned earlier, teaching, among other things, is about understanding students’ needs, and for that, there is a needs analysis that has to be conducted.

1.2 *Language for Specific Purposes*

Language for Specific Purposes is an aspect of linguistics that totally responds to students’ needs. According to some scholars, such as A. Waters (1987), D.Crystal (2003), K Westerfield (2012), and J.A. Fishman (1965), the true movement in LSP or specialized languages began in the early 1960s [11]. But, taking into consideration the importance given to other languages regarding, specialized language, which is minimal, English has prevailed and dominated this field of linguistics. But what led to the growth of this aspect of linguistics? In their book ‘English for Specific Reasons’, Hutchinson & Waters (1987[12]), list three main reasons for the emergence of ESP: the demands of a brave new world: The focus in here stands on the blooming of different areas of life such as Science, Technology, and Market. The biggest boom, and the most noticeable worldwide was that of the US be it in economy, science or technology, which consequently, marked the development and enrichment of the mother tongue of this country, English. This leads us to the other reason which is a revolution in linguistics, specifically in the field of lexicology and terminology, by bringing in an endless number of new words and new terms. This change that occurred after WWII, but most precisely in the 1960s and continues nowadays has empowered the English language, by estimating it today as a dominant or as D. Crystal (2003)[13] would consider it, a global language. People started to notice the importance of knowing the English Language even if they are not from countries with English as their first language. So, there started an ‘era’, where people had to or wanted to learn English for clear reasons, for specific purposes; a businessman wanted to expand his/her business offshore, an electrician had to know English because most of the manuals were in the English language, or just because someone wanted to learn more on his field of interest. The above-mentioned actually represents the third reason, which is the focus on the learner. ESP, is not general English where you get the fundamentals of the English language, no. Through ESP, you obtain the necessary means that will help you increase your knowledge of your field of study and make you capable of understanding and communicating with the right terminology. "ESP methodology is based on the fundamental principle that we can identify a set of core language needs of target learners and adopt teaching materials and practices that will facilitate learners to meet those needs" (Bhatia, et al., 2011, p. 3)[14]. When all spheres of life are either positively or negatively affected by technology, language learning, and ESP have not been spared from significant changes. This process was inevitable due to the advancements in technology and language teachers’ wish to fully integrate computer and mobile phone technology in the language learning process (Warschauer & Healey, 1998) [15]because the development of new technologies and language learning have always kept abreast (Vukićević-Đorđević, 2015)[16]. Teachers of ESP, having to actually deal with students whose needs and wants are clear, they have to be really careful and precise with the techniques and activities employed in the classroom. Specifically, integrating technology in ESP curriculum provides students with a lot of learning opportunities and advantages ranging from providing

5. [6] Morrison (1934), Dewey (1934). Retrieved from https://files.eric.ed.gov/fulltext/EJ1245288.pdf
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interactive and communicative activities related to their professions to tools for giving feedback and self-evaluation on that specific context (Butler-Pascoe & Wiburg, 2003).[17]

## 2. Methodology and Findings

This part of the article presents the overall design of a study conducted in the Polytechnic University of Tirana.

The study was conducted with the students of Engineering degrees, in the Polytechnic University in Tirana, Faculty of Mechanical Engineering.

### *2.1 Participants*

There are 56 students of Mechanical engineering degree, 26 students of textile engineering degree and 20 students of material engineering. The students participating in my study are mainly of age 18-21. They are mainly pre-intermediate and intermediate students.

Table 1.

**Students' Data**

| | |
|---|---|
| The number of participants | 102 |
| Gender | Female, Male |
| Average Age | 18-21 |
| English proficiency level | Pre-intermediate, Intermediate |
| Nationality | Albanian |
| The institution where the study was conducted | Polytechnic University of Tirana, Faculty of Mechanical Engineering |
| The period when the study was conducted | October 2021- January 2022 |
| Data collection Instrument | Questionnaire |

*2.2 The aim of the survey was to reveal:*

a. To what extent students ME are familiar with the ESP subject when they first start this course?

b. To what extent technology is integrated into the learning and teaching process in the classroom?

The study investigates the background knowledge that students of the above-mentioned study programs had on the subject they were going to deal with. The program lasted 14 weeks, from October to the end of January. Throughout the semester we have been working with a method called " Mechanical Engineering"[18], which covers general information regarding engineering and mechanical engineering (henceforth ME) specifically.

The book is arranged into three levels of difficulty by offering 400 vocabulary terms and phrases. The unit contains a text of entry comprehension, vocabulary, and listening skills which lead students to written and oral production activities. The text includes a variety of authentic passages, and career-specific dialogues with more than 45 readings and listening passages per Textbook lessons.

In the present study, two questionnaires were administered. The first questionnaire is conducted at the beginning of the semester while the second questionnaire is at the end of the semester.

*The data were collected and analyzed from the specific context, course, and students offering the student perspective; therefore, generalizations should be avoided.*

**Results and findings**

The aim of the first questionnaire was to reveal the familiarity of students of mechanical engineering faculty with ESP.

Even though they were aware that they would be dealing with English, most of them actually thought they would be dealing with general English and not specialized English which has in focus their own field of study.

On the other side, as it is shown on table 2. there was a percentage of students 27.45 %, out of 100%, as Rubin (1979 )[19] states for the "good" language learners, who set their own directions and take responsibility for their own learning, starting with some research regarding what will they be dealing with in faculty, had made some research on what the English language consists of. The above-mentioned shows also a degree of autonomy developed in these students.

Some students knew they would have an ESP subject and not General English (henceforth, GE), and then they learned that "Mechanical Engineering" is the course they will be attending. Students of the Polytechnic University of Tirana, have the right to choose among five languages, just one. Most of the students choose English. When asked why they chose to study ESP 32 students, that is 31.37 % of them, said that it helps them succeed in their future careers. This result shows that students consider ESP a very good means of getting further in their professional life. 54 students, 52.94% acknowledged the role of English as an international language when they agreed to the statement that through the English language, you have access to the information available on the internet regarding their field of study. Cantoni and Tardini ( 2006), state that

16. [17] Bulter-Pascoe, M. E. (2009). English for specific purposes (ESP), innovation, and technology. In T. Chiang, W. Chuang, & L. Li (Eds.), English Education and ESP (pp. 1-15). Taiwan: Chien University

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19. [19] Rubin (1973). Retrieved from https://www.academia.edu/33080958/Technology_in_ESP

the Internet is mainly a contemporary communication technology that has become into a massive part of people's lives, which is reconfirmed also by these findings. [20]

Table 2.

**Students' decision to study ESP**

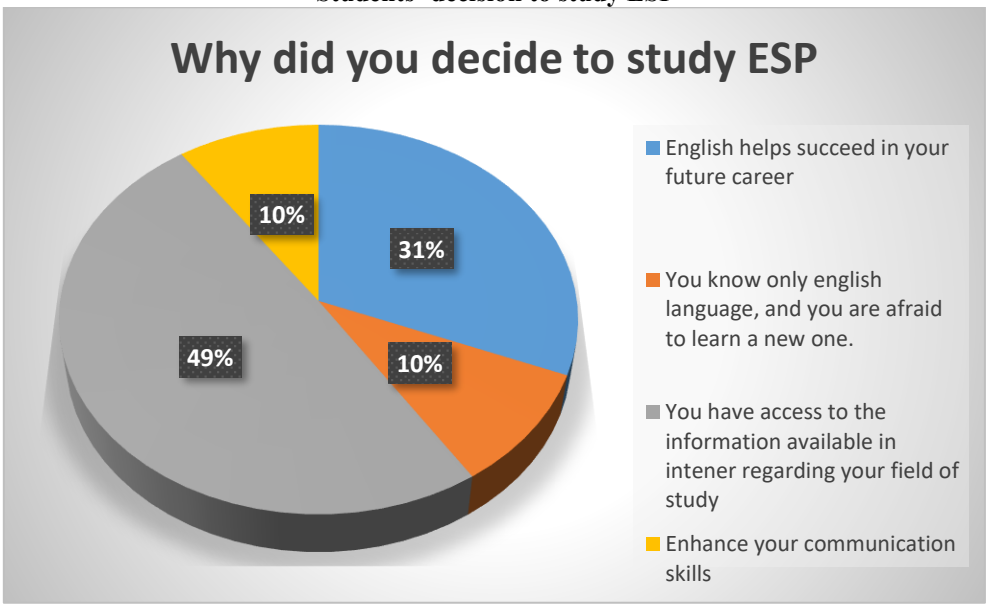
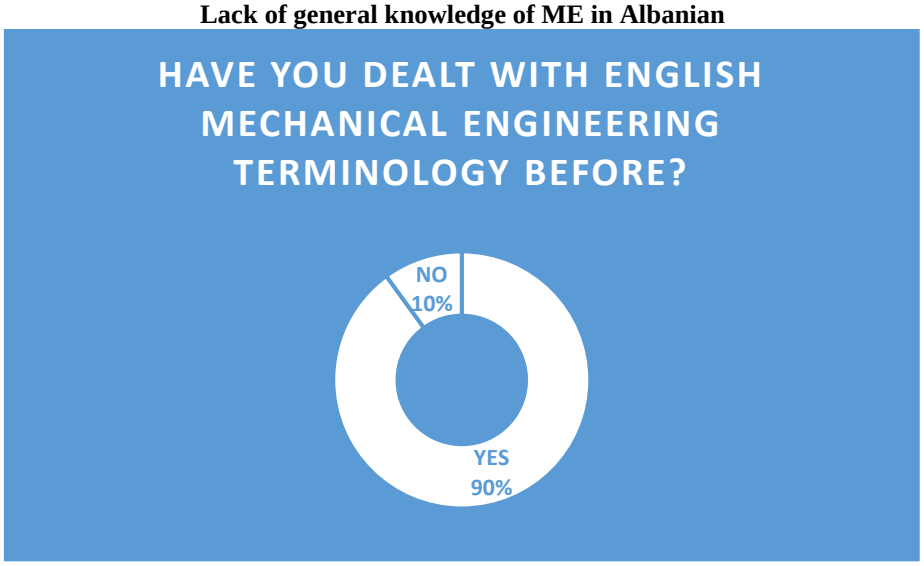



Table 3, sheds light to students' desire and readiness to study ESP, but the fact that students deal with English technical terminology without being introduced to the Albanian equivalent first it is a problem for 90% of the students. They express the concern of having to learn ME first, having no background knowledge in this area in Albanian. It is difficult they say, but however, they remain optimistic.

Table 3.

**Lack of general knowledge of ME in Albanian**




*Findings of the questionnaire at the end of the semester.*

***The second questionnaire is divided in two parts. The first part is focused on the experience students had with ESP and the second one deals with what is the main concern in this paper, the use of technology in ESP and its role.***

What is actually to be emphasized in the findings of the first part of the second questionnaire is the fact that students regret dealing with English only for a semester, which is about 40 hours total.

They find it really "disappointing". This, on the other hand, shows students' interest in learning ESP, technical English. The same question that was asked in the first questionnaire at the beginning of the course is

20. [20] Book "Internet" ByLorenzo Cantoni, Stefano Tardini

also asked in the second questionnaire; whether the absence of general knowledge in Albanian was an element that actually slowed down or interfered in the process of learning mechanical English.

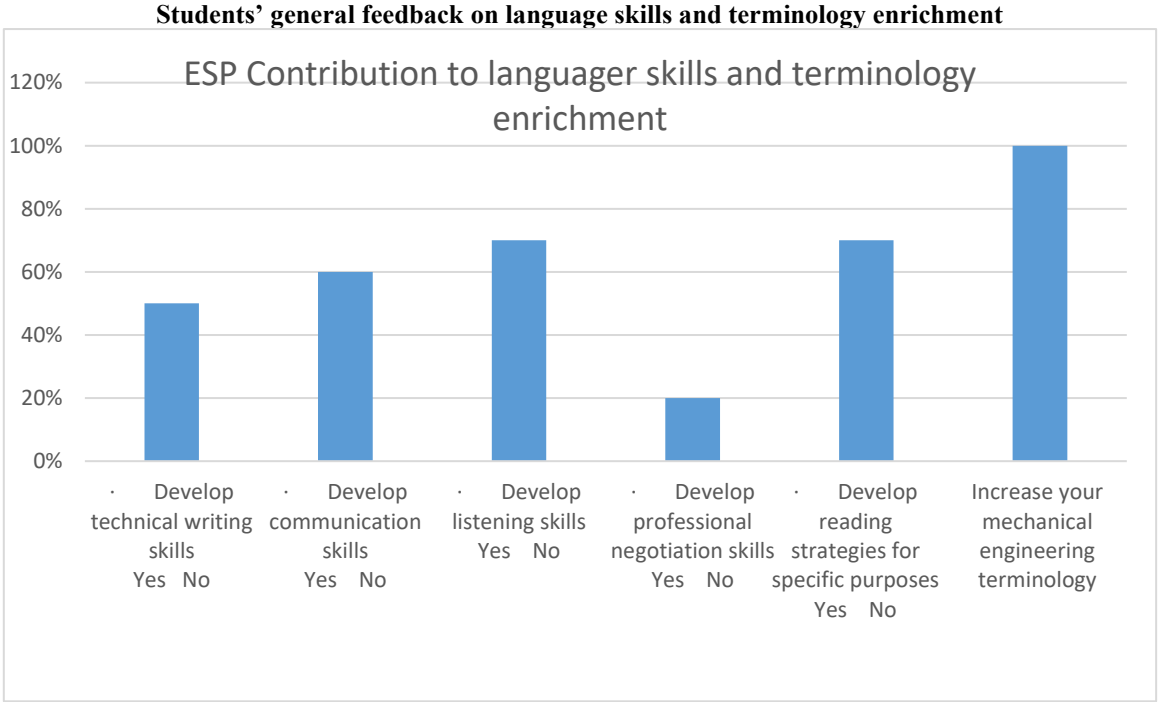
The answer varied, in accordance with the engineering degree of students. The answers from mechanical and material engineering were divided 50%/50%, where 31 considered it a drawback, while the others stated that it actually didn't interfere at all in the mechanical English learning process.

While textile engineering students were unanimous, and stated that the absence of general knowledge in Albanian impeded them from fully acquiring the English mechanical engineering corpus throughout the course.

When asked about the enhancement of different skills in ESP during the course, 100% answered that this subject increased English mechanical terminology.

Table 4.

**Students' general feedback on language skills and terminology enrichment**




Most of the students found this course contributing to developing communication skills and technical writing skills. Technical vocabulary is defined as vocabulary that has higher frequency words in specific fields such as engineering, science, and medicine (Harmon & Wood, 2018)[21]. These words have their own specific meanings that are designed specifically for certain fields (Hiebert, Scott, Castaneda, & Spichtig, 2019). [22]

*The second part of the questionnaire concentrated on the use of technology in the classroom by students and professors, from students' perspectives.*

The feedback from the students, as far as the use of technology is concerned, showed that the only technological tools used during the ESP Course were the laptop, provided by the professor herself, smartphones, and the Internet which was present every single time. On some rare occasions, a video projector would become part of the teaching process, because unfortunately there are few classes with a video projector in them.

However, their answers reveal that, even though there are not many tools attached to the teaching and learning process in the class, many different techniques and activities are performed throughout the process by improving teaching productivity, facilitating better planning, enabling an easy and practical learning, quick and correct assessment. Students' active participation and engagement in this process positively influences their academic performance (Emerson & Taylor, 2004). [23]

Throughout the semester it was noticed that most of the students had online dictionaries downloaded on their smartphones therefore they were asked about the type the dictionary, and most of the answers were: 55 % Free Online dictionaries and 15% free online technical dictionaries, while only 6 % mentioned visual dictionaries, while others had no dictionaries downloaded.

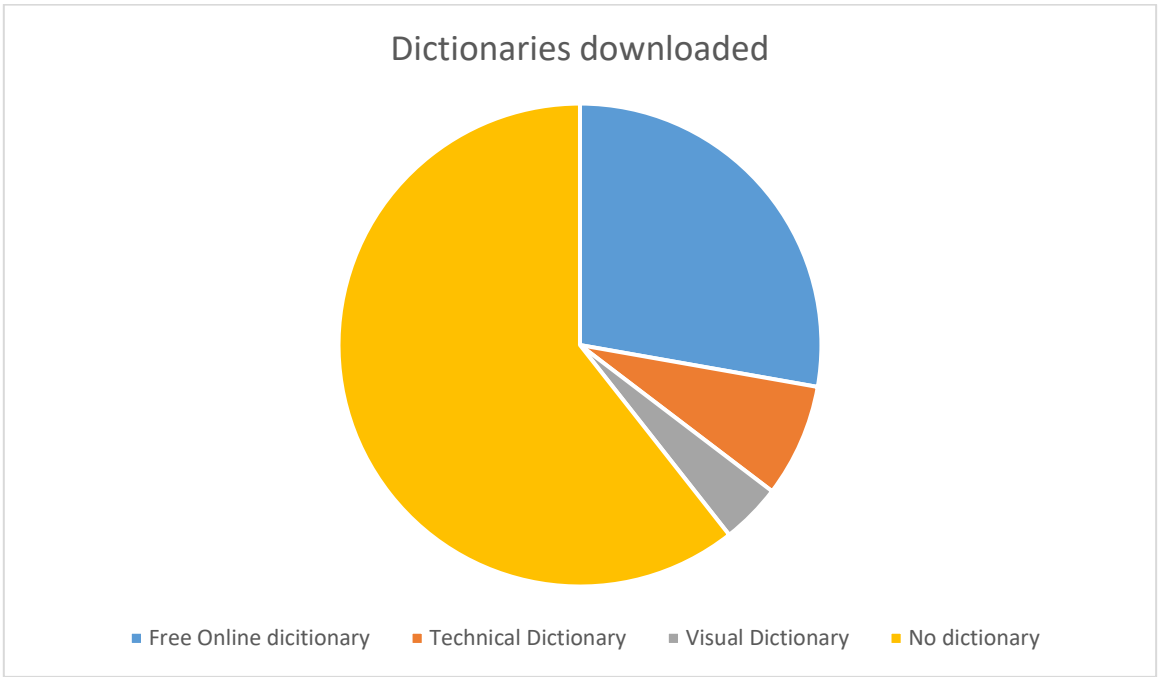
21. [21] Harmon, J., & Wood, K. (2018). The Vocabulary-Comprehension Relationship across the Disciplines: Implications for Instruction. Education Sciences, 8(3), 101.

22. [22] Hiebert, E., Scott, J., Castaneda, R., & Spichtig, A. (2019). An analysis of the features of words that influence vocabulary difficulty. Education Sciences, 9(1), 8

23. [23] Emerson & Taylor, 2004. Comparing Student Achievement across Experimental and Lecture-Oriented Sections of a Principles of Microeconomics Course

Table 5.

**Dictionaries downloaded.**




Dudley-Evans (1998)[24] includes vocabulary as one of the absolute characteristics of ESP: "ESP is centered on the language appropriate to these activities in terms of grammar, lexis, register, study skills, discourse and genre"[11]. This shows most of the students are aware of the crucial role vocabulary and technical terminology occupy in the ESP subject. The Internet has given rise to significant changes in language learning. The acronym ALIVE standing for the concepts of *authenticity*, *literacy*, *interaction*, *vitality*, and *empowerment* best captures the nature of these developments (Warschauer, Shetzer, and Meloni, 2000)[25]. Students were allowed to make use of smartphones in the classroom, as well as online dictionaries. Online dictionaries enhance learners' pronunciation of new vocabulary items as well as their ability to use these items in different contexts be it in writing or speaking.

According to Prabhu (1990), there is flexibility in choosing a method to teach ESP as this relies on some factors such as teachers, students, needs analysis, etc.; any method can be chosen to be used in an ESP classroom[26]. One of the means students of ME have been using is WhatsApp where the students and the professor discuss and exchange ideas, thoughts, or plan projects in this communication platform. "Krashen says that acquisition requires meaningful interaction in the target language - natural communication [18] - in which speakers are concerned not with the form of their utterances but with the messages they are conveying and understanding" (Liu, 2015, p.142)[27].

Table 6, refers to students' usage of WhatsApp. Students had the right to choose more than one option.

24. [24] Dudley-Evans, Tony (1998). Developments in English for Specific Purposes: A multi-disciplinary approach. Cambridge University Press.

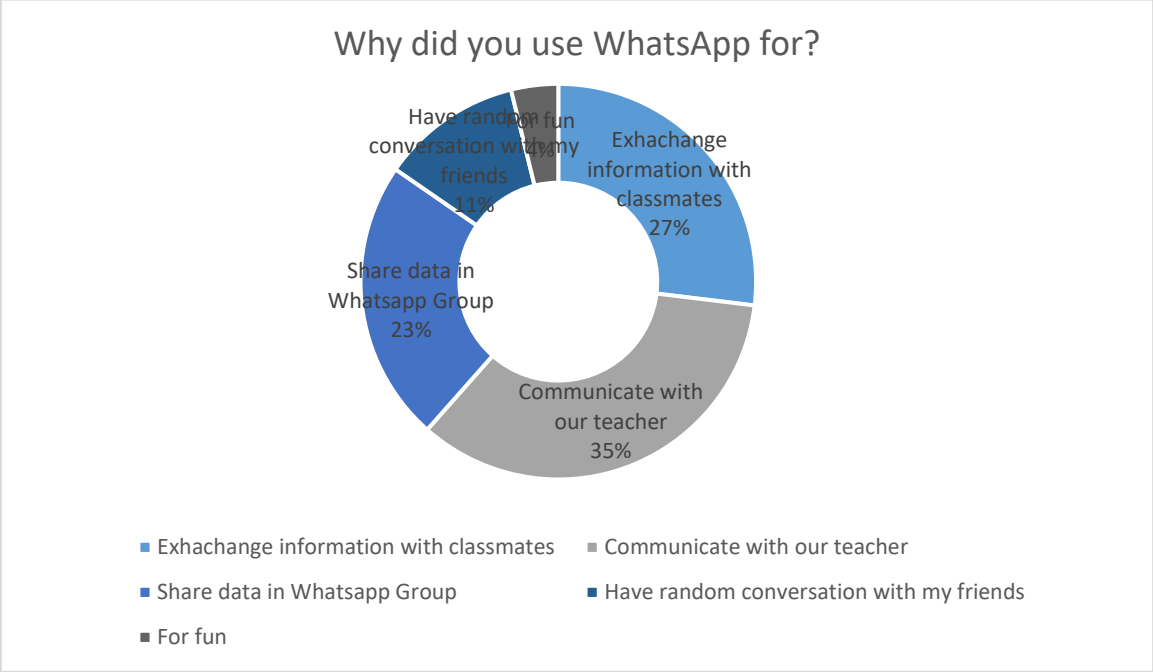
25.[25]Warschauer, M., Shetzer, H., & Meloni, C. (2000). Internet for English Teaching .Alexandria, VA: Teachers of English to Speakers of Other Languages.

26. [26] Prabhu, Nagore. There is no best method—why? Tesol quarterly, 24(2),
1990, pp: 161-176.

27. [27] Krashen, Stephen & Terrel, Tracy. 1983. The natural approach: Language
acquisition in the classroom. Oxford: Pergamon Press. Retrieved from https://www.researchgate.net/publication/342927756_A_Contribution_to_ESP_Teachers'_Training$

Table 6.

**WhatsApp**




As reported by students of ME in the questionnaire, WhatsApp has had a crucial impact on the good progress they have had from the start to the end of the course. Even though, there are different perspectives concerning the usage of social media in the learning and teaching process, some researchers (Alenazi, 2018[28]; Bouhnik & Doshen[29], 2014; Chiroma, 2016; Mbukusa, 2018; Rodliyah, 2016; Yeboah & Ewur, 2014) maintained that these social media applications were not feasible, other researchers (Ajid et al., 2018[30]; Alqasham, 2018; Asraf & Supian, 2017; Blair, 2014; Bouhnik & Deshen, 2014; Chariat, 2018; Eid & Al-Jabri, 2016; Jain et al., 2016; Lai, 2015; Mwakapina, 2016[31]; Rashid & Rahman, 2014[32]; Siemens & Weller, 2011[33]; Susilo, 2014; Ta'amneh, 2017[34]) have explained how using them has been fruitful for both teachers and students.

## 3. Conclusions and recommendations

Through this paper, some of the ESP elements and technology integration in ESP class were observed and analyzed. As the questionnaires and the semi-structured interview were focused on students' attitudes towards ESP and technology in the auditorium, we drew these conclusions:

1. Students of ME faculty prefer ESP subject and consider it a very important means of advancing and learning more it about their field of study.
2. The lack of background knowledge in Albanian appertaining to Mechanical Engineering, is an obstacle in the process of learning and teaching ESP, but however they remain optimistic and willing to learn the first new terms of Mechanical Engineering, in English.
3. Unfortunately, the usage of technology in class is restricted to only 2-3 technological tools.
4. Both students and teachers try to take the best out of what technology, and smartphones in particular, provide for education. WhatsApp and Online dictionaries are mobile-based sources, which contribute to the teaching and learning process. But, given the potential of technology, a sea of other platforms are available for use by educators and learners alike.

28. [28] Alenazi, A. (2018). WhatsApp Messenger as a learning tool: An investigation of pre-service teachers' learning without instructor presence. Journal of Education and Training Studies, 6(1). https://doi.org/10.11114/jet.v6il.2684
[29] Bouhnik, D., & Doshen, M. (2014). WhatsApp goes to school: Mobile instant messaging between teachers and students. Journal of Information TechnologyEducation, 13. https://doi.org/10.28945/2051
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33. [34] Ta'amneh, M. A. (2017). The Effect of using WhatsApp Messenger in learning English language among university students. International Research in Education, 5(1), 143-151. https://doi.org/10.5296/ire.v5i1.10801

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12. D. Crystal, English as a Global Language, Cambridge University Press, New York, 2003.
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# ANDRAGOGICAL APPROACHES TO CONTINUING ADULT LEARNING IN THE SYSTEM OF POSTGRADUATE PEDAGOGICAL EDUCATION

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# АНДРАГОГІЧНІ ПІДХОДИ НЕПЕРЕРВНОГО НАВЧАННЯ ДОРОСЛИХ У СИСТЕМІ ПІСЛЯДИПЛОМНОЇ ПЕДАГОГІЧНОЇ ОСВІТИ

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**Abstract**

In the modern world, knowledge and education are one of the key components of success in any field of activity. However, the rapid pace of technological change and growing demands for professional competence and personal development make it necessary for society to provide continuous adult learning. Adults are expected to improve their skills and acquire new knowledge throughout their lives. In this context, postgraduate pedagogical education becomes a necessary component of the process of professional growth of adults. The topic "Andragogical Approaches to Continuing Adult Learning in the System of Postgraduate Pedagogical Education" has become very relevant in the modern educational context, as it concerns the most effective methods and approaches to adult learning.

**Анотація**

У сучасному світі знання і освіта є однією з ключових складових успіху в будь-якій сфері діяльності. Однак швидкий темп технологічних змін та зростаючі вимоги до професійної компетентності та особистісного розвитку ставлять перед суспільством необхідність в неперервному навчанні дорослих. Від дорослих очікується, що вони будуть самостійно вдосконалювати свої навички та здобувати нові знання протягом усього життя. У цьому контексті післядипломна педагогічна освіта стає необхідною складовою процесу професійного зростання дорослих. Тема "Андрагогічні підходи неперервного навчання дорослих у системі післядипломної педагогічної освіти" набула великої актуальності в сучасному освітньому контексті, оскільки вона стосується найефективніших методів та підходів до навчання дорослих.

**Keywords**: education, professional competence, personal development, skills, knowledge, andragogy, methods, approaches, continuing learning, postgraduate.

**Ключові слова:** освіта, професійна компетентність, особистісний розвиток, навички, знання, андрагогіка, методи, підходи, неперервне навчання, післядипломна освіта.

Неперервне навчання дорослих – це важлива і необхідна складова сучасного освітнього процесу. У сучасному світі знання швидко старіють і змінюються, технологічний прогрес розвивається неабиякими темпами, а вимоги до кваліфікації та навичок на робочому місці безупинно зростають. У цьому контексті неперервне навчання стає ключовим елементом, що допомагає дорослим підтримувати актуальність своїх знань та компетентності протягом усього життя.

Андрагогія є науковою дисципліною, спрямованою на вивчення особливостей навчання та розвитку дорослих осіб [1]. Вона виникла як реакція на те, що методи та підходи, які були успішними в освіті дітей та молоді, не завжди ефективні в навчанні дорослих. Андрагогія прагне розуміти, які особливості характеризують навчання дорослих, і впроваджувати ці знання в навчальні програми та методику викладання.

Однією з основних характеристик андрагогії є акцент на самостійності та автономії дорослих учасників навчання. Дорослі мають здатність самостійно визначати свої освітні цілі, планувати свій навчальний шлях і приймати рішення щодо того, як, коли і що вони будуть вивчати. Андрагогія стимулює розвиток цієї самостійності.

Неперервне навчання дорослих представляє собою систему, що охоплює різноманітні форми та методи освіти та навчання після завершення основної або вищої освіти. Це включає в себе післядипломну освіту, курси підвищення кваліфікації, вебінари, семінари, самостійне навчання, електронне навчання, менторство та інші форми навчання, які дозволяють дорослим поглиблювати свої знання та вдосконалювати навички.

Основною метою неперервного навчання є розвиток та збереження професійної компетентності, а також особистісного розвитку. Дорослі можуть використовувати неперервне навчання для підви-

щення якості свого життя, покращення професійних можливостей, адаптації до змін у суспільстві та розв'язання актуальних завдань.

Акцент зроблений на активній участі дорослих у навчальному процесі. Вони мають бути здатними самостійно вибирати навчальні програми, планувати свій навчальний шлях і визначати свої освітні цілі. Оскільки навчання дорослих часто пов'язане з робочим оточенням, неперервне навчання може бути ефективним, коли воно інтегрується з робочими практиками і сприяє покращенню продуктивності та якості роботи.

Неперервне навчання дорослих є важливою складовою сучасної освіти, яка відповідає наростаючим потребам і вимогам суспільства та допомагає дорослим зберігати актуальність своїх знань та навичок у швидкозмінному світі. Дорослі, які навчаються, часто цінують визнання та заохочення за свої зусилля. Це може бути в формі сертифікатів, дипломів, підвищення заробітної плати або інших форм винагороди. Система мотивації та визнання грає важливу роль у стимулюванні неперервного навчання дорослих.

Проте, у навчанні дорослих існують численні виклики і бар'єри, такі як фінансові обмеження, обмежений доступ до ресурсів, недостатня мотивація, труднощі з об'єднанням навчання з роботою та особистими обов'язками. Розуміння цих викликів дозволяє розробляти стратегії та програми, які допомагають дорослим подолати бар'єри і досягти успіху в навчанні.

Андрагогічний підхід до навчання дорослих також має соціальний вимір, оскільки воно сприяє розвитку громадянської активності, культурної толерантності і збереженню соціальної рівності. Воно може сприяти вирішенню соціальних проблем, розвитку громад і підвищенню якості життя суспільства в цілому. Це відіграє важливу роль у розвитку і процвітанні сучасного суспільства, сприяє постійному розвитку і самореалізації дорослих, підвищенню їхньої конкурентоспроможності на ринку праці і збереженню актуальності знань та навичок у швидкозмінному світі.

Андрагогічний підхід неперервного навчання дорослих враховує наступні принципи [5]:

1. Принцип активності дорослих:

Цей принцип передбачає, що дорослі повинні бути активними учасниками навчання, а не пасивними слухачами. Вони активно визначають свої цілі навчання, ставлять завдання, обирають методи та ресурси для досягнення цих цілей. Активність дорослих означає їхню здатність приймати рішення, вирішувати проблеми та адаптуватися до змін в навчальному процесі. Вони вчаться бути самостійними та самокерованими учасниками навчання.

2. Принцип врахування дорослого досвіду:

Дорослі мають різні життєві досвіди, які можуть бути цінними ресурсами для навчання. Андрагогіка визнає цей досвід і використовує його для поглиблення знань та розуміння нового матеріалу. Врахування дорослого досвіду також підтримує створення сприятливого навчального середовища, де дорослі можуть ділитися своїм досвідом та взаємно навчатися один від одного.

3. Принцип орієнтації на розв'язання реальних завдань:

Андрагогіка спрямована на підготовку дорослих до реальних завдань і викликів, з якими вони можуть зіткнутися в своїй роботі або житті. Навчання повинно бути практичним і спрямованим на набуття навичок, які можна застосовувати в реальних ситуаціях. Цей принцип наголошує на важливості розвитку практичних компетенцій та здібностей, які допоможуть дорослим ефективно вирішувати завдання у своїй професійній діяльності.

4. Принцип гнучкості та індивідуалізації:

Гнучкість навчального процесу означає, що програми та методи навчання повинні бути адаптованими до різних потреб і можливостей дорослих. Кожен учасник може мати власний ритм навчання і підходити до навчання зі своїми унікальними вимогами. Індивідуалізація навчання передбачає можливість вибору шляхів і методів, які найкраще відповідають конкретним цілям і стилю навчання кожного дорослого.

5. Принцип співпраці та обміну знаннями:

Співпраця є важливою частиною андрагогічного підходу. Дорослі мають можливість спільно працювати, ділитися знаннями і досвідом, вирішувати завдання в групах і колективно виробляти нові ідеї. Обмін знаннями може відбуватися не лише між учасниками навчання, але й між учасниками та наставниками. Андрагогіка підтримує відкрите обговорення і взаємну взаємодію для спільного вирішення завдань і досягнення навчальних цілей.

6. Принцип саморефлексії:

Саморефлексія - це процес, що дозволяє дорослим аналізувати свій навчальний досвід, визначати свої сильні та слабкі сторони, розуміти, як їхні дії впливають на результати навчання. Цей принцип сприяє самосвідомості і саморозвитку, допомагає дорослим бути більш ефективними учасниками навчання і вдосконалювати свої навички.

7. Принцип практичності та застосовності:

Навчання у системі андрагогіки повинно бути спрямоване на набуття практичних навичок і знань, які можна застосовувати у реальних ситуаціях. Дорослі мають бачити відразу практичну цінність того, що вони вчаться. Цей принцип підтримує ідею навчання, яке допомагає дорослим покращувати свою роботу, вирішувати повсякденні завдання, розв'язувати проблеми та досягати конкретних результатів.

Отже, андрагогічні підходи стають все більш важливими у сучасній освіті для дорослих, оскільки вони дозволяють підготувати компетентних педагогів, здатних навчати та надихати дорослих студентів. Перспективи подальших досліджень включають в себе розширення наукового розуміння андрагогії, ефективність використання технологій у навчанні та розвиток нових методик для забезпечення якісної педагогічної підготовки дорослих.

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# THE ROLE OF PROJECT-BASED LEARNING IN PHYSICS-RELATED TEACHING OF BIOLOGY

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**Abstract**

The article notes that connecting Project-based learning with life processes not only improves the course quality, but also demonstrates the close relationship between biology and physics, creates a complete image of natural phenomena in students, and increases their interest in the learning process. The use of projects with interdisciplinary content plays a major role in deepening the concepts learned by the relevant sciences, preventing the repetition of the same material in different disciplines, in a complex approach to studying interconnected phenomena, and other issues.

**Keywords:** biology, interdisciplinarity, physics, osmosis, experience

It is possible to take a complex approach to studying biology and physics, use the laws and phenomena of science in detail in the process of studying another science, and expand interdisciplinary communication via project-based learning.

Integration with physical science is of great importance to obtain a complete image of the processes in living organisms. For example, a complex physiological process such as blood circulation involves hydrodynamic processes related to fluid flow, mechanical processes characterized by work, thermodynamic processes on heating, and electrodynamic processes providing the generation and propagation of nerve impulses. An endless number of facts may be shown about how living organisms adapt their life and activities to physics laws. For example, atmospheric pressure and diffusion phenomena play the main role in the lives of both humans and animals. Respiration and nutrition processes, heart function, the absorption process (drinking, eating), adhesion of worms to the intestinal wall, leech feeding are integrated with diffusion and atmospheric pressure. Simultaneously, in humans and animals, oxygen gets into the body and tissues, carbon dioxide gets rid of from the tissues to the lungs, and removed from there by the pressure difference. As we know, amoeba's nutrition and respiration occur through a single cell. Its cytoplasm and nucleus are covered by a semipermeable membrane. The membrane is porous, with high liquid viscosity on one side and low on the other. More precisely, oxygen or nutrients in the environment outside the membrane is more, and less in the inner membrane (cytoplasm). In this case, if the liquid inside the amoeba is thicker than the liquid surrounding, the water and oxygen dissolved in the water pass into the membrane covering the entire surface of the amoeba. The amount of other gases (carbon dioxide) inside the amoeba is more than in the external environment. In this case, those gases are released from inside the partition to the outside environment. Thus, the amoeba, a single-celled animal, respires. This process continues day and night. The main function of the collapsible bladder is to move the amoeba out of the outer membrane as a result of osmotic pressure. The amoeba surrounds its feeding by forming false legs. The nutrients entering the cytoplasm are covered with digestive juice (saliva) and a digestive cyst forms. Digestive enzymes diffuse into it from the cytoplasm. Nutrients in the digestive tract are digested by the cell (amoeba) as a result of osmosis and diffusion. The digestive bladder containing undigested food approaches the body surface of the amoeba and is removed from the body by reason of osmotic pressure. That is, the bladder gradually grows, when reaching a certain volume, bursts and is expelled due to the difference in osmotic pressure. Then a new cycle continues in that area and forms a new drop. This process is repeated periodically. Furthermore, water, nutrients, and oxygen enter the amoeba from the environment through the osmotic pressure of the outer membrane. The viscosity of various nutrients dissolved in the amoeba is higher than the viscosity of fresh water. So, an osmotic pressure difference is observed between the outside of the amoeba and the surrounding environment. The opening and closing bladder performs the function of regulating the osmotic pressure, removing the rest of the metabolic nutrients with water to the external environment.

Although osmosis is a simple water exchange in cells, osmosis is the basis of important complex processes in many living things (mainly plants). This is one of the most difficult topics for students to perceive in the school curriculum. So, a correctly chosen experiment is of great importance to understand the osmosis phenomenon. Project topics connecting with the osmosis phenomenon in biology teaching may be attributed to projects with interdisciplinary content.

The experiment used allows students to observe the osmosis phenomenon and even make measurements. For this, simple materials are required: acetic acid, hypotonic solution - boiled water, hypertonic solution - jam juice, raw eggs - 2, glass - 3, gloves, scales, marker, spectacles. No hazardous substances are used during the experiment. However, recommended to use gloves and protective spectacles just in case. Students may be allergic to acetic acid, or acetic acid may accidentally splash into the eye. If acetic acid splashes into the eyes, recommended to wash with plenty of water. The experiment consists of the following phases: [1]

Phase I:

- 2 raw eggs are taken and both are placed inside the glass;
- Acetic acid is added to the glass (until covering the eggs);
- The eggs should remain in the acetic acid for up to three days (It may be observed how the acetic acid dissolves the eggshell over time).

Phase II:

- The shelled eggs are washed with water, weighed on a scale and their mass is noted.
- Eggs are placed in separate glasses.
- A hypotonic solution (boiled water) is added to one of the glasses, and a hypertonic solution (jam juice) to the other.

You may note the name of the solution on the glasses with a marker. This allows students to visually see the names of the solutions and remember better. The eggs should remain in the solution for at least 8 hours. You may clearly observe how the volume of the egg in the hypotonic solution increases, while the egg in the hypertonic solution shrinks.

Phase III:

• The eggs are reweighed on the scale and the initial and subsequent masses are compared.

Jam juice, natural fruit juices, honey, jelly (grape syrup), various syrups may be used as a hypertonic solution. In this case, adding additional water to the jam water isn't required, otherwise, the osmosis process will take place later. You may use any acetic acid in your kitchen. You should be a little careful when using the extract, as it is thicker, and may destroy the lower membrane of the egg, consequently, the integrity of the egg may be compromised. In this case, shortening the waiting period (about 2 days) is required. At the end of the project, the conclusion of the experiment is submitted.

| Solution | Before | After |
|---|---|---|
| Hypertonic solution (jam juice) | 97 | 71 |
| Hypotonic solution (boiled water) | 85 | 94 |

Based on such facts, connecting the project topics with life processes improves the quality of the lesson and demonstrates the close connection between natural sciences, creates a more complete image of natural phenomena in students, gradually increases their interest in the learning process. Additionally, understood that studying all these features in detail allows for revealing the physico-chemical mechanisms in the nature of biological processes, creating changes in the desired direction in creatures through the physical effects of the environment.

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# THE PROCESS OF LEARNING A FOREIGN LANGUAGE AND PROBLEMS ENCOUNTER DURING LEARNING

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**Abstract**

Flora Lewis invites us to reason about the following sentence, "“Learning another language is not only learning different words for the same things, but learning another way to think about things.” (Flora Lewis)

Confirmed Processes: It has been confirmed that learning is the only life-long process that will never stop happening in one form or another, whatever path it takes to gain knowledge. Nowadays, where becoming a global citizen has become a necessity, the need to learn foreign languages arises. This process not only creates a passageway for life, but opens doors along this path.

It has been confirmed that learning processes are contacts during which we receive, register, classify, reinforce, compare, reason, synthesize, accept, contradict, internalize sets of knowledge, execute cultivated behaviors, maintain attitudes, lobby, self-actualize within our socio-cultural environments and in foreign socio-cultural and linguistic environments.

It has been confirmed that there is a variety of learning. In order for the learning process to be effective, it is important to find the right methods to accomplish the learning. These techniques and methods are "investigated" from time to time to verify if they are still appropriate for the learning process or if there is a need to experiment with new methods.

**Keywords**: Linguistic operant system, unconscious language acquisition, language transfer errors, linguistic analogy errors, bilingual education.

## Introduction

Learning is the only process in life that never ceases to happen in one way or another, whatever the path that leads to the acquisition of knowledge is. Nowadays, where becoming a global citizen has become a necessity, the need to learn foreign languages arises. This process not only creates a corridor for life, but opens doors along this path.

But what is the process of learning a foreign language? How does learning a foreign language happen? What are the ways of effective learning and what are the reasons that this process is so significant?

The learning process is the act of acquiring, reinforcing, modifying existing knowledge, values, skills, or synthesizing different types of information.

There are many types of learning. In order for the learning process to be effective, it is important to find the right methods for this approach. These techniques are investigated from time to time to verify if they are still appropriate for the learning process or if there is a need to experiment with new methods.

### *What is the learning process?*

The process of learning a foreign language is the same as that of any other subject with the only difference being that it takes place outside the environment in which the foreign language is spoken. Often the only difference between the process of learning a foreign language is that between *'foreign language'* and *'second language'*. Second language is a term which means that this language is spoken as an official language in this country. A foreign language is one that is learned outside of any context of its use.

Studying a foreign language allows the individual to communicate effectively and creatively, as well as participate in real-life situations through which he learns the culture and provides a meaningful approach to perspectives different from his own, enhances the ability to see connections between different countries while also promoting interdisciplinary perspectives and simultaneously gaining intercultural understandings.

Considering it from this point of view, language is the necessary tool for an effective communication between people, helping them not only to get to know other cultures, but also to better understand their own culture. The process of learning a foreign language provides the student with the opportunity to benefit from social and linguistic knowledge in order to know what to say, when to say it and where to say it (*Educational Project of Foreign Languages (2014)).*

*Krashen's Theory:* According to Krashen's monitoring theory, the process of learning a foreign language presents two hypotheses, according to which the individual has two operating systems to learn a foreign language: unconscious foreign language acquisition and conscious learning of foreign language.

In the first hypothesis, Krashen asserts that the process of acquiring a foreign language happens as naturally as the learning of the mother tongue by children. This necessarily requires practical communication of the language being learned, in which speakers should not be concerned so much with the form of expression, but with the accurate and clear conveyance of the message. Explicit learning of rigid grammatical rules is not so necessary in the acquisition of a foreign language (*Brown and Halton, 1970; Brown, Cazden, Bellugi, 1973*).

However, this does not mean that teachers or native speakers who care to teach cannot simplify the learning process by finding easier ways of expression

to aid in the learning process *(Snow and Ferguson, 1977))*.

In the second hypothesis, he claims that the conscious learning of a foreign language is also helped by the grammatical connections that students make while speaking. If in language acquisition they do not pay attention to strict grammatical rules, during the conscious learning process these rules play a very important role also in correct thinking. During this process, the individual progresses from simple learning to complex learning, unlike the first process *(Fanselow, 1977; Long, 1977)*.

Following this logic, James Lantolf, a researcher who was also extensively involved in further expanding Vygotsky's theory[1] in foreign language learning, asserts that foreign language learners progress to higher levels of language proficiency when they collaborate and interact with speakers of the foreign language who possess it to a higher degree.

However, the learning process is very complex and continuous and as such requires comprehensive support of all actors in the field of education, so that it is comprehensive.

***The role of the mother tongue in the process of learning a foreign language***

The role of the mother tongue in the process of learning a foreign language has been widely discussed for many years, often being seen as a problem that hinders this process. For years it has been assumed that the mother tongue is the only source of syntactic errors of individuals learning a foreign language *(Lado, 1957)*.

Subsequent empirical studies on the errors made during the foreign language learning process have led researchers to discover that these errors do not necessarily result from the interference of the native language, but are habitual among foreign language speakers who have different linguistic backgrounds *(Buteau, 1971)*.

Mother tongue can be a hindering factor especially when: a student acquires new vocabulary, tries to remember previously learned vocabulary or when he tries to form more complex sentences or expressions.

Since the great reform at the end of the 19th century, the role of the mother tongue is one of the most discussed methodological problems. Currently, official guidelines in many countries recommend that planned learning be as monolingual as possible, relying on the mother tongue only when learning difficulties arise.

In this dispute, an agreement has been reached in favor of a type of monolingualism with minor concessions: 'There is no point in trying to suppress the mother tongue completely' *(Harmer, 2001: 132)*. The mother tongue is generally considered a maneuver, which is used only in emergencies. Effective bilingual teaching techniques are a good one, not considered by schools. It often even seems that the so-called direct method, the use of monolinguals, is the new communicative approach and seems to have triumphed over all other methodologies.

Students' performance in foreign language acquisition is often marked by problems, which Pit Corder *('Error analysis and interlanguage', 1908)* classifies into three categories:

a. Transfering errors
b. Analogy errors
c. Errors caused during learning

These mistakes generally come because all students are members of a community, therefore the mistakes are generally the same since the views on reality are the same.

However, there are also some positive aspects of the mother tongue, which help students learn foreign languages.

Foreign language learning generally begins in the third grade of primary education. The third grade student faces a new language, while the learning process is not unknown to him. Languages cooperate with each other and therefore the knowledge, skills and abilities acquired by learning the mother tongue will help the student to understand the foreign language more easily. In a way, the phonetic system of the Albanian language can positively interfere with the pronunciation of foreign language phonemes.

As Pit Corder also says, the mother tongue gives us a language that is rich in hypotheses and can be used to learn a foreign language. Many of these hypotheses can be confirmed because languages have many things in common. Starting from this point of view, when learning a foreign language, the student does not discover everything to zero because most foreign languages have the same basic rules for ordering words in sentences or almost the same grammatical categories.

According to many linguists, being proficient in the mother tongue would be a help for students in the better acquisition of foreign languages. While the student has knowledge of the mother tongue, he is able to make the connection between the two languages.

"*He who understands the grammar of one language is capable of understanding the grammar of another language in terms of grammatical rules. However, they fail to understand or speak a foreign language because of the varieties of words or different grammatical forms that differ from one language to another*.' Roger Bacon.

***Do we struggle when we learn the mother tongue?***

Of course not. This is a process that arises naturally: first with stuttering, then with word formations and up to the construction of sentences with correct grammar. Most people start speaking in their mother tongue at the age of 4 and above.

Learning a second language happens in the same way. We cannot claim to be advanced from the beginning as each stage requires not only an investment of time, but also depends on the exposure the individual has to the environment in which this language is spoken.

The mother tongue has a main function in learning a foreign language because it also increases self-confidence, especially when the second language occurs at a young age in children.

According to Carless *(2008:331)*, mother tongue has both advantages and disadvantages. It can serve social and cognitive functions. The use of the mother

tongue is also related to the recognition of the national identity as long as it conveys the culture of the country giving positive feelings to the student. The mother tongue serves as a skeleton in learning a foreign language as many of the functions of words in sentences are transferred from it to the foreign language. According to him, the negative sides are related to supporting the student more than necessary in the native language while he is learning a foreign language. This mother tongue interference can often be harmful because the order of words in a sentence, for example, may not always be identical from one language to another. However, good students manage to translate from one language to another, taking into account the characteristics and linguistic functions of one language and another.

In conclusion, we can say that the mother tongue is multidimensional in learning a foreign language along with its positive and negative sides. It teaches the student to expand vocabulary and reading skills in a foreign language, but it interferes with speaking and writing in a foreign language.

Teaching a foreign language can be as difficult a process as learning it. For this reason, it should be considered as one of the most important factors during student learning. Finding efficient methods for improving foreign language learning with as little native language interference as possible is a must. It would be ridiculous to arbitrarily exclude the mother tongue as a tool for teaching a foreign language, however as long as it is not overused in the classroom environment it can have a positive didactic function.

***How the learning process happens in children and adults***

There are generally two ways that children learn a foreign language: simultaneously and sequentially (*McLaughlin, 1995; Tabors, 2008*).

Students who learn a foreign language simultaneously with their mother tongue are those children who are exposed to the mother tongue (in this case, the language of their parents) at home and are exposed to the language of the community in which they live through educational programs, which can do at school. Another case could be children, who have parents with different citizenships and who speak two languages to the children at home.

Up to a certain age children learn both languages with the same intensity and therefore do not prefer one language over another. This is because they build the same and equally strong language systems in their brains for both languages they hear. These separate systems allow children to learn two different languages without having a problem and without having one language interfere with the other. In fact, this path followed by these children, who are in some form bilingual, is also followed by children who have only one language as their mother tongue. After a certain age, for example 6 years, exposure to a third foreign language can influence these children to have preferences for a language over a language other than the one their parents speak. Therefore, it can often happen that most of the words or grammatical systems of a language can be lost. Knowing this, parents should be careful and expose the child to the same amount of words in the second language that he is exposed to in the first language.

Children who are sequential learners are those who are introduced to a second foreign language in the school environment, as part of the curriculum of that country. Unlike children, who are bilingual students, the learning of these children can happen at any age and can also depend on external factors such as: the skill and motivation of the student.

For years it has been thought that learning a foreign language for children is useless. For this reason, many studies have been developed, which sought precisely to find more meaningful answers on this topic. Harvard University confirms the opposite of what has been claimed to date. Children learning a foreign language at an early age not only makes them more creative, but also develops their critical thinking and flexibility of thinking. This is also related to the fact that learning a foreign language is a cognitive activity more than a linguistic activity.

If we were to consider this statement from a biological point of view, it would be right to also mention the active function that children's brains take on during the learning process, since this activity includes memorizing vocabulary or grammar rules.

According to Dr. Pascual-Leone, the younger the student is when learning a foreign language, the higher the chances of correct pronunciation and imitation of the phonemes of a language.

At a young age, e.g. 3 years old, children have the opportunity to learn through the game process. Their learning becomes more fun and grammar formulas are given through informal speech as children's brains are less complex and more open to new processes and language functions. At this age, before children become aware of their speech they have more self-confidence and less awkwardness while speaking.

Children who grow up learning a foreign language makes them more empathetic towards others, teaches them to understand their own culture and respect the culture of others, and prepares them to take their place in a global society. Among other things, career opportunities increase for those who have more languages to offer.

If children manage to learn a foreign language at a young age in the same way they learn their mother tongue, could adults learn a foreign language like children?

In fact, no one has looked more closely at this question than linguist Stephan Krashen.

According to him, it is important to distinguish between learning a foreign language with traditional models: grammar, vocabulary, and acquiring a foreign language: creating real situations in the same way that young children learn their mother tongue. So foreign language acquisition, a must for adults, happens where action and practice happen.

***How can adults acquire a foreign language? According to Krashen, these stages of learning are divided as follows:***

*1. We acquire a foreign language when we begin to understand messages in that language:*

According to Krashen, this is called comprehensible input and is about the exposure of comprehensible listening and reading materials. He also insists that in adults the emphasis should be on the interaction rather than form. If an adult says 'There are fishes in the lake' the correction should be 'Right, there is fish in the lake' without having to correct the grammar. *(Krashen, 1983)*

*2. The period of silence*

It was mentioned above that this period also happens with children during the process of learning a foreign language. Even adults can have their own problem period, regardless of the fact that exposure to a foreign language can also happen outside of the classroom. If the student does not participate actively during class discussions, it does not mean that he is not paying attention. It may simply be a signal that he is acquiring the foreign language unconsciously *(Krashen, 1983)*.

*3. Anxiety is a student's worst enemy*

The article also mentions the reason that children learn foreign languages better because of the lack of fear and embarrassment in speaking. The opposite happens to adults during the learning process. This best reminds us of Kashen's most famous point of view: the emotional filter. During the process of learning a foreign language, its acquisition drops significantly if the student is under stress. For adults, the classroom can be an environment that causes anxiety when acquiring comprehensible input.

One of the advantages that children have over adults when learning a foreign language is that children do not speak the language for the purpose of language acquisition. They talk and learn it as a fun activity unlike adults, who are forced to be perfectionists.

In conclusion, we can say that learning a foreign language is a process that requires time and dedication, whether the student is a child or an adult. The important thing is that the process happens naturally and is fun.

***What are the barriers that students encounter in learning a foreign language and what are some effective methods that would help them learn a foreign language?***

The question of why some students "grab" a foreign language faster compared to others has worried researchers and teachers, making the discussed topic an object of study to reach a common solution to help students.

Nowadays, studying a foreign language at school is a requirement of a country's educational programs, so students must be able to speak at least one foreign language in addition to their mother tongue.

The students who have more difficulties in learning a foreign language are precisely those who have also had difficulties in acquiring the reading of their mother tongue at a young age.

We often hear that in order to acquire a foreign language, we must live in the country where the foreign language is spoken. There are some studies that affirm it, however there are many others that also affirm that the classroom environment can help students learn a foreign language. The classroom can be a barrier to learning if the use of the foreign language is limited. At the same time it can be useful if it is the main source of understandable data *(Krashen, 1982)*.

Krashen also lists the obstacles that are encountered during the time when the foreign language is taught in the classroom. It can never be claimed that it would be spoken with the same fluency if it were acquired in the countries where the foreign language is spoken. Learning in an informal environment may transmit inaccurate inputs to the student, but the intensity with which the foreign language is conveyed during a day in a foreign country is the same as the lessons developed during a week at school. The classroom environment tries to create learning situations similar to those of the real world, but which again may not be as fruitful and as real as those in the natural environment.

The classroom will never be able to overcome their own barriers to learning a foreign language, however its purpose is not to be a substitute for the outside environment, but to bring students to the point where they can understand the necessary information. when they are out of class making the student competent in speaking and conveying information.

Sometimes these difficulties also extend to the potential and motivation of students within the classroom. Students may also have difficulties in the syntax and morphology of their native language, so it is often a double challenge for the teacher to simplify the foreign language for the student.

Nowadays, where the possibilities of experimenting with teaching methods are numerous, the teacher can lobby to make the lesson interactive, fun and at the same time very effective.

*First stage: Analysis of students who are learning a foreign language:*

a. Are they active or passive learners?

b. Do they use prior linguistic knowledge or not?

c. Do they make or not the connection or analogy of the grammatical rules of the mother tongue with the foreign language?

d. Are they confident when they try to express themselves in a foreign language?

These important questions are raised according to many researchers *Hosenfeld, Stern, Todesco* when designing teaching strategies by the teacher. It is often difficult to adapt to the individual needs of students in a lesson, however identifying the problems can be the first step towards an efficient solution.

*Second stage: Creating a student-centered lesson in order to increase their responsibility as students*

A student-centered lesson creates and motivates the student not only in the learning process, but also to increase his responsibility, to ask questions, to be more social, to become a more active thinker.

*Third phase: To increase the mother's motivation during the process of learning a foreign language.*

This stage is one of the most important if we are talking about learning a foreign language. This is made

difficult not only because learning in general is a difficult process, but especially when it happens in a language that is not the mother tongue.

A cooperation between the teacher and the student to set clear goals on the reasons why we should acquire a foreign language would increase their motivation to continue learning this foreign language. The goals can be long-term or short-term, however it is extremely important that they are realized by the students and the teacher. If a long-term goal would be to publish a book in a foreign language by the end of the year itself, a short-term goal would be, for example, to publish a novel by the end of the week.

*Fourth stage: Integrating theory with practice during the learning process*

This phase is one of the most important as it allows the teacher to understand how the learning process has taken place as it integrates theory, eg giving instructions, by practice, eg putting the given instructions to work.

This is also the final stage, Krashen's theory on foreign language acquisition is put into practice: grammar learning, monitoring, acquisition, motivation of the student.

In conclusion, we can say that communicating with students and creating a comfortable and fun environment can make the learning process not only easier, but also more productive. What teachers should try to do is to transform the classroom and teaching methods into their tool so that they serve the purpose.

Learning is a treasure that follows you everywhere. Why not giving more importance to the process of learning foreign languages? Language will always remain the map that leads you to culture. It tells you where people come from and where they are going. So that as an important part of the individual it would be a common good for a common purpose of improvement and further development of such processes.

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# PHILOLOGICAL SCIENCES

## REPORTING AS A GENRE OF JOURNALISTIC STYLE

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## РЕПОРТАЖ КАК ЖАНР ЖУРНАЛИСТКОГО СТИЛЯ

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**Abstract**

This article discusses the uniqueness of communication texts, ensuring the creation of stylistic speech, in accordance with its functional features, considering that in the journalistic speech reveals the actual subjects of public interest. The authors present the main idea of the future of journalistic statements as writer must keep in mind that the overall purpose of style is implemented in a specific task of the genre. Genres differ primarily its purpose. journalistic works are of extraordinary breadth of topics they can relate to any topic that falls to the center of public attention, underwater diving technology. This undoubtedly affects the linguistic features of this style: it is necessary to include a special vocabulary, self-explanatory, and sometimes detailed comments. A variety of topics is constantly in the public eye, and the vocabulary related to these themes becomes journalistic coloring. As part of the language of the dictionary is formed by a circle of lexical items specific to the journalistic style. Thus, the task of the article is to explain the analysis of related events.

**Аннотация**

В данной статье рассматривается уникальность коммуникативных текстов, обеспечивающих создание стилистической речи, в соответствии с его функциональными особенностями, учет того, что в публицистической речи раскрываются актуальные проблемы, вызывающие интерес общества. Авторы излагают основную мысль будущего публицистического высказывания, так как публицист обязательно должен учитывать, что общее назначение стиля реализуется в конкретной задаче жанра. Жанры различаются, прежде всего, своим назначением. публицистические произведения отличаются необыкновенной широтой тематики, они могут касаться любой темы, попавшей в центр общественного внимания, технологии проведения водолазных работ. Это, несомненно, сказывается на языковых особенностях данного стиля: возникает необходимость включать специальную лексику, требующую пояснений, а иногда и развернутых комментариев. Целый ряд тем постоянно находится в центре общественного внимания, и лексика, относящаяся к этим темам, приобретает публицистическую окраску. В составе словаря языка формируется круг лексических единиц, характерных для публицистического стиля. Таким образом, в задачу статьи входит разъяснение, анализ взаимосвязанных событий.

**Keywords:** reportage, style, vocabulary, journalism, genre, lyrics, themes.
**Ключевые слова:** репортаж, стилистика, лексика, публицистика, жанр, текст, тематика.

Основным жанром публицистики является репортаж. Качества репортажа зависят от степени погружения публициста в изучаемую среду. Лингвисты отмечают: «...В одних случаях автор выступает только как свидетель неких эпизодов, в других – он вмешивается в происходящее, и событие оказывается высвеченным изнутри. Наконец, нередко автор выступает в качестве инспиратора общественно значимого действия».

Э.А. Лазарева пишет, что широко распространенной и самой наглядной формой выражения авторского начала в публицистике является обозначение присутствия журналиста на месте события. А потому на практических занятиях рекомендуется уделить должное внимание аналитической работе с текстами репортажей. В процессе подготовки исследования мы посетили занятие преподавателя Б. , на котором шел процесс обучения студентов-филологов написанию репортажа. Ниже предлагаем анализ данного занятия.

Преподаватель преследовал следующие цели: познакомить студентов с особенностями репортажа как газетного жанра; подготовить к самостоятельной работе над сочинением-репортажем; воспитывать уважение к профессии репортера и к людям этой профессии.

*Оборудование:* газеты, таблицы с основными требованиями к репортажу, папка с памятками (на столах студентов), таблички с профессиональными словами, видеозаписи, фотографии репортеров, книги В.Пескова.

*Эпиграф:* «Многие и многие русские писатели отдавали репортажу много сил, внимания и находчивости». В.Гиляровский.

Занятие начинается с объявления темы и цели, во вступительном слове преподаватель говорит о том, что вся жизнь страны, вся жизнь планеты на газетных листах. Коротенькие заметки, репортажи, очерки, фельетоны и эссе на различные темы печатаются в газетах. Репортаж издавна был и остается в наше время одним из самых распространенных газетных жанров. Многие известные русские писатели начинали свою деятельность в качестве газетных репортеров. Эпиграф, записанный на доске, читается и комментируется студентом.

Далее организуется словарно-орфографическая работа. Студентам рекомендуется ответить на вопрос:

- Какие слова, относящиеся к работе журналистов, вы можете назвать? (Ответ: «Журналист, журналистика, рубрика, корреспондент, репортаж, репортер, хроника».).

В толковом словаре студенты находят лексическое значение слов *репортаж, репортер, хроника, хроникер, корреспондент* и записывают их в тетрадь.

(Репортаж – сообщение о местных событиях, о событиях дня, информация в печати, по радио, телевидению; репортер – сотрудник газеты, журнала, радио, информационного агентства, доставляющий сведения о текущих событиях и происшествиях).

Интересна и полезна работа в аудитории, посвященная усвоению семантики слова «репортаж»: оно произошло от английского report (рипорт) – как существительное оно значит – рапорт, доклад, сообщение; как глагол соответственно: рапортовать, докладывать, сообщать. Определяя значение слов «*журналист»* и «*репортер»*, студенты отмечают, что *репортер* – понятие более узкое, так как он занимается конкретной работой. Логичным является продолжение разговора, выводящее на понятия *хроника* (отдел сообщений в газете, журнале, на радио и телевидении, посвященный текущей общественной жизни), *хроникер* (сотрудник газеты, журнала, работающий в отделе хроники).

Перед чтением записи одного из репортажей А.Школьника преподаватель предлагает студентам подумать над вопросом: «Какими качествами должен обладать репортер?»

Отвечая на поставленный вопрос, студенты называют такие качества, которыми должен обладать репортер: он должен правдиво и точно изображать события, ярко и образно, уметь общаться с людьми, быть смелым и мужественным в своей работе.

О замечательном человеке, журналисте, телерепортере, фотографе, в прошлом ведущем программы «В мире животных» Василии Пескове, - рассказывает преподаватель:

- В.Песков написал замечательную книгу «Шаги по росе». Герои этой книги строят заводы, прокладывают каналы, воздвигают дома, сажают яблони. У них немало общего. И в то же время образ каждого из них, живой и яркий, несет те черты, которые присуще ему, и только ему. Каждое событие им не просто описано, а выношено, пропущено через свое, личное восприятие. Песков не боится «присутствовать» в своих материалах, но это присутствие не навязчиво, а органично. Автор здесь лицо активно действующее, думающее, остро видящее. Он умеет душевно беседовать, задавать людям нужные вопросы, искренне радоваться вместе с ними и, когда надо, негодовать. Это всегда вызывает доверие читателя.

Важной приметой творчества Пескова является то, что для него рассказать о человеке – это всегда написать о земле, на которой он вырос, об его отношении к родной природе.

Да, своим творчеством Песков славит людей труда. Но, подобно одному из героев своего репортажа, он утверждает: «Жизнь не представляю себе без птичьего пения…».

Василий Песков умеет видеть, слушать, чувствовать природу нашей Земли и пишет о ней свежо, сочно, подлинно. Песков много фотографирует. Он часто охотиться с фотообъективом за лесными загадками. В поле, в лесу он свой человек. Он все время напоминает: вы тоже можете стать «своим человеком». Лесной праздник доступен всем. «На этот праздник не нужен билет. Кладите краюху хлеба в мешок, проголосуйте попутному грузовику, или садитесь в автобус, или велосипед седлайте, а лучше – пешком. Пораньше из дому, лучше с самой зарей. Тогда весь праздник – ваш. Вы увидите, как стягивает солнце туманное одеяло с реки, увидите росу на красных осиновых листьях, увидите, как добывает свой «хлеб» трудолюбивый дятел. Не заявляйте о себе криками, приберегите песни. Слушайте тишину, и тогда осень лесная покажет вам все богатство…».

Теоретический материал о том, что репортажи бывают нескольких видов, студенты оформляют в тетради:

- информационный,
- оперативный (авторы сообщают о том, что видели и слышали),
- фоторепортажи.

Определяется несколько подгрупп, и каждой из них дается задание на определение вида репортажа и характеристику лингвистических особенностей.

Логичным является завершение занятия, когда начинается ролевая игра, и студентам предлагается представить, что они репортеры, а их тетради – репортерские блокноты. Определяется тема репортажа «Прекрасное живет рядом с нами», обговариваются условия создания фоторепортажа. Студентов предупреждают о том, что созданные ими репортажи будут заслушаны и проанализированы на занятиях СРСП.

Подводятся итоги занятия.

Необходимость работы над публицистическим стилем в условиях вузовской подготовки специалистов обусловлена, прежде всего, задачами развития устной и письменной речи. В.В. Виноградов писал: «Высокая культура разговорной и письменной речи – хорошее знание и чутье языка, умение пользоваться его выразительными средствами, его стилистическим многообразием – самая лучшая опора,

самое верное подспорье и самая надежная рекомендация для каждого человека в его общественной жизни и творческой деятельности» [1, с.19]. Типовая программа по русскому языку обосновывает важность функционально-стилистического аспекта в преподавании всего курса русского языка. Сама практика убедительно доказывает, что основное внимание в работе по стилистике должно быть направлено на овладение студентами структурой функциональных стилей речи, в первую очередь, если говорить о вузовской подготовке – научного.

Стоит вспомнить, что публицистический стиль занимает особое место в системе стилей литературного языка, поскольку во многих случаях он должен перерабатывать тексты, созданные в рамках других стилей. Научная и деловая речь ориентированы на интеллектуальное отражение действительности, художественная речь – на её эмоциональное отражение. Особенностью конца XX – начала XXI века в области образования является возрождение национального самосознания и повышение интереса к родной культуре, языку и литературе во всех регионах нашей страны. Современные высшие учебные заведения, ставя самые высокие и благородные цели обучения специалистов, значительно усилили лингвистическую направленность их становления: поставлена задача вооружить выпускников вуза коммуникативной компетенцией – умением говорить, читать и писать, свободно пользуясь тем жанром, которого требует конкретный случай.

Обучение студентов филологического факультета творческим письменным работам публицистического стиля имеет смысл, так как повышается общий уровень развития студентов, что позволит им попробовать свои силы в роли журналистов и имеет большую ценность в формировании знаний и умений, связанных с построением продуктивной устной и письменной речи. Формирование навыков написания творческих письменных работ публицистического жанра способствует совершенствованию культуры письменных публицистических высказываний.

Разговор о газетной публицистике, анализ различных жанров, определение особенностей языка газет может послужить примером для последующей работы по освещению вопросов, определяющих характер других средств массовой информации:

- Особенности жанров публицистического стиля на телевидении.
- Специфика публицистического стиля в журнальных произведениях.
- Публицистический стиль и Интернет.

Освещение этого круга вопросов может быть организовано в форме проектов.

Следует отметить, что данный элективный курс содержит одинаковое количество лекционных и практических занятий, что предполагает различные формы организации работы студентов – коллективные, групповые, индивидуальные.

Некоторые исследователи считают публицистический стиль принципиально неоднородным, по мнению других (их абсолютное большинство), уже в самой этой неоднородности прослеживается специфическое стилевое единство, целостность. Общие черты стиля с разной степенью активности проявляются в отдельных подстилях: газетно-публицистическом, радио-, тележурналистском и ораторском. Однако границы этих подстилей очерчены не резко, часто размыты. И об этой «размытости» также необходимо дать студентам вполне конкретную информацию.

Информация на занятиях должна быть представлена на основе применения инновационных методов обучения, которые соответствуют задачам вузовского становления и современным требованиям. Поэтому в ходе исследования мы обращались не только к теоретическим источникам по текстологии, но и к работам по стилистике, а также использовали материал по вопросам современной дидактики и методике преподавания языков.

Е.П.Прохоров указывал, что: «...публицистика предлагает особый тип ориентации – не столько в законах действительности и в эпохах развития общества, сколько в текущих событиях во всем их многоцветии и разнообразии. Это означает также что наука, искусство и публицистика взаимодействуют и здесь существуют переходные формы». Е.П.Прохоров отмечал, что «...публицистика призвана помочь практически процессу духовного сознания мира народными массами, способствовать правильному, глубокому, всестороннему ориентированию их в текущей действительности. Именно публицистика, нашедшая свое место, прежде всего в периодической печати, затем на радио, в кино, телевидении, в наибольшей степени соответствует особенностям формирования и функционирования этого типа сознания». Известно, что специфическое социальное предназначение публицистики – формирование общественного мнения. Формирование общественного мнения является важнейшей, но не единственной функцией публицистики. Е.П.Прохоров в своих трудах указывал на две функции публицистики: социально-педагогическую и информационно-познавательную [6].

Универсальных коммуникативных умений, обеспечивающих создание текстов всех типов и стилей речи, не существует. Умения конкретны, поскольку они тесно связаны с типом речи. Поэтому вся работа над обучением студентов публицистическому стилю речи конкретизируется в соответствии с его функциональными особенностями, учет того, что в публицистической речи раскрываются актуальные проблемы, вызывающие интерес общества. Определяя основную мысль своего будущего публицистического высказывания, пишущий обязательно должен учитывать, что общее назначение стиля реализуется в конкретной задаче жанра. Жанры же различаются, прежде всего, своим назначением. Например, назначение заметки – кратко сообщить о каком-либо факте, событии. Специфика репортажа – наглядно показать описываемый факт, событие современной жизни. В задачу статьи входит разъяснение, анализ взаимосвязанных событий.

Рецензия, отзыв – это размышления автора, это его желание поделиться своими впечатлениями [3].

Публицистика, как и художественная литература, имеет дело со словом. Публицистика, прежде всего, использует такой канал коммуникации, такие средства массовой информации и пропаганды, как журналистика. Государственные и негосударственные газеты, радио и телевидение, располагая широкой и разветвленной сетью корреспондентов, создает многообразную, разностороннюю, всеохватывающую «историю современности».

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# ARTISTIC MANIFESTATİON OF THE ISSUES OF HUMANISM IN THE NOVEL "JANE EYRE" BY CHARLOTTE BRONTË

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**Abstract**

The novel Jane Eyre is still widely read in modern society, and there are many controversial opinions surrounding the novel. Because Bronte draws the reader into the story and brings a modern aspect to the center of attention in the novel. Jane cleverly does this by appealing to the reader, "Reader, I married her..." to draw attention back to herself. In doing so, the reader is instantly pulled back every time they engage with the novel, therefore making it a more immediate action and happening in that very moment. This helps to capture the true essence of the novel and illuminates all the major important issues. All of the issues Brontë discusses are relevant to modern audiences and this has helped keep Jane Eyre a classic. Charlotte Brontë challenges the idea that men are emotionally, socially, and intellectually superior to women: "We women and men are equal as men are equal when we pass from the grave and stand at the feet of God!" (1)

The 19th century was a time of oppression for women. The patriarchal system that dominated the Victorian period in English history was one that Charlotte Brontë wrote and defined in her novel Jane Eyre. Brontë denounces the persecution women suffered at the hands of a society that believed men were emotionally, socially, and intellectually superior to Victorian women.

**Keywords:** Charlotte Brontë, Jane Eyre, women's liberation, Victorian Literature.

The belief that men were intellectually superior to women tainted the Victorian era. During that period, it caused women to be deprived of education based on their gender. Jane Eyre appears to be more intellectually advanced than her male counterparts despite being educated at a school with low standards such as Lowood. A school where not only the food, but also the facilities are "disgusting". She can confidently speak decisively and freely and on an equal footing even with men she does not consider superior to her. It is clear that Bronte strongly believes that women are equal to men in this regard. The fact that Jane was able to create "as beautiful a picture of Mrs. Reed as any painter could" (1) also indicated Brontë's support for the idea that women were as intellectually capable as men. Jane's skill in her paintings has led to criticism from some of the men who see her handiwork: "It seems to me that a hand has painted these pictures: is that your hand?" (3) By Jane's action against the stagnation of society, Brontë's disdain for society's limitations is demonstrated.

The Victorian era was a time when women's emotions were suppressed. It expressed the belief that men are emotionally superior to women. Brontë expressed her opposition to this idea by introducing the "passion picture" of Jane Eyre. This emotion and passion would not have been tolerated by others in Victorian society. Jane often "attempted some things like passion" in her youth. This was evident from his confrontation with John Reed; "You are like a murderer - you drag to be a slave."(2) In Victorian society, not only women, even young girls, did not usually display their anger. Brontë believed that the expression of women's emotions was crucial.

Arguing that women are not inferior to men, Bronte explains the reason for this idea by the fact that a woman has to climb up the social ladder or that she is "worthy of work and competent to do it". Love was a factor that many people denied. Brontë condemned this denial. Calvinism, a patriarchal religious system, taught its members that men were superior to women in many ways, including morals. The most "moral" people in Victorian society seemed to be Brocklehurst-type figures who were actually hypocrites. They were seen as pious and the chosen few to enter the gates of Heaven. Bronte portrays Brocklehurst as a shallow person and in the end, he loses his job because of his lack of humanity.

Victorian society had discriminating classes, differences between men and women. Thus, lines of inequality arise between both sexes. Brontë believed that women were equal to men in terms of intellect, emotions, morals, and also in relationships. Although these ideas originated in the mid-1800s, a modern reader may hold these beliefs. Jane Eyre challenged Victorian beliefs with phrases like "Traditionality is not morality. Loyalty to oneself is not a religion."

"You are dependent, my mother says that you have no money, your father left you alone. You should beg and not live here with the lords' children like us, eat our food, and dress at our mother's expense. Now I'm going to teach you to sort through my bookshelves, because they're mine, I own the whole house, or I will in a few years."(6). This quote expresses John's power and authority over Jane. Because he unexpectedly reveals that he is socially dependent on John and uses this fact to exclude him. Jane, on the other hand, rejects the idea of being born an orphan and uses it as a weapon to be treated as an equal. The Lowood Institute is a disciplined environment that exists to prevent any non-conformity of young women. However, Jane sees it as a chance for a fresh start, somewhere where she won't be judged on her financial worth. Unfortunately, this is not the case in the beginning, as Jane is oppressed by Mr. Brocklehurst, a vile and scheming man who profits from the misery of orphaned children. Oppression is a

central theme of the novel and is closely related to the class structure, as other characters in the novel use it to victimize Jane and exert power over her.

When Mr. Brocklehurst humiliates Jane in front of the whole school, Brontë expresses the unfair dominance of the upper classes. He uses contrasting language to describe Mrs. Reedy in relation to Jane to emphasize the social ideology created by the class system. Mr. Brocklehurst uses positive connotations to describe Mrs. Reed as "charitable, compassionate" simply because she is upper class, while portraying the lower-class Jane as "terrible, evil". Jane must then fight against any negativity associated with her class and force people to accept her for who she is. Because Lowood provided the same education, knowledge, and behavior associated with aristocrats, it helped him increase social class mobility. This highlights the importance of social boundaries established in society and how insignificant they are as they do not reflect a person's ability or potential. Brontë's portrayal of governesses is one of the most important positions when exploring the topic of social class.

In nineteenth-century Britain, life was governed by social class and hierarchy, and people rarely moved from one class to another. As an orphan, Jane had received a high standard of education to become a governess at the time, she does not have a definite social status and therefore falls between classes. She has an ambiguous social position as she lives with and converses with people from all walks of life, from working-class servants to upper-class aristocrats. Jane therefore causes extreme tension because she has upper-class sophistication but a lower-class background. Governesses of this era were expected to adhere to the high standards of aristocratic 'culture', but were often treated very badly by their employers.

Bronte created the Jane Eyre character with social mobility to help develop a wider community in the novel, therefore allowing the story to be more flexible. Brontë's protest is against the limitations of the social class system in England, and she creates problematic situations and events in the novel to highlight the social pressures practiced during this time. She cleverly transcends the boundaries created for both women and the lower classes, creating a stereotypically anti-normative character. However, Jane does not break every social rule as she refuses to marry Mr. Rochester when she learns the truth about his marriage. Although her marriage to Bertha is indeed loveless, Jane is determined not to subject herself to such moral depravity, and is proud to admit that even in the face of love, such an act would cast her out of society. This devotion to her personal morality underscores Jane's self-reinforcement that she will not succumb to the pressures of marriage for social status and wealth.

Jane begins to question her own class and self-worth when she meets her complete opposite, Blanche Ingram. Blanche is everything that Jane is not, rich and beautiful. Jane soon realizes the harsh truth and becomes acutely aware of the reality that her social class is holding her back from what she truly wants in life, Mr. Rochester. "A greater fool than Jane Eyre never walked the earth, a more terrible fool never fell for sweet lies and swallowed poison like honey."(6)

In this self-awareness, Jane Eyre expresses regret and hatred by referring to herself in the third person. Jane mocks herself by using words like "Silly, foolish" because she believes she might ever be good enough for Mr. Rochester. How could a woman of low class and no status deserve to have a relationship with a man of such high stature and worth? Acting as an outside observer in her own actions, Jane is very harsh and critical of herself. Jane is a woman who always considers herself a valuable, admirable member of society and is proud of who she is. But after this episode, Jane's self-confidence is dramatically shaken, and she now judges herself and the other characters in terms of class and status.

After escaping from Thornfield Hall, Jane embarks on a homeless, free, penniless and hungry journey to find freedom and purity in her life. In a strange town, far from where she has adapted, Jane faces real poverty. She now has no class, no property, no value, no status. The only useful thing Jane can do is her willingness to work.

"I remembered that strangers who come to a place where they don't have any friends and want to get a job, sometimes turn to a clergyman for introductions and help. It is the duty of a cleric to help those who want to help themselves, at least with their advice".

Here, bereft of everything, Jane found confidence and courage in the trail of hope for a new beginning. She can promise to commit to herself and be grateful to anyone who lends a helping hand. However, Jane's fears are repeated when she is greeted at the door of her only hope by Hanna, the maid at the Marsh End residence. Hanna, a maid of not so high class herself, makes the same assumptions that Jane, who has suffered all her life, is a pointless orphan.

"To my horror, Hanna had a look of utter disbelief on her face. This was the climax. A strong pang of conscience, a real pang of despair, pierced my ears and roared. I cried in the most desperate agony. It's a pity that this isolation, this expulsion is because of my class!"(9)

In this statement, Jane confirms how worthless Hanna thinks she is. This overwhelming feeling of emotion at this point in the novel depicts Jane becoming tired and frustrated at being judged and ostracized because of her social class. Referring to the "climax" tells the reader that this is the height of despair and that Jane will soon overcome the problem. At Marsh End, Jane finds the independence and freedom she seeks, learns that she has living relatives, and discovers that she is rich. She has been freed from the strict social hierarchies imposed by the English class system, and now that Jane is rich, she has a sophisticated attitude and class status to match her education. When Jane shares her wealth with the Rivers family, it shows that Jane is not looking for wealth and fortune, but independence and freedom. Jane's inheritance is not a chance for material wealth, but rather gives her the right to live as an independent woman and ensure her acceptance in society as she is not dependent on anyone or anything. From

a young age, and throughout the novel, Jane seeks this rightful passage into the social class system.

Throughout the novel, several characters mention Jane's uncle John Eyre, indicating that he will leave Jane a significant inheritance. Although Jane believes their relationship is bad, Bessie mentions in chapter ten that John Eyre once came to see Reed, but Mrs. Reed lied about Jane's whereabouts. Bessie insists that John Eyre "looked very gentlemanly," contradicting Jane's belief that her relatives were poor. Mrs. Reed's lie also raises suspicions that she is hiding Jane from her caring relatives. Mrs. Reid later confirms these suspicions in her dying confession in chapter twenty-one, when she reveals that she wants to adopt Jane after John Eyre's successful business ventures in Portugal. These events characterize Mrs. Reed as spiteful and cruel. However, these moments also create hope, implying that Jane is not truly alone in the world. Outside Gateshead, a letter to the Rivers sisters informing them of their uncle John's death also shows Jane's legacy. The details of their uncles' lives fit very well with what the reader knows about Jane's uncle.

Many of the gruesome events at Thornfield Hall feature the revelation of Rochester's previous marriage to Bertha Mason. Rochester tries to absolve himself of guilt when he vaguely refers to his first marriage as a "capital mistake" in chapter twenty. This strange conversation, along with Mr. Mason's visit, warns the reader that Mr. Rochester is hiding something. Grace Poole accuses Bertha of instigating an anonymous attempt to burn Rochester as a monstrous entity. Jane notes how odd it is that Rochester hasn't fired Grace Poole, despite the fact that he's clearly a danger to everyone. These suspicions suggest that Grace Poole may not be the real culprit, even if she is a convenient prisoner. Bertha then wears the wedding veil and then destroys it, adding a sense of dread to Jane and Rochester's impending marriage. With thoughts of the past, Bertha wearing a wedding veil symbolizes that she is still Rochester's bride. Finally, a storm that destroys the chestnut tree shows that all is not well with Rochester's proposal to Jane. After Rochester vows that God is on his side, the storm rages on. By this time, the thunderbolt takes on the air of divine judgment and suggests that God disapproves of Rochester's actions.

Two events in particular herald the burning of Thornfield Hall. The first is when Bertha burns Rochester's bed. At this point in the novel, the fire emphasizes the feeling that all is not well in Thornfield. In retrospect, this attack reveals Bertha's penchant for burning things and her anger at Rochester. The second incident occurs a few days before her wedding to Rochester, when Jane dreams of Thornfield Hall in ruins while walking with a child in her arms. As this dream is one of Jane's two nightmares leading up to the wedding, it evokes a sense of anxiety surrounding her impending marriage. In retrospect, this dream heralds the end of Thornfield. The important point is that Jane said throughout the dream that she was trying to find a place for the child, but could not find a safe place among the rubble. Emphasizing that Jane and Rochester have a son in Fernand, the child in the dream symbolizes that Jane has no future at Thornfield.

Jane's decision to return to Mr. Rochester, which results in her settling in Fernand, stems from the maturity she has developed by increasing her knowledge of the society in which she lives. Before this he had entirely addressed himself to Mr. Rochester, and, notwithstanding his intellectual equality, was certainly not his social equal. Jane had nothing to give Rochester in a relationship with someone of such high status, but now that she is free and wealthy, she can confidently and freely stand by him despite society's judgments. On her return, Jane learns of the misfortune that has befallen Mr. Rochester, who has been blinded and physically injured in a terrible fire at Thornfield Hall. This is an important point in the novel because the gender roles have been reversed and Jane is now the stronger sex. The female role has become a dominant character, and the male role has become both dependent and powerless. In doing so, Brontë reflects Victorian gender relations as a critique of the repression of women by men. As a symbol of female independence and freedom, she almost "disempowers" Mr. Rochester's masculinity. Only now that Mr. Rochester has lost an important part of himself and Jane has now found freedom, they can be truly equal in their relationship and their characters are balanced. The thirty-seventh chapter of the novel concludes many unresolved dilemmas. It sheds light on themes of love, status, and identity, and restores friendship in Jane's life, freeing her from society's conventions and constraints.

Foreshadowing something throughout the work makes the novel even more mysterious. Bronte preemptively uses this technique to demonstrate that people who purport to care for Jane, or in Rochester's case, claim to love Jane, are not being honest with her, and to emphasize that Jane's place in the world is unstable. Only after the truths are revealed does Jane find safety and stability.

**Conclusion**

The novel "Jane Eyre" in the 19th century is a novel that has a special weight in bringing the socio-social characteristics of the era to literature, and it is a work that reflects the artistic manifestation of all these characteristics.

In the article, the reflection of the characteristics of that period in the novels, which are the leading literary genre of the Victorian era, the rebellion expressed in the novel against oppression and the historical and social reasons that caused this rebellion were investigated. As a result, in order to solve the problems of humanism of the Victorian era in the novel "Jane Eyre", problems such as class discrimination against people in society at that time, humiliation of personality, and insults are laid before the eyes, and social ugliness is revealed through a young girl who has no class. As a result of the research, it is known that it was the Victorian period of the 19th century that created fertile conditions for the creation and writing of the novel "Jane Eyre". In the article, the discrimination between people, which is observed throughout the novel, and the people belonging to the poor class are insulted at every opportunity, is mentioned as the main shortcoming of the society. It

is clear from the analysis of the characters and their actions that what will come to people's aid in a bad day is neither class stratification nor the existing state.

From the research, we clearly observe that the rapid development, industrialization, or material wealth occurring in society cannot become a savior of a person in difficult times. It is shown that the main wealth valuable for man in the world is human qualities and humanism.

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# PHYSICAL SCIENCES

## CORRECTED SPECIAL THEORY OF RELATIVITY[35]

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**Abstract**

This article shows that the version of the special theory of relativity (STR) presented in all physics textbooks is incorrect, since relativistic formulas obtained therein are incorrect. They are incorrectly explained using the wrong principle of non-exceeding the speed of light and have led to incorrect conclusions about the physical unreality of imaginary numbers and the existence in nature of only our visible universe. This version of the STR proved to be in demand only because its authors were not able to explain physical sense of imaginary numbers. The article provides three proofs of physical reality of imaginary numbers and explains their physical sense in the theory of linear electric circuits, relativistic physics and astrophysics. This made it possible to obtain corrected relativistic formulas, from which appropriate conclusions were drawn.

**Keywords:** Special theory of relativity, imaginary numbers, Multiverse, dark matter, dark energy

### 1. Introduction

The special theory of relativity (STR) [1]-[3] created in the 20th century has been deservedly considered one of the most significant achievements of modern physics, since it introduced the principle of relativism into science. This is why STR is now taught in all university physics textbooks. However, the relativistic formulas obtained in this theory turned out to be incorrect due to the lack of experimental knowledge in physics of the 20th century necessary to complete their derivation. What is the physical meaning of named imaginary numbers and now is not explained in any textbook. Therefore, a postulate was introduced in STR, called the principle of not exceeding the speed of light, which allowed the physical meaning of imaginary numbers not to be explained, since nothing supposedly corresponds to them in nature.

This is how the STR has still been studied in physics textbooks.

### 2. The current version of the STR is incorrect

For a newly created scientific theory, this is pardonable, since such a theory must be developed. Therefore, over time, something in it must be refuted and corrected. The author of the concept of an open society, Sir Karl Raimund Popper, argued [4] that *"... the struggle of opinions in sci-entific theories is inevitable and is a prerequisite for the development of science."*

And in STR there are already a lot of such denials [5]-[54]. This is the existence of shock oscillations - tsunamis, music of pianos and other musical instruments, bell ringing in Christian churches and even swinging swings in playgrounds. This is the modern theory of resonance under the influence of not only sinusoidal oscillations of constant amplitude, but also damped sinusoidal oscillations, and even under the influence of exponential pulses. And this is even radio engineering created earlier by STR, since STR and radio engineering mutually refute each other.

But the authors of physics textbooks, not being able to challenge these refutations, neverthe-less, still do not take them into account [55]-[63].

### 3. The corrected version of the STR

Therefore, the corrected version of the STR [64] is in demand. In it incorrect principle of light speed non-exceedance STR denying physical reality of imaginary numbers is replaced by the principle of physical reality of imaginary numbers proven experimentally.

Let us show how, for example, this can be done by correcting the Lorentz-Einstein's formula

$$m = \frac{m_0}{\sqrt{1-(v/c)^2}} \qquad (1)$$

where $m_0$ is the rest mass of a moving body (for example, an elementary particle);

$m$ is the relativistic mass of a moving body;

$v$ is the velocity of a body;

$c$ is the speed of light.

It can be seen from the graph (see Fig. 1a) that the function $m(v)$ has a discontinuity at $v = c$. It corresponds to real numbers for argument values $v < c$, while for argument values $v > c$ it corresponds to imaginary numbers that were discovered in the 16th century and whose physical sense remained unexplained until the 20th century. And since we have proved the physical reality of imaginary numbers, in this situation it is necessary to explain their physical meaning. But on the graph of the function $m(v)$, its branch at the values of the argument $v > c$ corresponds to a physically unstable process that cannot exist in nature. Therefore, the Lorentz-Einstein formula cannot be explained. Hence, it is incorrect.

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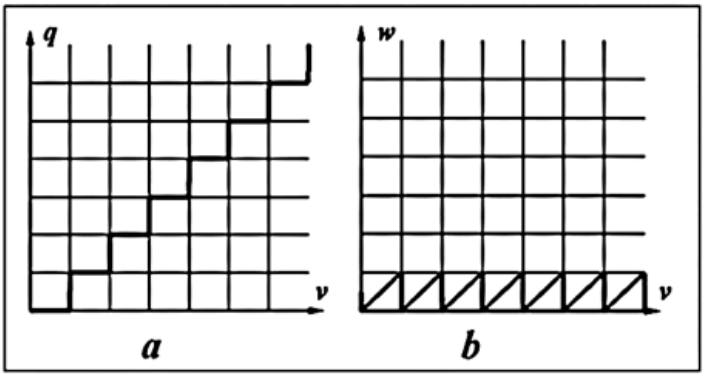


***Fig. 1.*** *Graphs of the function* $m(v)$ *corresponding to the generally recognized but incorrect and c orrected versions of STR in the subluminal* $v < c$ *and hyperluminal* $v > c$ *range*

And the graph of the Lorentz-Einstein formula, which can be explained (see Fig. 1b), on the range $v > c$ should be similar to the graph of this function (see Fig. 1a) on the range $v < c$. Thus, the corrected Lorentz-Einstein's formula can be written as follows

$$m(v) = \frac{m_0(i)^q}{\sqrt{1-(v/c-q)^2}} = \frac{m_0(i)^q}{\sqrt{1-(w/c)^2}} \quad (2)$$

where $q = \lfloor v/c \rfloor$ is the 'floor' discrete function of the argument $v/c$ (see Fig. 2a);

$w = v - qc$ is the local velocity that in each universe takes values in the range $0 \le w < c$ (see Fig. 2b).

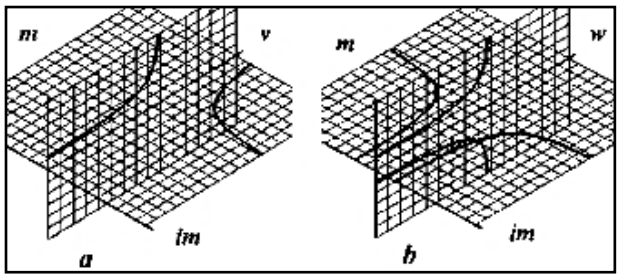


***Fig. 2.*** *Graphs of functions* $q(v)$ *and* $w(v)$ *illustrating the meaning of the 'floor' function of discrete mathematics*

Therefore, at $q = 0$ the formula (2) should be written as (1), and at $v > c$ it should be written as follows

$$m(v) = \frac{im_0}{\sqrt{1-(v/c-1)^2}} = \frac{im_0}{\sqrt{1-(w/c)^2}} \quad (3)$$

The graph of the function $m(v)$ in Fig. 1b shows that the value $q = 1$ corresponds to a fragment of this function on the interval $c \le v < 2c$. Those on this interval $c \le v < 2c$ it corresponds to universe adjacent to our universe. And this other universe is already invisible to us, as it is located beyond the event horizon. Therefore, for definiteness, we call it tachyon universe. Our visible universe will then be called tardion universe. The value $q = 2$ corresponds to an invisible tardyon antiverse, for which $2c \le v < 3c$. The value $q = 3$ corresponds to an invisible tachyon antiverse, for which $3c \le v < 4c$. Etc.

Therefore, it follows from the corrected Lorentz-Einstein formula that the statement contained in physics textbooks about the existence in nature of our only visible universe is incorrect. In fact, we are in the Multiverse, which, due to the mutual invisibility of the universes in it, we will call the hidden Multiverse. But to make sure that the invisible universes really exist, we need an appropriate experiment that made it possible to see them.

**4. Corollaries of the corrected version of the STR**

**4.1.How to see invisible universes**

In order to understand what this experiment can be, first of all, it is necessary to understand that in Formula (2) the parameter $q$ is an additional spatial dimension in which mutually invisible parallel universes[36] somehow drift relative to each other. They touch each other and even slightly penetrate into each other generating respective passages through which their matter content is exchanged. These passages are commonly referred to as portals [65], [66] or stargates [67]. And the entrances to them are presumably at least some of the anomalous zones, of which there are a lot on Earth [68]-[71].

[36] Since, despite their infinity, they do not intersect

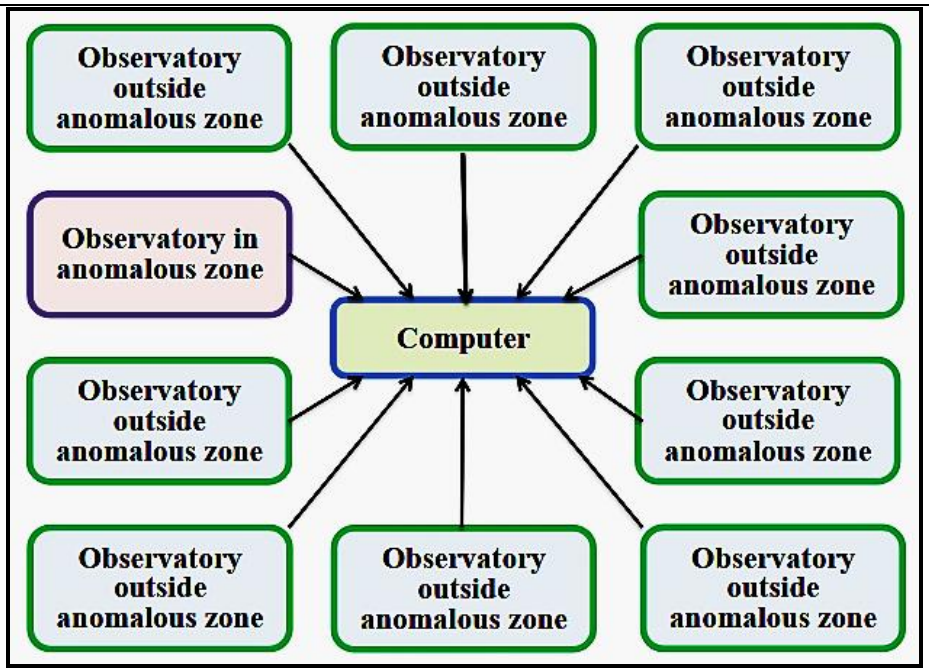


***Fig. 3.*** *Scheme of an astronomical complex for the detection of invisible universe*

And since in other universes the constellations in the sky inevitably differ from the constellations in our earthly sky, then when moving through the portals from the Earth to any neighboring universe, the map of our starry sky will gradually be transformed into a map of the starry sky of the neighboring universe. And if a telescope is placed in such a portal, then by comparing the position of the stars in the sky in the portal and outside the portal (see Fig. 3), changes in the position of the stars can be detected. These other constellations in the starry sky in the portals will be the desired experimental evidence [72]-[77]. The corresponding experiments[37] is very low-cost and easily implemented. Moreover, some observatories are already in anomalous zones. As, for example, the Main Astronomical Observatory of the National Academy of Sciences of Ukraine, which is located 12 km from the center of its capital, Kiev, in the Goloseyevsky forest.

**4.2. The need geophysical research of portals**

Naturally, the farther the telescope is placed in the portal, the more the constellations in its starry sky will differ from the constellations observed outside the portals. And the more convincing will be such astronomical observations. In addition, as a result of such astronomical observations, it will be possible to determine how many different neighboring invisible universes are located next to our visible universe [78]-[88].

But the great value of such observations lies not only in this. And also in the fact that the study of the geophysical characteristics of portals will make it possible to create artificial portals, with the help of which it will be possible to move from our universe to other currently invisible to us, and therefore unknown universes. That will accelerate the transformation of human civilization into a super-civilization.

However, people now avoid any visit to the portals, as the portals are invisible labyrinths in which it is impossible not to get lost. Therefore, in order to make visiting portals safe, it is necessary to create means of portal orientation that will allow invisible portals to be seen in the same way that a compass allows navigators to see the invisible magnetic field of the Earth. And this is quite possible to do if we use the fact that the intensity of the electromagnetic radiation of terrestrial radio stations decreases as we dive into the portals. And when it reaches the neighboring universe, this radiation will disappear completely. After all, on Earth there is no such electromagnetic radiation from neighboring universes.

**4.3. Dark matter, dark energy**

Having proved the existence of mutually invisible parallel universes, we need to find out their location in the hidden Multiverse, or, in other words, the structure of the hidden Multiverse.

We also need to understand the meaning of dark matter and dark energy called as such because of their incomprehensibility and because no chemical elements have been found therein, as well as because they neither absorb nor emit nor reflect nor refract electromagnetic radiation. However, they account for more than 95% of the whole mass-energy in space. More precisely, according to the data obtained by the WMAP spacecraft [89], the mass-energy of our visible universe (actually, the hidden Multiverse) consists of 4.6% of baryonic matter, 22.4% of dark matter and 73.0% of dark energy. And according to more recent data obtained by the Planck spacecraft [90], the entire universe (actually, again, the entire hidden Multiverse) consists of 4.9% of baryonic matter, 26.8% of dark matter and 68.3% of dark energy.

Therefore, the truth and completeness of knowledge in modern physics, which cannot explain

[37] They are analogous to the experiment of Sir Arthur Stanley Eddington in 1919.

the phenomena of dark matter and dark energy, raises serious doubts. And since it was proved above in the most indisputable way that in nature there is not the Monoverse, but the Multiverse, then in addition to searching for the clues to the nature of the phenomena of dark matter and dark energy at the Large Hadron Collider in the microcosm, it is also necessary to search for their clues in the macrocosm of our hidden Multiverse. After all, Albert Einstein himself said: *"Insanity: doing the same thing over and over again and expecting different results".*

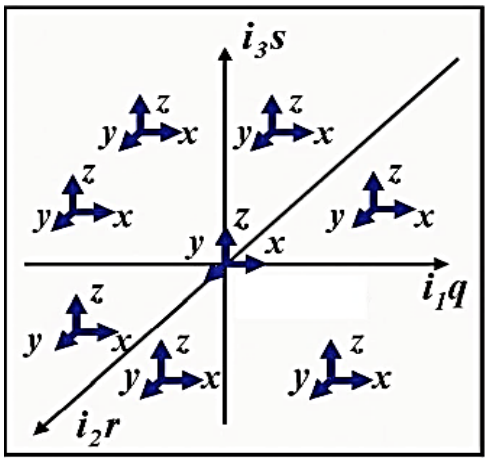


*Fig. 4. The six-dimensional space of the hidden Multiverse, in which* $\boldsymbol{q,r,s}$ *are the coordinates of invisible parallel universes, and* $\boldsymbol{x,y,z}$ *are the coordinates of the material content in each such parallel universe*

The search for a solution to this problem in the hidden Multiverse allows us to assume that [91], [92]:

- dark matter and dark energy are evoked by invisible parallel universes of the hidden Multiverse, creating a kind of its own gravitational shadow in our visible universe;
- dark matter is evoked by invisible universes of the hidden Multiverse adjacent to our visible universe;
- dark energy is evoked by the rest of the universes of the hidden Multiverse, except for our visible and adjacent invisible universes;
- chemical composition of dark matter and dark energy cannot be determined because they are just images.

Thus:

- the whole hidden Multiverse should consist of 100% / 4.6% = 21.8 parallel universes according to the experimental data obtained by the WMAP spacecraft, and of 100% / 4.9% = 20.4 parallel universes according to the data obtained by the Planck spacecraft;
- the whole hidden Multiverse should consist of 100% / 4.6% = 21.8 parallel universes according to the experimental data obtained by the WMAP spacecraft, and of 100% / 4.9% = 20.4 parallel universes according to the data obtained by the Planck spacecraft;
- dark matter should consist of 22.4% / 4.6% = 4.9 parallel universes according to the experimental data obtained by the WMAP spacecraft, and of 26.8% / 4.9% = 5,5 parallel universes according to the data obtained by the Planck spacecraft;
- dark energy should consist of 73.0% / 4.6% = 15.9 parallel universes according to the experimental data obtained by the WMAP spacecraft, and of 8.3% / 4.9% = 13.9 parallel universes according to the data obtained by the Planck spacecraft.

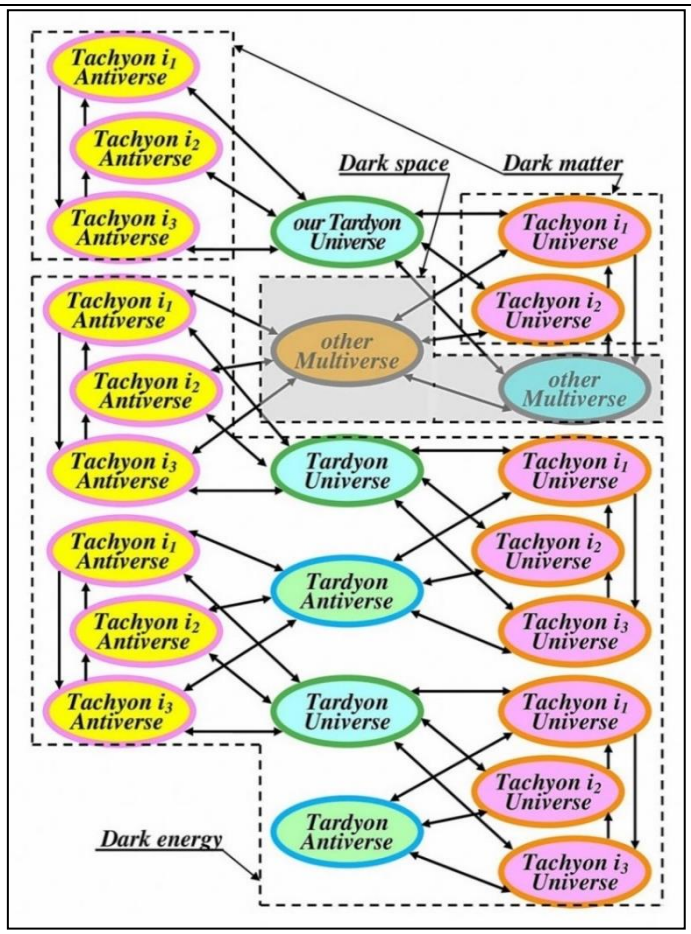


*Fig. 5. Possible structure of the hidden Multiverse*

Such an explanation of the phenomena of dark matter and dark energy provides important information about the structure of the hidden Multiverse. Indeed, given that mutually invisible universes of the hidden Multiverse are interconnected by numerous portals through which they exchange their matter content it can be argued that their mass-energy has significantly averaged over billions of years of their existence.

However… these results are inconsistent with the formula (2), since according to the WMAP and Planck spacecraft data, five-six rather than two invisible universes should be adjacent to our visible universe. Therefore, the relativistic formula (2) must be corrected again as follows:

$$m(q,r,s) = \frac{m_0 (i_1)^q (i_2)^r (i_3)^s}{\sqrt{1-[v/c-(q+r+s)]^2}} \quad (4)$$

where $v$ is the velocity measured from our tardyon universe;

$c$ is the speed of light;

$i_1, i_2, i_3$ are the related imaginary units [51], wherein

$$i_1^2 = i_2^2 = i_3^2 = -1 \quad (5)$$

$$i_1 i_2 i_3 = i_2 i_3 i_1 = i_3 i_1 i_2 = -1 \quad (6)$$

$$i_1 i_3 i_2 = i_2 i_1 i_3 = i_3 i_2 i_1 = 1 \quad (7)$$

**4.4. Antimatter, anti-time, anti-space**

Therefore, the hidden Multiverse has a quaternion structure in six-dimensional space (Fig. 4). For example, shown in Fig. 5, a helical structure in which adjacent to our visible tardyon universe is five invisible tachyon universes and anti-universes that evoking phenomenon of dark matter, as well as sixteen other invisible universes evoking phenomenon of dark energy. Thus, such a hidden Multiverse contains twenty-two invisible universes, which is consistent with the mathematically analyzed data obtained by the WMAP and Planck spacecraft. In addition, this structure is connected to two other universes that are outside the hidden Multiverse and form, together with the hidden Multiverse, the Hyperverse. And some invisible universes located in the Hyperverse outside the hidden Multiverse, as shown in Fig. 5 could presumably be adjacent to our visible universe. And then they can be discovered and studied by astronomical and geophysical research in portals.

From such a structure of the hidden Multiverse it also follows that in its cosmic antipodes of universes/antiuniverses there are matter/anti-matter, as well as time/anti-time and space/anti-space [93]-[101].

**4.5. Deja vu phenomenon**

The corrected version of STR allows explaining another unusual phenomenon – deja vu. It is so unusual that until now only medical scientists have tried to explain it. Translated from the French 'déjà vu', it means 'already seen'. And this term describes an allegedly psycho-emotional phenomenon corresponding to the state of a person in which it seems to him that he had already

been in exactly the same situation. Moreover, psychologists say that up to 97% of all people were in this state at least once in their lives.

And although a large number of hypotheses have been proposed to date to explain the phenomenon of deja vu, it's all not clear here. As in the phenomena of dark matter and dark energy. And all the deja vu hypotheses are not very convincing. They do not explain why almost all people sooner or later find themselves in this state, regardless of place of residence, age, gender and other factors. If it is an infection, how is it spread? Why, in spite of everything, almost all of humanity is infected? And if it is an infection, then why without any consequences and complications? And if not an infection, then why did the phenomenon of deja vu hit so many people? But why not everyone?

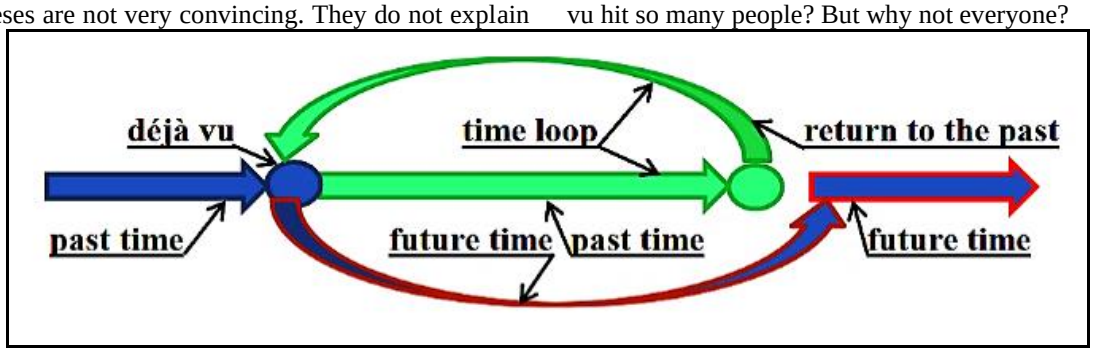


*Fig. 6. Explanation of the 'déjà vu' phenomenon, which is created as a result of the intersection of the time branch 'return to the past' and the time branch 'past time' with the formation of a 'time loop'*

Therefore, we propose another hypothesis - a physical one. Very unusual, but explaining everything. However, explaining in a different way than it is now customary in science to explain, using only the knowledge gained in the past. And we will explain using knowledge that is expected to be obtained in the future. Those suppose that in the future a highly developed human civilization, possessing extremely perfect computers, will be able to calculate any hypothetical situations in its development both in the past and in the future. Let's also assume that the inhabitants of these super-civilizations will be able to travel to their past. Then, the inhabitants of these super-civilizations, traveling into the past and making some changes to it, will be able to correct their future as well (see Fig. 6). And people who are exposed to such an impact, being in a time loop, from some point in time in their past further in the future will live in a different branch of time. And they will forget their previous life in the time loop, as the memories of everything that happened to them from their memory will somehow be erased. So this hypothesis really explains everything.

But a very important circumstance follows from it – the whole life of all people on Earth is currently under the control of aliens from the future and is recorded in the memory of their supercomputers. Therefore, they know everything about us. And they try not to interfere in our lives because it can change their future. And then they will not be able to return to their future to their relatives and friends. Nevertheless, sometimes they still find such situations in the past on their supercomputers, which correct their future in a favorable way, not excluding the possibility of returning to their relatives and friends. And these options are being implemented.

**5. Conclusion**

Thus, the article proves that the version of the special theory of relativity studied in the educational process of all universities - even the most prestigious ones - is incorrect. And the corrected version presented in the article has convincing experimental evidence and allows many inexplicable things to be explained. Therefore, in the existing physics textbooks, the presentation of the special theory of relativity must be corrected.

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**Conflict of Interest**

Nobody has anything to do with this research.

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# PSYCHOLOGICAL SCIENCES

## FLEXIBILITY-RIGIDITY OF COGNITIVE CONTROL AS A FACTOR OF PERSONAL MATURITY

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## ГИБКОСТЬ-РИГИДНОСТЬ ПОЗНАВАТЕЛЬНОГО КОНТРОЛЯ КАК ФАКТОР ЛИЧНОСТНОЙ ЗРЕЛОСТИ

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**Abstract**
The article reveals an understanding of the essence of flexibility-rigidity of cognitive control. Factors of personal maturity are determined, features of the relationship between cognitive needs and intellectual lability and rigidity as mental components of the formation of students' personality are revealed.

**Аннотация**
В статье раскрывается понимание сущности гибкости-ригидности познавательного контроля. Определяются факторы личностной зрелости, выявляются особенности взаимосвязи познавательных потребностей с интеллектуальной лабильностью и ригидностью как психическими компонентами формирования личности студентов.

**Keywords:** flexibility-rigidity, cognitive control, personal maturity.
**Ключевые слова:** гибкость-ригидность, познавательный контроль, личностная зрелость.

В современных российских условиях, в связи со сменой формаций, эпох, традиционных укладов и образов жизни происходят все более глубокие изменения взаимодействия человека и общества, межличностных отношений, особенностей познания себя и мира. На этом фоне возникают новые направления в социальных, ценностных ориентациях и взаимоотношениях людей, изменяя общественное и личностное сознание. Ввиду нарастающих тенденций информатизации общества, происходят необратимые изменения в личности человека, приводящие к потребительскому отношению к себе и к миру, к некоторой степени инфантилизации, примитивизации и поверхностности мышления, речи, поведения, общения и отношений. В связи с этим проблема зрелости в наше время входит в зону повышенной значимости и является составляющей проблем развития человеческой личности и сознания. Данные положения легли в основу теоретико-эмпирического исследования.

В психологии «ригидность представляет собой сложное многомерное свойство (или состояние)» [1, с. 48], она рассматривается на основе системного (структурно-уровневого) подхода к человеку, что позволяет изучить данный феномен во взаимосвязи личностных особенностей и поведения, а также в комплексе характеристик ее феноменологии и механизмов.

Ригидность искажает идентификацию человека с внутренним и внешним жизненным миром и выражается в полной неспособности человека адекватно определять самого себя в реальности. Как полагает О.В. Лукьянов, в случаях ригидной идентичности исчезает сама реальность [2].

Исследованиями ригидности занимались такие ученые, как: Ю.М.Антонян, Л.И.Анцыферова, В.Ф.Березин, Б.С.Братусь, В.К.Вилюнас, Г.В.Залевский, Б.В.Зейгарник, К.Изард, Е.Г.Самовичев и др.

Анализ психологической литературы показал максимальную разработанность проблемы зрелости в отношении социальной (социально-психологической) и личностной зрелости. Социальная зрелость понимается как совокупный уровень достижений социализации (Ю.П.Бардин, И.В.Бестужев-Лада, О.Н.Гундарь, И.М.Даниленко, С.Н.Иконникова, Т.А.Каландадзе, Л.Н.Коган, И.С.Кон, Ю.А.Наринский, С.Г.Плукин, А.А.Реан, В.Т.Степанова, Н.С.Темиров).

Личностная зрелость представлена описанием отдельных характеристик и критериального набора признаков-достижений в уровне личностного развития в исследованиях отечественных психологов, таких как: К.А. Абульханова-Славская, Б.Г. Ананьев, Л.И. Анцыферова, А.Г. Асмолов. Еще остается открытым вопрос о том, насколько ригидность или гибкость является отличительной чертой зрелой личности и ее формирующих факторов, чем объясняется выбор темы исследования.

Цель исследования: выявить особенности гибкости-ригидности познавательного контроля как фактора личностной зрелости.

Гипотеза исследования: когнитивный стиль гибкость/ригидность и интеллектуальная лабильность зависит от развития факторов личности зрелости (самоактуализации, а именно особенностей познавательных потребностей).

Методы исследования: самоактуализационный тест (САТ), (Алешина Ю.Е., Гозман Л.Я., Кроз М.В., Латинская М.В.); диагностика ригидности (тест Г.Айзенка); тест «Интеллектуальная лабильность»; методы математической обработки данных (критерий Стьюдента).

Выборку составили студенты гуманитарных вузов г. Самара в возрасте 18-23 лет в количестве 150 человек, из них 88 человек девушки и 62 юноши.

Как показало исследование по методики САТ высокий уровень познавательных потребностей достигло всего 8% из совокупной выборки, средний – 29%, тогда как низкий уровень у большинства студентов (63%).

Следует отметить, что низкий уровень познавательных потребностей может быть выражен в том, что такие студенты имеют неопределенные познавательные интересы к процессу обучения, в учебном процессе практически не участвуют. У таких студентов очень низкий уровень развития мотивации учебной деятельности: они учатся, так как этого требуют социальная ситуация. Как правило, у них отсутствуют жизненные планы, связанные с высшим образованием, или об этих планах упоминается достаточно формально - только потому, что они социально одобряемы.

Также следует отметить, что по всем показателям самоактуализации большинство студентов имеют средние и низкие значения, подобные данные могут быть следствием того, что самоактуализация еще только начала развиваться у студентов, находящихся как раз в таком возрасте, когда этот процесс становится возможным.

Результаты теста на интеллектуальную лабильность показали, что наименьшее количество студентов обладают высоким уровнем интеллектуальной лабильности (4%), следовательно, немногие из совокупной выборки способны к переключению внимания, быстрого перехода от одного вида деятельности к другому, т.е. им не свойственно оперативно и эффективно осваивать новые знания. Это может объясняться тем, что учебный процесс требует от них, в силу их стилевых особенностей, уделять максимальное внимание планированию своей учебной деятельности и четкой реализации выстроенной программы, что они эффективно не умеют делать, что можно объяснить и отсутствием достаточного уровня развития познавательных потребностей.

Результаты исследования по методике «Диагностика ригидности» (А.Айзенка) показали, что большинство студентов в исследуемой группе (72%) обладают средним уровнем ригидности, что говорит, что рассматриваемое свойство связано с когнитивными проявлениями, трудностями в обучении, познании, совершенствовании новых знаний, умений и навыков студентов, обусловленных процессами интеллектуального характера. Таким студентам свойственна неспособность и неготовность индивида к перестройке запланированной схемы активности в обстоятельствах, когда ранее намеченная программа требует существенных изменений. Уровень демонстрируемой личностью ригидности напрямую связаны не только с индивидуально-психологическими характеристиками конкретного индивида, но и со спецификой сложившейся ситуации, в рамках которой реализуется деятельность. Именно ригидность обусловливает реальную проблемность как индивидуального, так и группового поведения. Особенности такого поведения является низкие познавательные потребности студентов.

Изучение достоверности взаимосвязи познавательных потребностей и интеллектуальной лабильностью проводилось при помощи критерия Стьюдента. Полученное эмпирическое значение t (24.3) находится в зоне значимости, следовательно, результаты исследования можно признать достоверными.

Следовательно, на основании проведенных исследований мы можем говорить о взаимосвязи познавательных потребностей с интеллектуальной лабильностью и ригидностью как психическими свойствами личности, обусловленных личностной зрелостью. Одним из перспективных психологических направлений является изучение не только и особенностей стилевой структуры личности, но и факторов, формирующих зрелую личность. Одним из инструментов может послужить разработка методов повышения интеллектуального потенциала студенчества, способов и приемов повышения познавательного интереса к процессу обучения и как следствия – развитие личности.

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# TECHNICAL SCIENCES

## COMPARATIVE ANALYSIS OF GRAPH-BASED NOSQL DATABASES

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**Abstract**

In the introductory part of the paper, a brief historical overview of NoSQL databases, their origin and use, reasons for introduction, advantages and disadvantages, similarities and differences with relational databases will be described. In the next part, the focus of the paper will shift to graph-based NoSQL databases along with the main features and properties of three main categories of NoSQL databases – Neo4j, ArangoDB and OrientDB. Special emphasis will be placed on structure, implementation, examples of graph-based databases and use cases. It is important to single out main representatives of graph-based NoSQL databases, with a more detailed description of functionalities and architecture. All of the previously mentioned aims to present a comparative analysis of the previously described databases according to the given criteria in order to summarize the results of the analysis in the final part of the paper with recommendations and best practices.

**Keywords**: nosql, graph, Neo4j, ArangoDB, OrientDB

### Introduction

The world of computer science is advancing and evolving in line with numerous achievements in the fields of science and technology. Many improvements are taking place in programming languages, architectures, platforms, and processes. However, throughout all this time, one thing has remained constant - relational databases store data. There have been considerable challenges, many of which have found success in certain niches, but overall, the issue of data storage has been a central concern for architects when deciding to use relational databases. There is great value in the stability of this reign. The data that organizations store lasts much longer than the applications themselves, so it is highly valuable to have a stable data repository that is well-understood and accessible from many applications, systems, as well as platforms [1].

SQL (Structured Query Language) databases have been the primary mechanism for storing data for over four and a half decades. The use of these databases exploded in the late 1990s with the rise of web application development and open-source platforms, such as MySQL, PostgreSQL, and SQLite [2].

The digital world is growing rapidly and becoming increasingly complex in terms of volume (from terabytes to petabytes), diversity (structured, unstructured, and hybrid), and speed (high growth rate). For quite some time, relational databases have been the default choice for serious data storage, especially in the realm of business applications. However, in the last two and a half decades, a new "contender" has emerged under the label of NoSQL. It has arisen out of the need to handle larger volumes of data, which has forced a fundamental and significant shift in the development of hardware platforms in the form of servers [1].

NoSQL databases are non-relational data management systems that do not require a fixed schema. The primary purpose of using NoSQL databases is for distributed data storage with vast data storage needs. NoSQL stands for "Not only SQL" or "Not SQL." Carl Strozz introduced the concept of NoSQL at the end of the last century. Traditional relational database management systems (RDBMS) use SQL syntax for storing and retrieving data for further manipulation. Instead, the NoSQL database system encompasses a wide range of database technologies capable of storing structured, semi-structured, unstructured, and polymorphic data [3].

NoSQL is used for processing large volumes of data and real-time web applications. For instance, companies like X, Facebook, and Google collect terabytes of user data every hour [3].

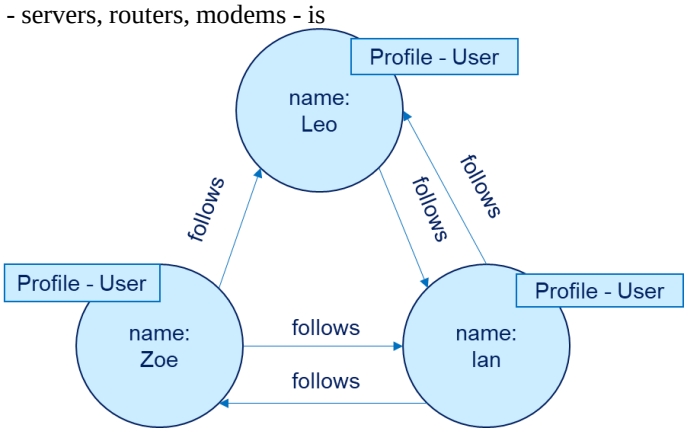
NoSQL databases have been around for some time, but they have gained prominence in recent years. After a long period of SQL dominance, the current excitement surrounding NoSQL databases comes as a surprise. The main idea is to explore the reasons why relational databases are not as dominant and why many scientists and researchers believe that the emergence of NoSQL databases can never completely replace relational databases.

### Problem Description

Graph-based databases are currently attracting significant interest because they can provide useful tools for modeling data that better align with understanding of data operates in the real world. This can enable a high level of flexibility as data can be represented in a way that makes the most sense for all involved parties while simultaneously leveraging complex interactions between them [4].

Before fully understanding of graph-based databases, it is necessary to grasp the concept of graphs. In mentioned context, a graph database represents a mathematical graph. Actually, a graph is simply a collection of elements - typically referred to as nodes (also known as vertices or points) - connected by edges (links). Each node represents some data in the graph, while each edge represents a connection between two nodes. Graphs are already present in the real world and in software development, too. Even everyday internet usage can be represented using a graph. Every computer on the Internet - servers, routers, modems - is a node, and each connection between them is an edge (connectivity, communication or file and message exchange) [4].

A graph consists of two elements: nodes and relationships (edges). Each node represents an entity (person, place, thing, category, or other data), and each relationship represents the way how two or more nodes are connected. The social network Twitter (recently rebranded as X) is also a perfect example of a graph database, connecting more than 330 million active users [5].




*Pic. 1. Twitter users represented in a graph database model [5]*

The upper illustration shows a small portion of Twitter users represented in a graph-based database. Each node (marked as the user) corresponds to an individual and is connected by relationships that describe user interactions. As illustrated on the picture, Zoe follows Ian on Twitter, as well as Leo and Ian, but even though Zoe follows Leo, Leo hasn't (yet) reciprocated.

Neo4j is a graph database management system, implemented in Java and accessible from software written in other languages through the Cypher query language over a transactional HTTP endpoint. Headquartered in San Mateo, California, Neo4j has offices in Sweden, Germany, Singapore and in the United Kingdom. The core concept and idea of Neo4j were conceived in the early 21st century [6].

Like many other open-source projects, Neo4j also had very specific origins. Neo4j is currently the world's leading graph database. Its architecture is designed for optimal management, storage, and interpretation of nodes and relationships. Neo4j is scalable and can be deployed as a standalone server or across multiple machines in a fault-tolerant cluster in production environments. There are two main editions of Neo4j available, the Community Edition and the Enterprise Edition. The Enterprise Edition includes everything that the Community Edition offers, along with additional enterprise features such as backup capabilities, clustering, and failover support [6].

In the beginning, Neo4j was not a complete graph database management system; it was more resembled a library that developers could use in their code to facilitate working with connected data structures. It was primarily focused on creating an abstraction layer for graphs for developers. After some time, the open-source project made a radical decision to move away from the MySQL infrastructure and introduce significant changes. The entire infrastructure, including low-level components like handling binary files, was optimized for working with graphs [7].

Neo4j is more visibly oriented towards the OLTP side of the database ecosystem. This doesn't mean that it's impossible to perform any analytical tasks with Neo4j. In fact, some analytical tasks, in the relational world, are much more efficiently executed within a graph database. In the future, there will almost certainly be additional enhancements to Neo4j that will make it even more suitable for OLAP tasks [7].

Neo4j has an upper limit on the size of graphs it can support and can handle individual graphs with tens of billions of nodes, relationships and properties. The current version of Neo4j supports approximately 34 billion nodes and relationships and around 274 billion properties. This is entirely sufficient for large-scale graphs like Facebook's, as well as similar network graph sizes. These storage limitations, in practice, do not pose any constraints because only large enterprises, such as Google, can surpass these limits and they are set for storage optimization and can be increased in future versions [7].

ArangoDB is the company behind the ArangoGraph Insights platform, a data and analytics platform that uncovers insights from challenging or impossible data using traditional SQL, document, or even other graph databases. The ArangoGraph Insights platform serves as a scalable foundation for graph analysis and complex data architectures for thousands of Fortune 500 enterprises and innovative startups across various industries, including financial services, healthcare and telecommunications. Founded in 2015 in Cologne, Germany, ArangoDB Inc. is supported by investors and data analytics companies based in San

Francisco, California, with offices and employees worldwide [8].

ArangoDB is a scalable graph database management system with a wide range of features and a rich ecosystem. It supports various data access patterns thanks to its multi-model approach, combining the analytical power of graphs with JSON documents [8].

ArangoDB is available in open-source and commercial editions and can be used for on-premises deployment as well as a fully customized cloud service through the ArangoGraph Insights platform. ArangoDB allows working with structured, semi-structured, and unstructured data equally in the form of schemas - free-form JSON objects, without the need to connect these objects to form a graph [8].

ArangoDB is designed to support multiple data models using a unified query language, AQL. ArangoDB also comes with an integrated search engine for information retrieval, such as text search with relevance ranking. ArangoDB is written in C++, built to operate at large scales, whether in the cloud or on a company's local servers [8].

ArangoDB is a multi-model database with a predominantly in-memory approach. All data is stored in persistent storage for durability. However, for efficient usage of ArangoDB, frequently accessed pages or the set of data used often (also called a working set) should fit into the main memory. At the same time, unlike most NoSQL databases, ArangoDB supports join operations and allows users to specify either multi-collection ACID transactions or standard single-document transactions to enhance performance [9].

ArangoDB's motivation is to combine the most common use cases of NoSQL databases. Other NoSQL databases that also use the JSON data format, like MongoDB for documents and Neo4j for graphs, naturally support only one data model. ArangoDB attempts to combine their use cases to build an all-in-one database, so users do not have to use a different database for various data types. The first version of ArangoDB was released in early spring in 2012 [9].

OrientDB is a multi-model NoSQL DBMS that supports graphs, documents, key-value, and object-oriented concept. Instead of merely implementing another layer with an API, OrientDB effectively integrates these models. It also supports both disk and in-memory storage. It is also an ACID-compliant DBMS capable of handling transactional workloads. OrientDB supports a multi-master distributed architecture [10].

OrientDB is an open-source database management system written in Java programming language. It supports schema-less, full-schema and mixed-schema modes. It has a robust security profiling system based on users and roles and supports queries using Gremlin along with extended SQL for graph traversal. The development of OrientDB continues to rely on an open-source community led by OrientDB LTD and the project uses GitHub for source code management and version control [11].

Ranked as the second most popular graph database according to DB Engines, OrientDB combine different models into a single engine, which makes powerful and user-friendly tool that doesn't restrict users to adopting just one database model. Originally developed by Luca Garulli in 2010, Luca transformed the existing OrientDB ODBMS platform in Java into OrientDB. In January 2018, CallidusCloud and consequently OrientDB, was acquired by SAP SE [10].

OrientDB Community Edition is free for any use (Apache 2 license). This open-source software is developed by a community of developers. Features such as horizontal scaling, fault tolerance, clustering, data sharing, and replication are not disabled in the OrientDB Community Edition. OrientDB Enterprise Edition is the commercial version of OrientDB Community Edition designed for handling more complex and demanding use cases. OrientDB Enterprise Edition includes additional features such as query profiler, distributed cluster configuration, metric logging, live monitoring, Teleporter (migration tool), and configurable notifications [11].

Table 1

Comparative view

| | Neo4j | ArangoDB | OrientDB |
|---|---|---|---|
| Pros | The most popular base and Cypher | Flexible schemes or no scheme | Various data types |
| | A lot of good documentation | Data sharing (sharding) | Record encryption: AES, DES |
| | Very good support | Multi-model | Token auth., LDAP integration |
| | Planning tools and backups | AQL supports JOIN operations | Hybrid scheme |
| | Scalability | Various data types | Multi-model |
| Cons | It does not support sharding | High memory usage | More effort because multiple concepts |
| | Expensive commercial editions | A little info for backups | Less support and smaller community |
| | Bugs of new functionalities | Scalability should be better | Slower queries for large graphs |
| | It does not support date types | Lack of built-in analytics | Existence of bugs |

**Results**

An interesting characteristic is that all three database models support many integrations such as BigBI, Hackolade, KeyLines and ReGraph. It is worth noting that Neo4j currently has the most documentation and is currently the most popular graph database. There are many training courses, tutorials and video materials available to help better understanding of database and how it operates. It also appears that Neo4j has the best support and it is very responsive to questions and inquiries. ArangoDB often sends "deployment ready" reminder emails to its registered users.

Graph databases provide better performance, flexibility, and agility compared to non-relational databases. The conclusion is that, although they serve the same purpose, which is storing large amounts of data with many interconnected relationships, they differ significantly in the functionalities they offer.

ArangoDB provides users with the ability to use a flexible schema. ArangoDB leverages similarities in document structures to save storage space. It identifies identical document schemas and stores each unique schema only once. This process is called shaping. ArangoDB features a modern query language called AQL, which bears a strong resemblance to SQL and allows for executing complex queries and processes, giving it a significant advantage. It also has functionalities like data sharding. It is a multi-model database and operates on Azure Cloud. Information available about ArangoDB backups can be somewhat confusing, making it an area that could benefit from improvement [12].

The advantage of using ArangoDB is evident in its support for multi-model capabilities, allowing users to work with documents, graphs and key-value pairs within a single database, eliminating the need for separate systems. Additionally, it provides a schema-less data model, enabling users to evolve their data structures over time without the need for predefined schemas. The AQL allows for searching across different data models and supports joins and graph traversal operations. Working with a multi-model database and the AQL query language may require users to become familiar with different data models and query syntaxes. While ArangoDB offers flexibility by supporting multiple data models, there may be performance trade-offs compared to specialized databases dedicated to specific data models [13].

Neo4j is one of the best choices when selecting a graph database and this software has key features such as a flexible schema, a powerful query language called Cypher, backup planning, execution, and retrieval tools, two types of architecture (server mode and embedded mode), scalability and cloud readiness. Neo4j does not support data sharding, which is a major weakness of this software so far [12].

Neo4j stores data in a graph format, allowing for visualization and traversal of relationships, making it particularly suitable for applications with complex and interconnected data. Its query language, Cypher, is specially designed for graph databases and provides an intuitive and expressive syntax for querying and manipulating graph data. It's worth noting that Neo4j offers both free versions and commercial editions, with commercial editions providing additional features and support. The commercial version can be expensive, especially for large-scale implementations or enterprise-level use. Organizations with budget constraints may face challenges when adopting the commercial version. While Neo4j is known for its performance, certain factors can impact its speed and efficiency. In specific situations, such as working with extremely large graphs or datasets that exceed available memory resources, Neo4j's in-memory storage can pose limitations. Overcoming these limitations may require memory management optimization, the use of disk storage options, or considering alternative database solutions. Although Neo4j has been in development for many years and offers a wide range of functionalities, some newer features may still be in early stages of maturity. These features may have limited documentation, fewer real-world use cases and occasional stability issues [13].

OrientDB's database can operate in a schema-less mode, but it also supports full-schema and hybrid-schema solutions. OrientDB uses Java, SQL, and Gremlin for data manipulation, supports data sharding, can be implemented in the cloud and exhibits excellent scalability when using a distributed architecture. There is not much clarity regarding how backups function [12].

One of the advantages of using OrientDB is that it allows users to model data as graphs, documents, key-value pairs, or even as a combination of these models, providing flexibility in data representation. It also ensures data consistency and integrity by supporting atomicity, consistency, isolation and durability in transactional operations. OrientDB supports multiple query languages, including the use of its SQL extensions. However, the drawbacks include the fact that OrientDB's multi-model approach and various query languages may require users to learn and understand multiple concepts and syntaxes simultaneously. While OrientDB has an active community, it may have a smaller user base compared to some other graph databases, which can result in a more limited ecosystem and community support [13].

It is noticeable that OrientDB and Neo4j share many common features (such as support for the Java language, fault tolerance through replication, and the HTTP REST protocol). Both ArangoDB and OrientDB are multi-model databases, support ACID properties and reliable server-side transactions. In contrast, Neo4j is exclusively dedicated to graphs and does not provide partitioning capabilities [14].

Both Neo4j and ArangoDB support fault tolerance through master-slave replication. They manage data storage using volatile memory and a file storage system. OrientDB and ArangoDB are both free databases licensed under Apache 2. However, Neo4j offers a commercial edition under the APGL license in addition to the free version [14].

Both Neo4j and OrientDB are dedicated to supporting the storage of large graph-based datasets. This ensures scalability and performance when inserting or querying data. The primary difference

between these two NoSQL databases lies in their underlying storage. Specifically, while OrientDB is primarily based on documents as its main storage (with an additional graph layer supporting graphs), Neo4j is based on graphs as its primary storage [14].

Unlike OrientDB, which supports a wide range of data types, Neo4j only supports primitive types. With Neo4j, precision is lost when storing decimal numbers (amounts, currencies, salaries, etc.). While OrientDB supports "date" and "date and time" types for easy date management, Neo4j, on the other hand, does not support date data types. Therefore, users have to manage date and time data differently. OrientDB also supports other complex types, such as a binary type for storing binary large objects (BLOBs), an embedded type for recursively storing embedded objects, collections, and maps. ArangoDB supports JSON data types, including numbers, UTF-8 strings, boolean values, arrays/lists, and documents.

Neo4j supports replication, but only in the Enterprise version. In both databases, Neo4j and ArangoDB, the replication mechanism is based on the master/slave architecture. This means that only one server can be the master. Therefore, Neo4j and ArangoDB are not able to scale by write operations because the throughput of these operations is limited by the capacity of a single master server. This type of replication allows scalability by read operations and supports creating backups [14].

Unlike Neo4j and ArangoDB, which support master/slave replication, OrientDB supports replication with multiple master servers and a schema-less architecture. This feature ensures data reliability. This means that all servers in the cluster are masters and capable of reading from and writing to the database. Indeed, in OrientDB, throughput is not limited by a single server [14].

OrientDB can host multiple databases per instance. In contrast, Neo4j allows only one database per server. With ArangoDB, it is possible to connect multiple secondary databases to the primary database. ArangoDB provides asynchronous replication and allows both vertical and horizontal sharding [14].

The operational database manages space without need for restart or maintenance interruption. When records are deleted, OrientDB has the advantage of automatically reusing the freed space. This is done transparently while the server is online. In contrast, Neo4j cannot automatically reclaim space from deleted records. To utilize the freed space, Neo4j requires a full server restart [14].

OrientDB supports basic security management based on the user and role model. It also supports secure SSL connections starting from version 1.7. Additionally, OrientDB offers the option to encrypt records on disk using AES or DES algorithms (starting from version 2.2). Encryption can be configured to operate at the cluster level or the database level. Furthermore, OrientDB supports token-based authentication and LDAP integration. Since OrientDB supports multiple master node replication, it is possible to replicate server databases within the cluster. This represents another security solution by reducing the risk of data loss and downtime while increasing data availability [14].

**Discussion**

Relational database models have successfully been the primary choice for storage models in the last fifty years. They excel at representing relatively linear data where relationships are not too complex. With the rise of the web and semi-structured data, highly interconnected and complex data have become increasingly prevalent in the technology world. Relational models have failed to adequately represent highly interconnected data, leading to the need for new database models.

Graph models have particularly demonstrated their advantages in specific domains such as the web, social networks, and transportation infrastructure. Various technology companies and independent researchers have developed their implementations of graph databases, such as Neo4j, ArangoDB, and OrientDB. Graph database technologies have significantly contributed to the growth of science and technology and will continue to do so in the foreseeable future.

NoSQL is generally a complementary solution for addressing scalability, complexity and performance-related issues. Non-relational databases offer many improvements over traditional relational databases, such as greater scalability across regular servers or instances. They also do not adhere to strict data insertion schemas and therefore can more easily accommodate various data types with minimal schema-level changes.

Graph database systems are designed to model and explore data relationships in a way that is not efficiently achievable in other types of database management systems. The need for a graph data model often arises from use cases such as social network analysis, identity and access management, recommendations for online products and services, network and device management, as well as detecting financial fraud in banking and insurance companies.

In general, the use of relational databases has remained quite stable recently. All other categories of databases have gained popularity, while the usage of graph database systems has increased by more than 500 percent. It's important to note that relational databases are still much more popular than any other type of database, constituting 82% of the total popularity score of all systems listed on DB-Engines and 7 out of the top 10 systems in the current rankings are relational systems [15].

The database landscape is quite extensive, and there appears to be a growing demand for all categories of database management systems. However, it's interesting to note that graph database systems are attracting an increasing share of attention from development teams within organizations.

In general, graph-based databases perform better with complex data during searches, especially in terms of traversing relationships. It is always recommended to use graph databases for more intricate and interrelated data. In other words, if queries are expected

to involve data from multiple tables, using graph databases with appropriate relationship orientations is advisable.

After all that has been presented in this paper, it is important to conclude that Neo4j and ArangoDB stand out for their functionalities and are the best options for graph databases in today's world. Neo4j is optimized for graph-based databases, while ArangoDB and OrientDB are suitable for databases with various data models (graphs, documents, key-value). However, it is still concluded that Neo4j is the superior software with enhanced implemented features compared to ArangoDB.

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