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DIGITAL TRANSFORMATION TRENDS IN FOREIGN LANGUAGE TRAINING OF STUDENTS OF NON-LINGUISTIC SPECIALTIES

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Education refers to the spheres of human activity that are most susceptible to digitalization. Within the framework of this article, the trends of digital transformation of foreign language training of university students of non-linguistic specialties are considered in the context of education 4.0, including digital space, digital technologies, and directions of the organization of educational activities. Longitudinal observations, pedagogical experiments, and analysis of educational data have been used in the research. The results suggest that the use of advanced digital learning technologies contributes to the activation of interaction between professors and students in an electronic educational environment, personalization of the educational process, increased motivation for the independent cognitive activity of students, as well as the formation of a wide range of competencies during foreign language training. Digital technologies in a foreign language(s) training, which are implemented in the educational process of the university and constitute a scientific and methodological foundation in the development and use of all types of digital educational resources, are identified. The expediency of their introduction to foreign language teaching is substantiated. One of the most effective directions of digital transformation is the introduction of virtual reality technologies. The analysis of the current use of VR technologies in the electronic educational environment of the university shows the positive impact of immersive on the cognitive functions of students.

Keywords: *digital transformation; foreign language training; non-linguistic specialties; electronic educational information environment; LMS Moodle; digital technologies; virtual reality technologies; extended reality; plugins*

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ТЕНДЕНЦИИ ЦИФРОВОЙ ТРАНСФОРМАЦИИ ИНОЯЗЫЧНОЙ ПОДГОТОВКИ СТУДЕНТОВ НЕЯЗЫКОВЫХ СПЕЦИАЛЬНОСТЕЙ

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Образование относится к сферам человеческой деятельности, которые наиболее подвержены цифровизации. В рамках данной статьи рассматриваются тенденции цифровой трансформации иноязычной подготовки студентов вузов неязыковых специальностей в контексте образования 4.0, включая цифровое пространство, цифровые технологии и направления организации образовательной деятельности. В исследовании использовались лонгитюдные наблюдения, педагогические эксперименты и анализ образовательных данных. Результаты свидетельствуют о том, что использование передовых технологий цифрового обучения способствует активизации взаимодействия преподавателей и студентов в электронной образовательной среде, персонализации образовательного процесса, повышению мотивации к самостоятельной познавательной деятельности студентов, а также формированию широкого спектра компетенций при обучении

иностранному языку. Выявлены цифровые технологии в обучении иностранному языку, которые внедряются в образовательный процесс вуза и составляют научно-методическую основу при разработке и использовании всех видов цифровых образовательных ресурсов. Обоснована целесообразность их внедрения в обучение иностранному языку. Одним из наиболее эффективных направлений цифровой трансформации является внедрение технологий виртуальной реальности. Анализ современного использования VR-технологий в электронной образовательной среде вуза показывает положительное влияние погружения на когнитивные функции студентов.

Ключевые слова: *цифровая трансформация; иноязычная подготовка; неязыковые специальности; электронная образовательная информационная среда; LMS Moodle; цифровые технологии; технологии виртуальной реальности; расширенная реальность; плагины*

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Introduction

The concept of digital transformation has been around since the late 90s, but originally it implied replacing paper-based information carriers with electronic ones. Today, digital transformation has become comprehensive. Its most important elements are the introduction of computer and supercomputer modeling technologies and digital twins of products, followed by virtual testing and optimization.

Moreover, the concept of digital transformation was primarily used in the context of the business environment. Nowadays it has become a focal area for the development of education around the world. In the Russian Federation, the development of digital technologies and the digitalization of society are implemented within the framework of the Decree of the President of the Russian Federation of May 9, 2017 No. 203 “On the

Strategy for the Development of the Information Society in the Russian Federation for 2017–2030" [7].

Digital transformation has been considered by many experts as an accelerated and forced process, taking into account such an important factor in recent years as the Covid-19 pandemic. In a number of areas, the digital format of interaction was defined by states as the only possible option during the most difficult period of social isolation. Even after the pandemic had subsided, online interaction remained in demand.

It should be pointed out that the terms digitization, digitalization, and digital transformation, sometimes used interchangeably, refer to distinct concepts.

Digital transformation is the next stage of development after digitization, which implies the transfer of analog data and processes into a machine-readable (digital) form, and digitalization, which means the use of digital technologies to increase the efficiency of particular areas [1; 12].

Long months of severe restrictions during the pandemic have shaped new behavior patterns of hundreds of millions of people around the world. Today these patterns impel the demands, and expectations of society and, accordingly, the subsequent development of technological products.

World academia is immersed in the processes of digital transformation as no other sphere, since traditionally it is the concentration point of the most active and ambitious intellectual potential of the state. Universities create new knowledge, implement the most daring projects, outline future trends and develop the vision for the development of our society.

For any modern university, digital maturity is now an objective indicator of its horizons, and, consequently, prospects and challenges in the highly competitive educational market.

In the recent past, the fame of the university as a "center of knowledge and learnedness" was associated with an impressive library and monographs of prominent professors. These days, for a competitive university, high-quality open educational online resources in the top subject areas, as well as its own digital platforms and advanced educational technologies, have become a matter of prestige and a tool to increase the attractiveness and recognition for applicants from the digital natives' generation

Speaking about DT of higher education institutions on the whole, L. Seres et al. define it as a process of technological and organizational changes, primarily caused by the development of digital technologies [20].

According to Oliveira & Souza, digital transformation in the context of education entails rethinking teaching and learning processes for a digital native audience, considering the practical aspects of the digital transformation through knowledge and technical skills, and being digital through the incorporation of skill, mindset, and digital attitudes, as well as considering the practical aspects of the digital transformation through knowledge and technical skills. Technological, human, organizational, and pedagogical drivers enable, support, and guide the digital revolution toward Education 4.0 [19].

G. Vial considered digital transformation as a process in which "digital technologies create disruptions triggering strategic responses from organizations that seek to alter their value creation paths while managing the structural changes and organizational barriers that affect the positive and negative outcomes of this process" [22].

Florence Martin and Kui Xie describe digital transformation as "a series of deep and coordinated culture, workforce, and technology shifts that enable new educational and operating models and transform an institution's operations, strategic directions, and value proposition" [18].

A.Yu. Uvarov considers digital transformation of education as a synergistic update of the required educational outcomes, the content of education, methods and organizational forms of educational work, as well as assessment of the results achieved in a rapidly developing digital environment for the purpose of dramatical improvement in educational results [6].

A. Marks et al. believe that digital transformation is concerned with transforming organizational processes; building new competencies and models through digital technologies in a profound and strategic way [16].

According to Holon IQ reports, a leading analytical company in the sphere of education, digital adoption and transformation remains the greatest challenge across regions and institutions globally. Since 2022, platform analytics has demonstrated a sharp increase in the proportion of higher

education leaders citing digital transformation as one of their biggest issues (from 50% to 69%). Comments suggest broad and deep reflection on the long-term higher education transition to digital, from systems, policies, and infrastructure to learning and teaching design and delivery [14].

M. Barzman et al, in their work on the scenarios for the digital transformation of education, pay attention to a combination of such factors as powerful new communication technologies, big data, commercial digital giants, new relations of citizens with information and knowledge, as well as the global state of the environment. The speed, often haste, complexity and multi-level nature of digital transformation may lead to a high level of uncertainty in the practice and organization of the process, and disagreements within civil society. The authors admit both the likelihood of DT's extraordinary success and its devastating consequences for the higher education system [8].

M. Barzman et al. offer 4 possible scenarios for the development of digital transformation based on the analysis of 27 variables combined into seven groups of components: context (society, economy, management); organization and management of the university; research practice; teaching and training practices; data; interaction between the university and society; digital culture and ethics [8].

Further expansion of the DT of higher education relies to a great extent on the development and implementation of educational technologies [11].

Among the top higher education technology trends in the coming years, most experts agree on Artificial Intelligence (AI), Virtual Reality (VR), Augmented Reality (AR), Digital Twins, the Metaverse (including digital avatars and NFT art for use in the Metaverse and other Web3-based virtual environments), Internet of Things (IoT), Blockchain, Cloud, Gamification, and Chatbots.

Hybrid learning environments have already become a must-have for most universities. Researchers point out a move towards a tribrid model which "flows between in-person, online, and simulated teaching environments" [13].

Our analysis of publications on the digital transformation of higher education indicates the great interest of researchers in the phenomenon

in recent years, as well as a significant variety of approaches, interpretations, and concerns. At the same time, the problems of digital transformation of foreign language training of students of non-linguistic specialties are considered in a small number of studies, and for the most part, they present case studies [18; 3].

Materials and methods

The purpose of this study was to analyze the trends of digital transformation of foreign language teaching of students of non-linguistic specialties. To achieve the objectives of the study, the following tasks were set:

1) Consider modern approaches to the concept of digital transformation (DT) of higher education.

2) Describe the main directions DT for foreign language training of students of non-linguistic specialties of SevSU (Sevastopol, Russia) for the period from 2018 to 2023 (before the pandemic, during the pandemic, and after the pandemic), including digital space, digital technologies, and new models (directions) of the organization of educational activities.

3) On the basis of the analysis determine the most promising and viable trends in the development of foreign language training for students of non-linguistic specialties.

To achieve the stated goals, the following methods of theoretical analysis were used: the study of scientific and methodological literature, and Internet sources on the research topic. The empirical methods included an online survey of 1st-year students of non-linguistic specialties, further processing of survey results; analysis of educational data based on plugins in LMS Moodle; pedagogical experiment, and observation.

LMS Moodle analytical plugins were used for the analysis of educational data. On the basis of the student's digital footprint, the plugins monitor the educational process in electronic courses, including student behavior, the frequency of accessing individual tasks, the time of students' access to individual elements, etc. The use of plugins makes it possible to conduct longitudinal studies of educational data in electronic educational courses for several years and to update approaches to pedagogical design underlying the blended learning format.

After demonstration classes using VR technologies (link to the SevSU website), a survey of students who took part in the experiment was conducted to study the pedagogical potential of this technology: types of motivation, directions activity, and understanding of cognitive orientation [2; 24].

Results

A.Yu. Uvarov identifies three main directions of digital transformation in higher education:

1) Digital space; 2) digital technologies; 3) development and dissemination of new directions of the organization of educational work [6].

Based on the approach of A.Yu. Uvarov, three directions of DT of foreign language training of students of non-linguistic specialties of SevSU for the period from 2018 to 2023 have been analyzed. Three main stages have been considered before the pandemic, during the pandemic, and after the pandemic. The results of the analysis are presented in Table 1.

Table 1.

Directions of implementation of digital transformation of foreign language training at SevSU (compiled by the authors)

Directions for digital transformation	before the pandemic	during the pandemic	after the pandemic
digital space	1. Professional development of the staff in e-learning course design. 2. Creation of the first ten e-learning courses and e-educational courses based on LMS Moodle for l A1 -B2 for the 1st year students. 3. Implementation of electronic accounting of students' progress.	1. Creation of the first version of the University's (EEIS). 2. Active development of new e-learning courses in the (EEIS) of the University. 3. Development, approval, the approbation of requirements, e-learning course templates. 4. Creation of a permanent center for video recording of educational materials. 5. Hot button for urgent feedback and solutions.	1. More than one hundred and fourteen e-learning courses have been developed in the (EEIS) of the university, in all disciplines of the foreign language for levels A1-C1. 2. Examination of new courses, modernization, and optimization of the developed courses, elements of personalization, gamification, scaffolding and etc.

digital technologies (methods, tools)	1. Online placement testing; online motivational surveys. 2 Mid and final online testing of students. 3. The usage of MOOCs, mobile applications for learning a foreign language. 4. Preparation for methodological recommendations of the usage of VR 5. Quiz Creator, Cloud Storage and File Sharing, social networks, Big Blue Button 6. Search engines.	1. Video conferencing platforms (e.g. Skype, Discord, BBB) 2. Live streaming conversations on social networks, YouTube, email, social networking sites. 3. Mind-mapping applications Microlearning H5P, Powerpoint presentations.	1. Video conferencing platforms 2. Using VR 3. Automated pronunciation & speaking 4. Data analytics to inform student feedback 5. Use of mobile devices 6. Ed Apps 7. Electronic statements. 8. Personal e-office of the professor, a student in the (EEIS) of the university.
new models (directions) of the organization of education	1. A mixed format of teaching is being implemented for individual areas of training based on LMS.	1. The online learning format is used 2. Flipped classroom.	1. A mixed format of foreign language teaching has been introduced for all areas of training in the (EEIS) of the university with variability in the percentage of offline and online learning 2. Educational VR space.

Compiled by the authors

To analyze the educational data collected during the application of electronic educational courses developed by the Department of "Foreign Languages" in the electronic educational information system of SevSU, the authors use a number of analytical plugins LMS Moodle: Heatmap, Behavior Analytics (v0.9.2), which includes elements (View student behavior, replay clustering, Configure resource nodes, Documentation, Clustering dashboard), as well as the Learning Analytics plugin.

Heatmap allows one to identify the most actively used elements of the course by students by coloring in different colors - from yellow to red. The richer the red color, the more popular the element. The analysis of the data obtained using the plugin allows course developers and teachers to identify unclaimed elements and replace them with other options or exclude them from the course.

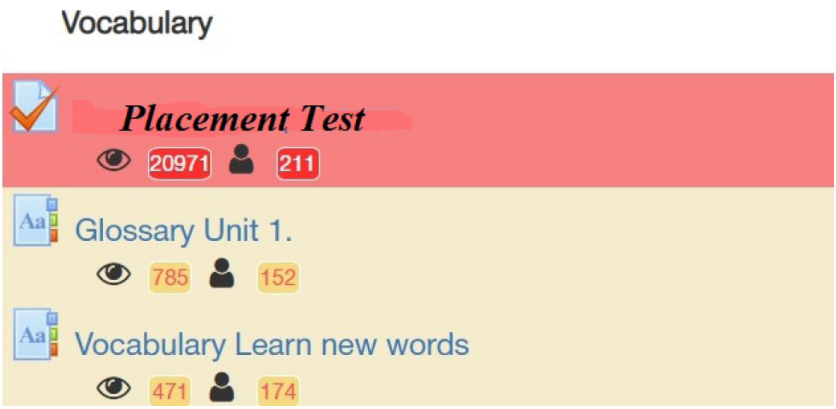

Fig. 1. An example of using the Heatmap analytical plugin in the course "English A2-B2" based on LMS Moodle.
Compiled by the authors

In 2018, on the basis of LMS Moodle at SevSU, an English language course of A2-B2 level was developed for 1st-year students of various directions. With the help of the plugin, it was revealed that the placement test was highly demanded as all first-year students had to pass it to determine their level of proficiency in a foreign language, see Fig.1. Since the course implements an individual educational trajectory, the students may choose any course level. Using a heat map, we have found out that the majority of students decided to improve their level of foreign language proficiency and performed tasks with a higher level of difficulty.

Learning Analytics for Moodle can track students' use of learning materials and tools to identify potential problems or gaps. offer an objective assessment of resources. This plugin allows educators to make rational decisions about changing approaches to training in an electronic training course on a discipline. Using aggregate student data, teachers can see ways to improve their course's learning process or structure. Over two years, we have analyzed the behavior of more than 10,000 students and their activity in the e-learning course. In Fig. 2, all accesses to tasks are presented in the form of a weekly heat map. Each hit is mapped to the corresponding time on the X axis and to the corresponding day of the week on the Y axis. This way, one can see which periods have the most

views. On Monday from 22.00 to 23.00, there are about 8000 views of tasks, and on Saturday from 12.00 to 13.00 there are up to 10,000 views and visits to the course on the platform. The plugin allows researchers to analyze the distribution of students' independent work, as well as its volume during the academic week in the course. Using the plugin the peak load on the platform and the course can be predicted, which will help students and educators manage their time. Figure 2 shows the peak activity for the month. The peak load coincided with the mid-term assessment week in the discipline.

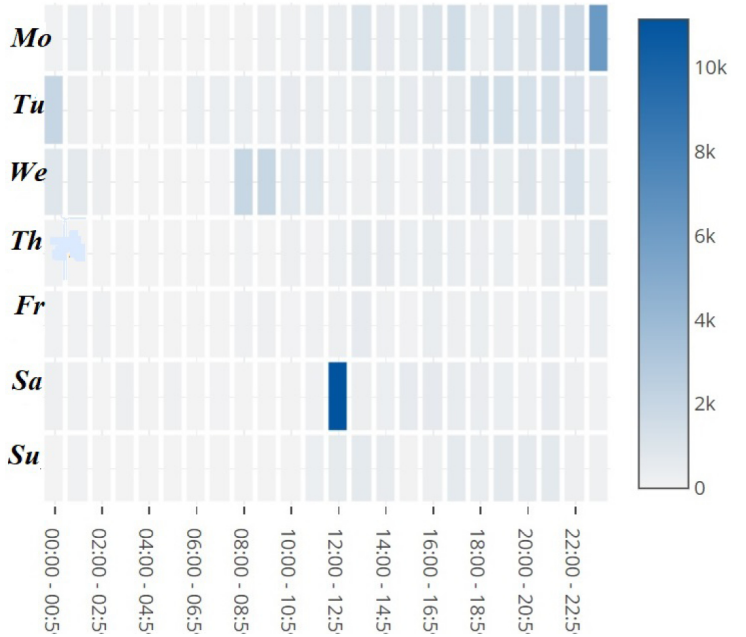

Fig. 2. Example of using the analytical plugin Learning Analytics for Moodle in the course "Presentation in English" based on LMS Moodle for 3rd-year students of non-linguistic specialties in a week.
Compiled by the authors

Behavioral Analytics (v0.9.2) interprets all students' activities as graph nodes. The links between nodes show students' access to course elements. This plugin allows one to determine which elements of the course are of

interest to students and which are ignored. Using this plugin the least accessible elements were revealed, e.g. the course description, announcements, forum, and bibliography. Thus, the introductory part should be thoroughly edited to meet the students' needs. The plugin allows one to create a standard algorithm of actions for students to complete the course.

Fig. 3. Example of using the analytical plugin Learning Analytics for Moodle in the course "Presentation in English" based on LMS Moodle for 3rd-year students of non-linguistic specialties per month. The horizontal axis is the days of the month, the vertical axis is the number of hits.
Compiled by the authors

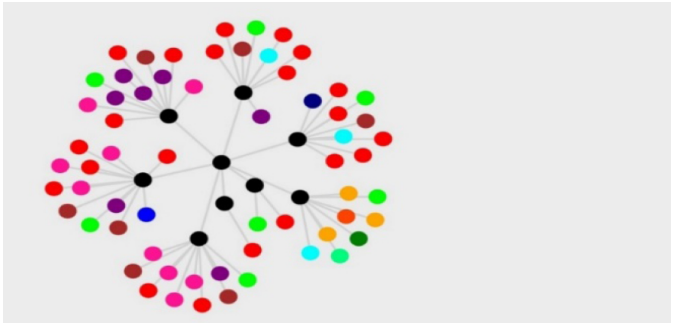

Fig. 4. Example of using the Behavior Analytics analytical plugin (v0.9.2) "Foreign language A2-B2" based on LMS Moodle for 1st-year students of non-linguistic specialties.
Compiled by the authors

The results (Fig. 4) of the survey conducted in groups participating in the experiment on the use of VR technologies in practical classes in a foreign language are presented below.

The first question for students was the following: "What modern foreign language training technologies are you familiar with?"

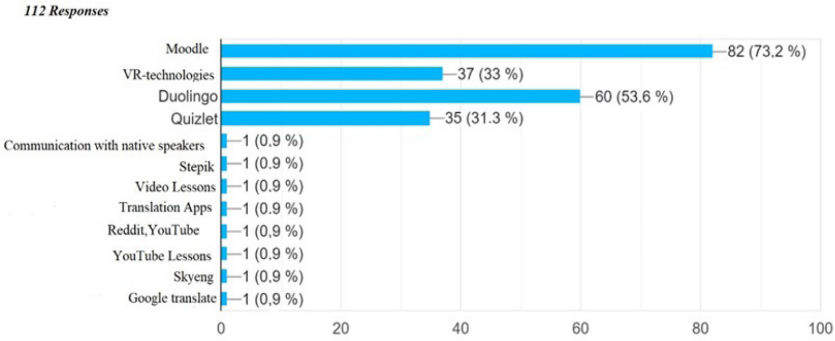

Fig. 5. Familiarization of students with digital technologies of training in a foreign language before the experiment.
Compiled by the authors

The survey showed that the absolute majority of students – 73.2% of respondents were well acquainted with LMS Moodle. This is due to the fact that LMS Moodle has been widely used at SevSU since 2018. According to the study, 53.6% of the students surveyed were familiar with Duolingo; and 33% of respondents applied VR technologies. In addition, 31.3% of respondents worked with Quizlet. The students also mentioned the experience of working with video tutorials, google translate, lessons on YouTube, and Skyeng resources.

The second question in the survey was the following: "Are you interested in learning a foreign language?"

At the control stage of the pedagogical experiment on the introduction of VR technologies in training students of non-linguistic areas, a survey was conducted. Almost one-third of respondents (31.3%) appreciated studying a foreign language (5), 30.4% of students were interested in studying (4), 25.9% of subjects – did not mind learning a foreign language (3), 10.7% of students are not interested in learning a foreign

language. In addition, 1.8 % of respondents demonstrated a low level of motivation of learning a foreign language. (Fig. 6).

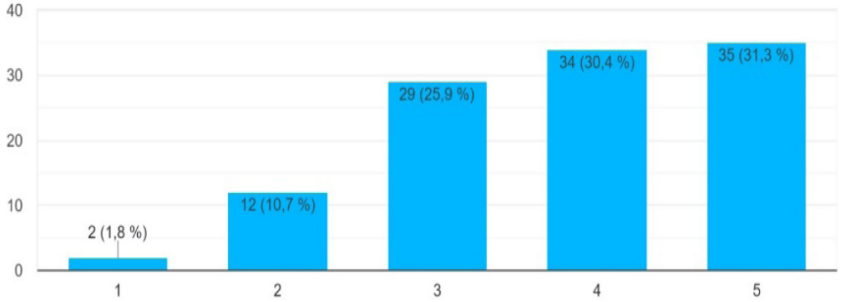

Fig. 6. Results of the survey of students at the control stage of the experiment. *Compiled by the authors*

The third question for students was: "Would you like to learn a foreign language using VR technologies?"

The results of the survey of students at the control stage of the pedagogical experiment indicated an increased motivation to study a foreign language after using VR technologies in a practical lesson compared to the ascertaining stage: 79.5% of students replied that they wanted to learn a foreign language using VR technologies, but 20.5% did not change their opinion. It can be concluded that VR technologies have become a motivating factor for learning a foreign language.

Discussion

Among the factors that caused the acceleration of the process of digital transformation of higher education, we can single out the fourth industrial revolution, covering all spheres of life in modern society; the pandemic, and the predominance of the digital natives' generation among university students. The pandemic period became an example of the "New challenges - new opportunities" situation. When new unique practices of organizing university activities online were developed under strict restrictions, problems, limitations, and weaknesses of traditional models and formats of education were identified, as well as the "vulnerability" of the portfolio of teachers' competencies [4; 5].

As the most evident negative aspects of the digital transformation of higher education, researchers note the following: the dehumanization of education, the time required for the preparation of educational materials, infoxication, the high cost of implementation and further maintenance of a high-tech educational environment, the negative impact on academic performance of the students, digital divide, high levels of distraction, plagiarism, privacy issues, a sense of isolation of students, etc. [21]

The currently observed DT of foreign language training is a dynamic process that requires a constant search for optimal solutions, pragmatism in choosing the most effective options from a vast number of educational technologies, and flexibility, and adaptability of the university.

Our results seem to be consistent with other research which found that immersive technologies are (IT) highly promising technologies for learning and training languages. Researchers point out that IT develops a sense of immersion and presence; enhances cultural learning and raises positive attitudes toward the target culture; promotes learner autonomy; stimulates task-based interaction; enhances motivation and task engagement through meaningful and authentic communication tasks; helps students construct agentive experiences of storytelling etc. Understandably, universities are still hesitant about its full-scale implementation due to the need for advanced technical knowledge, and the high cost and complexity of ER devices.

According to HOLONIQ, language learning, and higher education will be most affected by AI [10; 15].

R.R. Divekar in his work suggests integrating state-of-the-art AI technology with Extended Reality "to create a virtual world that immerses students in authentic visual and social contexts where they can practice their conversational foreign language and thus improve foreign language proficiency". This approach has important implications for developing a fully-featured immersive language learning environment [9].

Other AI prospects include applications like the ChatGPT application, which can create lesson plans, and study materials in a matter of seconds, act as an interlocutor who can be asked questions in real-time about any aspect of the language being studied, or even a personal teacher correcting student mistakes [23].

Chatbots used in the electronic educational digital environment of the university can provide the necessary support to students, professionally 24/7 providing answers to typical questions of students on the organization of the educational process, specific disciplines, etc. [13]

In the field of digital transformation of foreign language training, our research has shown that the most urgent problems of the digital transformation are the following: increasing the academic staff workload, as it is necessary to acquire new skills, and competencies, develop materials, regularly update courses in an electronic educational environment. Moreover, one should mention the high cost of high-tech equipment and software, the need for constant investment in the development of EEIE, ensuring digital sovereignty, and at the same time, the need to use authentic educational materials; questions of the use of educational analytics, which has a huge potential for digital pedagogy.

Perhaps the use of such technologies will significantly relieve teachers from routine work and will allow them to devote more time to creativity, scientific and methodological work, project work with motivated gifted students, and professional development.

Conclusion

Digital transformation has become a top-priority trend in the development of modern higher education in the field of foreign language training in the age of a post-industrial information-oriented society.

Currently, foreign language training is provided relying in a substantial way upon the electronic educational information environment of a university, integrating the most relevant tools, resources, models, and methods in the process of implementing various formats of the educational process (full-time, distance, blended).

The level of digital literacy of both students and academic staff has grown significantly over the past 5 years of digital transformation. At the same time, the students' have raised expectations of the quality and accessibility of the educational environment (online resources, university website, and digital platform, teachers' competencies), university technological infrastructure, and its involvement

in the implementation of advanced educational technologies and relevance of work programs.

The use of innovative digital technologies in foreign language training (for example, extended reality) provides enormous opportunities in terms of access to experiences that would be otherwise impossible for students. Immersive technologies improve students' motivation, increase their attention and enjoyment of learning, and ultimately demonstrate a positive impact on the formation of students' foreign language competencies. However, the introduction of such technologies is resource-consuming both at the stage of equipment purchase and while in operation. In addition, software for such devices is often imported and presents risks of losing access to the updates in the current situation of sanctions imposed on the RF.

Digital transformation makes education visible and transparent since analyzing the digital footprint of a student or teacher using special tools in the LMS allows educators to get a complete picture of their work, with a detailed report on activities. Analytical tools in the field of educational data also enable researchers to gain new knowledge in the field of digital pedagogy, pedagogical design, and educational psychology. At the same time, the issue of using the personal data of all participants in the educational process should be strictly regulated.

Comprehensive digital transformation of foreign language training of non-linguistic specialties is a complex process that includes three main areas: digital space, digital technologies, and new models for organizing educational work. Each of these areas involves increasing the digital competencies of teachers, attracting qualified specialists in the field of digital educational technologies, investing in digital equipment, digital tools, and software, conducting research in digital pedagogy, and analyzing digital data.

The practical experience analyzed in the study may be useful for educators specializing in language training and the development of the institutional policy of digital transformation.

Universities have made significant progress on their way to digital transformation, but there are still many changes to come, including al-

terations caused by the arrival of digital natives in the system of university management, and the domains of science, technology, and education in general.

To develop a full picture of the digital transformation of language training, further large-scale, including experimental studies will be needed that investigate learners' strategies, cognitive processes, and practices in the digital learning environment to gain knowledge from different perspectives of the effects of XR interaction on the learning process.

Conflict of interest. The authors declare that there is no conflict of interest.

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