Digital Transformation of Schools and Universities: how to Prepare Teachers for Digital Learning Environment

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Abstract: The article is devoted to the study of the problems of preparing teachers and students of pedagogical profiles for professional activity in the digital environment of general educational organizations. The authors highlight the essential characteristics of the phenomenon of digital transformation on the basis of the following scientific approaches: interdisciplinary, anthropological, sociological and culturological. The authors see the digital learning environment as a virtual space in which the subjects of the educational process interact with each other and learn via digital tools. The article presents the results of a survey of 67 school teachers of various subjects from Veliky Novgorod. The authors used the results of the survey to determine the level of teachers' readiness for professional activity in a digital educational environment. The authors came to the conclusion that it is essential to take into account the identified problems associated with the organization of learning in the digital environment during training of future teachers in higher education.

1 INTRODUCTION

Humanity is undergoing the fourth industrial revolution and is witnessing scientific, technological and socioeconomic changes connected with the introduction of technological advances such as artificial intelligence, blockchain, the Internet of Things, cryptocurrencies, and automation tools to various operations. According to N.E. Serditova and A.V. Belotserkovsky, we are witnessing a great technological revolution that is taking place in an extremely short period of time (from a historical point of view). This revolution is changing almost all aspects of human activity, and, as a consequence, completely transforming the labour market (Serditova & Belotserkovsky, 2020). These global trends, covering all fundamental spheres of human activity (politics, economy and social sphere), are making digital transformation in Russia a new state priority. As noted by A.D. Korol and Y.I. Vorotnitsky in their paper, taking into account the digital transformation of the economy and social sphere, exponential growth of the volume of digital information, and dynamic changes in the labor market, the education system should not see a learner as a passive object that follows the preordained plans and programs and allows a teacher to fill himself/herself with knowledge (Korol & Vorotnitsky, 2022).

In today's socio-economic environment, institutions of higher education that train teaching staff set themselves the ambitious goal: they strive to prepare future teachers to teach effectively in a digital learning environment. First, to meet this challenge,

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university faculty must deeply comprehend the transformational processes that are taking place in the economic and social spheres of modern information society. Second, they need to master a wide range of digital competencies that allow them to freely navigate the new digital reality and effectively use digital resources, technologies, and tools when working with students. Third, they must identify the real problems faced by secondary school teachers in the process of digitalization of general education, determine the nature of these problems and find the ways to overcome the professional difficulties. A comprehensive analysis of teachers' problems will be useful not only for training future professionals, but also for designing programs of additional education and professional development for employed teachers.

Digital transformation as an interdisciplinary phenomenon has been studied by representatives of various fields of scientific knowledge. From the perspective of interdisciplinary and transdisciplinary synthesis, A.A. Lazarevich considers the digital transformation as an essential characteristic of the modern era, the formation of which was influenced by a number of factors of social dynamics, the most significant of which are informatization and comprehensive digitalization (Lazarevich, 2020). In the works of Shelepayeva A.Kh., digital transformation in the cultural context is seen as a stage of human adaptation to the digital environment and the formation of digital culture and new ways of networking. This process is based on humanistic and human-centered foundations (Shelepaeva, 2022). The digital transformation of society is a change in the way traditional organizational structures make decisions, interact, and deliver services through a combination of technology, business models, and cultural specifics. At the same time, the most important factors of digital transformation are the changes in culture and behavior of people in modern society.

The anthropological approach to the concept of "digital transformation" is based on a holistic understanding of the individual in the context of the formation of digital culture and the value-semantic sphere of the individual and society as a whole. A sociological view of digitalization highlights the multifaceted and complex nature of this process and understands it as part of the social world, i.e. as a social fact (Popov et al., 2022).

Digital transformation improves the efficiency of technological processes, creates new services and products, changes business models and stimulates economic growth. Moreover, it promotes digital maturity in key sectors of the economy and the social sphere, including healthcare and education (Presidential Decree). The new digital reality is characterized by abundance and, unfortunately, fragmentation of information sources. People nowadays process large volumes of information on a daily basis. From this point of view, the most problematic area here is education, including higher education. University professors are no longer the only source of well-structured and reliable informationю Today's students are largely ahead of their mentors in mastering digital technologies and methods of communication in a virtual environment, which blurs the line between those who teach and those who learn. This creates the prerequisites for mutual learning and the establishment of equal relationship between students and teachers. In addition, some university professors, mostly seniors, are not ready to accept the digital standards of teaching because of their commitment to traditional teaching methods that have proven effective in previous years. In addition, given the current reality, we agree with the views of some researchers that teachers should not be blamed for their resistance to change because their activity at the workplace is affected by many adverse external and internal factors (Rogozin et al., 2022). The representatives of the teaching profession are always at the forefront when it comes to overcoming the challenges of the modern world (Makarenko et al., 2020). To sum up, it is obvious that the modern university needs to find new ways of teaching, new instructional principles and teaching tools based on, for example, AI systems. The main aim here is to improve learning motivation and digital literacy of students, as well as support the professional status of university teachers.

In Russia, informatization of education and the large-scale implementation of digital technologies has been incorporated into many state programs and is presented extensively in the Federal State Educational Standard (FSES) of general (secondary) and higher education. As a consequence, it is also presented in numerous development programs of different educational organizations (Nazarov et al., 2021). The digital transformation of education is one of the main strategic directions of Russia's development. The provisions of the strategy "Digital Transformation of Education" state the need to create the conditions for the implementation of a modern and safe digital educational environment that promotes self-development and self-education of students of educational organizations of all types and levels by 2024. To do so, it is necessary to update the information and communication infrastructure, organize professional training and develop a unifying

federal digital platform (Passport of the Strategy "Digital Transformation of Education"). For a qualitative transition to digital transformation of education it is necessary to create a digital educational environment in schools and universities. Such an environment will allow us to train competent teachers capable of meeting new socio-economic, scientific, technological and pedagogical challenges. They will be able to flexibly adapt to the current conditions and meet the global challenges of the modern world.

According to hygienic standards, digital learning environment (DLE) is a set of conditions for the implementation of educational programs using distance learning technologies. When creating DLE, it is necessary to take into account the principles of functioning of electronic information and educational environment, including electronic information resources and electronic educational resources. Moreover, we need to develop a set of information and telecommunication technologies, i.e. appropriate technological tools that ensure the high-quality learning, personal growth and professional development of students. The crucial principle for creating DLE is that we need to ensure that it is safe for the health of students. When choosing material and technical equipment and creating information, telecommunication and technological infrastructures of educational organizations, we need to take into account the potential impact on the human health (Hygienic standards and special requirements). The purpose of DLE is to provide equal access to the DLE platform to all students without exceptions, as well as to suppliers and consumers of digital educational content. DLE must contribute to the improvement of knowledge quality, development of various skills, competencies and qualifications, exchange of experience and practices, management of their own digital data, provision of state (municipal) services and execution of state (municipal) functions in the field of education, construction of an individual curriculum, monitoring of educational programs using digital education and training tools, including electronic educational and informational resources, means of determining the level of knowledge and assessment of competencies, as well as other things necessary for creating and maintaining the DLE, objective assessment of knowledge and diagnostics of skills.

Thus, the digital learning environment is a virtual space in which students and teachers interact digitally. Multimedia technologies and equipment (screens, interactive whiteboards, video and audio materials, online courses, e-books and other electronic resources) are actively used in the digital educational environment. It is important to note that DLE allows teachers to provide high-quality inclusive education for young people with special needs. It has become possible due to the accessibility and interactivity of the learning material provided digitally. The researchers point out that an increasing variety of digital technologies have become available to educational organizations in recent years (Avdeeva et al., 2022). The digital learning environment also allows students to communicate and collaborate with peers and teachers. At the same time, to achieve mutual understanding, productive communication, efficiency and effectiveness of the learning process in a modern educational organization, everyone involved must have strong digital skills. We agree that rethinking educational activities in the context of digital transformation is possible during activity-based and practice-oriented programs for professional development of teachers (Deryabin et al., 2021).

To improve the quality of teacher training, the Ministry of Education of the Russian Federation has developed a project "The Core of Higher Pedagogical Education", which aims to introduce a unified approach to the structure and content of practical, methodical and subject-specific teacher training and the conditions of its implementation in any higher education institution in Russia. One of the general professional competencies of a future teacher should be an ability to use modern information technologies to solve the problems emerging during teaching. So, studying in a pedagogical institute should be aimed at forming professional competencies in the field of media and IT literacy, ensuring the readiness of future teachers for professional activities in the digital space, including the use of AI (artificial intelligence technologies, such as GPT generative models) technologies (Ministry of Education of Russia from 14.12.2021 N AZ-1100/08 "On the direction of information"). At the same time, the teacher's professional standard states that no matter what function the teacher carries out, he/she must have general user and general pedagogical IT-competence, as well as subject-pedagogical IT-competence (Order of the Ministry of Labor and Social Protection of the Russian Federation). In our opinion, this document does not clearly state the competencies necessary for the effective use of digital technology in professional activities. This viewpoint is also shared by the authors of the article "Digital Transformation of Education and Analysis of Possible Risks: Results of a Survey of Teachers of General Education Organizations" who, among other things, believe that the professional

standard does not reflect the requirements for teachers to acquire new knowledge and master new technologies aimed at improving the quality of education in the context of digitalization (Galustov et al., 2021).

The digital transformation of education raises a number of questions about teachers' preparedness to digitalize education, their ability to effectively use modern digital tools in the educational process, and to shape students' digital literacy (Golodov et al., 2022). This applies equally to university teachers and general (secondary) education teachers.

As mentioned above, to improve the quality of training of future teachers, it is necessary to study the issues of digital transformation of the educational process in modern school. The authors conducted a study at the Laboratory of Digital Didactics of the Interdisciplinary Center for Open Education at Yaroslav-the-Wise Novgorod State University. The study was based on the reflection upon the results of an advanced training course for teachers of secondary education schools organized by the abovementioned laboratory.

2 RESEARCH METHODS

The authors used various empirical and theoretical approaches during the study, such as theoretical analysis of psychological, pedagogical, philosophical literature and normative documents on the subject of research; analysis of teachers' experience in the digital educational environment of the modern school; online surveys (questionnaire survey of teachers of different subjects); quantitative and qualitative analysis of the results of the survey.

The study is based on environmental approach, which allows one to identify problems of teachers in a digital learning environment and take into account the influence of its features on the formation of digital educational skills.

To determine the level of preparedness of school teachers for teaching in a digital educational environment, the authors of the article conducted a survey among 67 teachers from educational institutions of Veliky Novgorod. The questionnaire consisted of 22 questions, which can be conditionally divided into 3 blocks. The first block allowed us to identify the existing digital knowledge and skill levels of the survey participants. The second block was aimed at identifying the views regarding the experience of working with distance learning courses; The third set of questions concerned the respondents' attitudes toward the digitalization of modern education. Data were collected and statistically processed via Google Forms.

3 STUDY RESULTS

According to the results of the entrance diagnostics, teachers always use text editors in their professional activities (100%), presentation tools - 70%, tools for creating spreadsheets - 50%, photo, video, and audio editing software - 50%. Thus, an overwhelming number of teachers use digital technology to varying degrees in their classrooms.

The results of the survey show that most often teachers communicate with colleagues, students and parents in the digital environment (messengers and social networks) (100%). A significant proportion of respondents (85%) indicated that they search for and study popular science and other educational and entertaining content on the Internet. Half of respondents (50%) indicated that they use cloud storages to store documents, images and other files (Yandex.Disk, Google Drive, Dropbox, OneDrive, etc.). The same number of respondents (50%) indicated that they use the Internet to obtain state and municipal services. Slightly less than half of those surveyed (45%) use digital services (Zoom, MS Teams, Webinar, Skype, etc.) to participate in and hold online events. The study also shows that teachers do not use the digital tools for blogging, editing and managing websites, or receiving and submitting class assignments via special software. The opportunities of big data analysis, according to the survey results, are also not used by respondents.

The vast majority of teachers view the digital environment as a platform for posting practical assignments for students (95%), addressing various issues with students (80%), posting theoretical materials for classes (80%), obtaining information about the schedule (75%), collecting assignments from students (70%), learning information about various events and competitions (70%), posting diagnostic assignments and marks (65%), posting links to digital educational resources (65%), searching for various documents (65%), and sharing the information (65%). A small group of respondents places the results of interim and final certification online (30%) and uses a digital library (30%).

Next, respondents were asked to assess their level of proficiency in various digital skills. This step was necessary in order to determine the content of the upcoming professional development programs. According to the data, the vast majority of teachers do not know how to create distance learning courses,

work with digital information in modern educational environment and how to use big data. A significant proportion of the surveyed teachers possesses at least basic digital skills in various spheres, for example: learning in online format, use of distance learning courses as basic or supplementary teaching material, use of digital library resources, work with open information resources and databases. Among the respondents there were almost no teachers who rated their digital skills level as advanced. Only a small proportion of respondents indicated that they had fully mastered the skills of online learning and using distance learning courses as core or supplemental learning material.

The vast majority of the teachers surveyed have experience in conducting lessons remotely (80%) and 10% have experience in project presentation. Only a small group of respondents (15%) indicated that they had no experience in distant teaching. Of all the teachers surveyed, 75% said that they had not used distance learning courses developed by other colleagues in their educational process. 100% of respondents said that they are not planning to create distant learning courses. The vast majority of teachers (80%) do not rule out the possibility of improving their professional skills with open distance learning courses, and 15% of respondents plan their professional training in a distance format.

Analyzing the results of teachers' self-assessment, we can state that an overwhelming number of respondents do not use various digital products during classes. The vast majority of teachers do not use statistical packages, database management systems, packages for mathematical programming, multimedia software for working with sound and video, graphics editors, design programs, programs for modeling and editing 3D-objects, programs for 3D-printing, workflow automation programs, laboratory information management systems, programming languages and simulation software. Most teachers have basic skills in using audio and video communication programs and services (Microsoft Teams, Zoom, etc.). A small group of respondents noted that they know how to use software that is useful for teaching their subjects at the elementary level (visual editors and programs to create spreadsheets). Teachers who use simple text editors (Microsoft Word, Pages, etc.) and presentation software (e.g., Power Point) feel more confident in using digital technology.

Teachers use various Internet resources in their professional activities. The most popular tools amongst teachers (100%) are search engines (Google, Yandex) and educational portals (60%). Half of the respondents (50%) often refer to the website of the educational organization and various educational courses. A small group of teachers use video blogs and podcasts in their work (40%); public digital scientific libraries, online scientific journals, online versions of printed scientific journals (35%); phone applications that provide educational content (25%); document databases (Garant, ConsultantPlus, etc.) - 15%.

Computers in modern schools are used not only during computer science classes, but also in other classes, so respondents were asked whether they organize work in classes using PCs. An overwhelming majority of the teachers surveyed (65%) indicated that they did not need a computer for lessons. A quarter of those surveyed said they needed computers during specific classes, and only 10% of teachers said they regularly provide computers to students in their classes.

In order to study the problems of digitalization of the learning process in modern school, the authors considered it necessary to identify how digital capabilities of the organization coincide with the professional needs of teachers. An overwhelming number of respondents (95%) indicated that the organization provides them with projectors, audiovisual equipment and Internet access, and almost the same number of respondents (85%) indicated that they use them in their work. A significant proportion of teachers (65%) noted that the organization is equipped with interactive whiteboards, while only 40% use them in their teaching. Only half of those surveyed (50%) indicated that different software, including database managing software has been installed in their organization, with more teachers using them in their work, 65%, indicating that some teachers are only able to use software at home. Teachers also point to the need to provide them with access to simulators (VR/AR), specialized professional software, training grounds, virtual laboratories, local and/or network file storages, etc.

During the study, the researchers asked teachers to rate the availability of equipment necessary for the educational process in their organization (from 1 to 5 points). Respondents rated the provision of computer classes for learning and self-study differently - from 1 to 5 points, indicating a fragmented provision of digital equipment in their organization. The correspondence of computers and peripheral computer equipment to the modern level of IT development, according to most teachers, can be assessed at an average level (3 points). Respondents, on average, rated the provision of computer classes

with the necessary software at 2 and 3 points. Compliance of the installed common software with the current level of software development – 3 points. Compliance of specialized scientific and training software to the modern level of software development - 2 and 3 points. Quality of the local network, network resources (website, e-mail, DLE) - 2. Provision of classrooms with multimedia equipment, video/audio recording and online broadcasting equipment (teacher's PC, projector, screen, video cameras, microphones, electronic whiteboard, tablet, etc.) – 2 points. The speed of Internet access (wired) from the local area network was also rated differently by teachers (from 1 to 4 points), indicating the poor quality of the Internet connection and the uneven distribution of Internet bandwidth within the organization. Similarly, teachers evaluated the speed of Internet access over wireless networks (Wi-Fi).

Despite the fact that respondents highlighted a number of problems associated with the digitalization of the educational process, 75% of them say that, for the most part, they are satisfied with the resources of the digital environment that the educational organization provides, and 10.5% are completely satisfied with the state of the digital environment. Only 15.8% of respondents indicated a lack of access to digital resources in their educational organization.

There are quite a lot of well-established opinions among teachers about the impact of digitalization of the educational process on the working conditions in the educational organization. In this regard, respondents were asked to express their agreement or disagreement with several common statements. Fifteen percent of respondents fully agreed with the statement that the introduction of IT significantly changes the role and function of the teacher, 45% rather agreed, and 40% rather disagreed. The statement that the proliferation of online courses reduces the quality of pedagogical activity was strongly agreed upon by 5% of respondents, rather agreed upon by 25%, rather disagreed upon by 65%, and completely disagreed upon by 10%. The statement that the introduction of IT technology creates an additional burden on teachers and requires additional effort was strongly agreed upon by 25% of respondents, rather agreed upon by 50%, rather disagreed upon by 25%. 20% of respondents strongly agreed with the statement that modern digital and information technology improves teacher-student communication, 45% rather agreed, 30% rather disagreed, and 5% strongly disagreed. 5% of respondents strongly agree, 35% rather agree, 30% rather disagree, and 15% completely disagree with the statement that IT technology significantly reduces the burden of teaching lessons by moving some courses to an online format. 40% rather agree, 40% rather disagree, and 20% completely disagree with the statement that the transition to an online format leads to a reduction in the number of teachers. 20% of respondents strongly agree with the statement that there is a risk that older generations of teachers will be forced to leave because of the widespread use of IT technology, 40% rather agree, 30% rather disagree, and 10% completely disagree. The statement that there is an opportunity to increase the enrollment numbers by implementing an online teaching mode was rather agreed upon by 40%, rather disagreed upon by 45%, and completely disagreed upon by 15%. 20% of respondents strongly agree with the statement that new opportunities for the organization of the educational process are emerging, 65% rather agree, and 15% rather disagree.

To sum up, teachers indicated that as part of their professional development they would like to learn virtual and augmented reality technologies, as well as various multimedia technologies for working with audio and video content to improve the quality of professional work in school.

4 DISCUSSION

The results of an empirical study among teachers of general education schools showed that the DLE had been successfully created and it is in constant development. To keep the DLE up-to-date, the schools are being equipped with high-tech multimedia equipment, high-speed Internet, and up-to-date software. However, the level of teachers' mastery of various digital skills is still quite low due to the predominance of the older age group among the teaching community. It is important to note that the average age of a teacher in Russian schools, according to S.S. Kravtsov, the Minister of Education of the Russian Federation, is 45-47 years old. But, in our opinion, this data can largely be explained by the increased interest in the teaching profession among young people in Moscow, St. Petersburg, and possibly other cities with a population of millions of people in Russia. At the same time, in most Russian regions, the average age of teachers remains over 50. According to the National Research University Higher School of Economics, the most numerous age group among the teaching staff of Russian universities is represented by people over retirement age (19.5%), the share of employees between 50 and 65 years old is about 30% (Differences in the position of the teaching staff by age group). Such differences

in the age composition of schools and universities slow down the process of digital transformation due to senior teachers' preference for traditional methods of working with children and students, which do not imply the systematic use of digital technologies.

The problem of "aging" in the pedagogical labor market in Russia negatively affects the pace of digitalization of education and the actualization of the content of training in view of the new requirements for the qualifications of young professionals. This is evidenced by the survey data, according to which teachers rated the quality of the digital learning environment, on average, by 3 out of 5 points, with an overwhelming number of them (75%) indicated that the resources of the digital environment provided by the educational organization were sufficient. This contradiction indicates the conservatism of teachers in the choice of teaching methods and their unwillingness to assist the process of qualitative digitalization of the educational process. An analysis of the opinions of respondents regarding the role of digitalization in educational activities shows that teachers, in general, perceive digitalization as a modern challenge to the teaching profession, while they are not unanimous in their views on the advantages, disadvantages, risks and opportunities of digital technologies, which once again confirms the multifactorial and multidimensionality nature of such phenomenon as digitalization.

In our opinion, the main driver of the digital transformation of Russian education is young pedagogical staff, who not only have knowledge of classical and neoclassical pedagogy, but also have the ability to use digital platforms, IT tools and services in teaching as didactic and diagnostic tools for organizing full-time, distance and blended learning. This thesis is confirmed by the provisions of the Concept for the training of pedagogical personnel for the education system for the period up to 2030. Among the main problems of the education system identified in this Concept, the authors note: insufficient compliance of the results of graduate training with the current needs of the education industry, society and the state; shortage of teaching staff, insufficient level of training in universities of graduates of pedagogical specialties (The concept of training teaching staff for the education system for the period up to 2030). These problems are largely the result of a discrepancy between the rate of updating the content of higher pedagogical education and the outstripping pace of digitalization development.

5 CONCLUSION

One of the main objectives of this study was to determine the level of preparedness of teachers for professional activity in the DLE. For this, the following levels of preparedness were identified: *adaptive*: teachers understand the general concepts of DLE; predominantly use traditional teaching methods; use digital educational resources (DER) fragmentarily and unsystematically; *reproductive*: teachers are motivated to work in the DLE; use DER and are able to adapt them to the specifics of the educational process in an educational institution; *creative*: teachers systematically and consciously use DER; are able to develop new DER and effectively use them in their professional activities; able to act as digital consultants for other teachers.

The vast majority of teachers who participated in the survey are at the reproductive level of readiness for professional work in the DLE. On this level, teachers, to some extent, understand the theoretical and practical foundations of digitalization, but it does not allow to reveal the full educational potential of the DLE in teaching. According to the results obtained, it is necessary to improve the professional qualifications of teachers in a number of areas in the field of IT: digital services and graphic editors for visualizing educational materials, digital technologies for diagnosing educational achievements of students, pedagogical design of distance learning courses, technologies for working with digital educational platforms, information management and marketing in education, artificial intelligence tools in teaching.

To solve the problems of higher pedagogical education identified in the course of the study, it is necessary to keep the educational and methodological support up-to-date, taking into account the content and infrastructure of the DLE in educational institutions. According to the updated Federal State Educational Standard of secondary general education, the effective use of the information and educational environment implies the competence of employees of an organization engaged in educational activities in solving professional problems using IT, as well as the availability of IT support services (Federal State Educational Standard of Secondary General Education). In our opinion, the curriculum for the training of future teachers for the entire period of study should include a module aimed at the development of information and communication competencies, as well as digital literacy in the professional sphere; a module aimed at studying technologies for the development and application of

digital skills in a modern school; reverse mentoring, in which digital tutors (the most advanced students) will train school teachers and other students during the pedagogical practice period.

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REFERENCES

Avdeeva, S. M., Uvarov, A. Yu., Tarasova, K. V., 2022. Digital transformation of schools and information and communication competence of students. *Voprosy obrazovaniya*, (1), pp. 218-243.

Galustov, R. A., Gerlakh, I. V., Kopchenko, I. E., Spirina, O. N., Tvelova, I. A., & Khlopkova, V. M., 2021. Digital transformation of education and analysis of possible risks: results of a survey of teachers of general education organizations. *Pedagogicheskoe obrazovanie v Rossii*, (5 (53)), pp. 446-452.

Hygienic standards and special requirements for the device, content, and modes of operation in the conditions of the digital educational environment in the field of general education. Manual. 2020. Moscow: NMIC zdorovya detey Minzdrava Rossii.

Golodov, E. A., Gerlakh, I. V., Kopchenko, I. E., Spirina, O. N., Khlopkova, V. M., Chianova, E. V., 2022. Professional deficits of teachers in the field of ICT competencies, manifested in the conditions of digital transformation of education. *Pedagogicheskoe obrazovanie v Rossii*, (4 (58)), pp. 58-73.

Deryabin, A. A., Boytsov, I. E., Popov, A. A., Rabinovich, P. D., Zavedenskiy, K. E., 2021. Study of the ideas of Russian school principals about digital competencies of participants in the educational system. *Voprosy obrazovaniya*, (3), pp. 212-236.

Ministry of Education of Russia. (2017). *Concept of training of pedagogical personnel for the education system for the period up to 2030*. Retrieved from http://static.government.ru/media/files/5hVUIZXA2JMcPrHoJqfohMeoToZAwtA5.pdf

Korol, A. D., Vorotnitskii, Y. I., 2022. Digital transformation of education and challenges of the 21st century. *Vysshee Obrazovanie v Rossii*, 31(6), pp. 48-61.

Lazarevich, A. A., 2020. Digital transformation in the focus of transdisciplinarity of philosophical knowledge. *In Designing the Future: Problems of Digital Reality, Proceedings of the 3rd International Conference* (pp. 72-81). Moscow: IPM im. M.V. Keldysha.

Makarenko, A. N., Smyshlyaeva, L. G., Minaev, N. N., Zamiatina, O. M., 2020. Digital horizons of development of pedagogical education. *Vysshee Obrazovanie v Rossii*, (6), pp. 113-121.

Ministry of Education and Science of the Russian Federation. (2021). Letter from December 14, 2021 N AZ-1100/08 "On the direction of information" (together with "Methodological recommendations for the training of personnel in bachelor's programs in pedagogy based on common approaches to their structure and content ("Core of higher pedagogical education")). Retrieved from https://legalacts.ru/doc/pismo-minprosveshchenija-rossii-ot-14122021-n-az-110008-o-napravlenii/#100007

Nazarov, V. L., Zherdev, D. V., Averbukh, N. V., 2021. Shock digitalization of education: Perception of educational process participants. *Education and Science*, (1), pp. 156-201.

Passport of the "Digital transformation of education" strategy. Retrieved from https://docs.edu.gov.ru/document/267a55edc9394c4fd7db31026f68f2dd/

Popov, D. S., Strel'nikova, A. V., Grigoryeva, E. A., 2022. Digitalization of Russian high school: Return and risk factors. *The World of Russia: Sociology. Ethnology*, (2), pp. 26-50.

Ministry of Education of the Russian Federation Order No. 649 of December 2, 2019 "On Approval of the Target Model of the Digital Educational Environment". Retrieved from https://www.garant.ru/products/ipo/prime/doc/73235976/

Ministry of Labor and Social Protection of the Russian Federation Order No. 544n of October 18, 2013 "On Approval of the Professional Standard 'Teacher (Pedagogical Activity in the Field of Preschool, Primary General, Basic General, Secondary General Education) (Educator, Teacher)'". Retrieved from https://base.garant.ru/70535556/#friends

Differences in the position of the teaching staff in universities by age groups. Retrieved from https://www.hse.ru/data/2020/09/08/1579286584/Выпуск%2013-2020%20Различия%20в%20положении%20проф..ава%20вузов%20по%20возрастным%20группам.pdf

Rogozin, D.M., Solodovnikova, O.B., Ipatova, A.A., 2022. How university professors perceive the digital transformation of higher education. *Voprosy Obrazovaniya*, (1), pp. 271-300.

Serditova, N.E., Belotserkovsky, A.V., 2020. Education, quality, and digital transformation. *Vysshee Obrazovanie v Rossii*, (4), pp. 9-15.

Decree of the President of the Russian Federation of July 21, 2020, No. 474 "On the National Goals of the Development of the Russian Federation for the Period up to 2030". Retrieved from http://www.kremlin.ru/acts/bank/45726

Federal State Educational Standard of General Education. Retrieved from https://normativ.kontur.ru/document?moduleId=1&documentId=432227

Shelepaeve, A.Kh., 2022. Digital transformation: the main approaches to defining the concept. *Vestnik RUDN. Series: Informatization of Education*, (1), pp. 20-28.