Assessment of Digital Competence of Teachers

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Abstract: A teacher is a key structural unit of an educational organization. The level of preparedness of graduates depends on the level of qualification of the teaching staff. The state order for modern specialists presupposes practice-oriented professional digital competence of graduates of all educational organizations of professional training. This trend is actively supported by national projects of the Russian Federation. The role of universities within the framework of these national projects "Education", "Science and Universities", "Digital Economy of the Russian Federation", etc. – training of personnel for the modern digital economy, who should have the appropriate competencies. To implement these tasks, an educational consortium was created, which as of May 2021 includes 185 universities and 101 organizations implementing secondary vocational education programs. At the same time, the possibility of training specialists for the digital economy is directly related to the level of readiness of teachers of these educational organizations to work in new conditions, to use digital technologies, and therefore a high level of their digital competence is required. Currently, digital technologies have become the basis for the development of artificial intelligence. They are actively being introduced into all kinds of devices and gadgets, medical and special engineering equipment, robotics and other systems that acquire properties characteristic of artificial intelligence. Such a global digitalization of the human life environment changes the paradigm of thinking of a new generation. This, in turn, requires the modernization of traditional technologies to solve the teacher's unchanging didactic task - learning.

1 INTRODUCTION

The studies of V.I. Baydenko, N.F. Efremova, E.N. Zemlyanskaya, I.A. Zimnyaya, J. Raven, G. Halage, U. Hutmacher, A.V. Khutorskoy, V.D. Shadrikov and others are devoted to the peculiarities of the implementation of the competence approach in higher education.

The relevance of digital competencies is becoming more and more obvious in connection with the transformations that are taking place today in the activities of educational organizations. These transformations relate to the use of digital technologies (hereinafter referred to as DT) not only in the management of universities, but also directly in the educational.

According to Yu.A. Mosalov digital competence is considered as a set of skills and abilities necessary to perform specific actions based on the use of DTs. At the same time, we have divided digital competencies into four groups:

– basic, allowing you to work on a computer, view text and graphic information, find information on the Internet, use office equipment (printer, scanner, MFP, etc.), etc.;

– universal, allowing you to work in standard editors (text, tabular editors, electronic presentations, etc.), in electronic document management systems, global networks, etc.;

– general technical, allowing you to work with general technical computer application programs (CAD, CAE, CAM, CAPP, PDM, ERP, MDM, MES, SCADA, ECM, etc.);

– special, or industry-specific, allowing to implement professional tasks based on the use of computer equipment, specialized computer programs, etc.

Today, DT is not limited to the computer. They became the basis for the development of artificial intelligence. DT is actively being introduced into all kinds of devices and gadgets, medical and special engineering equipment, robotics and other systems

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that acquire properties characteristic of artificial intelligence. Such a global digitalization of the human life environment changes the paradigm of thinking of a new generation. This, in turn, requires the modernization of traditional technologies to solve the teacher's unchanging didactic task – learning.

Scientific research of N.S. Alexandrova, N.A. Astashova, S.N. Velitchenko, A.N. Gluhenky, A.M. Gluhenky, A.S. Zueva, O.B. Ivanov, S.V. Ivanova, E.I. Kazakova, V.L. Kamynin, A.A. Kindeeva, S.L. Melnikov, A.P. Tonkikh, I.Yu. Tryapitsina, A.V. Fakhrutdinova, A.F. Yudintseva, V.D. Yanchenko and others emphasize the importance and prospects of using DT in the educational process. However, the problem of digital competence of teachers remains relevant to this day.

We will highlight the main problems of the formation of digital competence of the teaching staff of educational organizations:

1) Low digital competence and demotivation of young university graduate teachers, lack of "entrance control";

2) The problem of material, technical and software support of educational organizations. Here we additionally note the absence of unified software modules of the electronic information educational environment (EIEE) or a similar digital educational environment (DEE), electronic library environment (ELE), etc. for all educational organizations;

3) The problem of the lack of specific requirements and "viable" models and instructions for the implementation of digital competence programs;

4) The problem of the system of stimulating the self-improvement of teachers in the field of digital technologies and other professional skills;

5) The problem of implementing a security system against the negative impact of digital resources.

Survey conducted by Yu.A. Mosolova of 286 people from among the teaching staff of 75 Russian universities showed that the overall level of their digital competence of respondents is defined as average (55.2%), 40.2% consider their level high, and only 2.1% defined it as low; 2.4% of respondents found it difficult to assess their competence.

The presented results of the NAFI Analytical Center show the following level of digital literacy of teaching staff:

1) According to estimates of 38% of school teachers, 40 to 100% of their colleagues are uncertain about using digital technologies or do not use them at all. One fifth (21%) have been using digital technologies for less than 5 years. The majority of teachers (91%) actively use the Internet and have no difficulties working on a computer and other digital devices (84%). At the same time, teachers are interested in new applications, programs and resources (77%) and actively use social networks (71%).

2) According to estimates of a third of higher school teachers (32%), 40-100% of their colleagues are uncertain about using digital technologies or do not use them at all. 19% of teachers have been using digital technologies for less than 5 years. The vast majority of teachers (more than 90%) actively use the Internet and do not have difficulties working on a computer and other digital devices. At the same time, more than two-thirds of teachers are interested in new applications, programs and resources (69%) and 59% actively use social networks.

It should be noted that the survey is not an objective assessment of practice-oriented digital competence. Subjective assessment significantly depends on the level of worldview and knowledge of innovations.

We recommend building the competencies of the teaching staff on the basis of positive stimulation. However, for some disciplines of professional training, for example, "engineering graphics", "computer science", 3D modeling, etc., digital competence is the main criterion for matching the qualifications of the teaching staff.

Thus, there is a need to divide disciplines into categories depending on the level of digital competence required from the teaching staff:

1. Specialized technical disciplines;
2. General and specialized humanities disciplines;
3. General and specialized practice-oriented disciplines.

Disciplines of the *first category* require maximum digital competence from the teaching staff. At least 90%. These are mainly specialized disciplines of technical orientation of professional training, where interaction with computer technologies, information and communication and digital technologies is inevitable and, moreover, is a criterion for the effectiveness of a specialist in professional work.

The disciplines of the *second category* include general education and specialized humanities. The required level of digital competence here is at least 70%. For teachers of this category, DT is an addition to the implementation of fundamental didactics. In these disciplines, DT accompany the educational process continuously, but are not fully an assessment of professional qualifications, but only its component.

To the *third category* we propose to include general and specialized practice-oriented disciplines. General practice-oriented disciplines include, for example, physical culture, while at the faculties of

physical education it will be a profile. The same category includes disciplines of art and music, dance skills, etc. For teachers of practice-oriented orientation, the level of digital competence requires at least 50%. Physical qualities and practical skills are formed in these disciplines. The use of DT is necessary mainly at the initial stage – the formation of knowledge about skills and the control stage – the assessment of mastering skills (concerts, competitions, exhibitions) where digital technologies are necessary to provide a demonstrative and control-analytical component.

In addition, for objectivity in modeling the formation of professional digital competence in each category, it is recommended to divide the possession of DT into three levels:

– initial (the teacher performs simple tasks related to the use of DT);

– basic (the teacher actively uses DT in solving professional tasks and processing information);

– advanced (a teacher with the help of DT can solve complex professional tasks, creatively create or modify, configure systems to optimize their activities, etc.).

The formation of each level of digital competencies involves appropriate training and advanced training based on the nature of the professional tasks solved by teachers.

Based on these recommendations, it becomes necessary to determine the specific requirements of the digital competence of the teaching staff and to define a clear assessment system for each level in each category. The following table can serve as an example of such requirements:

Table 1: Table of evaluation of the levels of digital competence of the teaching staff by category in % ratio.

No.	Categories of digital competence of the teaching staff	Levels of digital competence of the teaching staff in % ratio		
		Elementary	**Basic**	**Advanced**
		Teacher	*Senior Teacher*	*Associate Professor, Professor, Supervisor*
1	Specialized technical disciplines	55–70%	70–85%	85–100%
2	General and specialized humanities disciplines.	40–55%	55–70%	70–85%
3	General and specialized practice-oriented disciplines *University staff.*	25–40%	40–55%	55–70%

According to the conformity assessment criteria in this table, it is recommended to link the levels of required digital competence to positions. Thus, a teacher requires entry-level digital competence, for senior teachers –basic level, and for associate professors, professors and heads of departments, centers, etc. – advanced level.

Given the globality of digitalization, digital competence is currently required for all university staff serving the educational process. Similarly, according to the third category of Table No. 1, inspectors, editors, researchers, trainers, laboratory assistants, etc. positions can be attributed to the initial level of digital competence requirements. To the basic level - positions with the prefix "senior" - senior inspector, senior editor, senior researcher, senior coach, etc. To the advanced level it is recommended to include designers, moderators, administrators of Internet sites of universities, positions with the prefix "chief", as well as deputies and heads of departments, units and services, etc.

The structure of the required digital competencies contains the following tasks:

a) formation of cognitive reflection with a focus on professionally significant values;

b) improvement of the functional component of digital competencies;

c) the formation of digital culture, expressed in the awareness of moral meanings, the foundations of digital security and constructive motivation;

d) the embodiment of the stimulation of creative activity, readiness to realize their values, personal meanings and worldview in professional life.

To assess digital competence, it is proposed to organize control and verification activities in three areas together. Assessment of knowledge and skills.

Assessment of knowledge about DT used in the education system as a whole – can be presented in the form of a comprehensive test about the functions of certain digital resources (for example, a computer and computer programs, a smartphone and mobile applications, etc.).

Assessment of the skills of using publicly available DT can be presented in the form of practical tasks: on

the compilation of generally accepted documentation, collection and processing of numerical and temporal data; on the compilation of tables, presentations and the simplest editing of photo, audio and video materials, on the processing of official mail, translation of text and voice audio material, on the creation of a secure information environment.

Assessment of the skills of using DT in professional activity – can be presented – in the form of practical tasks: on the creation of operational surveys, tests, lectures on educational portals on the Internet; on the organization of remote classes and videoconferences online; on the creation of comprehensive reporting presentation materials (for example, prospects for the development of the department or faculty for the next year); creation of stands and banners, design and editing of website pages; creation of thematic video material and artistic image processing. Additionally, the complex of special skills characteristic of the profile areas is evaluated.

As part of the implementation of national projects of the Russian Federation, it is recommended to organize such an assessment at the all-Russian level. An example of such universal testing can be the "All-Russian Environmental Dictation" or the Unified State Exam (USE).

In addition, the all-Russian scale of testing will allow:

– to determine the level of digitalization of the Russian education system;

– to determine the quality of the digital side of the education system;

– to define a single set of requirements for the necessary digital competence of the teaching staff of universities;

– to define a unified system for assessing general and professional digital competencies;

– to create unified software modules of EIEE or DEE, ELE, etc. and implement them in all educational organizations of the Russian Federation;

– to identify problem areas in the geography of the education system, through an additional anonymous survey window. These may be questions about the level of material, technical and software equipment of a separate educational organization that promotes or hinders the effective use of digital resources in professional activities; about the level of stimulation by the leadership of an educational organization to increase the digital competence of the teaching staff; about the participation of municipal authorities in the implementation of national projects of the Russian Federation, etc.

2 CONCLUSION

Currently, it is necessary to focus attention to solve the existing problems of the lack of a unified system of requirements for the digital competence of the teaching staff and staff of universities, material, technical and software. This article discusses recommendations on the organization of digital competence formation and its evaluation.

The requirements of national projects force educational organizations to create their own EIEE, DEE, ELE, etc. Currently, it is necessary to create uniform requirements for the formation and assessment of competence, design a single "software package" that should be "distributed" to all educational organizations to implement a high-quality, orderly and uniform educational environment and proceeding from this at the next stage to adjust the criteria of digital competence of the teaching staff and staff of universities.

It is important to note that an objective assessment of practical skills must be carried out practically.

REFERENCES

Batova, M.M., 2019. Formation of digital competencies in the system "education - science - production" // Issues of innovative economics, 9, No. 4. pages 1573–1584.

Burlutsky, A.N., 2019. To the problem of digitalization of vocational education in the back of the fourth industrial revolution.Features of state regulation of foreign economic activity in modern conditions: Materials of the VI All-Russian scientific and practical conference, Rostov-on-Don, November 14–15, 2019. - Rostov-on-Don: Rostov branch of the state educational institution of higher education "Russian Customs Academy", P. 426-433. EDN TTIVMM.

Vesna, E.B., 2019. Modern technologies for monitoring the information and legal environment. Psychology of the 21st century: challenges, searches, ensuring development: Collection of materials of the All-Russian Symposium of Psychologists, Ryazan, April 05, 2019.: Academy of Law and Administration of the Federal Penitentiary Service, 2019. P. 568-574. EDN WOOGRL.

Vyazemsky, E.E., 2019.Era as a period of fundamental changes in the field of modern general and higher pedagogical education.

Gerchikova, T.Ya., Degtyarev, N.I., Kirilenko, V.V., 2021. Development of personnel digital competencies. Labor Economics, V. 8, No. 6. pages 585–600.

Zemlyanskaya, E.N., 2017. Formation of qualifications among undergraduates in the field of designing educational programs. Pedagogy of Primary Education: Traditions and Innovations: Proceedings of the

International Scientific and Practical Conference, Moscow, April 27–28, 2017. P. 54-64.

Konstantinova, D.S., Kudaeva, M.M., 2020. Digital skills as a basis for the transformation of vocational education. *Labor Economics*, V. 7, No. 11. pages 1055–1072.

Masalova, Yu.A., 2021. Digital competence of teachers of Russian universities. *University management: practice and analysis*, V. 25. No. 3. pages33-44.

Fadeeva, O.A., 2020. To the problem of pedagogical teaching staff in the field of modern digital technologies. P. 214-218.

National project "Education" [Electronic resource]. URL: https://nationalprojects.rf/projects/obrazovanie (Date of access: 01/19/2023).

National project "Science and Universities" [Electronic resource].URL: https://nationalprojects.rf/projects/nauka-i-universitety (Date of access: 01/07/2023).

National project “Digital Economy of the Russian Federation [Electronic resource].URL: https://nationalprojects.rf/projects/tsifrovaya-ekonomika (Date of access: 01/17/2023).