

Development of Competences of the Digital Economy of Teachers in the Conditions of Digital Transformation Education

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Abstract

The article deals with the formation and development of the competencies of the digital economy among teachers. The concept of digitalization of society and education is considered, the factors influencing the relevance of this process are analyzed, it is indicated that one of the trends in modern education is digitalization.

It is concluded that the transition to the digital economy should significantly change the education system, the key element of the transformation of which is the corresponding competencies of teachers. The competencies of the digital economy have been formulated for both teachers and heads of educational organizations.

A model for the development of competencies of the digital economy in an educational organization is proposed, an example of its implementation in TSPU named after L.N. Tolstoy.

Keywords ¹

Digitalization of education, digital technologies, competencies of the digital economy, digital transformation, electronic educational resources, a model for the development of competencies in the digital economy.

1. Introduction

In the past few years, one of the drivers of time in the Russian Federation has been the course adopted by the state to digitize the economy and all socially significant spheres of society.

In order to implement the Strategy for the Development of the Information Society in the Russian Federation for 2017–2030, the program “Digital Economy of the Russian Federation” was approved by the order of the Government (order No. 1632-r dated 28.07.2017) [Pro17]. The goal of developing the digital economy in our country is to improve the quality of life of citizens, to ensure the high competitiveness of Russia and its national security.

Digital innovation and transformation must lead society and the state to a large number of economic and social benefits (see Fig. 1).

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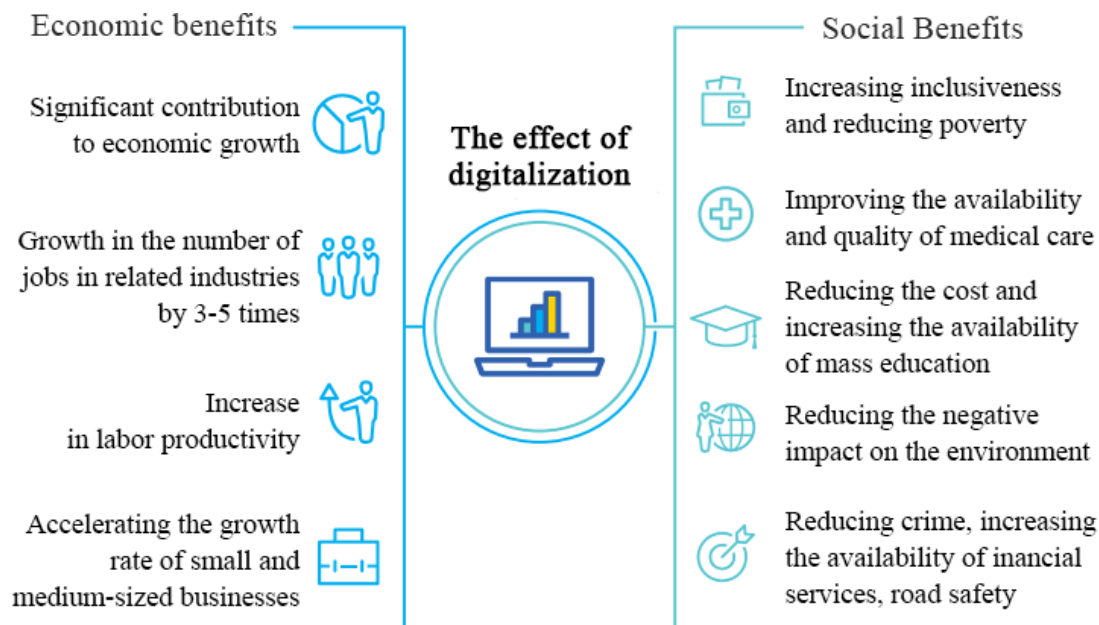


Figure 1: Trends and results of the development of the digital economy. Source World Bank; McKinsey GlobalInstitute [DiR20]

At the same time, the digital era requires the rapid adaptation of all industries and citizens of Russia to new conditions, including this fully applies to the education system, which must quickly respond to changes in the needs of the economy and a dynamically developing society.

The transition to the digital economy should significantly change the education system: along with the spread of information technologies in teaching and upbringing, the digital competencies of the younger generation and teaching staff are becoming critically important from the point of view of the development of a digital society.

The digital transformation of modern society puts on the agenda questions about innovative types and forms of training teachers for all the above processes that are adequate to the current state of society and the tasks of economic development.

The above applies in full measure to pedagogical universities, as organizations engaged in the training of pedagogical personnel. Pedagogical universities must prepare and seriously revise the requirements for students as future teachers, since many methodological, didactic aspects, as well as technologies and tools for digital learning have not been affected by previous waves of introduction of information and communication technologies, and should be ubiquitous in the near future. This also applies to electronic educational resources, e-learning systems (LMS: Google Classroom, Canvas, Moodle), programs for creating portfolios and multimedia content, automated knowledge testing systems (Indigo, GoogleClass), Internet services and platforms for the development of individual educational trajectories of students, as well as other tools.

Digitalization of education is one of the key areas of the Education national project adopted by the Russian government in 2018 [Mad20]. The challenges of digital transformation facing the education system were updated and partially solved during the forced transition to distance learning in March 2020 in the context of COVID. Promptly, and without reducing the quality of education, many educational organizations switched to new models of distance learning with innovative approaches to the implementation of all types of activities, basic and auxiliary processes, new principles of remote interaction of participants in the educational process and new digital services.

In the conditions of an unfavorable epidemiological situation, it was extremely important and relevant to use the possibilities of digital technologies in education (online and video lectures, online

practical classes, open educational resources and services, digital technologies for testing students' knowledge, the use of digital educational multimedia content). The experience in the implementation and application of digital technologies has also identified a number of problems, among which the following can be noted: currently there are no legal, administrative regulations and conditions for the effective use of digital technologies in educational practice, taking into account the speed of technological changes in the modern world and the need to form new competencies as teachers, and students. Special attention should be paid to identifying, forming and developing digital skills and competencies of all subjects of the educational process, conducting pedagogical research and analyzing the results of successful practices of digital transformation of education at different levels.

2. Purpose and objectives of the research

Digital skills have become an integral part of the professional skills of citizens in the economy, industry, and the field of education and science. It seems obvious that the process of digitalization of education predetermines the compulsory acquisition and development of the competences of the digital economy among teachers, teachers, methodologists and heads of educational organizations.

Thus, the subject of research in this article is the structure and content of digital competencies of teaching staff. The purpose of the study is to formulate the requirements and suggest possible ways of developing the competencies of the digital economy for both working teachers and students of a pedagogical profile - as future teachers and leaders of educational organizations.

Research objectives: to analyze the concept of digitalization of society and education and, on their basis, characterize the main qualitative transformations taking place against this background in the education system, formulate the stages and propose the structure of a model for the development of digital economy competencies among employees of educational institutions, formulate the content of those competencies that should acquire or to develop all teaching staff, taking into account the national requirements in this area.

3. Literature review

At the State Council on the topic "Communications, Communications and the Digital Economy" on January 21, 2020, the Minister of Communications and Communications Maksut Shadayev presented the results of the implementation of the "Digital Economy" program and plans for its further development until 2025: the program enables citizens to get a new high-quality education and prepare children for life in a digital society.

The Minister demonstrated the realized opportunities for students of all schools:

1. Online video lessons with subject teachers.
2. New educational technologies in classroom teaching.
3. Digital technologies for testing students' knowledge.
4. Technologies for the development of individual educational trajectories of students.

The government plans that by 2024, 100% of small and remote schools, as well as all children with special educational needs and disabilities will use online video classes, 50% of classroom activities will be conducted using digital educational content, two thirds of homework will be done in digital form with automatic verification, more than 80% of students in the framework of additional training will use electronic educational services and content to study the subject [Met20]. In Appendix [Pri20] to the Order of the Ministry of Economic Development of Russia dated January 24, 2020 N 41

"On Approval of Methods for Calculating Indicators of the Federal Project" Human Resources for the Digital Economy "of the National Program" Digital Economy of the Russian Federation ", a list of key competencies of the digital economy is formulated.

When organizing training using digital formats, one should take into account the national requirements for the competencies of the digital economy of citizens, aimed at the widespread use of a wide variety of digital means and technologies, setting individual development goals, the ability to solve new problems with non-standard methods, free operation and analysis of information flows.

When forming the competencies of the digital economy (DE), it is supposed to take into account the formalization of the stages proposed by L.V. Lapidus [Lap19] (see fig. 2):

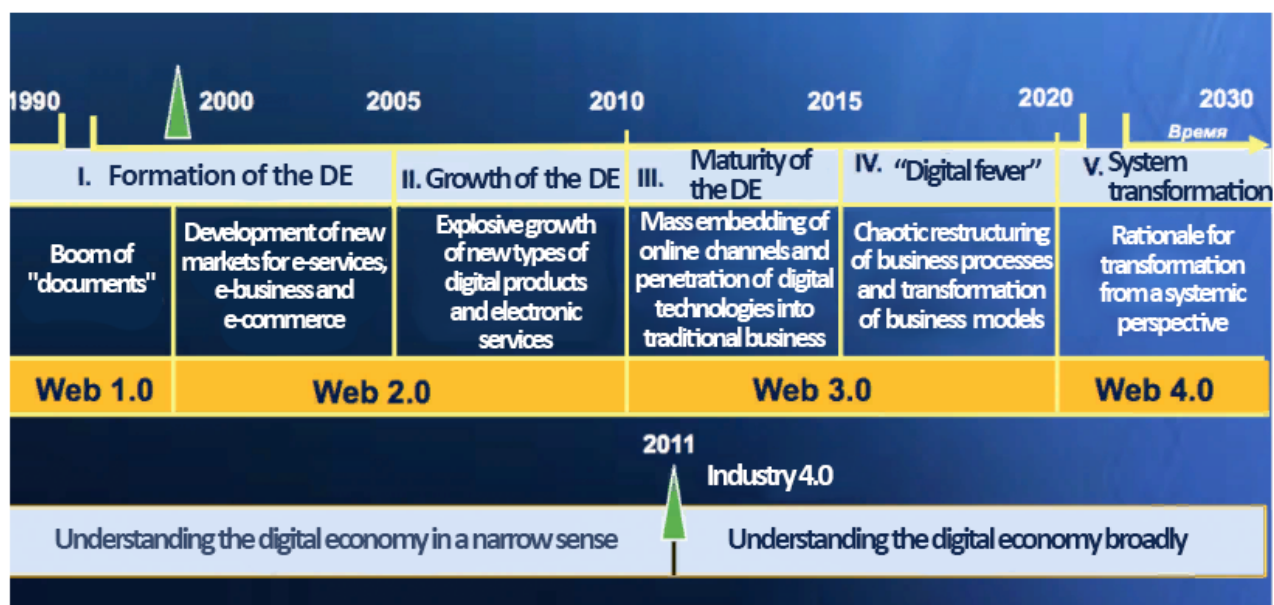


Figure 2: Evolution of the digital economy. Author: L.V. Lapidus

As for the education system, at the moment, according to the assessment of the Russian Association for Electronic Communications (RAEC), the level of penetration of online technologies in Russian education as a whole is only 1.1%. Globally, e-learning accounts for about 3% of the total educational services market, according to the educational resource EduMarket. In Russian universities, e-learning today covers about 4% of students. According to Tadviser estimates, this share will grow to 9% by 2021 [Dig18].

Based on the foregoing, we believe that today the processes of digital transformation in educational organizations are non-systematic. To solve the tasks set by the state and prepare teachers for life in a modern digital society, changes are needed, both in pedagogical universities and in the system of additional professional education for teachers.

4. Methodology

Schools, colleges, universities, centers of additional education need to constantly search for innovative solutions and methodological approaches based on the use of digital educational technologies [And20]. The learning process should become more flexible, providing learners with an individual trajectory, opportunities for self-realization and creativity. In a number of cases, the digital educational environment turns out to be a noticeably more preferable tool for acquiring knowledge independently in comparison with traditional technologies, it allows you to analyze large amounts of information and make decisions of various kinds of problems based on analysis.

Proposing a model for the development of digital economy competencies in an educational organization, we will rely on the analysis of fundamental works in the field of pedagogy and psychology (L.S.Vygotsky, A.A. Derkach, I.Ya. Lerner, A.M. Novikov, V.A. Slastenin, E.L. Yakovleva and others); theory of the competence-based approach (A.A. Verbitsky, E.F. Zeer, I.A.Zimnyaya, A.P. Tryapitsyna, and others) and its implementation (E. Ya.Kogan, V.S. Lednev, A. V. Khutorskoy, etc.); theories and methods of vocational education (G.V. Mukhametzyanova, V.D.Shadrikov and others); theoretical aspects of the creation and development of a digital educational environment (A. Bruns, S. V. Panyukova, etc.); the use of ICT tools in the process of training personnel in vocational education in a digital educational environment (S. Beshenkov, O. Kozlov, A. Morozov, E. Polat, I. Robert, A. Yu. Uvarov, S.R. Udalov and others), as well as dissertation research on the development of competencies in the context of digitalization of education (S.Yu. Archakova, Ya. Banasikova, M.E. N.A.Ershova, S.A.Zaitseva, M.D. Kitaygorodsky, T.S.Mospan, T.E. Pakhomova, A.N.Sergeev, I.N.Smirnova, M.V.Shmantsar, etc.) allowed us to identify different approaches to the definition of the concepts of digitalization of society and education.

The analysis made it possible to identify different approaches to the definition of the concepts of digitalization of society and education, the lack of a single definition. In our study, digitalization of education will be understood as an objective process in education, as a result of which the use of information and digital technologies, microelectronics and telecommunications in the educational process leads to the modernization of all areas of educational activity.

In turn, the methodological apparatus used by the authors in this study is based on the most important principles: studying the transformation of education in the digital age, as a natural development of pedagogy; the unconditional priority of the safety of the personality of the student and teacher when using digital technologies; the adequacy of the application of digital technologies to the essence of the studied subject and puts the methods of analysis and modeling, pedagogical experiment at the fore.

The digitalization of education implies the development of educational and management processes along with the widespread introduction of technologies for the creation, processing, exchange and transmission of large amounts of information (information resources) on non-paper (digital) media in the context of the analysis of digital traces of students and the organization of the information and educational environment of the educational organization.

Based on research devoted to the development of competencies in the context of digitalization of education, we should consider the process of integration in the content of vocational education, from the point of view of opportunities to develop a teacher's system of professional knowledge, improve the skills of using information technologies in their subject area and the ability to solve professional tasks in the context of digital transformation of education.

5. Results

Pedagogical workers, heads of educational organizations understand the need for mastering digital competencies and are actively involved in training and self-education in this direction. We conducted a survey to study the level of teachers' readiness to work with digital technologies. Pedagogical workers of all categories enrolled in advanced training courses at the Tula State Pedagogical University named after L.N. Tolstoy ", suggested questions for introspection of the competencies of the digital economy.

Analysis of the survey results showed that for the period from 2017 to 2020. the share of teachers with basic digital skills increased: working with applied programs, services and Internet platforms,

participation in professional network communities. At the same time, the demand for mastering the techniques of working with infographics, data visualization technologies has increased, skills of organizing, designing and conducting educational webinars and video meetings, recording and editing video lectures, and creating educational content for distance education are required.

The results of the survey also showed that a small number of respondents (28% of the total number of respondents) know the pedagogical methods of organizing the activities of students using digital technologies and resources. 42% of those who answered the questionnaire do not know what cloud services and technologies are, and only 5% of teachers know how they can be used in educational activities. Only 15% indicated that they are able to organize independent work of students using electronic educational resources, and only 10% have experience in organizing network interaction with students and their parents.

Taking into account the results of the questionnaire and the government's requests for the development of digital competencies of citizens, and based on previous experience, a model for the development of the competencies of the digital economy among employees of educational organizations was developed, including several stages.

The first stage should be the stage of defining the tasks facing the educational organization in the light of digital transformation, analyzing the digital technologies used and the requirements for their expansion in each educational organization. The achievement of this goal is facilitated by the solution of the following tasks: compilation of a detailed list of digital infrastructure (digital and computer equipment, data transmission network and access to the Internet, the availability of pedagogical digital educational tools in the organization, the availability of system and application programs, availability of access to online platforms, universal and educational services), determination of current short-term and long-term plans for the modernization of the fleet of digital equipment and technologies, allowing an educational organization to solve the problems of digital transformation [Pri17].

At the second stage, on the basis of the formulated tasks of digital transformation, it is necessary to determine and approve the directions of the digital transformation strategy in the educational organization, which will lead to the improvement of educational and management processes. Digital transformation of education is the renewal of the planned educational results, educational content, methods and organizational forms of educational work, as well as the assessment of the results achieved in a rapidly developing digital environment to dramatically improve the educational results of each student [Uva19].

This is inevitably associated with changes in the organization of educational and educational work, the use of effective methodological and didactic solutions, supported by an updated fleet of digital teaching aids. The factors of successful expansion and integration of digital solutions in an educational organization include:

- elaborated methodological and didactic solutions;
- support from all participants in the educational process, mutual understanding in issues and areas of digital transformation;
- use of digital educational solutions and services for which the skills of a confident user of digital technologies are sufficient.

At the next stage of the model for the formation and development of competencies in the digital economy, it is necessary to assess the initial level of formation of digital literacy and competencies of the digital economy among participants in the educational process, as a starting point for the formation of a development trajectory.

Employees at all levels in the education system will have to acquire or develop competencies in the digital economy. For leaders in the education system, these are the managerial competencies of the digital economy, which include:

1. Identification and substantiation of ways to digitalize an educational organization.

2. Development and approval of strategic documents: strategies for the development and digital transformation of an educational organization, taking into account state policy and strategies for the development of a digital society, based on an understanding of the processes of the digital economy, regional characteristics.
3. Search and assessment of ways to implement digitalization based on new opportunities of the digital economy, creation of innovative start-ups.
4. Development of a plan for digitalization of an educational organization.
5. Ability to solve applied problems within the framework of managerial powers using digital technologies.
6. Organization and control of the work of all employees on the basis of modern digital technologies, taking into account the requirements of information security of the individual and personal data.

Educators must have the following professional competencies in the digital economy:

1. Create, evaluate and use electronic information and educational resources.
2. Master the technologies of visualization of educational material - create presentations, podcasts, videos, multimedia resources.
3. Have the skills of creating virtual communities for educational, educational and educational purposes: blogs, web pages, sites, wiki platforms.
4. The ability to search for information necessary in professional activity, skills in analyzing and storing information using digital technologies in order to effectively use the information received to solve professional problems.
5. Use the capabilities of educational Internet platforms and services for professional self-development and advanced training.
6. Create and use social networks and Internet communities in professional activities.
7. Use online tools to implement modern teaching practices: flipped classroom, blended learning, mobile, e-learning, project-based learning, and more.
8. Have the skills to safely use digital learning tools and a culture of personal information security.

At the next stage, it is necessary, using various pedagogical techniques and methods, to carry out flexible and individual development of the competencies of the digital economy among teachers. The factors here are the presence of a digital environment, organizational conditions, and building a system of continuous professional development of teachers.

Based on the above, we can imagine a model for the development of digital economy competencies in an educational organization (see Fig. 3):

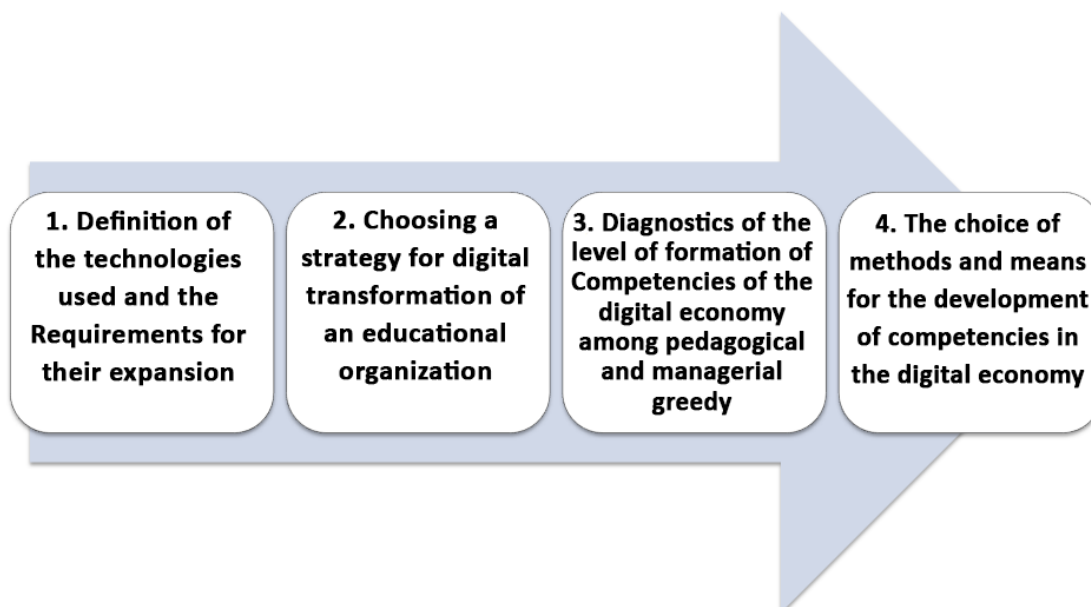


Figure 3: Model for the development of digital economy competencies among employees of educational organizations

The developed model is also aimed at creating and developing conditions for the implementation of educational programs using e-learning, distance learning technologies, taking into account the functioning of the digital educational environment, which includes electronic information and educational resources, Internet services and platforms approved for use for the implementation of basic educational programs in accordance with the established procedure, a set of information and telecommunication technologies, appropriate technical means that ensure the development of educational programs by students in full, regardless of their location.

An important stage in the model for the development of competencies in the digital economy is the stage of reflection and assessment of the quality of the events held. So, after the first month of transition to distance learning at the Tula State Pedagogical University. L.N. Tolstoy at the Faculty of Mathematics, Physics and Informatics, a survey of students on the satisfaction of the transition to distance learning was conducted in order to analyze the problems and difficulties faced by students and teachers. Also in April 2020, the head of the Department of Informatics and Information Technologies prepared a report "On the positive experience and problems of the implementation of the educational process and the elimination of student debts in the context of the transition to remote interaction." Digital technologies were presented that were used by the teachers of the department during the period of remote interaction with students (Table1):

Table 1
Digital technologies used by teachers of the Department of Informatics of Information Technologies

Form of classes	Technology name	Discipline
Video meeting	Google platform	IP architecture Software engineering Operating systems
Video meeting	Platform ZOOM	Computing systems, networks and telecommunications
Video lecture	Video hosting	Artificial intelligence systems

	YouTube	Structures and algorithms for computer data processing
Webinar	Platform Mirapolis	Database Medical information systems
Webinar	Platform jit.si	Intelligent systems Algorithms and complexity analysis
Testing the knowledge of students	Platform IClass	Informatics
Presentation and control of tasks execution	Creation of group chats on the social network VKontakte	Algorithmization and programming Object Oriented Programming Study practice
	Google Class	Software engineering Operating systems
	LMS Moodle	For all readable disciplines of the department

The main tasks of measures for the professional development of the competencies of the digital economy among teachers are to understand the essence, purpose and expected results of work on the digital transformation of education; formation of teachers' readiness to develop skills and abilities to work with information, to introduce new administrative rules and regulations of work, taking into account the expanding information and educational environment (including information security issues); to form teachers' willingness and ability to actively participate in the development and implementation of online training programs, e-courses and programs, taking into account the use of the potential of the developing digital educational environment of educational organizations.

An important condition for the development of the competencies of the digital economy among teachers, in our opinion, is the possibility and motivation of the independent professional development of teachers using open educational resources, informal online communication with colleagues, and participation in voluntary professional (including network) communities.

As an example of the development of the competencies of the digital economy among employees and teachers of the Department of Informatics and Information Technologies of the Tula State Pedagogical University. L.N. Tolstoy, during the period of an unfavorable epidemiological situation (March-June 2020), more than 15 online meetings were held with colleagues at the university using various online platforms MeetGoogle, Mirapolis, Zoom, more than 20 groups were created on the social network VKontakte, in WhatsApp and Telegram messengers for solving current issues of educational activities with students.

In the system of fundamental pedagogical education, it is necessary to introduce new approaches to teaching, the formation and development of the competencies of the digital economy and a high level of basic digital literacy of students. The high level of formation of the competencies of the digital economy among teachers is an important condition for information security and the harmonious development of schoolchildren. The result of the development of the competencies of the digital economy should be: a high professional level of teachers in the field of working with digital devices, possession of digital pedagogical technologies and methods of using electronic information and educational resources.

To solve the problem of providing the education system with highly qualified pedagogical personnel who own modern digital technologies, advanced training and professional retraining courses for managers and teachers play a special role. They will allow specialists of those educational organizations to acquire new skills that are not able to independently organize the process of training, development and testing of new digital technologies. So at the Tula State Pedagogical University

named after L.N. Tolstoy at the Department of Informatics and Information Technology for the period from 2017 to 2020. the following professional development courses and professional retraining programs for students and employees of educational organizations were developed and successfully implemented:

1. Information security of an educational organization.
2. Modern digital technologies for citizens.
3. Microsoft Excel: ready-made solutions for professional activities.
4. Educational robotics.
5. Technologies for creating educational videos for online courses.
6. Development of professional competencies of teaching staff using modern ICT tools.
7. The use of ICT for the development of subject and pedagogical skills.
8. Teaching robotics in an educational organization.
9. Teaching informatics in educational institutions.

6. Conclusion

At present, it is obvious to many educators, researchers, managers and parents that the traditional model of education, which does not take into account the peculiarities of the surrounding digital world, aimed only at transmitting knowledge to schoolchildren, is already outdated. A transformation of the education paradigm itself and a revision of existing approaches and teaching models aimed at developing general digital literacy skills, social and emotional skills for the success of students in the future digital world is necessary.

The main goal of the ongoing and planned changes related to the digital transformation of education is the implementation of the transition to mass quality education aimed at the comprehensive development of the student's personality. The proposed model for the development of the competencies of the digital economy among employees of educational organizations can contribute to solving the important task of forming / developing the competencies of the digital economy among teachers, methodologists, teachers and heads of educational organizations in order to improve the quality and competitiveness of Russian education as a whole.

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