

The Model of Teachers' Digital Culture in the Economic Environment of the Region

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ABSTRACT

Nowadays education faces new challenges, which are aimed at improving competencies in information and communication technologies and developing the digital skills of all participants in the educational process. The tasks make the teachers to possess a high level of competencies associated with the competent assistance for students in the space of a digital learning environment.

Today, educational organizations provide the base for digital experience of graduates. But there is a certain lack of technical devices for these purposes. Despite the definite financing the amount of personal computers and other digital equipment is not sufficient.

According to the data analyzed in terms of teachers' digital literacy and competencies level there are few of them who can provide adequate training for students in context of digitalization.

The analysis of the digital education process, the role and the content of digital literacy and digital competencies prove the need for modeling digital culture of teachers.

Thus, on the theoretical view point the essence of digital literacy and competencies should be enriched up to digital culture including the digital experience of digital education resources operating. On the practical view point the offered recommendations can be helpful to fulfill the demands of the State to get the highly qualified specialists ready to develop the digital economy of the region.

Keywords: digital literacy, digital competencies, digital culture, digital experience, computer literacy, information literacy, media literacy, communicative literacy

1. INTRODUCTION

In the epoch of digitalization, there are new requirements for the quality of specialists training aimed at the overall development of the economy [25]. The regulatory framework of the Russian Federation defines new guidelines for the high level of digital literacy of specialists [26], for the restoration of technological and digital infrastructure in the education system [22], and for the creation of conditions for the possibility of receiving education throughout life [8]. Today education faces new challenges, which are aimed at improving competencies in information and communication technologies and developing the digital skills of all participants in the educational process.

The tasks make the teachers to possess a high level of competencies associated with the competent assistance for students in the space of a digital learning environment. [20]. In the context of digitalization process, the education system has a significant role to play in providing Russia's economy with a competent workforce with digital skills, which will subsequently lead to productivity growth and new employment relationships [3].

The challenges facing education presented in the normative documents demonstrate a high level of all public authorities awareness of the need for qualified

pedagogical personnel capable of training graduates with a sufficiently high level of digital skills.

2. PROBLEM STATEMENT

In recent years, the share of funding educational institutions with the necessary equipment for the transition to digital education environment has increased. Thus, the number of computers for administrative purposes and computers for educational purposes in educational institutions of the Sverdlovsk region is increasing annually (Figure 1). However, as you can see in the diagram, the share of computers for educational purposes is much lower than for computers for administration. Thus, it can be stated that the technical equipment of educational institutions for educational purposes is insufficient.

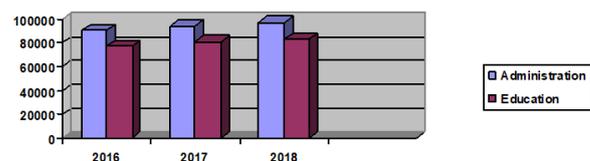


Figure 1 Personal Computers for Administration and Education Purposes

In spite of the digital economy order in personnel possessing modern digital competences training few graduates demonstrate a willingness to work in a digital environment. According to the NAFR Analytical Center (National Agency for Financial Research) [9], only 64% of specialists with higher education have some degree of digital literacy (Figure 2). University and school teachers also do not demonstrate absolute mastery of digital skills (88% and 87% respectively).

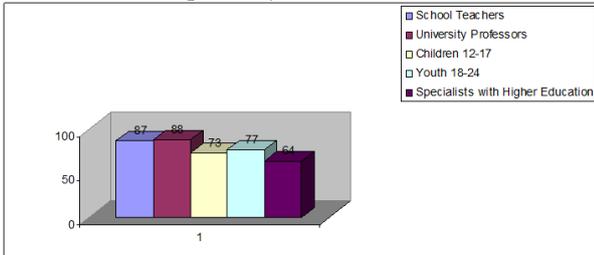


Figure 2 Digital Literacy Index of Different Social Groups

2.1. Research Questions

Given the above data, there are contradictions that hinder the training of competent professionals for the digital economy at different levels:

- between the state order for of specialists with digital competences training and the lack of technical equipment in the educational institutions;
- between the need of regions for digital literacy of employees and insufficient number of them;
- between the availability of large educational content in the information environment and the inability of educational institutions to integrate it into the educational process properly.

2.2. Purpose of the Study

The purpose of this study is to build a model of teachers’ digital culture, aimed at training qualified personnel for the digital economy of the region. The tasks of this research are the following.

1. To study the legal documentation, providing the possibility of forming a digital culture of teachers.
2. To determine the structure and content of the digital culture of the teacher, using data from foreign and domestic studies.
3. To develop a model of teachers’ digital culture, aimed at training qualified personnel for the digital economy of the region.
4. Provide some offers on the formation of teachers’ digital culture in the Sverdlovsk region that meets the economic needs of the region.

3. RESEARCH METHODS

This study is aimed at examining the level of teachers’ digital competence in the context of preparing graduates who meet the requirements of the digital economy.

The authors used logical and systematic methods of analysis of the obtained data as research methods. The stated issues structured the ongoing study. The authors analyzed the level of digital competences development by different social groups, and revealed differences in digital literacy of university teachers and school teachers, as well as students themselves. The authors modeled the teachers’ digital culture based on foreign and national studies.

The course of this study included the following steps:

- study of work carried out on the topic of digitalization of the education system;
- analysis of studies regarding the level of digital skills and competencies of teachers;
- modeling the digital culture of the teacher;
- providing the offers for the formation of a digital culture of the teacher in the educational space of the region.

4. FINDINGS

Today, digitalization process has a huge impact on culture due to the emergence of the Internet as a mass form of communication and the widespread use of personal computers and other devices. Digital technologies are so prevalent around the world that the study of digital culture potentially encompasses all aspects of everyday life and is not limited to the Internet or modern communication technologies. Specific characteristics of digital culture can be explained by the types of technical process involved, the types of cultural forms that arise and the types of events that digital culture entails.

Understanding digital culture requires new, innovative forms of research and new approaches, such as the broad field of digital humanities, digital hermeneutics and digital ethnography, to improve understanding of the culture generated by digitalization.

Considering that digital materials are easily copied, distributed and modified, digital cultural products are potentially in a constant state of “formation”, which is in some respects more adequately described as process rather than finished products. The new opportunities created by information and communication technologies (ICTs), expressed through global connectivity and the growth of networks, represent a challenge to traditional ways of understanding culture and lead to its vision as an open and dynamic process based on interactive communication. ICT and especially the Internet give these relationships a new dimension by enhancing the flow of cultural goods and services and a new understanding of cultural creativity [5]. Digital technology itself, digitalization, mass digitization of cultural heritage does not directly lead to digital culture as a personal component, to the type of culture in the traditional sense: culture may or may not be formed [14].

In the cultural and philosophical aspect, digital culture is interpreted as a new form of being, "third nature" (traditionally, "second nature" is understood as "culture" as a whole), continuing the natural environment and the "world of things". "A person gains a new being in virtual space, while the value of the real world is gradually shifting towards the virtual. The border between them is blurred; the illusion of being is increased" [28].

Like any type of culture, digital culture determines a lifestyle, motivation, especially communication, and human behavior [14].

We consider the content of digital culture in the interpretation of different researchers.

Some others consider digital culture as a stage in the development of information civilization, marking the transition to artificial forms of life, or as a variety of directions and practices of information society, generated by the convergence of information technologies and socio-humanitarian knowledge.

D.E. Prokudin and E.G. Sokolov continue to develop this idea, considering digital culture as a transition from analogue forms to digital formats, accompanied by a transformation of the hierarchical structure of culture ("core" - "periphery") in the clustering of its forms and network communications; elimination of "symbolic order" and establishment of "order of things" [24].

S.S. Horuzhiy considers digital culture in the context of human history and its purpose – spiritual perfection of man and humanization of social structure [17].

O.O. Savelieva and O. Shlykova define digital culture as "a socio cultural reality in which computers, multimedia and the Internet open up new forms of perception of natural, human and social reality" [27].

D.V. Galkin identifies the following levels in digital culture:

1. The material level of digital culture; the objects of analysis are digital devices in all the existing diversity.
2. The functional level of digital culture, which includes social institutions
3. The symbolic level of digital culture. Symbolization in culture is always associated with a specific language. In the context of digital culture it is a programming language.
4. The mental level of digital culture is a reflection of numbers in the traditional culture of the individual, in the system of prevailing attitudes and values that are directly reflected in the habits of working with information and digital devices.
5. The spiritual level of digital culture [12], [13].

The spiritual level of digital culture is singled out by E.V. Gnatyshina and A.A. Salamatov, interpreting the digital culture of a teacher as the values of digitalization, which are accepted by him, that do not contradict the general humanistic values, the availability of digital competence, the possession of technology of optimal orientation in the digital reality and productive communication in the information space [14].

In recent studies, digital culture has been described in terms of a cultural-archival approach, in which electronic culture sees as archiving cultural heritage and redistributing its contents by media users for their own

purposes; communicative-linguistic and socio-communication [4].

A.Yu. Alekseev develops this idea and suggests considering digital culture as "spiritual and material components that are formatted by artificial intelligence" [2].

Bearing in mind the above approaches to understanding the role and content of digital culture, it should be noted that digital culture is a general concept that describes the idea that technology and the Internet to a large extent determine how we interact, behave, think and communicate like people in society. This product of ubiquitous technology and unlimited access to information is the result of breakthrough technological innovations in our society.

Digital culture integrates the Internet, transhumanism, artificial intelligence, cyber ethics, security, privacy and politics. It is hacking, social engineering and modern psychology. More specifically, digital culture uses social networks as the main way to interact with others; to share every moment of one's life on the Internet; the anonymity provided by online communities; Apple Pay and Android Pay; wearable technologies; the use of emoticons to improve communication; Internet/cellular; the economy of sharing / on demand; cloud computing and storage; Internet things.

Digital culture is applicable to several themes, but it all comes down to one theme: the relationship between people and technology. These ideas are often overlooked, as technology becomes a second nature to us. People use modern technology to improve or change their quality of life in accordance with changing environment and human needs. Digital technologies and platforms emerge as artifacts to facilitate connectivity and interactivity. The result is the need for digital skills and literacy to practice digital rituals.

The content of digital culture of the educational process participants is presented in different ways in scientific areas.

Kristen M. Snyder. includes four elements in the concept of digital culture that interact with each other to form a digital culture of reflection [30]. Figure 3 shows how technology is used for communication and learning (pedagogy), which affects the role of the learner, the teacher, the way knowledge and learning are viewed. The technology is designed to meet the needs and learning opportunities that enhance both human communication and technology. It affects the organization of learning and the institution in terms of planning, resource allocation, use of space, learning models and curriculum organization.

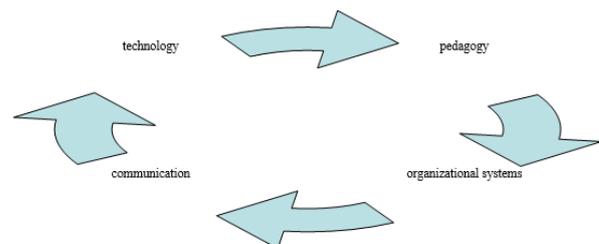


Figure 3 Snyder's Digital Culture

It should be noted that the pedagogical culture is the highest degree of correspondence between the personal development and professional readiness of a teacher to the specifics of pedagogical activity. In conditions of rapid change of various technologies, digital culture of a teacher implies the following:

- awareness, understanding, assessment of their own pedagogical experience;
- the ability to analyze their professional work in general;
- quickly and constructively bring their activities in line with new value orientations - master new technologies, ways, and reach a new level of results.

Digital competence has therefore become a key concept in discussing, which skills and understanding teachers should have in the society of knowledge. Among the components of professional ICT competence, a teacher should possess [23]:

- general user ICT competency;
- general educational ICT competency;
- subject-pedagogical ICT competence (reflecting professional ICT competence in the corresponding field of human activity). ”

I.V. Sonina marks the following digital competencies of a teacher [33]:

- Digital technical literacy: search data, information and digital content; evaluation and analysis of data, information and digital content.
- Computer literacy: possession of software permanently located on a PC; operation of peripheral devices.
- Creation and development of digital content: design, creation and development of digital content; modification and integration of digital content.
- Communication and cooperation: information exchange through digital technologies; digital etiquette.
- Security: protection of personal data and ensuring confidentiality; health protection.
- Solving problems related to digital technologies: solving technical problems; identification of needs and technological solutions; creative use of digital technology; identifying gaps in digital competency.

The author considers digital competences of a student to be similar to those of a teacher and distinguishes them only in the competence to solve problems related to digital technologies by the lack of indicators: creative application of digital technologies; identification of gaps in digital competence.

A. Shirokopoyas calls the possession of ICT competencies digital literacy and puts the following digital competencies in its content [29]:

- The ability to address a variety of information and communications technology (ICT) challenges;
- The ability to use and create content through digital technologies, including searching and sharing information, answering questions, interacting with others;
- Computer programming.

Foreign authors include the following ten digital skills in the list of necessary digital pedagogical competences of a modern teacher:

- Find and evaluate educational online materials;
- Create visually interesting materials;
- Create virtual sites for your class: blogs, sites, wiki platforms;
- Be able to effectively search for information on the network;
- Use the capabilities of social networks for professional development;
- Recommend learning resources;
- Create, edit and distribute digital portfolios;
- Create, edit and distribute multimedia content;
- Use online tools to implement modern teaching practices: inverted class, blended learning, mobile learning, project learning, etc.
- Build relationships with other teachers.

The European Commission, in its definition of digital competence, stresses the importance of conscious and responsible use of digital technologies in learning, at work and in public life. Digital competence should include the capacity for digital cooperation, security and problem solving. Digital literacy includes the personal, technical and intellectual (digital) skills needed to live in the digital world. In this way, digital competence is the latest concept that describes the skills associated with technology. It should be noted that in a foreign context information literacy, digital literacy and digital skills are considered as synonyms [18].

P. Krumsflick, studying digital competences of educators, defines them as "the ability of a teacher to use ICTs with good pedagogical and didactic understanding, and this can affect the learning and educational strategy of students [19].

G. Ottestad, M. Kelentrić and G. Guðmundsdóttir propose three main aspects of describing the professional competence of teachers in the field of digital technologies [21]:

- General digital competency encompasses disciplines in subjects and defines the general knowledge and skills that teachers, teachers and students must acquire in order to act as digital teachers. This dimension is identical or very close to already existing descriptions of general digital competence.
- Didactic digital competence encompasses the digital specificity of each subject, which a teacher considers important. It is in this dimension that real differences in didactics between subjects will be described, for example, mathematics taught using ICT versus a foreign language or pedagogy taught using ICT.
- Professionally oriented digital competency describes the digital features of an extended pedagogical profession, the question of what teachers need in digital literacy in other areas of work, for example, when they plan subject lessons, sort grades, write down grades and delay, communicate with parents and others in groups. According to the Digital Agenda Scoreboard (2015), 40% of the EU population have insufficient digital competence,

including 22% who do not use the Internet [1]]. The European Competence Framework (DigCompEdu) assigns digital competences to eight key competences and to the confident and critical use of the full range of digital technologies for information, communication and basic problem solving in all aspects of life.

DigCompEdu details 22 competences organized in six areas. The main focus is not on technical skills. Rather, the structure aims to describe in detail how digital technologies can be used to improve and innovate in education and learning.

In the course of this work, the authors analyzed the approach to assessing digital literacy of teachers proposed by the NAFR Analytical center. The approach is based on the assessment of indicators of information, computer, communication literacy, media literacy and attitude to technology. Each of these indicators is evaluated in three aspects: cognitive (knowledge), technical (skills), and ethical (attitudes) (Table 01):

- the cognitive aspect describes how a person evaluates, creates, and critically approaches working with

information, computers, and media, how they communicate with other users, and how they relate to technology;

- the technical aspect reflects the ability to find the necessary information, media materials, as well as an understanding of how digital devices and new technologies work;

- the ethical aspect evaluates people's ability to follow generally accepted norms when using digital environment tools.

The main advantage of this approach is that the indicators for measuring digital literacy are formulated on the basis of an analysis of the objective needs of the economy — on the basis of big data and machine learning technologies, vacancies are studied and the requirements of employers for digital skills and knowledge of candidates are typologized (demand-side analysis). At the time of the study, this methodology seems to be the most developed and practice-oriented, it was the result of joint work of specialists from different countries of the world.

Table 1 Digital Literacy

information literacy	knowledge	skills	the value system
	understanding the role and degree of influence of information on a person's life	ability to search and find information on different resources	understanding the benefits and harms of information
computer literacy	understanding the technical components of a computer and the principles of their interaction	ease of using digital devices regardless of the platform	understanding the purpose of the computer and the purpose of its use
media literacy	understanding the diversity of information sources, forms and channels of its distribution	ability to search for news in different sources, check their completeness and reliability	critical attitude to information messages, news
communication literacy	understanding the difference between digital communications and live communication	ability to use modern means of communication	awareness of the existence of special ethics and norms of communication in the digital environment
attitude to technological innovations	understanding of technological trends	readiness to work with new modern technologies	understanding the benefits of technological innovations

Based on these indicators, the overall digital literacy index is calculated, which is created for each country, and should equally balance the interests of each professional group. By introducing such an index, it is assumed that the government will aim to target the most vulnerable social occupational groups that lack basic skill sets that are valuable to employers and society as a whole [6].

The NAFR analytical center calculated the digital literacy index for university and school teachers (Figure 2). As shown in the graph, teachers of higher education institutions demonstrate high indicators of knowledge, skills and attitudes in the field of digital technologies (88 out of 100). Obviously, working in the modern education system is impossible without knowledge, skills and attitudes in all five components of digital literacy. The digital literacy index of school teachers is also significantly high (87 out of 100).

It should be noted that digital literacy does not include the concept of work experience, while digital culture implies free conscious operation of digital technologies to achieve goals. Thus, we consider it necessary to include the readiness of teachers to use digital technologies in the educational process actively in the digital culture.

Based on the European Digital Competence Framework and the proposed classification of experience levels, we consider it appropriate to include digital teacher readiness in the content of digital culture. Consider the six levels of experience [9].

A1 Newcomer: the teacher needs to develop skills in using digital technologies in the educational process. It is necessary to improve the educational process, follow the improvements in the new semester/new quarter, and gradually increase the competence in the field of digital technologies.

A2 Explorer: the teacher is aware that digital technologies have a high potential, and would like to study them in order to apply them in their teaching practice. I started using digital technology in my classes from time to time.

B1 Integrator: a teacher experiments with digital technologies in different contexts and with different goals, integrating them into their teaching practice. Uses them creatively, seeking to improve their professional skills and expand the scope of digital technologies.

B2 Expert: a teacher confidently, creatively and critically uses a range of digital technologies in their professional activities. Purposefully selects digital technologies and materials for specific situations and tries to understand the advantages and disadvantages of different digital strategies. He is full of curiosity, open to new ideas and understands that there are still many digital technologies that he has not tried out that he could apply in his teaching practice. By experimenting, it adds to, structures, and improves its Arsenal of strategies.

C1 Leader: the teacher has formed a consistent and integrated approach to the application of digital technologies in teaching practice. He has a whole set of digital strategies and knows how to choose the most appropriate one for a given situation. The teacher constantly reflects and develops his practical skills. He is always up to date with innovations, as he regularly exchanges experience with experts and is always ready to help colleagues — teach them how to use digital technologies in the educational process and explain what benefits digital strategies can bring to education.

C2 Pioneer: the teacher questions the adequacy of modern teaching practices, both with the use of innovative solutions and traditional methods. He reflects on the limitations and shortcomings of the modern educational process and strives to improve it. An innovator teacher experiments with highly innovative and complex digital technologies and / or develops new pedagogical approaches. It is also a conductor of innovation and an example for other teachers.

According to the NAFI study, educational institutions are experiencing great problems with the practice of using digital technologies by teachers (Figure 4). Only 1% of teachers have experience in using digital resources at a high level. They question the adequacy of modern teaching practices, both using innovative solutions and traditional methods, reflecting on the limitations and shortcomings of the modern educational process and seeking to improve it by experimenting with highly innovative and complex digital technologies and/or developing new pedagogical approaches. The group of Newcomers who need to carefully develop all the skills of using digital technologies in the educational process was 2% among school teachers and 3% among University teachers.

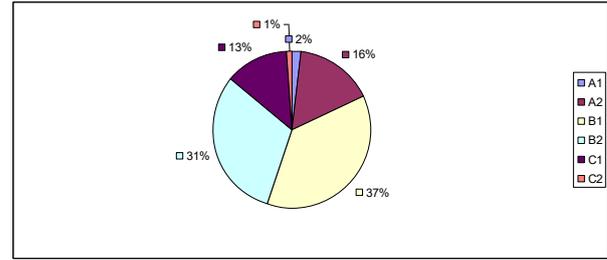


Figure 4 Teachers' Digital Experience

Thus, the analytical method proves the need to include the experience of activity in the model of digital culture of the teacher, which, as a result of this study, is a constantly updated system of knowledge, skills, experience and values in the context of information, technological, communicative and innovative literacy.

Based on the modeling of the digital culture of the teacher, the authors formulated proposals for its formation in the territory of the Sverdlovsk region. All offers are divided into three levels according to the levels of management in the education system: offers to state authorities, heads of educational institutions and teachers directly.

At the level of regional authorities, it is necessary to develop appropriate standards and programs for improving the digital culture of teachers that meet the economic requirements of the digital environment of the region. Further, it is necessary to review the issues of financing educational institutions at the expense of local municipalities in the context of increasing the share of digital devices and educational platforms for free access of teachers and children. It is advisable to develop programs for the exchange of experience of innovative teachers and improving the digital culture of teachers by funding regional competitions of digital innovations for teachers.

At the level of educational management, it is necessary to recommend creating a comfortable digital educational environment for improving the digital culture of teachers. Creating a system of measures that motivate teachers to use digital technologies in the educational process will help attract interested teachers to the educational institution who are seeking to increase the level of digital readiness of graduates.

At the level of pedagogical improvement, it is necessary to recommend that teachers exchange experience with colleagues and involve students in the practice of using digital technologies in the educational process. It will increase the personal level of digital culture of each teacher.

5. CONCLUSION

Summing up the analysis of the digital education process, the role and the content of digital literacy and digital competencies we should mark the following.

Today, educational organizations provide the base for digital experience of graduates. But there is a certain lack of technical devices for these purposes. Despite the

definite financing the amount of personal computers and other digital equipment is not sufficient.

According to the data analyzed the level of teachers' digital literacy and competencies there are few of them who can provide adequate training for students in terms in digitalization.

Thus, on the theoretical view point the essence of digital literacy and competencies should be enriched up to digital

culture including the digital experience of digital education resources operating.

On the practical view point the offered recommendations can be helpful to fulfill the demands of the State to get the highly qualified specialists ready to develop the digital economy of the region.

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