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A Study into the Requirements of Digital Society and Educators' Digital Literacy

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Abstract

The relevance of the research is justified by the digital transformation of public life, which imposes new requirements on educator training. As the Russian educational system is being modernised, much attention is paid to the inclusion of digital technologies and digital-based modes of study in the educational process. It certainly entails new challenges for the educational system, which needs time to adapt in order to integrate with the digital environment. The problem under study is relevant, firstly, due to the urgent need to introduce the tools of the digital learning environment into the established teaching model in the national education system. Secondly, the efficiency and quality of teaching depends on overcoming the existing digital divide in teachers' competences. The main research methods were the analysis of the concepts of digital society and digital literacy, the structuring of the main competences of a modern teacher that are crucial to ensure his/her competitiveness in the digital economy, and identifying existing digital gaps in the design and implementation of digitalisation in teacher education. To assess digital literacy, a questionnaire-based survey of both students – future teachers, and practising teachers, was chosen as the leading research method. The conducted study on the assessment of pedagogical digital literacy identified the existing digital divide in the design and implementation of the educational process as well as the opportunities for enhancing the interaction of its participants by incorporating technical tools and digital learning technologies. The research made it possible to determine a new vector in the construction of the pedagogical landscape of the modern learning environment in universities, aimed at preparing future teachers' creative and self-developing personalities.

Keywords: digital learning environment, digital educational resources, digital competences, digital literacy, digital divide, digital gaps.

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Introduction

The digital transformation of education is part of the global changes in society caused by the rapid development of new technologies. Their impact is so extensive and far-reaching, that education has not yet fully caught up with them. It cannot always anticipate changes and adapt to them systematically, appropriately and methodologically. It has taken time to realise that it is not just a matter of digitalisation of the educational process. Rather, the issue is one of systematic and in-depth transformation. It is necessary to elaborate the regulatory, ethical, methodological aspects, as well as aspects of another kind, of applying digital technologies for the long term, to develop a model and mechanisms for the personalization of learning implemented through the individual trajectories and routes of students' development. The implementation of an adaptive education and assessment system in the digital learning environment will allow us to take into account the needs, level and interests of the student to the greatest possible extent. Thus the education quality will increase due to the high motivation of learners and due to a change in the role of the teacher, who, to a greater extent, should become a mentor in the educational process and a designer of a personalised educational trajectory rather than a "transponder" of information. The problem under study is relevant due to the urgent need to introduce the tools of the digital learning environment into the established teaching model in the national education system, and also due to the existing digital gaps in teachers' competencies, the overcoming of which the efficiency and quality of teaching depend on.

In the current situation of the coronavirus pandemic, one is not only an observer, but also an active participant in the changes that take place in education. Research publications on the effectiveness of learning in a digital learning environment immediately started to appear in pedagogical circles worldwide (Abouhashem et al. 2021). The digital competence of an educator has been considered by scholars an important factor in achieving pedagogical goals (Joia & Lorenzo, 2021).

This rapid transition to distance learning has shown that the education system is not ready for a dramatic digital transformation. There are several reasons for that. Firstly, a clear statement of purpose is required, i.e. clearly formulated and measurable educational outcomes that reflect the needs of the modern digital world. The competences formulated in the Federal State Educational Standards for Higher Education are too global and very broad, hence they are difficult to measure. They lag behind the rapidly changing demands of the digital society. Secondly, there is a lack of competence of the teaching staff in working with new digital solutions and technologies. And most importantly, digital technologies are inaccessible for many higher education institutions.

This study was begun before the coronavirus pandemic. The research is based on the emerging demands related to the modern digital transformation of public life. The reason for these transformations is the society's entry into the digital economy, defined as a new way of economy based on knowledge and digital technologies, within which new digital skills and opportunities are being formed in the society, businesses, and the state. Education, oriented towards these demands, seemed to be actively involved in the digitalization process. However, the reality has shown that steps in this direction have been insufficient.

Purpose and objectives of the study

In the current study digital divides that prevent the creation of effective digital interactive learning environments were identified. Effectiveness and quality of teacher training depends on overcoming these gaps. In respect of the improvement of educator training programmes, it was important to assess the level of digital literacy of practising teachers in order to reduce the digital gaps of our graduates. The conducted analysis of the components of digital competences and the assessment of practising teachers' pedagogical digital literacy facilitated the identification of the existing digital divide in the design and implementation of the educational process. It made it possible to determine opportunities for enhancing the participants' interaction by incorporating technological tools and digital learning technologies into it.

Literature review

To define the competences required for a teacher to design and implement a digital learning environment, it is essential to clarify the concept of digital learning environment. In this study the term “digital learning environment” stands for a set of conditions created for the implementation of educational programmes, based on an open set of information and communication systems that are designed to meet the needs of the educational process and to guarantee the mastery of educational outcomes by students regardless of their location. The digital learning environment includes:

- Technology platforms and learning services;
- Teaching: learning technologies, technologies for engaging and motivating the audience;
- Assessment technologies: evaluations aimed at improving learning outcomes and personalising learning processes;
- Supportive external environment: regulatory and incentive measures, motivation of managers and teachers;
- Reliable infrastructure: networks, equipment (digital devices and gadgets), content, personal data policy.

The concept of digital learning environment in the works of educators and the corresponding directions of its development are considered from different perspectives (Latyshev & Latysheva, 2018).

In the scope of digital pedagogy, which is establishing now, the following points are being studied: content, approaches to define the terms “learning environment” and “digital learning environment”, and digital learning environment’s structures (Mironenko, 2019). The authors of studies on digital learning environment consider a set of different aspects of digital technology integration in the educational process: the social use of digital technology, the constructive decisions made in relation to these products, and the material resources that help them work (Garcia & Nichols, 2021).

Many colleagues identify factors that hinder the implementation of online learning. Educators’ digital competence is considered to be the most significant one (Sulisworo et al, 2021). When analysing the current conditions, the following barriers that arise in the creation of digital learning environments were identified:

- Poor working infrastructure at home (computer, camera, microphone, internet connection);
- Insufficient methodological support in the organisation of distance learning;
- Low level of self-organization and motivation of learners;
- Insufficient level of digital literacy of both educators and learners.

When selecting and developing questionnaires to study educators’ digital literacy, modern understanding of the notion «digital literacy» was adopted: digital literacy is the ability to use the opportunities offered by modern society with all its technologies, the ability to communicate with people in a new social format, to be ethical and considerate to each other. Shamalo and Aleksandrova (2007) in their study of the information competence of future teachers emphasized that this characteristic is integral. It arises from the use of information technology in educational work and includes a process of self-education based on pedagogical experience. Shmelkova (2016) notes that amongst professionals in digital economy, those are of particular importance who at first hand ensure the entire process of establishing the society of digital economy and the implementation of the digital competence model, and who themselves possess it. Consequently, in order to realise the potential of the digital learning environment, a teacher needs: media literacy, ability to think globally, ability for continuous education and creative problem solving, willingness for teamwork, communication skills and professional mobility, formed civic awareness and legal ethics. In modern digital pedagogy scholars take into consideration several terms characterizing the teachers’ competences for successful performance in the digital learning environment. These are “digital literacy”, “digital competences”, “information competences”, and “information and communication competences”.

Digital literacy is defined by some authors as the set of knowledge and skills needed to use digital technologies and Internet resources safely and effectively.

It includes digital consumption – the knowledge and use of Internet services for work and life, digital competences – the skills to use technologies effectively, and digital security – the basics of online safety (Berman, 2017). Other scholars define digital literacy as the ability to use and create content based on digital technologies, including finding and sharing information, answering questions, interacting with others, and computer programming (Eisner & Kurbatova, 2019). Sharikov (2016) examines the transformation of the definition of “digital literacy” and suggests considering a four-pillar model of digital literacy.

Digital literacy is based on digital competences, which can nowadays be classified as universal (Frumin & Dobryakova, 2019). Those are:

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

The European Commission (2017) in its definition of digital competence in the Digital Education Action Plan (DEAP) emphasises the importance of conscious and responsible use of digital technologies in teaching, at work, and in public life. It has been noted that digital competence should include the capacity for digital collaboration, security assurance, and problem solving, whilst digital literacy should include personal, technical, and intellectual (digital) skills necessary to live in a digital world. More and more educators are dedicating their research to identifying the main development directions of teachers’ digital competence to ensure the quality of educational processes in the context of the transformation of the learning environment (Zabolotska et al 2021).

Methodology

In the current study, a total of 153 respondents took part. The respondents are school teachers of history (45 respondents) and of foreign languages (108 respondents) in the Republic of Tatarstan undergoing advanced training at the Kazan Federal University. The professional experience of the respondents vary: under 5 years of experience (27 people), from 5 to 10 years (36 people), from 10 to 20 years (72 people), and from 20 years and over (18 people).

To evaluate teachers’ digital literacy the researchers used the questionnaire “Digital Literacy Skills” and the diagnostic survey “Assessment of the Ability to Use the Digital Learning Environment”.

In the questionnaire “Digital Literacy Skills”, respondents were asked to assess their confidence according to four criteria:

- Understanding digital practices;
- Information retrieval;
- Use of information;
- Creation of information.

The questionnaire had two scales: a ten-point scale and a three-point scale. The introductory part of the questionnaire contained five general questions. The respondents were asked to rate on a 10-point scale their confidence in their ability to:

- Work effectively and safely on the Internet;
- Find relevant information quickly;
- Determine whether the information found online is relevant and derives from a good source;
- Make the most of social media (Facebook, Instagram, VKontakte);
- Manage their «digital identity».

All questions were related to the educators’ digital information skills.

Results

As one can see from Table 1, the use of social media (mean score 4.0) and managing their “digital identity” (mean score 5.1) are the most challenging for most respondents.

However, respondents with up to 5 years of experience rated their digital competency skills higher. Respondents who have more than 20 years of experience rated low almost all mentioned skills.

Table 1. Assessment of respondents’ «digital information skills» in relation to work experience

№	Digital competence skills	Work experience/mean score				Total
		<i>Up to 5 years</i>	<i>5-10 years</i>	<i>10-20 years</i>	<i>20 years or more</i>	
1	Working effectively and safely on the Internet	9,6	7,25	6	4	6,7
2	Finding quickly the necessary information	9,6	8,75	6,625	5	7,4
3	Determining the relevance and quality of an information source found on the Internet	7,3	7,25	6,1	3	6,2

4	Taking advantage of online networking tools like social media	6	3,5	4,4	1	4,0
5	Managing «digital identity»	6,3	5,75	4,5	5	5,1

Figure 1 shows that the correlation in the assessment of digital competence skills is inversely proportional to work experience: the more experience, the lower the level of proficiency.

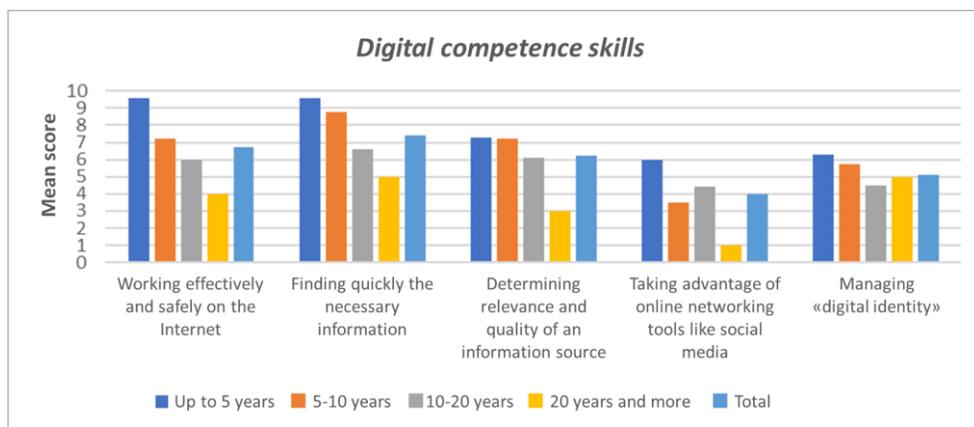


Figure 1. Correlation between digital information skills and work experience

Respondents gave answers to the questions in the form of an assessment of their confidence in mastering certain digital skills. The answers were later arranged according to the skill command levels:

- “Not confident” – 0 points – low level;
- “Fairly confident” – 1 point – medium level;
- “Very confident” – 2 points – high level.

In the part “Understanding the digital environment” a large number of respondents find it difficult: to determine the legality of reusing online information (47% of respondents rate as low and 35% as medium) and to identify who owns the information and ideas presented online (58% of respondents rate as average and 23% as low).

When assessing digital skills related to information retrieval, the majority (58% rated as low and 36% as average) found it particularly difficult to keep up to date with information from trustworthy people or organisations, constantly updating it by subscribing to RSS feeds.

There are also abilities the majority of the respondents experience issues with, and therefore demonstrate an average level of proficiency. These are:

- The ability to use advanced search parameters to limit and refine the search (18% low, 58% average);
- The ability to set information filter in order to get quick results in case there is a large number of search queries (18% low, 53% average);
- The knowledge of when to change the search strategy or stop searching (58% average).

In the evaluation of skills “use of information” only two abilities were rated as high by a fairly large proportion of respondents. These are the ability to use information from different media, for example podcasts or videos (47% assessed as high and 47% as average) and the ability to quote references to online resources (e.g. when preparing a learning assignment) using the correct format (47% high and 53% average). The assessment levels are rather evenly distributed across all the parameters. For instance 47% of the participants master the ability to use multimedia capture devices on a low level and 41% on an average level; whereas 53% of respondents indicated mastering the ability to communicate with others online on an average level and 29% on a low level.

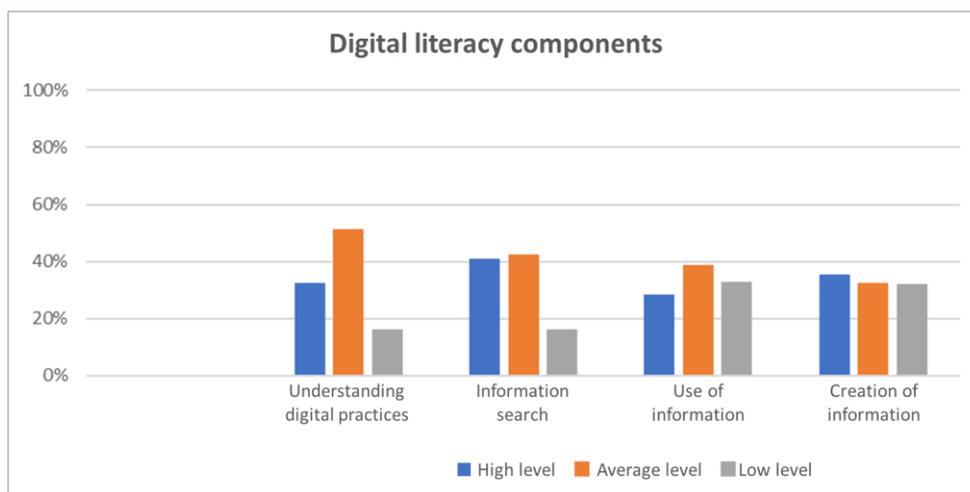


Figure 2. Development levels of digital skills according to the diagnostic units of digital literacy

The analysis of the diagnostic units presented in the diagram shows that in teacher training special attention should be paid to the development of such digital skills as the use and creation of information.

In order to consider not only the information component of digital literacy, but also the command of digital tools, a diagnostic questionnaire “Assessment of the ability to use the digital educational environment” has been developed. Six sections, presented in Table 2, were proposed for evaluation. They include digital tools that help enhance participants’ interaction in the educational process. To assess the ability in digital language proficiency, a five-point scale was used, where 5 is the highest degree of ability and 0 means a person has never heard of this product before.

Table 2. Tools of digital learning environment

TOOL	Usage in the educational process
Virtual interactive whiteboards	Designed to study (video, text, photo, graphics) notes that can be shared with others, to work together, to place on the pages of sites or blogs.
Mobile phone during the lesson	Using a mobile phone for voting or in an interactive learning environment.
Interactive workbooks	A section that concentrates on developing workbooks for students and teachers to work more conveniently with textbooks.
Cloud software	It is an integral part of document management. The cloud is used to store everything, e.g. photos, research projects, term papers, music.
Screencast	It is a digital recording of computer screen output. It contains audio or text narration.
Collaborative work	The use of tools such as Trello or Base Camp enables students to start experimenting with effective online collaboration

The analysis of the survey on digital language proficiency, shown in Figure 3, led to the conclusion that the majority of educators assessed their ability to use the technologies in the digital learning environment as average.

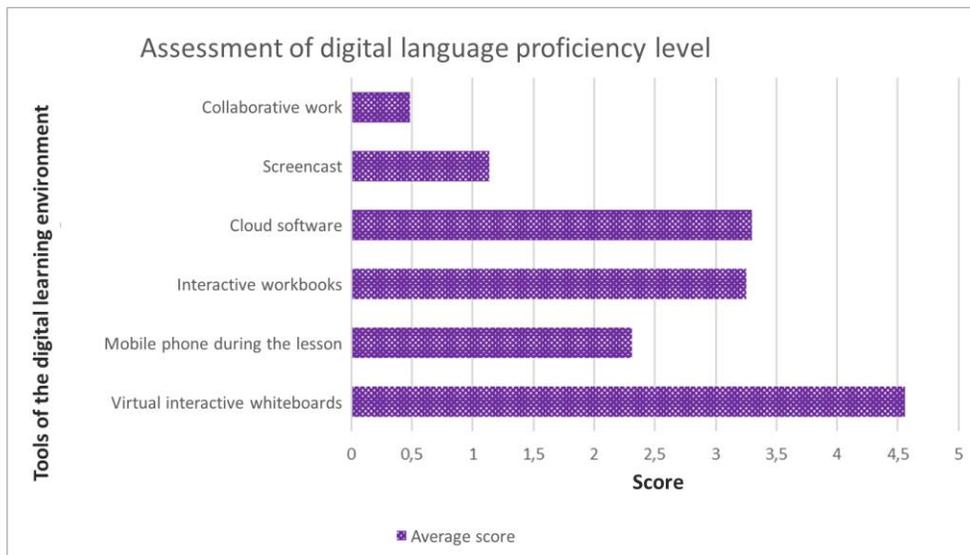


Figure 3. Results of the analysis on mastering digital language proficiency

The diagram shows that the respondents have little command in organizing collaborative work using digital tools (0.484 mean score). The skill of using screencast is also quite low (1.135 points). The command of cloud software and of interactive workbooks are rated by respondents at an average level of 3.32 and 3.254 points respectively. Teachers gave a low score (2.31, below average level) to their ability to use mobile phones in the classroom. The most advanced skill (4.56, average score) is the use of virtual interactive whiteboards.

Discussions

Currently, there is no clear unambiguous interpretation of new terms related to the development of digital education in Russian pedagogical science and practice. The analysis of approaches to terminology introduction presented by researchers Weindorf-Sysoeva et al. (2018) clearly shows the importance of the establishment of a new branch of pedagogical science, “Digital Didactics” (Blinov, 2019), that will address a wide range of digital education issues, including digital competencies of the educator.

In the current study, the emphasis is placed on the technological component, on the development of teachers' ability to consciously use new digital tools in the learning process and the ability to create new content. The study does not address such aspects as the influence of digital learning tools on the teacher's methodological repertoire, the teacher's ability to adapt teaching methods to different learning formats (blended, hybrid, etc.), changes in the forms of social interaction with the learner in the digital environment and many other aspects related to the complex digital transformation of the educational process.

This approach is not accidental. Its logic is determined by the imposed conditions of the pandemic when all participants of the educational process suddenly and without any preparation found themselves in entirely new conditions so that the main focus of their attention was on the mastery of digital learning tools. Such a drastic change meant a radical restructuring of the whole learning process, revision of the roles both of a teacher and a student, revision of approaches to lesson organisation, independent work, feedback, social interaction, reassessment of the significance and efficacy of different teaching methods in the new conditions.

Based on the conducted research changes have been made to the educator training programmes at Kazan Federal University, both at the bachelor's and master's levels. The new modules «Pedagogical activity in a digital educational environment» (bachelor's degree) and «Design of digital educational environment» (master's degree) are aimed at the formation and development of digital competencies of students - future teachers. These competencies will enable students to meet pedagogical challenges in new conditions of the digital world. The effectiveness of the development of these competencies will become a further focus of the authors' research during the implementation of pedagogical educational programs. Improvement of these programs will undoubtedly take place with reference to the research carried out in the pedagogical community.

Conclusion

The conducted analysis showed that in teachers' training special attention should be paid to the development of such digital skills such as the use and creation of information. It is also important to note that when organizing the learning processes, teachers use digital tools to a far less extent than the capacity they offer. As the results of the study demonstrated, educators hardly use the resources for organising collaborative work. Instead they rather prefer to use email for sharing the notes or to distribute materials during the class. This has been proven in the time of coronavirus pandemic when the transition to remote work was inevitable. Screencast is not favoured as an educational digital tool. Teachers opt for live communication rather than conducting online lessons.

The evaluation of the results on the use of interactive educational whiteboards show that educators are ready to use them in the classrooms. Moreover, they are confidently using and integrating them into the educational processes.

Based on the analysis of the literature, conducted research diagnostics and pedagogical experience, the researchers identified “Digital gaps in the creation of a digital interactive educational environment” that is focused on obtaining a high-quality learning outcome. These digital gaps are:

1. Lack of unified ideas, concepts and theory of digitalisation of education.
2. Lack of adequate definitions and terminology on digitalisation of education.
3. Absence of a systematic field of scientific knowledge examining digitalisation that goes beyond classical pedagogy, which is based on the philosophy of education, psychology, systemology, computer science, and cybernetics.
4. Restructuring of the classical learning environment, i.e. expanding educational space and blurring the boundaries of educational institutions.
5. Lack of targeted intensive digital information flows within the educational environment.
6. New quality of educational documents.
7. Low methodological teacher training in the use of digital learning environment.
8. Lack of awareness of digitalisation in the teaching environment.
9. Unpreparedness of teachers and students to work with digital media.
10. A limited number of adapted software products (IT) and educational programs to work in a digitalised environment.
11. The high cost of modern digital learning platforms and the complexity of transferring content from one platform to the other.
12. Low level of emotional connections, emotional contagion.
13. Loss of empathy.

When improving teachers’ university training, it is necessary to take into account the demands of modern society and the needs of education to create an effective digital interactive educational environment and to strengthen the development of digital skills of future teachers.

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