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OVERCOMING BARRIERS TO THE DEVELOPMENT OF HIGHER EDUCATION TEACHER DIGITAL COMPETENCIES: CHALLENGES AND SOLUTIONS

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ABSTRACT

Objective: Investigate barriers to higher education teachers' development of digital competencies and propose solutions.

Method: A survey was conducted among teachers at the National Research University "MPEI" to classify barriers into organizational, technical, methodological, and psychological categories.

Results: The survey identified significant organizational and psychological barriers. Proposed solutions include assessing teachers' digital competencies and incorporating these assessments into performance indicators, alongside comprehensive support systems for teachers.

Practical Implications: Emphasizes the need for collaborative efforts between university administration and teachers to enhance digital competencies, crucial for adapting to digital education.

Conclusions: Developing digital competencies among higher education teachers is vital for successful digital education adaptation, requiring joint efforts to overcome identified barriers and improve educational quality.

Keywords: Digital Competencies, Higher Education, Teacher Development, Educational Barriers, Technology Integration

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Introduction

In recent years, the digital economy in Russia has demonstrated significant growth, making a significant contribution to the country's Gross Domestic Product. According to research, in 2022, the gross added value of the IT sector amounted to 3.2% of Russia's total GDP (Anisimov et al., 2023). According to statistics, the number of graduates studying in the field of IT technologies has increased by 15% over the past 5 years. This indicates the growing interest of young people in digital professions and the state's interest in constantly increasing the effectiveness of policies in the field of digital economy and education.

The rapid development of digital technologies leads to changes in all the most important areas of human activity, including education. The International Association of Universities (IAU) has identified the study of the implementation and development of digital technologies in higher education as one of its 4 strategic priorities. "…*This constitutes an important transformation of higher education that comes both with new opportunities as well as challenges. It is an ongoing process that higher education institutions are reacting to, interacting with, shaping to remain relevant and to adapt to increasingly digitalised societies*" (International Association of Universities, 2022).

The report "Higher Education in the Digital Era: The current state of transformation around the world" published by the IAU presents the results of monitoring the current state of digital transformation in higher education. The report noted that the majority of university leaders who participated in consultations on the development of education consider its digital transformation a priority (68%). At the same time, it is noted that purchasing and installing the latest equipment can be a fairly simple process, however, increasing the motivation and activity of teachers, staff and students requires more attention and effort from university management (Jensen, 2019).

Really, the process of digitalization of higher education is radically changing the work of universities and has an impact on all aspects of their activities: teaching, educational, research, administrative and financial-economic. It requires the creation of appropriate infrastructure and widespread use of digital technologies in teaching and research, as well as preparing students and teachers to master the new digital competencies required in their professional activities.

Literature review

The digital competencies of higher education teachers are an important factor in successfully adapting to the changes caused by the education digitalization. Today, there is great interest among researchers in the topic of working with university teachers digital barriers. All authors emphasize that in the modern world digital technologies play an increasingly important role, and teachers need to be able to use them in the educational process. In this regard, it is important not so much to learn how to use technology, but to be able to adapt to changes and overcome emerging barriers.

Ertmer's study on the integration of digital technologies among teachers identified two types of barriers: first-order and second-order. First-order barriers relate to external obstacles, such as limited resources or lack of technical support. Second-order barriers, such as lack of confidence or different mindsets, are internal barriers (Ertmer, 1999). In other works, R. Bland (2007), T. Buchanan, P. Sainter, G. Saunders (2013), N. Magen-Nagar D. Maskit (2016) classified barriers into individual and organizational ones. Individual barriers relate to characteristics of

individuals, such as levels of self-esteem and digital proficiency. Organizational barriers relate to organizational responsibilities, such as access to resources or resistance to change.

R. Schulz, G.M. Isabwe, and F. Reichert (2015) proposed four types of barriers, including human factors, intrinsic values, tool requirements, and environmental factors. C. Mercader and J. Gairín (2020) identify similar groups of barriers: personal, professional, institutional and contextual. They also note that the most significant professional barriers are pedagogical beliefs about teaching using digital technologies and lack of knowledge about the didactic use of digital technologies.

M.P. Prendes (2010), M. Romero (2011) and J. Salinas (2008) identify the following types of factors influencing the integration of digital technologies: political, economic, ideological, educational, cultural and psychological. Political factors relate to university policies, economic factors relate to resources for change, and ideological factors relate to the ability of faculty to see the benefits of digital technologies. Instructional factors refer to the ability to learn professionally, cultural factors refer to the culture of change and culture of intention, and psychological factors refer to trust in technology.

C. Mercader and J. Gairín note that professional barriers to the development of digital competencies are higher among teachers of humanities and arts-related disciplines. In addition, the authors indicate that it is necessary to work to increase the level of digital competencies of teachers, including through the inclusion of these tasks in the strategic plans of universities (Mercader & Gairín, 2020).

L.M. Andryukhina, N.O. Sadovnikova, S.N. Utkina and A.M. Mirzaahmedov (2020) in their work they classify barriers into didactic, risk and image barriers that prevent teachers from mastering information, communication and digital technologies.

E.Yu. Turner identifies socio-economic and psychological-pedagogical barriers as barriers to digital transformation. Among the psychological and pedagogical barriers that impede the development of digital competencies among higher education teachers, several main aspects can be identified. First, many teachers lack interest in introducing new technologies and innovations. They prefer to continue using traditional teaching methods without resorting to digital tools. Second, some educators find it difficult to keep up with new technological changes. The rapid pace of development of digital technologies can create a feeling of lag and uncertainty in their use in the educational process. In addition, some teachers and students have formed beliefs about the complexity and need for special skills to use digital technologies. This may create additional barriers to the successful implementation of digital tools in the educational process. And finally, some teachers do not want to leave their comfort zone and prefer to stay on familiar ground, unwilling to adapt to new technologies and change their outdated teaching methods (Turner, 2022).

In general, research confirms that any barriers play an important role in limiting digital transformation in the educational sector. To successfully develop digital competencies among teachers, it is necessary to actively overcome these barriers and encourage the introduction of new technologies into the educational process (Basilotta-Gómez-Pablos et al., 2022; Masalova, 2021; Moreira et al., 2023; Noskova et al., 2022).

Methods

In this study, barriers are classified into 4 groups:

1. Organizational barriers that are associated with a lack of support from the university administration, insufficient funding for projects to develop digital competencies and the lack of a coordinated development strategy.

2. Technical barriers, which include low Internet connection speed and limited access to digital resources, etc.

3. Methodological barriers associated with the inability to use digital technologies and adapt educational material to the digital environment.

4. Psychological barriers, which include negative attitudes and concerns of teachers regarding the use of digital technologies.

The survey was conducted using the Yandex-form service, the link to which was distributed through corporate email. The survey consisted of 3 blocks: general, special and additional. The first block included general questions about the respondent: gender, age, position, education, field, subjective assessment of his digital literacy level. In the second block of questions, respondents had to use a Leukert scale to assess the presence of organizational, technical, methodological and psychological barriers, and 5 questions were presented for each type of barrier. The third block included additional questions that were aimed at determining the teacher's attitude to the phenomenon of digitalization of education, their assessment of the importance of professional digital competencies, digital services and tools.

As part of the study, a survey was conducted among teachers of the National Research University MPEI to assess their level of barriers from four identified groups. 288 teachers took part in the survey. The age of the respondents ranged from 31 to 78 years. More than half of the respondents have a basic technical education: 36.5% in the field of technology and technical sciences, 34.4% in the field of engineering, 15.6% in the field of mathematical and natural sciences, and 13.4% have a basic education in the humanities. pedagogical and other areas of training. Almost half of the respondents have the position of associate professor (47.9%), 20.1% - senior lecturer, 16.3% - assistant.

More than half of teachers highly rate their digital literacy (8 points – 33.7%, 9 points – 26.0%, 10 points – 12.5%), and less than 7.3% of respondents believe that their level of digital literacy is below 5 points.

Results

The results of the survey confirmed the hypothesis that teachers face all the identified types of barriers. At the same time, the level of organizational and psychological barriers for teachers of the National Research University MPEI have higher values.

Analyzing the results, it should be noted that teachers at the National Research University "MPEI" use a fairly large number of digital technologies and tools, their distribution by type of activity is presented in Figure 1.

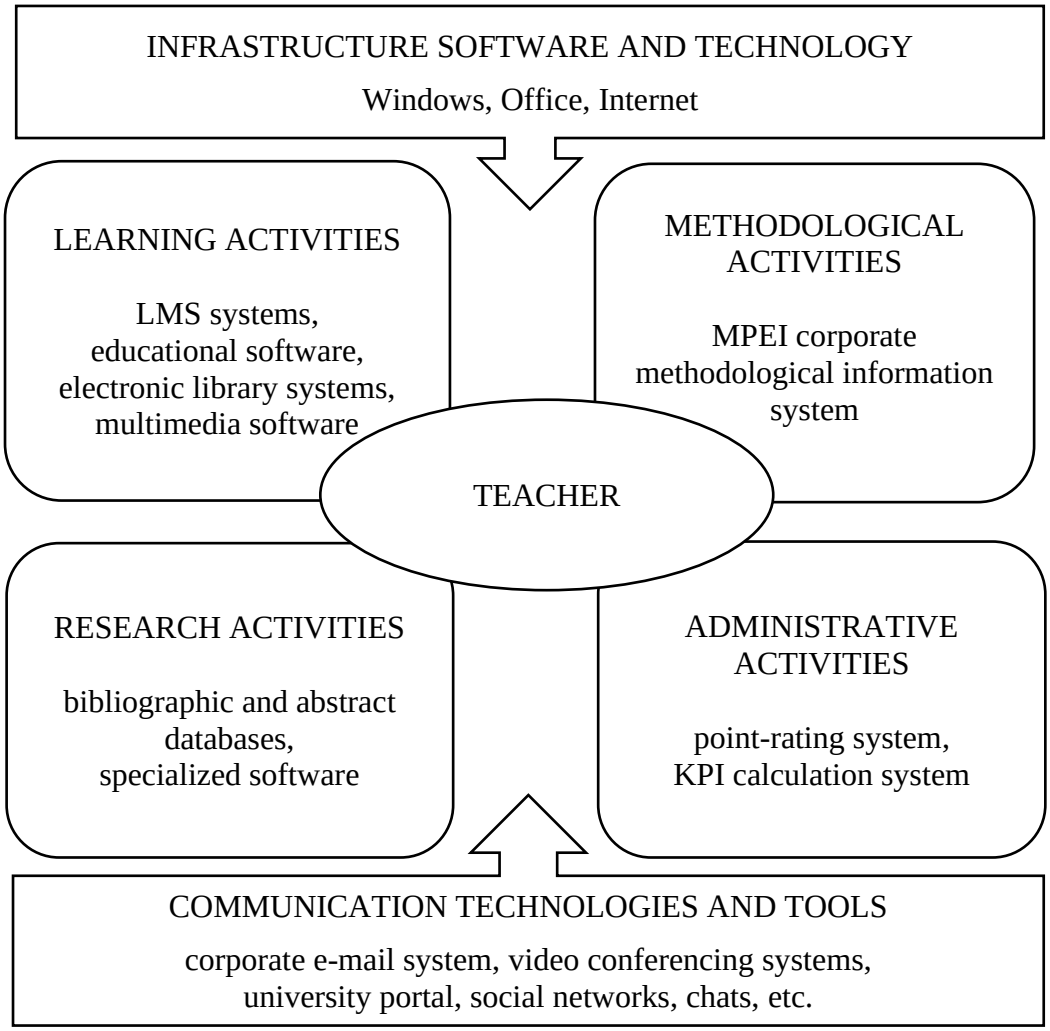
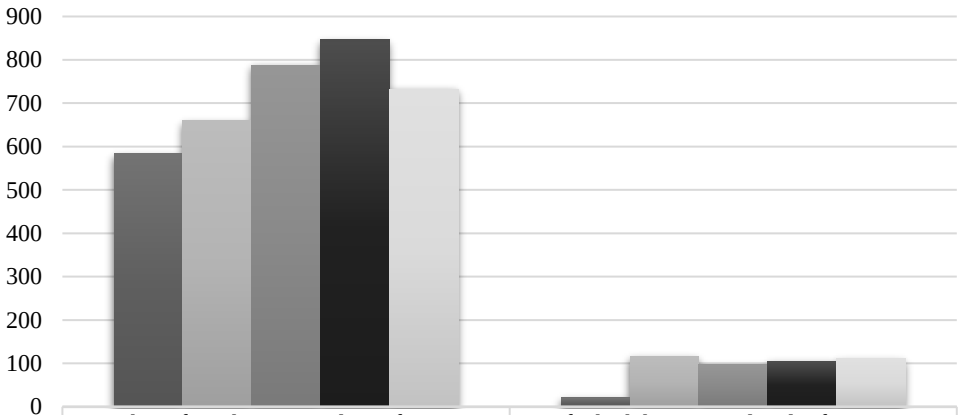


Figure 1. Digital environment of the National Research University teacher "MPEI"

University teachers regularly improve their level of professional competencies in the field of computer science and digital technologies. Data on the number of teachers who have undergone advanced training in this area are presented in Figure 2.

It should be noted that the structure of training programs changes every year. So, if in 2019 and 2020 most of the teachers underwent advanced training in information technologies, which relate to administrative and methodological activities, then in 2021 and 2022 - to educational ones.

However, despite the structured work to improve the digital competencies of teachers, surveys and interviews showed that they have barriers that impede the development of digital competencies.



	Number of teachers trained in information technology	of which have completed information technology training 2 or more times
2019	584	21
2020	660	115
2021	788	97
2022	846	105
1st half of 2023	732	111

Figure 2. Number of teachers of the National Research University "MPEI" who underwent advanced training in information technology for 2019-2022

Table 1 presents the most significant barriers to the development of digital competencies from the point of view of teachers at National Research University MPEI, as well as possible ways to overcome them.

Table 1. Barriers to the teachers digital competencies development and ways to overcome them

Barriers	Possible Solutions
Organizational:	
Lack of assessment of teacher digital competencies	– Development of a methodology for assessing digital competencies of teachers and inclusion of assessment results in key performance indicators (KPI)
Lack of management support system	– Implementation of a service for self-selection and enrollment in additional education programs (including information technology) into the teacher's personal account. – Providing opportunities for advanced training for teachers in other educational organizations, participation in conferences, exhibitions and round tables
Excessive teacher workload	– Revision of teaching staff workload standards – Using flipped classroom technologies
Technical:	
Low user-friendliness of the information systems interface	– Systematic, centralized work on the creation and refinement of digital services of the university - according to uniform quality standards and in accordance with the requirements of end users (employees, students, industrial and academic partners of the university, etc.)
Methodological:	
Copyright threat	– Inclusion of information security and intellectual property protection programs in the teacher training plan
Psychological:	
Generation gap	– Continuous training of teaching staff in information technology at programs of various levels, depending on the completed assessment of digital competencies – Using digital assistants

The most significant for MPEI teachers turned out to be organizational barriers to the development of digital competencies - these are barriers associated with the lack of support

from the university administration, insufficient funding for digital educational projects, and the lack of a coordinated strategy for the development of digital competencies of teachers. Organizational barriers are associated with responsibilities related to the organization itself, for example, such as the provision of resources, so they cannot be overcome without the use of organizational measures at the administrative level.

Thus, many teachers do not see the point in mastering information technology due to the fact that the management of the university does not in any way assess the level of their digital competencies. This barrier is especially highlighted by employees from 41 to 50 years old; department heads are the leaders among positions. Considering that 80% of employees name financial incentives as the main incentive for the development of digital competencies, the most effective would be not only to systematically evaluate them, but also to include its results in the calculation of teacher key performance indicators.

Also, many teachers note among the problems the lack of a support system in mastering digital competencies. Despite the system of drawing up a plan for advanced training of teaching staff based on requests from departments and the constant improvement of information accessibility of the activities of the continuing education unit, for many teachers the process of selecting the necessary educational program and enrolling in it is still a difficult undertaking. The introduction of a self-selection and registration service into a teacher's personal account will simplify this process and, as a result, increase the effectiveness of such programs.

However, we must not forget that the number of technologies used in education will always be greater than the number of advanced training programs offered within the university. It is very important for teachers to see the experience of other universities, attend exhibitions dedicated to the digitalization of education, undergo internships, and participate in conferences and round tables. And this is impossible without the allocation of funding from the management of the educational organization.

Teachers named their excessive classroom and teaching load as one of the most significant barriers. This point was especially highlighted by associate professors, and a little less so by senior teachers and assistants. Indeed, the workload of teachers is never limited only by the class schedule. Most of the working day is spent preparing materials, developing academic course working program and methodological recommendations, scientific work, and consulting students. The organization's goal is to teach teachers to reduce their workload through the use of information technology, and not to increase it even more. An alternative is the use of flipped classroom technologies: transferring part of the lecture classes to videoconferencing or using online courses and video lectures for general disciplines.

Technical and technological barriers to the use of digital technologies are associated, for example, with low Internet speed or lack of access to digital educational resources. According to the results of a survey for MPEI teachers, the highest level of barriers is related to the inconvenient interface of digital services used for methodological work. This problem is most effectively solved at the stage of designing information systems - including in the terms of reference the development of a "friendly" interface and the use of a single style for all information systems or their modules at the university. However, often an educational organization already uses a large number of information systems with different functionality and very different interfaces. In this case, it is necessary to provide for the possibility of processing the systems interface and their integration.

Methodological barriers are associated with the inability of teachers to use digital technologies for teaching, lack of knowledge in the field of e-learning, and inability to adapt educational material to the digital environment. However, among all the possible

methodological barriers, teachers of the National Research University MPEI cited concerns about preserving their copyrights on materials transmitted to students using the Internet. As possible ways to overcome this barrier, we can propose the inclusion of programs on information security and intellectual property protection in the training plan for advanced training of teaching staff.

Psychological barriers are associated with negative attitudes and concerns of teachers regarding the use of digital technologies in teaching, lack of understanding of the value of digital technologies for the educational process, as well as low motivation of teachers. The highest psychological barrier is the barrier associated with the fact that teachers perceive a generation gap in the use of information and digital data between them by students, and on this issue all teachers participating in the survey expressed almost complete unanimity. To reduce the impact of this barrier, it is necessary not only to include information technology programs in the teaching staff training plan, but to send teachers to programs of different levels depending on the completed digital competencies assessment. Also, a possible solution to the problem would be the spread of the practice of using digital assistants.

Conclusion

Digital competencies of higher education teachers play an important role in successful adaptation to the digitalization of education. Research shows that the need for digital competencies among teachers is driven by the growing dependence on technology in education. Teachers need to be able to use digital technologies in the educational process, as well as adapt to changes and overcome emerging barriers.

Organizational, technical, methodological and psychological barriers are the main obstacles in the development of digital competencies of teachers.

To overcome these barriers, it is necessary to develop methods for assessing the digital competencies of teachers, introduce support and training systems, improve the technical infrastructure and create a positive atmosphere at the university.

A study conducted among teachers of the National Research University MPEI showed that the most significant barriers identified by them are organizational barriers. To overcome them, it is proposed to develop methods for assessing the digital competencies of teachers, including assessment results in key performance indicators, and introducing a system of support and professional development for teachers.

In general, the development of digital competencies of higher education teachers is an important task that requires joint efforts of the university administration and teachers. Only by improving the digital competencies of teachers can successful adaptation to digital education be ensured and the quality of the educational process improved.

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