educação revista do centro de UFSM educação ISSN: 1984-6444

ISSN: 1984-6444 | http://dx.doi.org/10.5902/1984644466423

Digital competence of teachers and students in Yakutia: problems and prospects of e-learning during the pandemic

Competência digital de professores e alunos em Yakutia: problemas e perspectivas do e-learning durante a pandêmica

Maksim Anatolyevich Sorochinsky
M. K. Ammosov North-Eastern Federal University.
maksimsorochinsky@yandex.ru - http://orcid.org/0000-0002-4651-3384

Recebido em 24 de junho de 2021
Aprovado em 26 de agosto de 2021
Publicado em 30 de setembro de 2021

RESUMO
Sob medidas de auto-isolamento e quarentena durante a pandemia COVID-19 em 2020, o ensino à distância é urgente em todos os níveis educacionais. Esses eventos afetaram a competência digital de professores e alunos de especialidades pedagógicas que lecionam para alunos e escolares. O artigo analisa as competências digitais necessárias para um professor moderno implementar com sucesso as necessidades educacionais dos alunos ao usar tecnologias de ensino à distância e e-learning. O objetivo da pesquisa é aumentar o nível de competência digital, avaliando esse nível e identificando problemas na utilização do e-learning. O estudo foi realizado por meio de um questionário desenvolvido pelo centro analítico da Agência Nacional de Pesquisas Financeiras (NAFR) Russian Teachers 'Digital Literacy, permitindo a identificação das principais competências exigidas para um professor moderno, como atuar em ambientes de ensino à distância, conhecimentos sobre a noções básicas de tecnologias de nuvem e a capacidade de organizar a interação online e offline, usando vários serviços. De acordo com o cálculo do coeficiente de concordância de Kendall, foi feita uma classificação dos lados positivos e negativos identificados na organização da interação remota entre professores e alunos da República de Sakha (Yakutia) durante a pandemia. Os resultados do estudo permitiram aumentar a eficiência do trabalho com alunos e professores e organizar cursos de atualização e apoio na implementação do e-learning.
Keywords: Competência digital; E-learning; Pandemia.

ISSN: 1984-6444 | http://dx.doi.org/10.5902/1984644466423

ABSTRACT
Under self-isolation and quarantine measures during the COVID-19 pandemic in 2020, distance learning is urgent at every educational level. These events affected the digital competence of teachers and students of pedagogical specialties who teach students and schoolchildren. The article analyzes the digital competencies required for a modern teacher to successfully implement students' educational needs when using distance educational technologies and e-learning. The research objective is to increase the level of digital competence by assessing this level and identifying problems in the e-learning usage. The study was carried out through a questionnaire developed by the National Agency for Financial Research (NAFR) analytical center Russian Teachers' Digital Literacy, allowing identification of the main competencies required for a modern teacher, such as work in distance learning environments, knowledge of the basics of cloud technologies, and the ability to organize online and offline interaction, using various services. According to the calculation of Kendall's concordance coefficient, a ranking of the plus and minus sides identified in the organization of remote interaction among teachers and students of the Republic of Sakha (Yakutia) during the pandemic was made. The study outcomes allowed increasing the efficiency of work with students and teachers and organizing refresher courses and support in the e-learning implementation.
Keywords: Digital competence; E-learning; Pandemic.

Introduction

The world population constantly faces certain challenges, solving which, humanity is moving forward, and this gives an impetus for the development of all spheres of human activity, new inventions, and discoveries. The COVID-19 pandemic is currently a challenge. Despite all its negative consequences, there are factors that have allowed making a distance format as a main tendency in many countries' education system during the quarantine and self-isolation. In this regard, the skills required for the organization of unimpeded contact work, using distance educational technologies and e-learning, have gained significant relevance among teachers.

In Russia, special attention is paid to the digitalization of education. The Digital Economy of the Russian Federation Program emphasizes a need to increase the awareness and digital literacy of Russians. The task is set to expand the share of the population with digital skills to 40% by 2024 (GOVERNMENT OF RUSSIAN

ISSN: 1984-6444 | http://dx.doi.org/10.5902/1984644466423

FEDERATION, 2018). In addition, within the framework of the Education national project (2019–2024), a number of projects are envisaged contributing to the development of teachers' digital competencies: Teacher of the Future, Young Professionals, and Digital Educational Environment (MINISTRY OF SCIENCE AND HIGHER EDUCATION OF RUSSIAN FEDERATION, 2021).

The purpose of the article is to increase the level of digital competence in the region by analyzing the level of digital competence of teachers and students of pedagogical specialties and identifying plus and minus sides in the use of e-learning in Yakutia during a pandemic. In our opinion, this allows working out a strategy for the development of digital technologies through advanced training and upgrading educational programs in the region.

Despite the rather common term, researchers single out various components of digital competence. Nevertheless, teachers need a clear and amenable structure for the development and improvement of this kind of competence.

Literature review

Based on the Russian and foreign researchers' opinions and studies, the conclusion is that the pandemic has significantly affected the education sector, and, in particular, the use of modern educational resources. It triggered the development and digitalization of education.

The concept of digital competence is based on such concepts as ICT and information competences and includes digital literacy.

In 1997, P. Gilster first defined the term "digital literacy" in his monograph "Digital Literacy". The author understood it as "the ability to critically assimilate and use information obtained with the help of a computer in various forms from a wide range of sources" (1997, p. 10). A. Martin and D. Madigan continued their scientific research in this area and defined it as "the awareness, attitudes, and ability of individuals to properly use digital tools and means" (2006). Along with digital competence, the processes of theory (BLAYONE, 2019) and practice of digitalization in education, the effective use of e-learning and its components have been developing. Among them

ISSN: 1984-6444 | http://dx.doi.org/10.5902/1984644466423

are learning in the digital age (BATES, 2019), the use of interactive whiteboards in teaching children with autism spectrum disorder (CATTIK, & ODLUYURT, 2019), teaching students using a complete inverted learning (BARBER & BLAYONE, 2018), identifying the effectiveness of using smartphones in the educational process (MAXWELL et al, 2017), integrating mobile learning in colleges (QUARLES et al, 2017), using programming languages in teacher training (PROKOPIEV et al, 2020), and using digital technologies in music education (GORBUNOVA, 2019). R.C. Clark and R.E. Mayer developed recommendations for users and developers of e-learning materials (2016, p. 507).

Also, the development of this direction has been taking place in Russia. The education informatization has been actively developing since the 90s. M.P. Lapchik considers the problem of teachers' training in the dynamically developing aspects of education informatization (2021); N.V. Gafurova pays attention to the creation of a methodology for teaching information technologies and their development (2011). There is a widespread use of the term ICT competence, considered by G.U. Soldatova as "... the ability and readiness of an individual to confidently, effectively, critically and safely choose and apply information and communication technologies to solve problems in various spheres of life" (2015, p. 6). Continuing research in the field of informatization and ICT competence, the aspect of digital competence is developing. So in S.M. Gushchina's work, the key role is assigned to the formation of the teacher's digital competence in digital technologies (2017).

The teacher is one of the key figures in the field of digitalization and the development of digital competencies. So in E.Z. Vlasova's research (2017), special attention is paid to the effective training of future teachers to use e-learning. Digitalization sets a new vector for the development of the northern territories, affording endless opportunities for development and communication and training specialists in pedagogy (TRETYAKOVA, 2020). Researchers have accumulated a wealth of experience in the education digitalization in the northern regions (BARAKHSANOVA, 2019), training teachers to use the elements of e-learning in the Arctic regions, the aspects of which are dealt with by E.A. Barakhsanova (2017).

ISSN: 1984-6444 | http://dx.doi.org/10.5902/1984644466423

The COVID-19 pandemic accelerated the pace of digitalization and revealed the problems and prospects for the development of e-learning (DE' et al, 2020). Numerous studies were carried out during the pandemic which showed the impact of the pandemic on the education in various countries. A study by Jan Delcker and Dirk Ifenthaler at a vocational school in Germany concludes that a special role is played by the technological infrastructure and teachers' competence (DELCKER & IFENTHALER, 2020). At the same time, research conducted in Italy at the Politecnico di Milano University pays special attention to efficient management in the educational establishment, focus on the students' needs and support of teachers for the continuity of education (AGASISTI & SONCIN, 2021). Researchers from Portugal, M. J. Sá and S. Serpa, come to similar conclusions that it is necessary to improve the digital sustainable development of higher education by participating in the elimination of the consequences of the pandemic (2020). Also, data are given concerning the education digitalization in the UK and the USA, presenting digital inequality of low-income families and shifting responsibility for the education of children from schools to parents (GREENHOW et al, 2021).

Taking into account international experience, during the pandemic, Russian scientists actively investigated the problems of education digitalization: identification of various approaches in the implementation of online education (GORBUNOVA, 2019), the important role of the electronic educational environment of the university as the basis for the education digitalization (KOSTIKOVA et al, 2020), the transformation of pedagogical education during the pandemic (TRETYAKOVA et al, 2020), and a study of digitalization of pedagogical universities and pedagogical specialties (VLASOVA et al, 2020).

After analyzing the international and Russian experience of education digitalization and the development of digital competence, the following understanding of digital competence is suggested: the willingness and ability to use digital resources in educational activities, creation of educational content for the implementation of e-learning, establishing collaboration and interaction using mediated technologies, and realization of the digital educational environment potential.

ISSN: 1984-6444 | http://dx.doi.org/10.5902/1984644466423

Materials and methods

The study involved teachers of higher and secondary vocational education and students acquiring pedagogical competence at institutions of higher and secondary vocational education. Fifty teachers to a hundred students is the ratio in the study.

At the first stage, the level of digital competence was determined applying a questionnaire Readiness to Use Digital Technologies in the Educational Process developed by the NAFR analytical center Russian Teachers' Digital Literacy (1). According to the methodology, 22 competencies are assessed, which are grouped into the following parts: 1. Professional responsibilities (16 points); 2. Digital resources (12 points); 3. Teaching and learning (16 points); 4. Assessment of students (12 points); 5. Empowerment of students' rights, opportunities and independence in the educational process (12 points); 6. Development of students' digital competence (20 points). The maximum score for all parts is 88 points.

At the second stage, a survey was conducted, applying the method of expert assessment, to identify positive and negative experiences in the use of e-learning and elements of distance educational technologies among teachers and students of pedagogical specialties during the pandemic The respondents expressed their opinion and singled out 5 positive and negative factors, described and ranked them in descending order of importance (rated from 0 to 5, where 0 is not important, and 5 is very important).

The results of the survey were grouped and mathematically processed to rank and check the objectivity of the data obtained. To check it and determine the consistency of opinions, Kendall's concordance coefficient was calculated with the following formula:

$$W = \frac{12S}{n^2\,(m^3 - m)}$$

where, *S* is the sum of the squared deviations of all assessments from the mean, *n* is the number of respondents, *m* is the number of statements to be analyzed. The coefficient under consideration can vary in the range from 0 to 1, where 0 is a complete inconsistency of opinions, and 1 is an absolute agreement among experts.

ISSN: 1984-6444 | http://dx.doi.org/10.5902/1984644466423

Results

The data in Table 1 present the assessment of the level of digital competence.

Table 1 – Assessment of the level of teachers' and students' digital competence

Blocks' names	Teachers (average grade)	Students (average grade)
Block1. Professional responsibilities (16 points)	10	5
Block 2. Digital resources (12 points)	6	8
Block 3. Teaching and learning (16 points)	11	9
Block 4. Assessment of students (12 points)	8	5
Block 5. Empowerment of students' rights, opportunities and independence in the educational process (12 points)	5	5
Блок 6. Development of students' digital competence (20 points)	10	14
Total (Maximum 88 points):	50	46

Source: own research

The average indicator of digital competence of the tested teachers turned out to be slightly higher (by 4.5%) than that of students. However, if we analyze each block separately, we observe a slight prevalence of average scores among students in blocks 2 and 6.

Block 1 includes: professional cooperation, reflection, communication, using digital communication, and continuous professional development in the field of digital technologies. In view of the fact that students are still in the learning process, the indicator for this level is significantly lower than that of teachers.

Block 2, digital resources, including competencies in the ability to select educational resources, create and use digital content, ensure the protection of personal data, demonstrates a slight advantage (by 8.3%) in students. Block 6, the development of students' digital competence, shows imparting information literacy, the creation and responsible use of digital content (students' level is higher by 20%). This may be due to the fact that students have a better command of the selection of digital materials and ensure their data protection.

ISSN: 1984-6444 | http://dx.doi.org/10.5902/1984644466423

According to the data in blocks 3 and 4, teachers have a level higher by 12.5% and 33.3%, respectively. The organization of students' education, using digital technologies, including joint work and project activities, is reflected in block 3. Block 4 includes receiving feedback, monitoring students' progress and analyzing the data obtained. Teachers have a higher level, which indicates more pedagogical experience in working with students.

All respondents have the same level in block 5. This block shows the management of the educational process, students' involvement in it, and strengthening cognitive abilities.

The second stage revealed the positive and negative experiences in using e-learning by teachers and students during the pandemic. Table 2 presents the results of calculating Kendall's concordance coefficient and ranking the identified factors.

Table 2 – Assessment of the plus and minus sides in the use of e-learning by students and teachers during the pandemic

Rank	Teachers		Students	
	Factors	**Kendall's concordance coefficient**	**Factors**	**Kendall's concordance coefficient**
Plus sides				
1	High efficiency	0.83	Availability and individualization of training	0.71
2	Communication regardless of location	0.59	Communication regardless of location	0.65
3	Availability and individualization of training	0.55	High efficiency	0.53
4	Low cost and economic efficiency	0.32	Low cost and economic efficiency	0.3
5	Ecological compatibility	0.1	Ecological compatibility	0.24
Minus sides				
1	The quality and complexity of the development of educational materials	0.88	Motivation and self-organization	0.67
2	Necessary equipment and ability to work with it	0.6	The quality and complexity of the development of educational materials	0.6
3	The Internet access problems	0.42	The Internet access problems	0.54
4	Lack of personal contact with the teacher / student	0.4	Lack of personal contact with the teacher / student	0.5
5	Motivation and self-organization	0.21	Necessary equipment and ability to work with it	0.27

Source: own research

ISSN: 1984-6444 | http://dx.doi.org/10.5902/1984644466423

The calculated Kendall's concordance coefficient coincides with the average point for each factor and allows us to conclude about the objectivity of the data obtained and the assigned significance of each factor (ranking). This stage of the study allowed identifying the problems and prospects for the development of e-learning, which is necessary for the further development of digitalization of education. So the plus sides include:

High efficiency.

Teachers put this factor in the first place in terms of importance, because high efficiency of the educational process can be achieved through the use of visual multimedia materials and the ability to repeat and view materials at any convenient time. Students put this factor in the third place in terms of importance. So the educational process becomes easy enough to track both for students and teachers.

Communication regardless of location.

Students noted that they can join the lesson or take lessons from anywhere in the world where there is an Internet connection. The teachers focused on communicating with colleagues from other cities and countries and conducting joint research.

Availability and individualization of training.

This factor scored the most points among students. Its significance is also confirmed by the calculated coefficient (0.71). Students are attracted by the opportunity to study with first-class teachers from all over the world. Online learning allows choosing the time convenient for you, the place for learning, and the program acquired at your own pace. Despite the fact that this factor takes the third place among teachers, its importance is also great (0.55).

ISSN: 1984-6444 | http://dx.doi.org/10.5902/1984644466423

Low cost and economic efficiency.

Teachers and students were unanimous regarding this factor; the calculated coefficient (0.32 and 0.3) indicates a low level of agreement. This means that this factor is not of priority importance for both groups.

Ecological compatibility.

It is at the lowest priority level. However, some respondents point out that the deforestation is reduced due to the transition to electronic format.

In this study, the most important minus sides in the e-learning use were also identified. These data are the most valuable, as they allow determining the further developmental trajectory. Let us consider the interpretation of negative factors:

The quality and complexity of the development of educational materials.

It is the most significant negative factor among teachers (0.88). They point out that every teacher must master a large number of different programs and platforms, as there is no single platform. It is necessary to prepare each lesson from a technical point of view, as well as to keep the attention of trainees remotely. Students, on the other hand, note (the second place) that the quality of materials is low, sometimes they lack clarity and interactivity, which has a great impact on the education quality.

Necessary equipment and ability to work with it.

It is much more difficult for teachers to organize the educational process without the necessary equipment, including software to prepare the materials. This factor is less significant for students due to the use of mobile devices among other things for learning.

The Internet access problems.

This factor takes the third place in both groups and has an average level of importance (0.42 and 0.54) but demonstrates the significance of this problem. There

ISSN: 1984-6444 | http://dx.doi.org/10.5902/1984644466423

is an uninterrupted access to the network at the speed necessary for the transmission of video and audio information not throughout the territory of Yakutia. There are also disconnections and unstable connections.

Lack of personal contact with the teacher.

The factor is ranked fourth, but, according to the calculated coefficient (0.4 and 0.5), it has an average concordance value. From the teachers' point of view, personal contact allows monitoring the knowledge acquisition and more interaction. Students note that communication with the teacher and classmates is substantial.

Motivation and self-organization.

It ranks first among the factors among students, but the coefficient does not indicate the highest degree of agreement (0.67). During the remote work, students noted that they could not concentrate at lectures, especially since there is always a temptation to be engaged in social networks or do other things. Among teachers, the factor is not so relevant and has a weak consistency (0.21), but nevertheless it is still significant. They noted students' low motivation in online interaction and problems in enhancing their activity.

Discussion

The level of teachers' digital competence exceeds that of students dealing with pedagogical areas by 4.5%. Students' results are higher in the blocks on digital resources and the development of students' digital competence. But in terms of development, it is necessary to pay special attention to the block of professional responsibilities and assessment of students.

The teachers coped well with the assignments regarding the blocks of teaching and learning and professional duties. In terms of development, attention should be paid to working with digital resources and the development of students' digital competence. Thus, teachers and students demonstrate an average level in the use of digital technologies in educational activities.

ISSN: 1984-6444 | http://dx.doi.org/10.5902/1984644466423

When comparing the results of the study, connection is found with the all-Russian study in 2019. According to the NAFR analytical center, the index of teachers' digital competence in Russia averages 45 points; in our study this indicator is 50 points (5.7% higher), and it equals to 46 points among students of pedagogical specialties.

A bottleneck in the study is that the assessment of the level of digital competence was carried out using one questionnaire, where all components could not be taken into account. This problem is eliminated by the chosen technique, which is certified and widely used in many countries.

Conclusion

According to the data obtained, we come to the conclusion that the teachers' and students' digital competence is at an average level, and that of teachers is even slightly higher (by 5.7%), compared to the average results in Russia, as evidenced by the study outcomes. In addition, the experience gained in working with distance educational technologies has identified positive and negative aspects that must be taken into account when developing digital competence in the region.

The pandemic is coming to an end, but the accumulated theoretical and practical base for using the possibilities of digital technologies remains at the teachers' disposal. Due to the identified positive and negative factors related to the use of digital technologies in education, it is necessary to combine and rationally apply the gained knowledge and the accumulated experience.

Based on the data obtained, a strategy was developed to improve the digital competence in teachers and students:

- creation of a digital ecosystem;
- building an individual trajectory for the development of competencies;
- interaction with centers of education and professional development;
- participation in conferences, competitions, strategic sessions and other skill development events.

The main stages for the development of digital competence should include: assessment of the competence level; the professional development process support; and training and professional development.

ISSN: 1984-6444 | http://dx.doi.org/10.5902/1984644466423

References

ANALYTICAL Center NAFI. Digital literacy of Russian teachers. **Analytical Center NAFI,** 2019. Available at: https://nafi.ru/projects/sotsialnoe-razvitie/tsifrovaya-gramotnost-rossiyskikh-pedagogov/. Accessed: 1 mar. 2021

ANDREW, Alison et al. Learning during the lockdown: Real-time data on children's experiences during home learning (IFS briefing note BN288). **Institute for Fiscal Studies**, 18 may 2020. Available at: https://ifs.org.uk/uploads/Edited_Final-BN288%20Learning%20during%20the%20lockdown.pdf. Accessed: 1 mar. 2021

BARAKHSANOVA, Elizaveta Afanasievna, et al. Peculiarities of quality management of teachers' e-learning training in the Arctic regions. **Espacios**, Caracas, v. 38, n. 55, p. 25, 2017.

BARAKHSANOVA, Elizaveta Afanasievna, et al. Current trends in digital education development in the Republic of Sakha (Yakutia). **Espacios**, Caracas, v. 40, n. 9, 2019. Available at: https://www.elibrary.ru/item.asp?id=38689142. Accessed: 1 mar. 2021

BARBER, Wendy; BLAYONE, Todd. Student perceptions of fully online flipped community learning: A case study progress in education. **Progress in education**, n. 53, p. 161–183, 2018. Available at: https://www.researchgate.net/publication/329217207_Student_Perceptions_of_Fully_Online_Flipped_Community_Learning_A_Case_Study. Accessed: 1 mar. 2021

BATES, Tony. **Teaching in a Digital Age.** 2 ed. Vancouver: Tony Bates Associates Ltd, 2019. Available at: https://pressbooks.bccampus.ca/teachinginadigitalagev2/. Accessed: 1 mar. 2021

BLAYONE, Todd. Theorizing effective uses of digital technology with activity theory. **Technology, Pedagogy and Education**, v. 28, n. 4, p. 447–462, 2019. Available at: https://doi.org/10.1080/1475939X.2019.1645728. Accessed: 1 mar. 2021

CATTIK, Melih; ODLUYURT, Serhat. The effectiveness of the smart boardbased small-group graduated guidance instruction on digital gaming and observational learning skills of children with autism spectrum disorder. **Turkish Online Journal of Educational Technology**, Turkey, v. 16, n. 4, p. 84–102, oct. 2017. Available at: https://files.eric.ed.gov/fulltext/EJ1160646.pdf. Accessed: 1 mar. 2021

GREENHOW, Christine; LEWIN, Cathy; STAUDT WILLET, Bret, 2020 The educational response to Covid-19 across two countries: a critical examination of initial digital pedagogy adoption. **Technology, Pedagogy and Education**, v. 30, n. 1, p. 7-25, 2021. Available at: https://doi.org/10.1080/1475939X.2020.1866654. Accessed: 1 mar. 2021

ISSN: 1984-6444 | http://dx.doi.org/10.5902/1984644466423

CLARK, Ruth Colvin; & MAYER, Richard. **E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning**. Hoboken: John Wiley & Sons, 2016. Available at: http://dx.doi.org/10.1002/9781119239086. Accessed: 1 mar. 2021

DE', Rahul; PANDEY, Neena; PAL, Abhipsa. Impact of digital surge during covid-19 pandemic: A viewpoint on research and practice. **International Journal of Information Management**, United Kingdom, n. 55, dec. 2020. Available at: http://dx.doi.org/10.1016/j.ijinfomgt.2020.102171. Accessed: 1 mar. 2021

GAFUROVA, Natalia Vladimirovna; CHURILOVA, Elena Yurievna. **Methods of information technologies teaching. Practicum: Handbook**. Krasnoyarsk: Siberian Federal University, 2011.

GILSTER, Paul. **Digital Literacy**. New York: Wiley, 1997.

GORBUNOVA, Irina Borisovna. Music Computer Technologies in the Perspective of Digital Humanities, Arts, and Researches. **Opcion**, Zulia, v. 35, n. 24, p. 360-375, 2019.

GUSHCHINA, S. M. **Forming teacher's digital competence in the area of developing digital education resources**, 2017.

DELCKER, Jan; IFENTHALER, Dirk. Teachers' perspective on school development at German vocational schools during the Covid-19 pandemic, **Technology, Pedagogy and Education**, v. 30, n. 1, p. 125-139, 12 dec. 2020. Available at: http://dx.doi.org/10.1080/1475939X.2020.1857826. Accessed: 1 mar. 2021

KORNILOV, Yuri, et al. Different approaches to the development of online learning in higher education. **Propositos y representaciones**, Lima, v. 8, n. S3, p. e706, 2020. Available at: http://dx.doi.org/10.20511/pyr2020.v8nSPE3.706. Accessed: 1 mar. 2021

KOSTIKOVA, Natalia Anatolyevna, et al. The didactic potential of university electronic information and educational environment in the context of a pandemic. **Propositos y representaciones**, Lima, v. 8, n. S3, p. e707, 2020. Available at: http://dx.doi.org/10.20511/pyr2020.v8nSPE3.707. Accessed: 1 mar. 2021

LAPCHIK, Mikhail Pavlovich. **Preparing pedagogical personnel under conditions of informatization of education**: Handbook. Moscow: BINOM, 2013. Available at: http://znanium.com/catalog.php?bookinfo=485601. Accessed: 1 mar. 2021

MARTIN, Allan; MADIGAN, Dan. **Digital Literacies for Learning**. London: Facet Publishing, 2006.

ISSN: 1984-6444 | http://dx.doi.org/10.5902/1984644466423

MAXWELL, Alec; JIANG, Zhaoshuo; CHEN, Cheng. Mobile learning for undergraduate course through interactive apps and a novel mobile remote shake table laboratory. In 2017 ASEE ANNUAL CONFERENCE AND EXPOSITION. **Conference proceedings, v. 24**. Columbus: American Society for Engineering Education, 2017. Available at: https://www.asee.org/public/conferences/78/papers/18403/view. Accessed: 1 mar. 2021

RUSSIAN FEDERATION. Ministry of Science and Higher Education. **Modern Digital Educational Environment**, 2021. Available at: http://neorusedu.ru/. Accessed: 1 mar. 2021

RUSSIAN FEDERATION. Government. **National Program "Digital Economy of the Russian Federation"**, 2018. Available at: http://static.government.ru/media/files/9gFM4FHj4PsB79I5v7yLVuPgu4bvR7M0.pdf. Accessed: 1 mar. 2021

PROKOPIEV, Mikhail Semenovich, et al. Development of a programming course for students of a teacher training higher education institution using the programming language Python. **Propositos y representaciones**, Lima, v. 8, n. 3, 2020. Available at: https://www.elibrary.ru/item.asp?id=43856945. Accessed: 1 mar. 2021

QUARLES, Audrey McCrary et al. Integrating digital/mobile learning strategies with students in the classroom at the historical black college/university (HBCU). In: KEENGWE, Jared. **Handbook of Research on Digital Content, Mobile Learning, and Technology Integration Models in Teacher Education**. Grand Forks: University of North Dakota, 13 jul. 2017, p. 390–408.

SÁ, Maria Jose; SERPA, Sandro. The covid-19 pandemic as an opportunity to foster the sustainable Development of teaching in higher education. **Sustainability**, Basel, v. 12, n. 20, p. 1-16, 2020. Available at: http://dx.doi.org/10.3390/su12208525. Accessed: 1 mar. 2021

SOLDATOVA, G. U.; SHLYAPNIKOV, V. N. Digital competence of Russian pedagogues. **Psychological science and education**, Moscow, v. 20, n. 4, p. 5–18, 2015.

AGASISTI, Tommaso; SONCIN, Mara. Higher education in troubled times: on the impact of Covid-19 in Italy. **Studies in Higher Education**, v. 46, n. 1, p. 86-95, 2021. Available at: http://dx.doi.org/10.1080/03075079.2020.1859689. Accessed: 1 mar. 2021

TRETYAKOVA, Tatiana et al. A Digital education as a new vector of development of education in the northern regions. In INTEGRATING ENGINEERING EDUCATION AND HUMANITIES FOR GLOBAL INTERCULTURAL PERSPECTIVES. **Lecture Notes in Networks and Systems,** St.-Petersburg, p. 864-870, 2020.

ISSN: 1984-6444 | http://dx.doi.org/10.5902/1984644466423

TRETYAKOVA, Tatiana et al. Distance pedagogical education in the conditions of the coronavirus. **Propositos y representaciones**, v. 8, n. S3, p. e718, 2020. Available at: http://dx.doi.org/10.20511/pyr2020.v8nSPE3.718. Accessed: 1 mar. 2021

VLASOVA, Elena Zotikovna et al. Effective adaptive training of students in Russian pedagogical universities to use e-learning technologies. **Espacios**, Caracas, v. 39, n. 23, p. 10, 2018.

VLASOVA, Elena Zotikovna et al. Teacher education in higher education systems during pandemic and the synergy of digital technology. **Propositos y representaciones**, v. 8, n. S3, p. 719, 2020. Available at: http://dx.doi.org/10.20511/pyr2020.v8nSPE3.719. Accessed: 1 mar. 2021