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IMPACT OF DIGITALIZATION ON THE CONTINUING PROFESSIONAL EDUCATION OF SPECIALISTS FOR INDUSTRY 4.0

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Digitalization of continuing professional education for Industry 4.0 specialists is caused by the contradiction between the growing need for specialists' skills development in Industry 4.0 and the impossibility of traditional education to realize mass training of specialists in conditions of their intensive labor activity, rapid updating of production technologies, and digitalization. Meeting the educational and professional needs of specialists, a digitalization model was proposed that included: informing of potential learners about advanced training programs, electronic educational environment, electronic educational content, electronic communications for educational and pedagogical interaction, and digital tools. The measures to increase digital literacy of learners are offered. The model was tested in empirical research, involving more than 4000 learners. To solve the research tasks observation, questionnaires, study and analysis of the students' outcomes were used. The indicators achieved statistically important difference that is 1.2–2 times compared with the indicators of previous years.

Keywords: digitalization of continuing education, advanced training, specialists for Industry 4.0, electronic educational environment, electronic educational content, electronic communications for educational interaction, electronic tools.

Introduction

Industry 4.0 requires specialists with radically new labor functions, which neither graduates of universities nor a significant part of working professionals have obtained. On 9.02.2018 the Government of the Russian Federation approved the plan of measures for the direction "Personnel and Education", section 02.02.007 of which includes the item "The system of additional vocational education works in the interests of training competent specialists for the digital economy"[1]. The state, enterprises, and individual competing professionals claim social challenge for large-scale Industry 4.0 specialists' professional advanced learning [3, 4, 12, 16, 20].

Introduction of the program direction "Personnel and Education" requires a large number of activities both for specialists' mastering the competences for digital economy and for digitalization of the educational sphere. Therefore, it is natural to study the problems of digitalization of advanced professional learning, which cover a number of interrelated issues: digitalization of the educational process, digitalization of management of continuing education of personnel for the Industry 4.0, increase of digital literacy and competence of specialists. As the program of digitalization of the economy has been launched in our country the third question has been studied to the greatest extent, by Russian educators-researchers mostly [5, 13, 21]. Professional educational sphere is favorable for mastering digital competencies that's why both digitalization of the educational process and its management require special attention and research. The subject of the research in this article is the digitalization of the educational process in the system of specialists' for Industry 4.0 continuing advanced education. This category includes both self-employees of enterprises and scientific and academic staff of the university, whose qualification has impact on the quality of training and professional development of specialists.

[1] Order of the Government of the Russian Federation Dated July 28, 2017 No. 1632-r "On Approval of the Program" Digital Economy of the Russian Federation]. Available at: http://www.consultant.ru/document/cons_doc_LAW_221756/ (accessed 07.11.2020).

Stating relevant problem of the Industry 4.0 specialists' advanced learning digitalization

Continuing renewal of labor due to the rapid obsolescence of digital technology, leads to the need to intensify the mass development of specialists' skills, reduce frequency and increase efficiency of their advanced learning. The modern system of continuing education, including its non-formal and informal forms, is a valid instrument for quick and mobile learning. Students build individual trajectories and become mobile selecting programs at all levels of the formal and non-formal education, which provide the opportunity for permanent renewal of competences. The update competencies and academic loans can also occur in the process of production of goods, knowledge and technology [14]. But still this system is limited due to lack of: high quality programs for advanced training of specialists; difficulties in the development of programs for educational programs, the need to unite specialists of different directions for these purposes; weak points of distance education.

This allows us to ascertain the escalation of the contradiction between the growing need for specialists in professional development in the conditions of Industry 4.0 and the inability of traditional education to realize the necessary advanced training in the conditions of intensive labor activity of specialists, the intensive increase in the rates of development of digital in Industry 4.0.

In order to remove this contradiction, it is necessary to solve the tasks: increase the efficiency of professional advanced learning, of the material and teaching aids, of the qualifications of teachers to ensure the quality of education, make the advanced courses more relevant, frequent, and mass. Digitalization of various aspects of additional vocational education is one of the possibilities for solving these problems.

Digitalization of continuing education gives possibility to imply various modern forms of learning: on-line courses, e-learning, educational platform, webinars, etc. Most of them involve indirect (distant, mediated) interaction between learners and teachers. The specialists study material any time and place they like, and choose the appropriate content and method of study.

Results of a survey conducted in October–December 2013 M. Gaebel, V. Kupriyanova, R. Morais, E. Colucci show the perceived benefits of e-learning: "revision of teaching methods, education of large number of students, monitoring study progress and creation of data on student learning, interactive collaboration among students, students work in small learning groups, developing students' reflective learning and critical thinking, enhancing learning and teaching in foreign languages, facilitating traditional in-class learning without significantly altering it, devoting more of the teacher's time to individual students" [9]. The impact of E-learning on university students' academic achievement and creativity is revealed [23]. Advantages of various types of educational digitalization are revealed by other authors [1, 7, 15, 17]. The features of digitalization allow us to resolve the contradiction revealed:

- providing an individual educational trajectory,
- possibility to meet personal educational and professional needs,
- operativeness,
- flexibility,
- mass character.

However, these educational methods and forms have some typical weaknesses, identified by scientists.

Some scientists worry about extending the idea of mass digitalization of education [18]. L.K. Fryer, H.N. Bovee, K. Nakao, revealed the reasons for the lack of motivation for students' being involved into e-learning: low task value and poor ability beliefs [8]. J. De Vos emphasizes that there is a contradiction between psychologization and digitalization [6]. We agree that the immanent weaknesses of some forms of digitalization (excluding intrapersonal communication) are:

- lack of interpersonal interaction, influence and experience exchange in education (not study) process;
- limitations in some forms of self actualization and social recognition.

Moreover, the drawbacks of digital tools' implementation are:

- poor program content;
- weak soft-ware;
- lack of places for study;
- methodical and digital illiteracy of tutors;
- lack of pedagogical and psychological knowledge of instructors.

It allowed to set a suggestion that digitalization of educational process of specialists' advanced learning can solve the problem of mass and quick development of their digital competence, and complex measures of digitalization contribute to non-reversal of shortcomings of each method and provide a synergistic effect

when achieving the results. Nevertheless, they are not sufficient means for the development of specialists' personality, their socialization and social self-actualization. So, the interpersonal interrelations should not be rejected in conditions of digitalization.

Complex model of the specialists for 4.0 advanced learning digitalization

Targeting to solve our problems, we developed the complex model of the specialists' for Industry 4.0 advanced learning digitalization in order to embrace all the opportunities of the digitalization of educational process. Social networks, such as Facebook, YouTube, Twitter, LinkedIn, Instagram, etc. can be used in education [2, 10], and their integrated usage improves the efficiency and effectiveness of specialists' for Industry 4.0 advanced learning. Thus, the assumption arises that if the digitalization capabilities of various aspects of the educational process are used in a comprehensive manner, significant steps can be taken to resolve the problem of the organization of professional development for industry professionals 4.0. In order to solve the problem, it is necessary to solve the tasks: increase the efficiency of professional development, use relevant material, choose qualified teachers to ensure the quality of education, raise the frequency of courses' study and their mass character. Thus, the task is to intensify the training, professional development and retraining of specialists for the industry 4.0.

According to the principles of adult education specialists play leading roles in organizing their professional development: in the choice of the content of education, organizational forms and even methods. They have a vital, educational and professional experience, which forms the basis for further education. Maturity of the professional position leads to an independent choice or the construction of an educational trajectory in accordance with the professional tasks being solved and the prospects for field, organizational, and personal development.

Therefore, at the initial stage of interaction with potential leaners, we conducted a study of specialists' preferred content and forms of education. At the same time, taking into account the tasks facing continuous education: the implementation of operational upgrading of skills, the continuous updating of the educational material, the upgrading of the qualifications of teachers to ensure the quality of education and increasing the frequency of courses and their mass character, it was decided to use the digitalization capabilities of advanced professional education that are: individualization of the content of education, independence of learner from each other and from the teacher, the choice of the individual trajectory of education both in time and space, the mass coverage of learners.

We proposed to develop and introduce into the practice of advanced learning the model of digitalization of the educational process in the continuous education of specialists for the industry 4.0, which encompasses all components of the educational process: target, content, procedural, estimating and resulting (Table 1).

The dual purpose of the model includes both the formation of digital literacy and the competency of the specialists, and the digitalization of the educational process as an adequate means of their formation.

Digitalization of the content component implies the availability of a variety of digital media for the content of education at all levels, beginning with standards up to educational material. There was a turn from the use of printed sources of information to the use of digital informative sources. It concerns educational material [2, 17]; books (teaching aids, textbooks, monographs in electronic forms) [11, 15]; educational environment as a content complex [1].

The central unit of procedural, assessment and resulting components is the student-teacher digital interaction [19, 22]. There are at least two essential points while teaching adult specialists: age and lack of digital literacy and experience. According to the results of R. Vilkonis, T. Bakanoviene, and S. Turskiene "Readiness of adults to learn using e-learning, m-learning and t-learning technologies is prompted by good computer literacy, by experience gained in the field of distance learning and other e-services" [22, p.189]. "They fail to exploit the full learning potential of these gadgets for lack of an appropriate learning strategy and system" [22, p.183]. In our model all possible forms of interaction (distant, interpersonal, and mixed) were used according the specialists' preferences.

Our key idea was that a) digitalization had a complex character embracing all the components of the educational process; b) had a supplementary character not substituting interpersonal interrelations; c) the age characteristics of adults were taken into account.

Table 1

Digitalization of the components of the continuing education

Components of educational process	Elements of digitalization
Target component (setting goals of education, their acceptance by all subjects, the formation of the orientation of the individual to the development of labor functions in the industry 4.0).	Digital informing of potential learners about programs
Content component (educational material and educational means of education)	Electronic educational environment (e-books, videos, presentations, Words documents, links to websites), digitized content educational tools (textbooks, teaching aids, methodological developments), electronic resources of the Internet
Procedural component (organizational forms and methods of educational and pedagogical interaction, means of communication)	Use of: organizational forms (distance education, e-learning, space bridges); educational and pedagogical interaction (in the electronic educational environment, in Skype, on teleconferences, in social networks, including using the peer-to-peer method); devices (computer, computer networks, social networks, telephones)
Assessment and resulting component	Verification of works, issuance of recommendations, evaluation in Electronic SUSU 2.0. Discussion of results in social networks, evaluation, self-evaluation and mutual evaluation, including using the peer-to-peer method

Verification of digitalization model

The model was tested in the Institute of continuing education (ICE) at SUSU in 2017–2020.

To implement the digitalization model, the following activities were realized:

(1) The notification of potential about programs (through the ICE site, in social networks, in electronic media).

(2) Development of an educational environment for retraining programs with placement on the MOODLE platform at Electronic SUSU. The materials included, depending on the specifics of the program: electronic versions of lectures, presentations of lectures, electronic educational and methodological and scientific literature or links to it, links to sites, films, videos, and assignments for learners.

(3) Providing the possibility of electronic teaching, pedagogical, intra-group and external communications: via Skype, in groups in social networks, through a forum in an electronic educational environment.

(4) Providing the possibility of evaluating and evaluating the results of program development: via Skype, in groups in social networks, through a forum in the electronic educational environment.

On the whole the number of digitalized programs increased in comparison with the last academic year. The quantity of the following types of programs has grown:

- programs aiming to develop digital competencies of specialists – by 46.9%;
- programs containing modules dedicated to the development of labor functions related to the implementation of digital competencies – by 8.1%;
- programs conducted in the electronic educational environment – by 11.9%;
- programs based on distance or mixed forms of education – by 15.8%;
- programs using the electronic devices – by 5.6%.

General growth of the quantity of all the programs of different types was about 20 %.

In Table 2 some typical programs in which (or in some models of which) all the components of the educational process (target, content, procedural, estimating and resulting) were digitalized are enumerated.

Research methodology

To test the model and search for the optimal study of programs, the following parameters were empirically investigated: a) the attitude of learners to the digitization of education; b) the effectiveness of specialists' advanced learning digitalization. In various kinds of testing 1294 specialists were examined.

The attitude of learners to digitalization of education was studied during an introductory conversation with potential learners, who usually chose between distant, interpersonal or mixed

Table 2

Digitalized programs (examples)

Programs of advanced learning	
Retraining programs	Advanced training programs
Creation of high-tech product International activity of academic staff University academic staff Personnel management of the organization Management of educational organization Methods and technologies of university management in modern conditions Pedagogical Education: Theory and Practice of Vocational Education Metrological support of production, organization and performance of metrological works Physical and chemical foundations of innovative technologies of metallurgical production. Modern methods of materials research Industrial and civil construction	Programming machining on CNC machines Automated design (basic course Solid Works) Automated design (advanced course Solid Works) Automated design (basic course AutoCAD) Internet Marketing (Basic Course) Accounting. 1C: Accounting 8 Basics of Project Management LabView: Introductory Course Basics of Computer Literacy Information and Communication Technologies Computer technologies: Corel Draw, Photoshop, InDesign Methods of improving technical systems and forecasting their development Mathematical modeling of the experiment Computer technologies: Ansys (Finite element method and its applications in the problem of strength of constructions) Computer technologies: Ansys (Solution of hydro and gas dynamics problems) Computer technologies: 3D Max Automated design (advanced course Solid Works) Work in mathematical packages MATLAB and Maple 1C: Accounting 8 Architecture platform “1C: Enterprise 8”, “1C: Trade Management 8”, “1C: Personnel Management 8” Computer text processing (advanced features of MS Word) In-depth linguistic preparation. English (different levels) Digital transformation of the education Digital competence of the academic staff

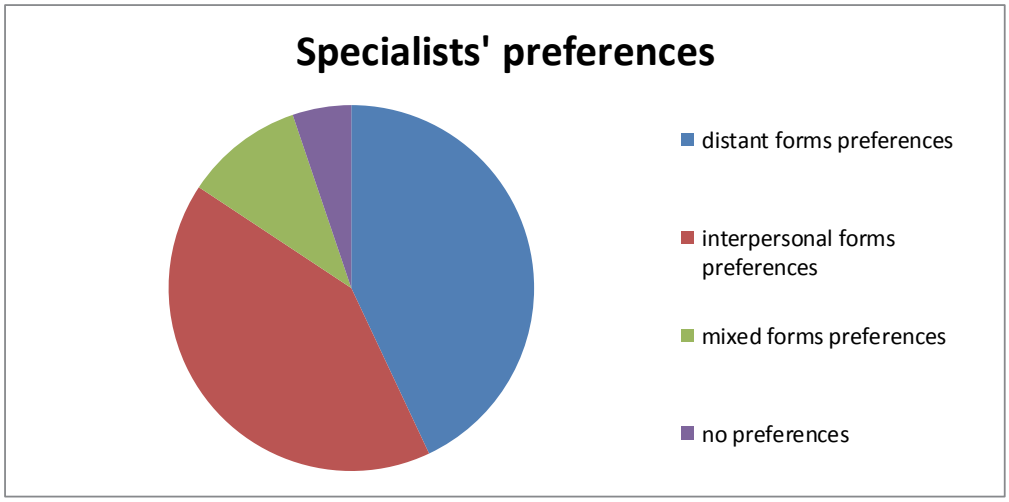

Fig. 1. Learners preferred forms of learners’ and pedagogical interaction

forms of instruction. Learners were divided into four categories: three categories were adherents of the forms proposed, the fourth category – learners who do not have preferences due to various reasons (tolerance to all forms, formal attitude to advanced learning, lack of information) (Fig. 1).

In addition, it was found out that a significant part of the learners (48.8%) prefer self-improvement training, using methods of self-education. At the same time, more active position is occupied by scientific and pedagogical workers and post-graduate students (85.7%); among them the level of independence in the choice of the content of

education and the form of education is higher than among practitioners (28.1%). Also, preferred methods and means of educational and pedagogical interaction were revealed. The opinions of the learners differed, so that interpersonal and electronic methods of educational and pedagogical interaction still were considered as topical.

The adult students do not approve: reproductive methods, excess of the lecture form, lack of instruction (either interpersonal or digital).

The adults prefer active and interactive forms (both interpersonal and digital) giving the opportunity of self actualization, case study to connect learning material with professional tasks, discussions, watching video, role and business games, intellectual games, round tables, space bridges, and web seminars.

One of the most significant indicators of digitalization positive effect was the growth of total number of learner, who successfully mastered the programs in 2017–2020. As an example, compare the projected figures for 2020 year and the number of specialists of the previous year training (4200 and 5925 correspondingly). Choice of programs shows their validity to professional interest and other preferences of the specialists.

The effectiveness of using digitalization tools in the educational process was assessed by criteria: specialists' mastering of digital competences; measure of usage of electronic environment materials; usage of electronic means of teaching. In accordance with these criteria, a scale was developed that includes three levels: I. Origin level of digital competence. II. Reproductive level of digital competence. III. A productive level of digital competencies (Table 3). Table 3 was developed and used for determining personal levels of specialists' digital competence. To determine the level the learning and professional products of the learners, characterizing specialists' knowledge and skills, were estimated.

The model of information competencies is currently being developed as part of the direction of Russia's digitalization program "Personnel and Education". The following general competences of life in the digital space were assessed: value, personal, information literacy and competencies.

Value competencies: the value attitude to life, health, the surrounding world, the stability of the surrounding world; value of Homo Sapience as a species; understanding of the value of the digital economy in the social life and production; acceptance of corporate values, ethics and organizational culture of the company, following it, assistance in achieving corporate goals; values and risks of integration of bio and digital objects.

Personal competencies: the person's orientation to promote the development of his country, organization, personal development; independence in taking decisions on the basis of values, principles and ethical norms; readiness to change the technologies of activities; responsibility for the results and consequences of personal domestic and professional activities in the digital environment; responsibility for family, social group, society, Nature in digital world.

Informational literacy and competencies: communication in a digital environment; information management; creation of information objects using digital resources and technologies; possession of information and computer technologies, understanding of the possibilities and risks of their use; creation of new information, knowledge systems and content; creation of innovative products for the Industry 4.0; readiness to work in AR and VR environment, create IT-technologies; fulfill research in digital environment; legal literacy in the digital world; the ability to distinguish real world objects from their digital images; preserving of one's and people's health (physical, mental, social) in a digital environment.

Table 3

Specialists' digital levels' indicators

Criteria	Digital competence levels' indicators		
	Origin level I	Reproductive level II	Productive level III
Specialists' mastering of digital competences; measure of usage of electronic environment materials; usage of electronic means of teaching	The specialist is a novice user of electronic means, is not able to use them in the professional sphere; when learning avoid using of electronic means; refers to the materials of electronic environment with external help	The specialist can use of electronic means in the professional sphere according to pattern; when learning refer to electronic means and to the materials of electronic environment	The specialist can choose, use, and vary electronic means in the professional sphere to achieve professional purposes; when learning refer to electronic means and to the materials of electronic environment, can seek for extra materials by himself

Table 4

Comparing specialists' digital levels

Academic year	Digital competence levels			Sample mean	Adjusted sample variance
	Origin level I	Reproductive level II	Productive level III		
2017/2018	32.0 %	43.7 %	24.3 %	0.641	0.0441
2019/2020	19.0 %	45.4 %	35.6 %	0.722	0.0289
$\alpha = 0.05$; $t_{obs} = 0.02$; $T_{crit} = 1.967$; $t_{obs} < T_{crit}$					

When acquiring of value and personal competencies, emphasis was placed on the individual use by trainers not only of relevant information, but also on interpersonal discussions of problems interpersonal interaction.

Table 4 shows the dynamics of the levels of specialists' knowledge of digital competences.

The essential result is a decrease in the carriers of the first level and an increase in the carriers of the third level. This means that the number of professionals who do not use digital resources in their professional activities has decreased. The number of specialists who are able to set independently professional tasks, to select methods and means for their solution and to find these solutions has increased significantly. The growth was measures for approximately 1000 specialists with significance $\alpha = 0.05$.

Conclusions

Digitalization of the educational process, carried out within reasonable limits, taking into account the peculiarities of education as a means of socialization, self-realization, self-identification and other personal aspects of human activity, makes it possible to intensify the additional education of specialists for the industry 4.0.

Digitalization of the educational process is a complex of activities aimed at the use of digital technologies in all components of the educational process: target, content, procedural, estimating and resulting, which include: notification of potential learners about programs; development of an educational environment; providing the possibility of electronic communications; the possibility of evaluating the results of program development.

The constructed model has proved the possibility of increasing the efficiency of professional development by means of usage of relevant material, growth of teachers' qualification to ensure the quality of education, raising the frequency of courses and their mass character.

References

1. Araya D., Peters M.A. Peer-to-peer Networks and Collaborative Learning. *E-Learning and Digital Media*, 2010, no. 7 (4), pp. 326–327. DOI: 10.2304/elea.2010.7.4.326

2. Baran B. Facebook as a Formal Instructional Environment. *British Journal of Educational Technology*, 2010.

3. Baumol. U., Bockshecker A. Evolutionary Change of Higher Education Driven by Digitalization. *16th International Conference on Information Technology Based Higher Education and Training*, 2017. DOI: 10.1109/ITHET.2017.8067811

4. Chandran D., KempeGowda S. Transforming the Educational System for the Digital Economy. *Proceedings of the 18th International Business Information Management Association Conference*, 2012, no. 2, pp. 714–720.

5. Cheremisina E.N., Kreider O.A., Belaga V.V., Kirpicheva E.Y. Training Talent for Digital Economy at Dubna State University. *CEUR Workshop Proceedings*, 2017, no. 2023, pp. 110–114.

6. De Vos J. The Neuroturn in Education between the Scylla of Psychologization and the Charybdis of Digitalization? *Constructions of Neuroscience in Early Childhood Education*, 2017, pp. 20–36. DOI: 10.4324/9781315445120

7. Filippi L., Spalanzani A. Using Technology in an E-learning Training Course: the Role of the Student's Personal Environment. *International Journal of Business Information Systems*, 2012, no. 11 (1), pp. 41–68. DOI: 10.1504/IJBIS.2012.048341

8. Fryer L.K., Bovee N.H, Nakao K. E-learning: Reasons Students in Language Learning Courses don't Want to. *Computers and Education*, 2014, no. 74, pp. 26–36. DOI: 10.1016/j.compedu.2014.01.008

9. Gaebel M., Kupriyanova V., Morais R., Colucci E. *E-learning in European Higher Education Institutions. Results of a Mapping Survey Conducted in October-december*, 2013, EUA Publications Publ., 2014. 92 p.

10. Jucevičiene J., Valinevičiene G. A Conceptual Model of Social Networking in Higher Education. *Electronics and Electrical Engineering*, 2010, iss. 6, pp. 55–58.

11. Kahlon R.S., Tse M. The Impact of Digitalisation in Higher Education Libraries. *Proceedings of the 2009 International Conference on the Current Trends in Information Technology*, 2009, pp. 184–189. DOI: 10.1109/CTIT.2009.5423120

12. Khalin V.G., Yurkov A.V., Kosov Y.V. Challenges of the Digital Economy in the Context of Globalization: Training of PhDs in Software Engineering in Russia. *Digital Transformation and Global Society. Communications in Computer and Information Science*, 2017, vol. 745, pp. 120–122. DOI: 10.1007/978-3-319-69784-0_10

13. Kuladzhi T.V., Babkin A.V., Murtazaev S.-Y. Enhancing Personnel Training for the Industrial and Economic Complex in the Conditions of the Digital Economy. *Proceedings of 2017 IEEE 6th Forum Strategic Partnership of Universities and Enterprises of Hi-tech Branches (Science. Education. Innovations)*, January 2018, pp. 67–70. DOI: 10.1109/IVForum.2017.8246053

14. Kuzminova Y., Frumin I. Russian Education – 2020: the Model of Education for Economy, Based on Knowledge. *IX International Scientific Conference "Modernization of the Economy and Globalization"*, 2008, no. 1–3, pp. 39.

15. Maabreh K.S. The Impact of E-learning Usage on Students' Achievements: a Case Study. *International Journal of Knowledge and Learning*, 2018, no. 12 (3), pp. 193–203. DOI: 10.1504/IJKL.2018.092312

16. Machekhina O.N. Digitalization of Education as a Trend of its Modernization and Reforming. *Espacios*, 2017, no. 38 (40).

17. Morais E., Morais C., Paiva J. Myths and Realities of E-learning: Exploratory Survey of Higher Education Students. *E-Learning and Digital Media*, 2014, no. 11 (3), pp. 300–313. DOI: 10.2304/elea.2014.11.3.300

18. Sahl S., Martens A. Digitalization in Teaching and Learning: The Emperor's New Clothes? *Lecture Notes in Informatics (LNI), Proceedings-series of the Gesellschaft fur Informatik (GI)*, 2016, P-259, pp. 999–1000.

19. Tawata A., Yodmongko P., Chakpitak N., Sureephong P. Impacts of E-learning on High School Students: the Role of Conventional Interation. *International Journal of Science, Mathematics and Technology Learning*, 2016, no. 23 (1), pp. 19–27. DOI: 10.18848/2327-7971/CGP/v23i01/19-27

20. The Action Plan of the Programme "Digital Economy of the Russian Federation". Available at: http://static.government.ru/media/files/k87YsCABuiyuLAjcWDFILEh6itAirUX0.pdf (accessed 11.11.2020).

21. Peshekhonov V.G., Gutner I.E., Kolesov N.V., Belyaev J.V., Kutuzov V.M., Kupriyanov M.S., Bureneva O.I. Training of Top-class Professionals in the Field of Digital Economy Hardware and Software Platform. *Proceedings of 2017 IEEE 6th Forum Strategic Partnership of Universities and Enterprises of Hi-tech Branches (Science. Education. Innovations)*, January 2018, pp. 7–10. DOI: 10.1109/IVForum.2017.8245955

22. Vilkonis V., Bakanoviene T., Turskiene S. Readiness of Adults to Learn Using E-learning, M-learning and T-learning Technologies. *Informatics in Education*, 2013, no. 12 (2), pp. 181–190. DOI: 10.15388/infedu.2013.12

23. Zare M., Sarikhani R., Salari M., Mansouri V. The Impact of E-learning on University Students' Academic Achievement and Creativity. *Journal of Technical Education and Training*, 2016, no. 8 (1), pp. 25–33.

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ВЛИЯНИЕ ЦИФРОВИЗАЦИИ НА ЭФФЕКТИВНОСТЬ НЕПРЕРЫВНОГО ОБРАЗОВАНИЯ СПЕЦИАЛИСТОВ ДЛЯ ИНДУСТРИИ 4.0

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Актуальность цифровизации непрерывного профессионального образования специалистов Индустрии 4.0 вызвана противоречием между растущей потребностью в повышении квалификации специалистов в Индустрии 4.0 и невозможностью традиционного образования реализовать массовую подготовку специалистов в условиях их интенсивной трудовой деятельности, стремительного обновления производства, появления новых цифровых технологий. Для удовлетворения образовательных и профессиональных потребностей специалистов была предложена модель цифровизации, которая включала: цифровое информирование потенциальных слушателей о программах повышения квалификации, электронную образовательную среду, цифровизацию образовательного контента, электронные коммуникации для учебно-педагогического взаимодействия, использование цифровых устройств в образовательном процессе. Одновременно в модель включены меры по повышению цифровой грамотности слушателей. Модель апробирована в эмпирическом исследовании с участием более 4000 слушателей. Для решения исследовательских задач использовались наблюдение, анкетирование, изучение и анализ результатов обучения слушателей. Показатели достигли статистически значимой разницы в 1,2–2 раза по сравнению с показателями прошлых лет.

Ключевые слова: цифровизация непрерывного образования, повышение квалификации, специалисты Индустрии 4.0, электронная образовательная среда, цифровизация образовательного контента, электронные коммуникации для образовательного взаимодействия, электронные устройства.

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