Development of a Methodology for Building a Digital Profile of a Teacher

Olga Staroverova [1][0000-0003-2605-9417] and Arkadiy Urintsov [1][0000-0003-0273-5134]
and Ekaterina Sviridova [2][0000-0002-9257-8795]

[1] Plekhanov Russian University of Economics,
Stremyanny lane, 36, Moscow, 117997, Russian Federation,
staroverova05@mail.ru, urintsov.ai@rea.ru

[2] Center for Expert, Analytical and Information Technologies
of the Accounts Chamber of the Russian Federation,
Zubovsky Boulevard, 21-23, building 2,
Moscow, 119021, Russian Federation,
e.sviridova006@gmail.com

Abstract. The first part of the article examines the existing definitions of the concept of "digital twin" and related terms of the digital economy. A general description of the digital profile of the university teacher, as well as the modern digital educational environment, is given. In the second, the concept of building a digital profile of a university teacher and a methodology for the formation and maintenance of a digital profile of a university teacher was developed, a description of the functions and requirements for the digital profile of a university teacher was given. The paper also describes the need for digitalization of the activities of a teacher of a higher educational institution - the creation of a dynamically updated profile based on the developing technology of digital twins. The aim of the study is to develop a methodology for constructing a digital profile of a university teacher, which will allow assessing the effectiveness of the teacher's professional activity and is designed to promote the rational use of the educational and creative potential of scientific and pedagogical workers, and improve their professional qualifications. The use of the methodology for constructing the profile of the University teacher is aimed at increasing the involvement of teachers in the main processes of the university, as well as in reducing the time spent by teachers for performing routine processes in favor of conducting promising scientific research and ensuring high quality of the educational process.

Keywords: digital twin, higher education institution, teacher's digital profile.

1 Introduction

In a post-industrial (information) society, many types of activities are transferred to the information environment, in which a person performs the functions of collecting, accumulating, processing and disseminating information using modern digital technologies. This trend fully relates to the field of education in connection with the development of distance and network learning technologies, the creation of content and

Proceedings of the of the XXIII International Conference "Enterprise Engineering and Knowledge Management" (EEKM 2020), Moscow, Russia, December 8-9, 2020.

knowledge management systems, the development of academic mobility of teachers and students. The very management of a higher education institution is transferred to an electronic educational environment, when all administrative processes are performed using information and communication technologies [1, 2, 3].

The above circumstances cause the need to change the role of the teacher in the educational process, the need for digitalization of his activities, the creation of a dynamically updated digital profile based on the developed technology of digital twins [4, 5]. The need to develop a methodology for constructing a digital profile of a teacher determines the relevance of the chosen topic of the final master's thesis.

The scientific novelty of the study lies in the fact that in assessing the effectiveness of a university teacher, dynamic (actual) data from external and internal information systems are used, which form the teacher's digital profile [6, 7, 8].

The theoretical significance lies in the development of a methodology for constructing and using a digital profile of a teacher of a higher educational institution in increasing the efficiency of scientific and educational activities of the university based on the technology of digital twins.

Practical significance. The use of the methodology for building a profile of the University teacher is aimed at increasing the involvement of teachers in the main processes of the university, as well as in reducing the time spent by teachers for performing routine processes in favor of conducting promising scientific research and ensuring high quality of the educational process [9].

2 Literature Review

From the standpoint of the dynamic development of digital twin models, it is of interest to define a digital twin as a learning system consisting of a complex of mathematical models of different levels of complexity, refined based on the results of field experiments, which allows obtaining the first full-scale product sample that meets the requirements of the technical specification, as well as predicting its behavior on the entire life cycle. This definition was formed by specialists of the United Engine Corporation (UEC), which is one of the leaders in the implementation of digital twin technology in Russia, along with oil and gas enterprises, where the use of digital well twins helps companies save up to 20% of capital costs [10:13].

According to the strategy of the state corporation Rostec, which includes the United Engine Corporation JSC, the main task of the Corporation is to ensure Russia's technological advantage in highly competitive world markets. One of the key tasks of Rostec is the introduction of a new technological order and digitalization of the Russian economy. The implementation of the equipment monitoring system is one of the steps towards the digitalization of production at domestic engine-building enterprises, an important element in the implementation of the Industry 4.0 ideology [14]. An innovative system of domestic development, which is being implemented at the enterprises of the United Engine Corporation, makes it possible to obtain comprehensive information about the state of the machine tool park and increase the efficiency gain of its work by an average of 15% [15, 16].

Another example of the implementation of the concept of digital twins is the Dispatcher automated information system (AIS), developed by Tsifra. This system is the first domestic system that uses not only the technologies of the industrial Internet of things, but also artificial intelligence. Using predictive analytics, the system can predict equipment breakdowns and control tool consumption [17]. At the moment, the AIS Dispatcher users are more than 50 large industrial holdings, including UAC, Russian Helicopters, Rosatom, Almaz-Antey concern, and many others. More than 9000 machines are connected to it at 270 Russian enterprises.

3 Materials and methods

A digital twin is a software and hardware complex that displays the state of the components of a real physical object (product, equipment, asset, subject of activity) in time. The digital twin receives information from its physical counterpart, for example, using the Internet of Things (IoT) and, if necessary, carries out control actions to bring the physical object to the required state. At the same time, the digital twin can perform analytical and predictive functions, analyzing large amounts of data, functioning, in fact, as a software agent endowed with the intellectual ability to simulate situations[18]. Digital twins can be combined into multi-agent systems to model more complex technological and business processes. For digital twins, it is very important to reflect the state of the simulated physical objects in dynamics.

From the standpoint of the dynamic development of digital twin models, it is of interest to define a digital twin as a learning system consisting of a complex of mathematical models of different levels of complexity, refined based on the results of field experiments, which allows obtaining the first full-scale product sample that meets the requirements of the technical specification, as well as predicting its behavior on the entire life cycle [19:22].

The technology of digital twins can be applied not only to technical objects of various nature, but also to economic entities: people and their organizational associations. The purpose of creating such digital twins is to study the needs and capabilities of people and their organizational associations in economic processes and optimize their behavior when solving emerging problems. The creation of dynamic models about the behavior of economic entities in the digital economy is simplified by the fact that they continuously use digital services in the Internet environment and leave about themselves in this environment not only simple personal data, but also more detailed information about their preferences, requests, activity, reactions to events, etc.

4 Discussion

Currently, digital profiles of citizens are being created at the state level, which are "a set of digital records about individuals and legal entities contained in state information systems, the provision of which is ensured using a technological infrastructure that allows the use of user data with consent, provided in digital form" [23].

At a meeting of the presidium of the government commission on digital development, the use of information technology to improve the quality of life and business conditions, the concept of a digital profile of a citizen was approved. The final version will be approved by government decree. The task of this platform is to provide access to data about a citizen or legal entity contained in other state information systems through the portal of public services.

The digitalization of education in modern conditions makes special demands on the teacher, who must interact with students in a digital educational environment, carrying out the most individualized learning. These requirements in the form of necessary digital competencies determine the digital profile of the teacher, which include the ability, first of all, to receive and master new knowledge in a huge amount of information, to structure this knowledge in accordance with the competence model of students and, finally, to use modern teaching technologies to convey knowledge to students[24, 25]. From this point of view, the learning process should be carried out using a digital platform, which essentially implements the functions of an integrated knowledge management system, in which both the teacher and the student become equal participants in the innovative process of knowledge formation, and gain new knowledge in the process of joint innovation and project activities.

A distinctive feature of the digital educational platform, built on the principles of a knowledge management system, is the integration of many diverse sources of knowledge, usually for solving general educational problems [26].

In order for the student to be able to choose a teacher for training, the digital profile of the teacher should include not only the usual personal data: position, education, advanced training, academic degree, academic title, work experience, etc., but also specific data on the areas of professional activities, main achievements in these areas, scientific projects carried out, publications, descriptions of the results of intellectual activity, digital presence and activity in the information and educational space, as well as feedback on the quality of teaching and research activities [27:30].

The digital profile of a teacher, as a rule, is posted on the portal of a higher educational institution and is formed by the teacher from his personal account. But many information can be downloaded from external sources of knowledge, for example, from professional social networks, knowledge bases of professional associations, materials of scientific conferences and seminars.

The digital profile of a teacher is used, first of all, for effective personnel management in a higher educational institution, as well as in the formation of scientific teams for the implementation of grants and scientific and methodological publications, the implementation of projects of additional professional training, career guidance work.

A professional digital profile of a teacher is needed not only for a better organization of the educational process, but also for the development of teachers themselves, determining their points of growth, areas of professional development and promising scientific research. In this regard, the digital platform, built on the principles of a knowledge management system, fully supports the digital profile and the implementation of analytical and predictive functions. In subsequent chapters, the methodology for constructing digital profiles of teachers who implement the functions of digital twins will be

developed on the basis of digital platforms using the principles of building integrated knowledge management systems.

The digital profile of the teacher should allow assessing the effectiveness of the teacher's professional activity in various aspects: educational, educational, methodological, scientific, educational, social work and is designed to promote the rational use of the educational and creative potential of the teaching staff, improve their professional level, as well as optimize the selection and placement of personnel [31].

The digital profile of the teacher should reflect:

- the results of scientific and pedagogical activities of employees in their dynamics;
- personal contribution to improving the quality of education in the disciplines taught, to the development of science, to solving scientific problems in the relevant field of knowledge;
- participation in the development of teaching and education methods for students, in the development of new educational technologies;
- professional development.

Students evaluate the work of teachers according to the following criteria:

1) professionalism or depth of knowledge of the taught discipline;
2) the availability of the presentation of the material;
3) objectivity in assessing students' knowledge.

5 Results

As a result of the study, we can conclude that recently, more and more attention is paid to the processing of data about a person in various fields, such as business, science, education. The continuous accumulation of data about a person based on the technology of digital twins makes it necessary to develop methods for structuring and processing digital profiles of people and ways to use them to extract valuable information from them for the development of intellectual potential.

The digital profile of a teacher is used, first of all, for effective personnel management in a higher educational institution, as well as in the formation of scientific teams for the implementation of grants and scientific and methodological publications, the implementation of projects of additional professional training, career guidance work.

The proposed methodology should be based on the development of a comprehensive system of comprehensive, independent and objective assessment of teachers' work on the basis of quantitative and qualitative indicators, including both formal and informal characteristics of the results of their work [32, 33]. For CPD, general performance indicators can be distinguished, such as knowledge of educational and professional standards for the profile of educational activities, taking into account the decomposition of the competencies of educational standards and generalized labor functions of professional standards to the level of such characteristics as labor function, labor action, knowledge and skill. Also, general performance indicators can be indicators such as work experience in a professional field; reviews and results of customer surveys; the results of professional development; availability of professional certificates both in the subject area and in the field of certification of computer rights; possession of business

communication skills in various information media (e-mail, social networks, instant messengers, etc.); creativity of thinking, the ability to generate new ideas and methods of e-learning; participation in international symposia and conferences with reports on the development of distance educational technologies, psychological readiness to work in the conditions of informatization of education [34:36].

For employees from among the teaching staff, important indicators of labor efficiency in terms of e-learning, in our opinion, will be indicators of the level of proficiency in the functionality of the distance learning system, the ability to design various components of educational content suitable for loading into the LMS and adequately perceived by students; indicators related to psychological resistance to prolonged work on a computer, etc.

6 Conclusion

The result of the research is the development of a methodology for constructing a digital profile of a university teacher, which makes it possible to form a convenient information space for the work of a teacher and all monitoring centers (structural units) associated with the formation and use of digital profiles.

Thus, on the basis of the proposed methodology for constructing digital profiles of teachers of higher educational institutions, it is possible to create an automated information system that will allow for a comprehensive assessment of the effectiveness of the results of work of scientific and pedagogical workers and ensure the continuous development of the intellectual potential of the university.

References

1. Gorbunov AS Personality and digital technologies in the mass information society. *Bulletin of the Moscow State Regional University. Series: Philosophical Sciences*, 2018, No. 4
2. Danelyan T. Ya. Information technologies in psychology. M .: LENAND, 2015.
3. Minaev V. A., Mazin A. V., Zdiruk K.B., Kulikov L.S. Digital twins of objects in solving control problems. *Radioindustry*, 2019, V. 29, No. 3.- P. 68 - 79
4. Verkhoturova Yu. S. Ontology as a model of knowledge representation. *Bulletin of the Buryat State University* 15, 2012
5. Avdeeva I. L., Golovina T. A., Parakhina L. V. Development of digital technologies in economics and management: Russian and foreign experience. *Management issues*. No. 6. 2017.
6. Izmailova MA The impact of the digital economy on the transformation of the labor market and the formation of new business models. *Economy in industry*. 2018. Vol. 11. No. 3.
7. Kafidulina N.N. Digitalization as a trend in Russian education. *Sphere of knowledge: issues of productive interaction of sciences in the XXI century.* - 2018. - pp. 109-111.
8. Keshelava A.V., Budanov V.G., Rumyantsev V. Yu. Et al. Introduction to the "digital" economy. Capurro R. Digital ethics. M.: VNIIGeosystem, 2017.
9. Gutorova N. A. Features of communication between a teacher and a student in social networks: the ethical aspect. Sign: the problem field of media education. 2019. No. 2 (32).

10. Vinogradov A.G. Methodological arsenal of social-cognitive theory of personality. *Psychol ogy. Journal of the Higher School of Economics*, 2014. V. 11. No. 3. P. 23–36
11. Danelyan T. Ya. General provisions on consulting in commercial activities (marketing). Information technologies and consulting. *Economic sciences*. 2019. No. 6 (175). S. 41-49
12. Dedov N.P. Positive mechanisms of regulation of professional activity in the context of digitalization of society. *Akmeologiya* 3, 2018
13. Dneprovskaya N. V. Method of researching the competencies of subjects of the digital economy. *Open education*, vol. 24, no. 1. 2020
14. Bolshakova E.I., Efremova N.E., Sharikov G.F. Instrumental tools for developing systems for extracting information from Russian-language texts. *New information technologies in automated systems*. M., 2015. pp. 533-543.
15. Brazhnik T.A. Legal issues of ensuring information security of the individual. *Information law*, 2018, No. 4
16. Volokitin Yu. I., Kupriyanovskiy V. P., Grinko O. V., Pokusaev O. N., Sinyagov S. A. Problems of the digital economy and formalized ontologies // International Journal of Open Information Technologies vol. 6, no.6, 2018
17. Akatkin Yu. M., Yasinovskaya E.D. Digital transformation of public administration. Datacentricity and Semantic Interoperability. Moscow: DPK Press, 2018.
18. Dobrolyubova E.I. Public administration by results in the era of digital transformation: an overview of foreign experience and prospects for Russia. *Issues of state and municipal administration*. 2018. No. 4.
19. Zarzhitsky I. What are the risks of the digital economy. *New defense order. Strategies.* 2018; (3):74-78.
20. Ivanov V.V., Malinetskiy G.G. Digital economy: from theory to practice. *Innovations*. 2017; 12:3-12.
21. Ivanovskaya L.V. Digitalization or digital science: problems and prospects. *University Bulletin*. 2019; 6:45-50.
22. Krasilnikov D.G., Sivintseva O.V., Troitskaya E.A. Modern Western management models: synthesis of New public management and Good governance. *Ars Administrandi*. 2014; (2):45-62.
23. Voskanyan E. Digital turn. *Method.* 2018; (1):14-18.
24. Higher education. Great Soviet encyclopedia / Ed. by A. M. Prokhorov. 3rd ed. M.: Soviet encyclopedia, 1969-1978.
25. Garanin M.A. Influence of "digital twins" on the economy of the public sector. *Creative Economy*. 2018; 12(11):1733-1758.
26. Gasparian M.S. Development of a system for assessing the effectiveness of scientific and pedagogical workers on the basis of an integrated information and educational space. *Open Education*. 2015; (6).
27. Gasparian M.S., Lebedev S.A., Filyuk M.A. Approaches to the development of a system for assessing the effectiveness of personnel in the context of informatization of education. *Uchenye zapiski ISGZ.* 2016; 1(14):146-149.
28. Abrosimova O.M., Korsheva M.A. Education of the future in the conditions of industry 4.0: the view of students. *Formation of general cultural and professional competencies of a financier*. 2018; 3-8.
29. Kokorev D.S., Yurin A.A. Digital twins: concept, types and advantages for business. Colloquium-Journal. 2019; 10(34):31-35.
30. Krivogin M.S. Features of legal regulation of biometric personal data. *Law. Journal of the Higher School of Economics*. 2017; (2):80-89.

31. Smirnova O.S., Vlasov D.A., Shishkov V.V., Alymov A.S., Ishin I.A., Kolesni- kov I.E., Petrov A.I. Description of the user's information image social network taking into account its psychological characteristics. *International Journal of Open Information Technologies.* 2018; 6(4):24-37. URL: http://injoit.org/index.php/j1/article/view/562
32. Kryukova D.Yu., Mokretsov Yu.V. Actual problems of legal regulation of circulation and protection of personal data in Russia. *Penitentiary Science*. 2017; 2(38).
33. Loiko V.I., Lutsenko E.V., Orlov A.I. Modern digital economy. Krasnodar: KubSAU; 2018.
34. McCarthy P. Business on the Internet on the example of well-known brands. Moscow: AST Publishing House; 2019.
35. Molchanov N.A., Matevosova E.K. Information security doctrine of the Russian Federation (novel of legislation). *Actual problems of Russian law*. 2017; 2.
36. Kislova I.I., Ronshina E.S., Stegostenko Yu.B. Digitalization. Challenges for Education. *Problems of Higher Education*. 2018; (1):157-159.