Digital platform as a professional education management tool

A V Feoktistov[1], O N Trofimenko[2], S P Ognev[1], M V Lyakhovets[1,3] and R S Koynov[1]

[1] Novokuznetsk College of Building Technologies, 4, Michurina street, Novokuznetsk, Kemerovo Oblast, 654027, Russia
[2] Ministry of Education and Science of Kuzbass, 58, Sovetskiy av., Kemerovo, 650064, Russia

[3] E-mail: mvlyakhovets@yandex.ru

Abstract. The paper considers one of the approaches to solving the problems of managing educational institutions of secondary vocational education, associated with the use of a digital platform. The capabilities of the digital platform in the implementation of the full cycle of educational process management are characterized. The features of five interrelated subsystems of the platform are presented: performance monitoring, methodological support, management of personalized educational trajectories, record of the academic achievements and employment promotion, virtual laboratory educational and research complexes. The principles of using the platform at two levels of management are described - the level of the educational organization and the level of the regional system of vocational education.

1. Introduction

Currently, the system of secondary vocational education has faced new challenges. Firstly, the introducing the self-isolation regime in order to prevent the spread of the new coronavirus infection COVID-19 required a search for new forms and technologies of undirected interaction. Secondly, for the period from 2019 to 2024, the decree of the President of the Russian Federation approved the national program "Digital economy of the Russian Federation", the tasks of which include "creating the key conditions of personnel training for the digital economy" and "transforming priority sectors of the economy and social sphere, including healthcare, education, industry, agriculture, construction, urban economy, transport and energy infrastructure, financial services through introducing the digital technologies and platform solutions." These tasks are contained in the passport of the national program "Digital Economy of the Russian Federation" in the form of Federal projects "Personnel for the digital economy" and "Digital technologies".

As indicated, nowadays there is a need to find and develop new drivers that would allow the systematic transformation of the traditional education system into an innovative digital one. Only the global digitalization of education will make it possible to achieve the assigned tasks.

However, the current situation in the vocational education system is aggravated by the following factors:

- lag in the field of education informatization;
- continuously increasing requirements for the speed and quality of managerial decision-making, efficiency of resource use;

- the presence of patchwork local automation in the vast majority of educational organizations, which is characterized by a large number of information systems implemented at certain stages of the management process and little interconnected;
- insufficient development of methodological and informational support of distance technologies, including for organizing and conducting practical and laboratory classes.

Currently, there are various approaches to solving the problems of digitalization of secondary professional educational organizations [1-3]. As the studies showed, the authors and pay attention to the formation of the digital infrastructure in educational organizations, and the created digital products, as a rule, are used to solve the problems of e-learning. For instance, the study [1] considers an approach to college digitalization as a single information space. The work [2] presents a model of the college information system within the digital educational environment. The experience of using the practical development "Digital College of the Moscow Region" (www.academia-moscow.ru), aimed at providing distance education, is known.

It is believed that the solution to the issues related to digitalization is associated with the use of new management tools, one of which is a digital platform that integrates the functions of monitoring, accounting and management of participants in the educational process and implements the functionality of laboratory educational and research complexes.

2. Digital platform model

The proposed digital platform is designed for the integrated management of the activities of a professional educational organization, is built on a modular principle and includes the following subsystems (figure 1):

- performance monitoring;
- methodological support;
- management of personalized educational trajectories;
- record of the academic achievements and employment promotion;
- virtual laboratory educational research complexes.

2.1. Subsystem for performance monitoring

In education, the introduction of an effective contract is justified by the need to correct the shortcomings that emerged during the implementation and application of the new pay system that has been introduced over the past several years. In the program documents of the Government of the Russian Federation, it is noted that it was not possible to solve the problem of personnel incentives, taking into account the results of their work, for all organizations: indicators and criteria for the efficiency of workers of educational organizations are not sufficiently developed, and their application is formal. In the pay systems for employees of educational organizations, in many cases, previously applied incentive payments, which have low efficiency in modern conditions, have been preserved (for example, performance of duties in good faith, labor intensity, labor quality, etc. without specifying specific measurable parameters).

The introduction of an "effective contract" entails certain costs, which are caused by the need for regular assessment of the achievement of quality indicators, performance and efficiency of each employee. These costs can be minimized by introducing automatic grading using electronic technology with an appropriate computer program.

The subsystem makes it possible to automatically calculate the performance indicators of both the teaching staff (TS) in the conditions of work under an effective contract, and structural divisions of the educational organization in the main areas: educational and methodological work, organizational and educational work and other activities.

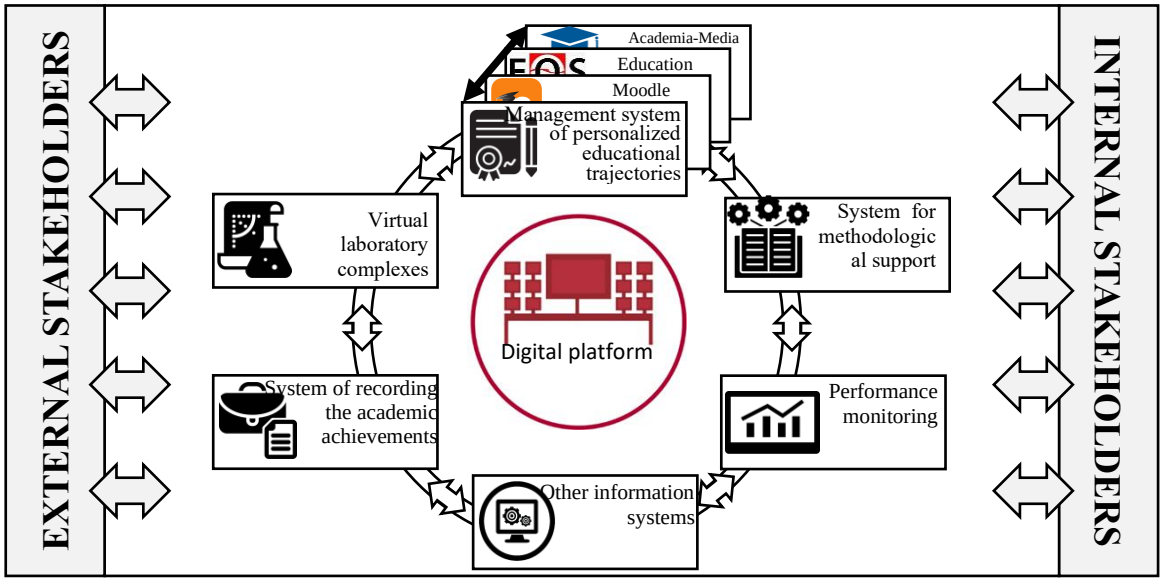

Figure1. Model of a digital platform for vocational education.

The objectives of monitoring the effectiveness of the teaching staff and structural units are:
to determine the performance results of the TS, which can serve as the basis for establishing the payment for labour and introducing it into the employment contract;

- to stimulate professional development, professional growth, increase in productivity of pedagogical and scientific work, development of the creative initiative of teachers;
- to assess the performance of structural units that implement the functions of an educational organization;
- to collect complex analytical information characterizing the results of the educational organization and to report documents to management for the development and management decision-making.

The performance monitoring subsystem is a software-algorithmic complex consisting of:

- an information database that comprehensively reflects the activities of both the educational organization as a whole, and its structural units and teachers separately;
- procedures for calculating a single comprehensive criterion for assessing and monitoring the effectiveness of an educational organization, departments and teachers;
- a user interface implemented using Internet technologies and allowing to enter the initial data in a convenient form to determine the rating, provide information on the values of performance criteria for analysis, and also administer this subsystem.

One of the advantages of the subsystem is the ability to flexibly adjust the procedures for calculating performance indicators to take into account the specifics of a particular educational organization. In addition, it is possible to implement automatic procedures for obtaining initial data from adjacent automated information systems.

2.2. Subsystem for methodological support
As is known, from the point of view of documentation support, any educational process is strictly formalized, since it is regulated by the requirements of national standards. Moreover, it should be taken into account that educational standards do not remain "frozen", as society develops, they change, which

is recorded in legislative documents. The following documents can be referred to the documentation support of the vocational education process: educational program; syllabus; work programs for a discipline and practice; calendar and thematic plan; complexes of control and assessment tools for academic disciplines and practices, etc.

The subsystem of methodological support allows for an integrated approach to the creation of documentation that ensures the implementation of the educational process. Moreover, it can be used as a didactic tool for managing teacher training, an information model of the educational system that defines the structure and reflects the elements of the educational process.

Users of this subsystem develop and upload educational and methodological documentation to the information base, and in the future this documentation is available on request. In addition, some documents can be generated automatically using data from related systems of an educational organization.

The subsystem of educational and methodological support makes it possible to reduce the costs of registration and content of documentation support of the educational process, to ensure control over the readiness of current documents.

2.3. Subsystem for management of personalized educational trajectories

Currently, in vocational education, much attention is paid to the design and implementation of the educational process aimed at developing the professional potential of the learner. Conditions are required under which the learner acts as a subject of educational activity that is, they have the opportunity to build their own individual trajectory for mastering general and professional competencies. The subsystem allows one to manage the choice, fix goals, results, and collect individual elements of educational information into integral structures. Thus, it creates conditions for the formation of a personalized educational strategy, taking into account the characteristics of the learner's personality and needs for professional development.

The subsystem enables to flexibly manage the educational process (including remotely), organize information exchange between teachers and learners in the interactive mode and keep track of the results of learners' educational activities with the possibility of adjusting their individual achievements.

This subsystem for managing the learning process is based on the learner's model in the educational information environment, described in [4]. The use of the subsystem makes it possible to make the learning process adaptive, depending on the individual characteristics and preferences of the learner. It provides for the allocation of a structurally minimal amount of educational information, which is optimal for a certain set of individual characteristics of the learner (quantum of educational information).

Such a subsystem, together with the subsystem of methodological support, enables to create a full cycle of management of the learning process: after mastering each structural element of educational information, an analysis and verification of the level of competence formation follows, correction of the further course of the learning process, after which the advance to the next element of educational information is made.

2.4. Subsystem for recording the academic achievements and promoting employment

The subsystem allows for a complete accounting of educational, professional, creative, sports and other achievements of students. The subsystem provides for the use of Internet technologies of social networks, which makes it possible to automatically select the optimal conditions and promptly organize interaction between employers and job seekers.

The subsystem for recording individual academic achievements provides: implementation of an individual approach in the educational process; support for high learning motivation; obtaining, accumulating and presenting to all interested persons, including parents, information about the academic achievements for any period of time; the basis for making management decisions and measures aimed at obtaining positive changes in the educational activities of the organization in order to increase its effectiveness.

The use of the information system for storing the achievements of students makes it possible to act as an element of the Center for youth promotion and employment [5]. The subsystem can automate the process of selecting the best job option for both graduates and employers. On the one hand, information about students can be used as a basis for the formation of an applicant's resume according to the requirements of employers; on the other hand, the presence of a certain rating of enterprises and employers will allow the graduate to help navigate the labor market. The use of Internet technologies and social networks allows organizing interaction between alumni and employers, for example, for conducting virtual interviews and excursions to enterprises. The provided mechanisms of socialization and feedback enable to automatically generate rating assessments of the reliability of employers.

2.5. Virtual laboratory educational research complexes

One of the problems of distance learning, which any organization of professional education faces, is the problem of laboratory and practical work. This is due to the fact that it is difficult to obtain practical skills in virtual laboratory installations. The authors believe that the solution to this problem should be comprehensive - in the educational process of a professional organization, it is necessary to use both virtual laboratories (which are software that allows simulating laboratory experiments) and remote laboratories (laboratory complexes, which include the real laboratory, software and hardware for installation control and digitization of the obtained data, as well as communication means) [6].

One of the topical areas is the use of educational research automated training complexes (ATC) [7] as a base for laboratory, practical and educational research work with built-in expert information systems designed to track work results and evaluate the effectiveness of training. Automated training complexes provide the integration of various methodological guidelines and manuals, print simulators, automated laboratory installations and simulation software into a single information and educational environment, which allows for a flexible and efficient mode of operation with integrated training tools, and built-in software agents and expert modules to increase the "intelligence" of the interaction of students, teachers, developers with systems.

Educational and research complexes, implemented on the basis of digital twins of real production facilities and technological processes, allow active training on simulators implemented on the basis of a full-scale model approach and using virtual and augmented reality tools.

3. Digital platform implementation

The platform architecture is based on the PaaS (Platform as a Service) cloud service delivery model, a cloud computing delivery model in which the consumer gains access to the use of information technology platforms hosted by a cloud provider. The main advantage of such a model for distributing application software for a service consumer is the absence of costs associated with installing, updating and maintaining the equipment and the software running on it. This is particularly important taking into account the relatively small amounts of funding for the development of information technologies of budgetary educational organizations.

Positioning the digital platform as an element of PaaS enables to put into operation (and in the future to launch) any of the above subsystems in a complex or independently, both autonomously (figure 2) at the level of employees and students of an educational organization, and to be integrated into the system of secondary vocational education of the region as a whole (figure 3). When using the platform at the regional level, the executive authorities have the opportunity to transparently monitor any subordinate educational institution in terms of meeting targets.

It should be noted that the use of PaaS, regardless of the level of digital platform operation used for an educational organization, makes it possible to facilitate and remove a certain part of the time and financial costs for the deployment and support of IT services in such a way that during its operation the staff does not need to administer the operating system and system software. To manage the platform, a web interface will be provided, with the help of which the educational organization will be able to add the necessary content to its site, including active content (scripts, databases, etc.).

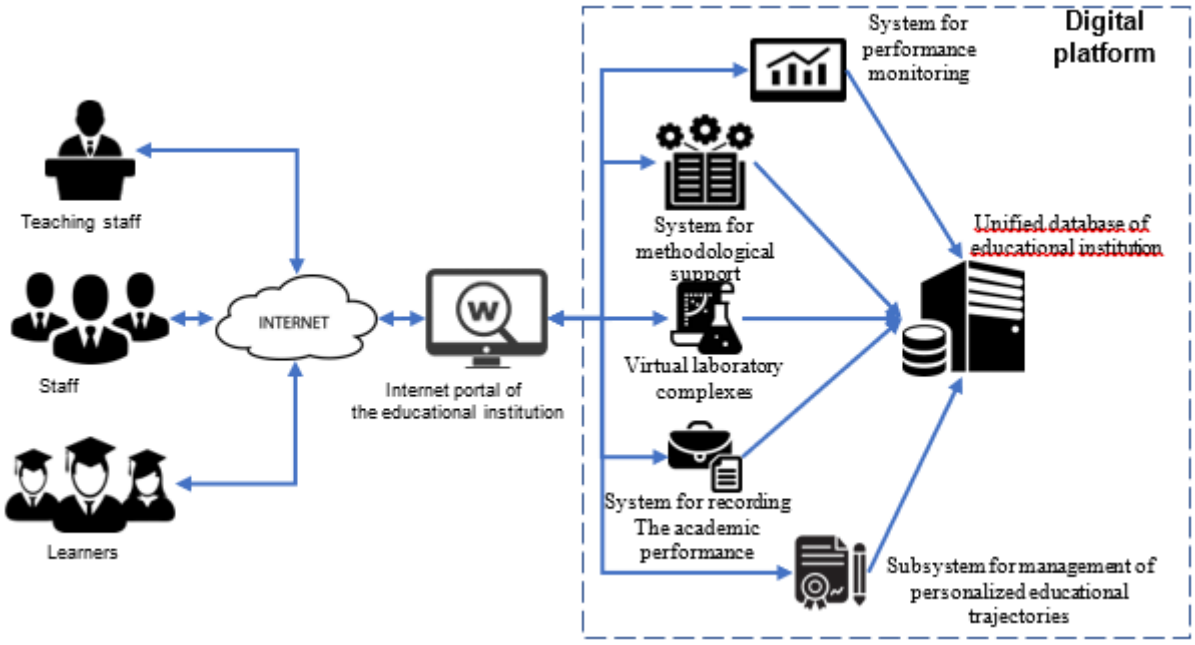

Figure 2. The level of educational institutions.

The server administration load (both its hardware and software) lies with the operator providing the service. This approach allows the operator to be used as a data aggregator platform and, with a certain interest of the region, to monitor the work of any subordinate organization.

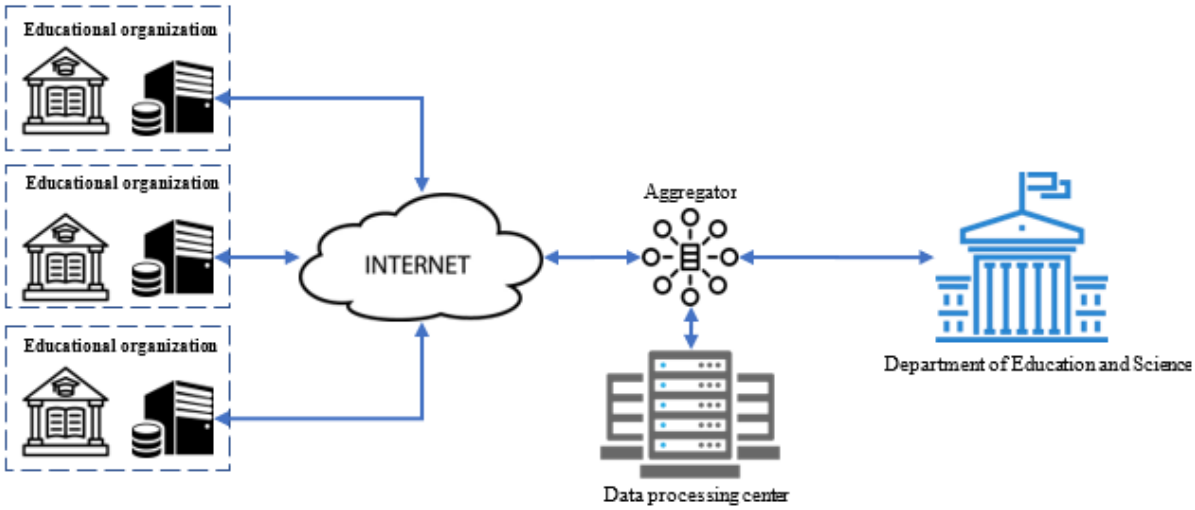

Figure 3. Regional level.

Microsoft SQL Server was chosen as the basic database management system, which supports a structured query language and has proven itself well when working with both personal and large enterprise-scale databases. However, at the request of the customer, the database can be implemented using any relational database management system.

The digital platform is implemented on the basis of Internet technologies using the ASP.NET web application development platform (part of the .NET Framework) in the C # programming language. In particular, the ASP.NET Web Forms framework is used, which makes it possible to create modular web

pages from components with handling user interface events on the server side, which makes it possible to reduce the requirements for the user's hardware and software complex - an installed browser is enough to access the Internet.

4. Conclusion

The implementation of the tasks of managing professional educational organizations of secondary vocational education cannot be achieved without the use of automated information systems. The use of the proposed digital platform is the key to the success of bringing an educational institution to a qualitatively new level of manageability, the subsequent sustainable development of the education system and is a factor in the successful implementation of the tasks of modernization and digitalization of education.

References

[1] Shipulin N I and Maidurov S A 2009 Development of an open inormation and educational environment in a modern college *The world of science, culture and education* **7(2)** 109-13
[2] Mitrokhina E V 2018 College digital learning environment *Best training practices* 499
[3] Toktarova V I and Fedorova S N 2018 Information and educational environment of the university: intepretive and content analysis *Vestnik of the Mari State University* **12** 77-87
[4] Toktarova V I 2018 E-learning management in an adaptive information and educational environmnet of a university *Vestnik of the Mari State University* **12** 96-101
[5] Ilyasov E 2005 Employment of university graduates: a support system *Higher Education in Russia* **7** 3-13
[6] Trukhin A V 2002 On the use of virtual laboratories in education *Open and distance education* **4** 81-2
[7] Gulevich T M, Fedotov A A, Lyakhovets M V and Feoktistov A V 2014 Automated training complex based on Internet technologies in universities and engineering centers *Informatization of engineering education – INFORINO-2014* (Moscow: National Research University “Moscow Power Engineering Institute”) 481-4