

Modeling the training system of masters of public service using Web 2.0

Yevhen M. Khrykov¹[0000-0002-5496-2753], Alla A. Kharkivska²[0000-0003-4782-1079],
Halyna F. Ponomarova²[0000-0001-7658-9833] and Aleksandr D. Uchitel³[0000-0002-9969-0149]

¹ Luhansk Taras Shevchenko National University, 1 Gogol Sq., Starobilsk, 92703, Ukraine

² Kharkiv Humanitarian-Pedagogical Academy, 7 Rustaveli Ln., Kharkiv, 61001, Ukraine
enxr@ukr.net, kharkivska_hgpa@ukr.net, rector-hgpa@kharkov.com

³ State University of Economics and Technology,
5 Stepana Tilhy Str., Kryvyi Rih, 50006, Ukraine
o.d.uchitel@i.ua

Abstract. The article concerns grounding the technology of training masters of public service with the use of Web 2.0. This technology is based on the concept of sign-contextual learning, the positions of the laboratory-brigade method, the concept of Web 2.0, case technology, project method, problem learning. The main features of this technology are changes in the correlation between theoretical and practical training, in-class and individual studying; changing teachers' functions; extensive use of information technology capabilities in learning.

Keywords: Training technology, Masters of public service, Use of Web 2.0.

1 Introduction

The relevance of the problem of modeling the innovative technology for the organization of the educational process in a higher educational institution is determined by several factors. The first factor is the need to ensure the system of professional training of public servants is in line with the realities of today. These realities are the grandiose digitization of all spheres of public life, the country's full-scale entry into the global information space. First and foremost, it concerns production, management, public administration and education. Digitization caused not only the emergence of fundamentally new mechanisms of administration, new content of management activity, but also changed the very essence of public management.

The second factor is the emergence of new means of organizing students' learning activities. Among them, technology-based Web 2.0 is at the forefront [17; 32], and now Web 3.0 is about to appear.

The third factor is the fundamental changes that occur in the formation and development of the modern personality, who is ready to use information technologies in all spheres of human life. In the context of creating even "state in a smartphone", the level of information culture, information competence of a public servant should

correspond to the existing requirements.

These factors determine the need for more complete implementation of information technology potential in the process of training masters of public service. It will contribute to the development of their information and communication competencies and increase the efficiency of public administration.

2 Methodology of the research

The research was conducted over five years in several stages. The first stage was devoted to singling out the factors that influenced the organization of the educational process for master's degree program "Public Service". It was carried out by analyzing the state requirements for public servants, the scientific literature on the organization of the educational process in higher education, and distinctive features of graduate students. The obtained results allowed us to substantiate the requirements for the technology of the educational process for master's degree program at the second stage of the research.

The third and the main stage of the research was aimed at modeling the training system of masters of public service using Web 2.0. This model envisaged modernization of the structure of masters of public service training, determining the target component of training – masters' competences and their indicators, singling out theoretical grounds on which the learning process should be based (concept of sign-contextual learning, laboratory-brigade method, Web 2.0 ideas, case technology, project method, theory of problem learning, ideas of student-centered approach, which provides for the realization of students' information needs).

The fourth stage of the research involved implementing a valid model in the educational process at Luhansk National University for three consecutive enrollments of graduate students over 4.5 years. At this stage, the results were diagnosed by interviewing graduate students, employers, and analyzing the volume of recruitment to the graduate program.

At the fifth stage, the results were summarized, conclusions were drawn and suggestions were made for further research.

3 Literature review

The theoretical foundations of informatization of modern society were studied by Syed A. Ahson [1] (cloud computing and software services), Alex Amies [2] (developing and hosting applications on the cloud), Rajkumar Buyya [6] (cloud computing), Richard N. Katz [16] (higher education in the age of cloud computing), Wolfgang Lehner [22] (web-scale data management for the cloud), Dan Marinescu [23] (cloud computing), Vladyslav Ye. Velychko [8] (informatization of education as a pledge of the existence and development of a modern higher education). The problems of using information technologies in education were investigated by Kees Blokland [4] (testing cloud services), Olga V. Bondarenko [5] (didactic potential of virtual information educational environment), Olena O. Lavrentieva [21] (virtual reality in the system of

vocational training), Wolfgang Lehner [22] (web-scale data management for the cloud), Yevhenii O. Modlo [25] (methods of using mobile Internet devices), Pavlo P. Nechypurenko [28] (augmented reality in education), Liubov F. Panchenko [29] (methodology of using structural equation modeling in educational research), Serhiy O. Semerikov [26] (ICT-based competence approach), Myroslav I. Zhaldak [38] (computer-based learning systems), Hua Zheng [39] (using Web 2.0) and others. Andrey A. Verbitsky [37] and other researchers devoted their studies to theoretical backgrounds for the technology of educational process organization in the system of training masters of public service in higher educational institutions.

In the scientific discourse there are numerous works focused on the information problems in educational sphere. However, insufficient attention has been paid to the analysis of Web 2.0 technology usage in the system of masters of public service training. A striking example is the work by James I. Gow and Sharon L. Sutherland [9], which analyzes the missions, curricula, and peculiar features of about 200 public administration master's programs, but does not focus on the use of information technology in the learning process.

Thus, educational theory and practice substantiate a large number of approaches, concepts, tools for using Web 2.0 in vocational training, but it does not eliminate the need to model the original training system in each case. Such models cannot be the same and should take into account the characteristics of students, their future professional activities, content of education, available facilities and human resources.

4 Justification of the training system model for masters of public service

Nowadays modeling educational process on the basis of information technology is complicated by the division into separate scientific specialties of the theory and methods of vocational education and information and communication technologies in education.

The aim of our article is to model the system of training masters in specialty "Public Service", which is relatively new for Ukraine and its educational standards are in constant development.

To justify this technology, it is necessary to single out the factors that influence the organization of the educational process for master's degree program "Public Service". Among them, the most significant are the following:

- constant improvement and updating of requirements for training specialists in this specialty;
- development of a large number of technologies for the organization of vocational training;
- a high level of students' self-awareness, self-esteem, democracy, insistence on high standards, orientation towards the use of information technologies in all spheres of their life;
- students' combining studying for the degree and practical activities in the field of

public service, their life experience, focus on the position of the subject of the educational process, subject-subject relations with teachers, other students, management staff.

Taking into account the following factors allows determining the requirements for the technology of the educational process for the master's degree program:

- the technology should ensure that competences relevant to public officials are formed;
- the technology should anticipate a high level of student activity, covering all spheres of their life in educational institution;
- the technology should overcome the excessive level of theorizing of the educational process and provide a high level of not only theoretical but also practical training;
- the technology should involve participation of teachers, students, department laboratory assistants, dean's offices or directorates staff in its realization;
- the technology should provide for certain changes in the functions of the teacher, who can no longer be the main source of information for students. The teacher should become the organizer of students' educational, research, project, practical activity. It is what his position should be so that to correspond to students' peculiar qualities, increasing the amount of accumulated information, the potential of modern technologies of the educational process, the goals of vocational training in modern conditions;
- the technology should involve the integration of traditional and innovative learning forms and methods. Implementation of the principles of mixed learning, which allows for the flexibility and convenience of information technology and the benefits of traditional organization of the educational process. For a long time of its existence pedagogical science has developed a significant number of technologies and approaches to the organization of professional education, some of which are fundamental, and some require their updating in the light of the realities of today;
- the technology should be modeled taking into account the current level of the development of information technologies, their use in the civil service and local government. These technologies allow finding, accumulating, classifying, analyzing, transmitting, creating information, providing social interaction, communication, joint activity. Realization of available potentials can enrich the educational process, increase its efficiency, make it more relevant to our time, students' characteristics;
- the technology should be based on a specific distance learning platform, teachers' training blogs, cloud facilities, classroom activities, individual and group students' activity.

The realization of the abovementioned requirements calls for the modernization of the structure of training masters of public service. Its main components should include: learning sessions; performing tasks on the distance learning platform; implementation of the case- study; implementation of projects, development of plans, consideration of problematic issues; writing master's thesis; processing information on the sites of institutions, departments, social networks and messengers. These components of the

training system can become more effective by implementing some innovations and extensive use of Web 2.0.

Even learning sessions should create opportunities for graduates to express their opinion, to share their experience and have it evaluated, to get acquainted with the experience of others, to ask questions.

A key role in building a training system belongs to the target component, which characterizes the competencies that this system should focus on. We can determine the core competencies of a public servant on the grounds of the competent approach and taking into account digital competence framework the DigComp 2.0 and 2.1 [7].

The recent research allowed us to determine the following competencies and their indicators: *ability to ensure effective work* (a clear understanding of the purpose and current tasks of their activity; perseverance, energy, efficiency; self-organization; resistance to difficulties; orientation to external and internal clients; availability of knowledge and skills required for effective activity); *ethical behavior* (positive attitude towards others, to oneself, to work, to the state; moral knowledge; decency, sincerity; adherence to the general rules of public servants' conduct; preventing conflict of interests); *ability for self-development* (the desire to improve their activities; awareness of own strengths and weaknesses; objectivity of self-esteem; active self-education and professional development); *analytical thinking* (ability to connect past, present and future; critical thinking; having a well-founded personal position; ability to analyze documents; ability to develop programs of development; vision of department development possibilities); *ability to work in a team* (respect for colleagues; ability to negotiate; focus on cooperation and assistance; ability to perform various functions in the team; contribution to the overall results of the work; ability to share results); *ability to communicate effectively* (culture of communication; proficiency in the state language; mastering the basics of conflictology; mastering the basics of information technology); *ability to use information technologies* (ability to find necessary information, analyze and generalize it; ability to use network services for creating databases, conducting surveys; providing information security; ability to create necessary documents, presentations) [18].

Most of the abovementioned factors and requirements for the training system are taken into account by the concept of sign-contextual learning [37]. Elaine B. Johnson states in the monograph "Contextual Teaching and Learning" that "contextual teaching and learning contributes to the effective adaptation of students to future professional activities and determines the relationship of academic knowledge with life situations" [14]. This concept is based on the theory of activity, according to which the acquisition of social experience is the result of activity of the subject. The organization of training according to this concept is based on the following principles: activity of the individual; problem-centered approach; unity of education and upbringing; sequential modeling by means of forms of students' educational activities and conditions of specialists' professional activity.

It is well known that sign-contextual learning is a form of active learning, modeled for using in higher education, which is focused on students' vocational training. This form is realized through the systematic use of professional context, the gradual saturation of the educational process with the elements of professional activity. Any

theoretical question should be examined in relation to production. This concept offers two ways of integrating practical and theoretical training:

- the curriculum of any academic discipline must include such theoretical material that is as close as possible to the practical problems of a particular professional activity;
- taking into account the practical needs of professional activity, it is necessary to determine the content of the theoretical disciplines of the professional cycle.

If the first way involves the advancement from theory to practice, the second goes from profession to theory.

Sign-contextual learning implies that all knowledge is provided and learned only in the context of future professional activity. A common basis for different techniques is the professional context, the need for cross-subject and interdisciplinary relations.

In the process of modeling the system of masters training we rely on the laboratory-brigade method, which was created in the 1920s [12]. As it is known, this method is characterized by the following features:

- overcoming the shortcomings of the subject matter principle of teaching;
- priority of empirical knowledge over theoretical, focus on the study of society, production, nature;
- reorientation of the teacher from information delivery to the organization of educational activity;
- prevalence of group work in the educational process.

The current system of the educational process in higher educational institutions does not allow implementing the laboratory-brigade method in full, but its key ideas have retained their value and can be applied.

It is advisable to use the ideas of Web 2.0 as the next conceptual basis for the process of modeling the masters training system [10]. The introduction of Web 2.0 into education involves using new information and communication technologies to improve the quality of vocational training by facilitating access to resources and services, as well as through the remote exchange and collaboration of online community members.

Web 2.0 technology is based on social networking services that support the involuntary development of communities consisting of people interested in sharing information, developing specific problems, and communicating.

Web 2.0 is a social service platform that allows any user, in our case, a master, a teacher, a manager, to get, create or be a co-author of information, perform synchronous and asynchronous network communication.

The use of network services creates the conditions for meaningful and instrumental enrichment of the activities of masters, teachers, management staff. Knowledge sharing services [13], textbook creation services [3], online communication services [36], services for storing documents, photo, audio and video materials [20], geoinformation systems [27], bookmarking services can assist in the completion of vocational training tasks.

The realization of Web 2.0 potential involves masters' using spreadsheets [33], tools for control and self-control of educational achievements [34], tools for creating

multimedia presentations [35], general-purpose search systems, training support systems, text editors [24], distance learning platforms [30], cloud-oriented learning support activities [31]; testing and completing online questionnaires in the course of monitoring procedures; analyzing survey results by MS Excel; creating interactive posters, presentations in Prezi, smart cards, infographics; participation in web conferences, webinars, forums, chats, creation of e-portfolio.

Modeling innovative technology it is advisable to rely on case technology [19]. At the heart of this technology is the idea of a case-study, which emerged at the beginning of the last century in the process of training management specialists, and remains the key one in training masters of business administration in all the leading business schools in the world. This technology allows structuring the content of education, educational tasks, masters' educational activities, their control tasks and report forms. Cases should be mainly complex, cover the content of vocational training, meet the optimum amount of self work and provide for the participation of all members of the training group in solving educational tasks. The basis for the development of the case structure may be the structure of competencies, practical tasks of public servants, and disciplines of the curriculum.

It is advisable to use the case-technology ideas in the light of all the other methodological foundations of the new technology, and first of all Web 2.0.

An example of a case study is "Overcoming Corruption". This case envisages attending classes on "Public Service", "Legal Bases of Public Service", "Ethics of Public Service", "Quality Management System of Administrative Services"; studying laws, scientific literature as well as having experience in solving corruption problems. Depending on the number of classes attended, each graduate student performs the tasks assigned by the disciplines on the distance learning platform.

The next step is to accomplish an interdisciplinary collective task: to identify the task of rooting out the corruption at the state, regional and public service levels. On the weblog created, students together fill in a spreadsheet (Table 1).

Table 1. Tasks for Overcoming and Preventing Corruption

Tasks at the state level	Tasks at the regional level	Tasks at the level of institution
--------------------------	-----------------------------	-----------------------------------

The training blog creates an opportunity to take into account the contribution of everyone to the collective activity and to coordinate the participation of the teachers and the students themselves.

The case involves developing individual projects – anti-corruption programs of institutions or creating micro-groups for this purpose, if employees of one institution are simultaneously trained. This project involves identifying corruption threats to the organization, analyzing procedures for providing administrative services, developing tools for questioning citizens to assess the level of corruption, studying the experience of other institutions and countries, organizing the evaluation of the developed program by citizens, its agreement. The development of an anti-corruption program should be based on the previous work on identifying three groups of tasks to tackle and prevent corruption.

Another methodological basis of the new teaching technology, which is advisable to use, is the project method. It allows arranging graduate students' educational activities, to formulate their results and organize their assessment [15]. The projects should be of complex character, covering different disciplines, and be implemented by micro-groups of masters (teams).

We can provide a following example of such a complex task: create a database of codes of conduct for public servants (using Internet technologies and visiting public service institutions); analyze common and different features in these codes of ethics; to which extent their content corresponds to the legislative and regulatory documents; analyze the practices of public service institutions and find out whether they comply with regulatory, legislative documents; when visiting public service institutions, conversations with employees, citizens, analyze the activities of the institution and find out the reasons for the violation of certain ethical standards and suggest ways to optimize civil servants' activities.

Another methodological basis for modeling the master's training system is theory of problem learning [11], when the teacher does not deliver information, but organizes students' activity on obtaining new information. Here are the examples of problematic issues and practical tasks on "Public Service Ethics", which fundamentally change the role of the teacher, transform masters into subjects of the educational process, shift the focus of students' attention to the issues that are important for public service practice.

- Can a person, who did not study hard for a master's degree program, work effectively in public service?
- Can the level of ethical culture of the manager be lower than the ethical culture of the subordinates?
- Compare ethics of public servants in different countries.
- Find in the Internet and compare codes of conduct for different professions. What do they have in common and what do they differ in?
- Analyze the ethical principles of public servants' behavior to you in a particular situation.
- Describe the instances of misconduct by public officials that you have witnessed.
- Analyze the ethical principles of behavior at Ogurtsov's meeting in "Carnival Night".
- Develop criteria for assessing the ethics of a public servant's behavior.
- Suggest a system of methods for assessing the ethics of a public servant's behavior.
- Model a conversation with a citizen to study the level of ethics of a public servant's behavior.
- Develop rules of communication for a public servant with citizens.
- Develop rules of communication for a public servant with colleagues.
- Suggest ethical requirements for communicating the manager with public officials.
- Make a self-improvement plan for your ethics.
- After observing the behavior of public servants, describe the typical situations in which ethics are violated.
- Ask the public about cases of interaction with public officials and analyze the ethical foundations of their behavior.

- Analyze citizens' attitudes towards local governments.
- Design the behavior of a public servant in a conflict situation with a citizen who came to solve their problems.
- Analyze the causes of ethical misconduct by public officials.
- Analyze the causes that lead to violations of ethical conduct by the manager.
- Suggest a plan for a manager to implement the Code of Conduct for Public Officials.
- Suggest criteria for assessing a public servant's ethical conduct during certification.

It is advisable to organize teams that will look for arguments to support opposing positions when addressing problem issues.

An important part in masters training is a master's thesis. Its quality now depends on the systematic use of information technologies. Nowadays, they allow discussing and approving the topic of the research promptly, ensuring continuity in the development of certain problems, finding scientific information, information about the activity of public service institutions, legislative and regulatory information, information about the experience of other countries, conducting surveys, establishing communication with employees of different institutions, promptly communicating with the scientific advisor, presenting the results of the research in various forms, checking whether the principle of academic integrity is implemented.

A crucial peculiarity of modern education is its orientation to the student-centered approach. In the context of our research this approach means that the effectiveness of the master's training system depends on the extent to which the learning process allows them to fulfill their diverse information needs. There are two logics behind the construction of the master's training system: to satisfy the existing needs of students, or to realize the potential of modern information technologies. The first logic is not fully effective because the information needs of the learners may lag behind the potential of modern technologies, which necessitates the formation of these needs according to the potential capabilities of information technologies.

Taking into account the peculiarities of the learners allows structuring their information needs. The first group consists of the information that provides the educational process (scientific, legislative, educational, about the activities of public service institutions). The second group consists of the personal information about teachers, students, graduates of previous years, employees of administrative structures, important events in the process of masters' collective life. The third group consists of the organizational information about the schedule of the educational process, the schedule of classes, conferences, social events, the results of the educational process, conducting a survey of graduates, providing proposals for improving the training system.

To fulfill these information needs, it is necessary to create and maintain websites of dean's offices, departments, functioning of distant learning platforms, repository, profiles in social networks, educational blogs. The guarantor of the master's degree program can coordinate the realization of these tasks, as well as integrate the activities of all interested parties: graduate students, teachers, laboratory assistants. Particular attention should be paid to creating pages of departments in social networks. Such pages encourage students' interest to studying, student life, provide opportunities to create the

history of graduate school, certain traditions, to establish connections with graduates.

5 The results of the research

The results of the research were obtained on the grounds of the analysis of changes in the educational process, a survey of graduate students and the management staff in the executive and local government bodies.

During the annual survey graduate students were asked to assess the following factors: the level of complexity of problems that they had faced working on disciplines in the intersession period at the university's educational portal <http://do.luguniv.edu.ua/> in the Moodle system, the optimality of the combination of traditional and information technologies in the educational process, sources of obtaining the information on the organization of the educational process, the quality of information and reference materials on the site of the department <https://sites.google.com/site/kafedratsunsz>, sources of information used for preparation for seminars and practical lessons, changes in the level of information and communication competences during the training, the level of the available information and methodological support of the educational process. The results presented in the diagrams (Fig. 1, 2, 3) thus indicate that graduate students positively assessed the changes in the educational process after implementing Web 2.0 technologies.

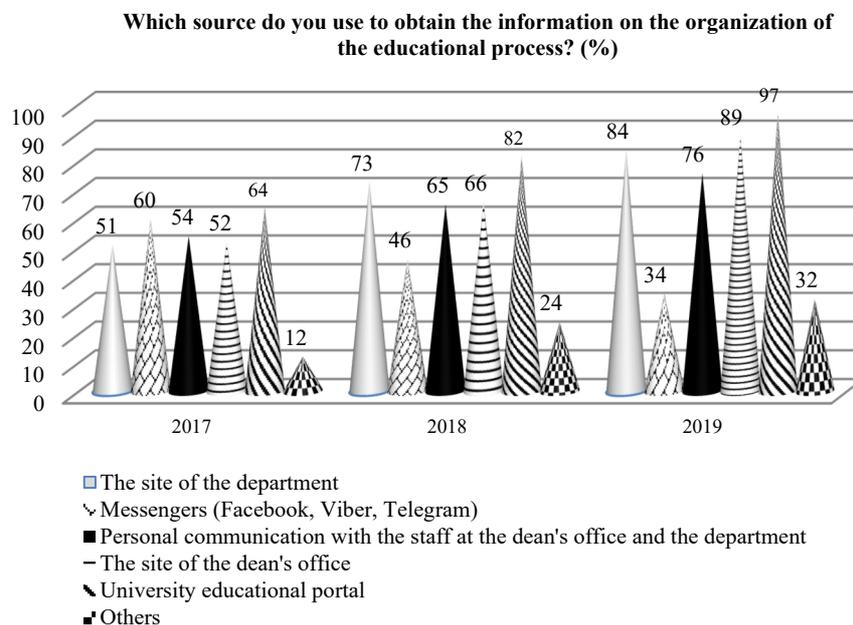


Fig. 1. Monitoring the sources of information by higher education stakeholders

Additional information on the results of the implementation of the simulated

technology was obtained by surveying the employers' of the graduate students in the executive authorities and local government. It shows stable positive assessment of the graduates' work. A survey of this category of stakeholders identified a problem that arose in the course of their employees training. It appeared that the employers did not always have an opportunity to provide an educational leave for graduate students. So, it was the information technologies that made it possible to flexibly combine in-class learning with distant education using the Internet services.

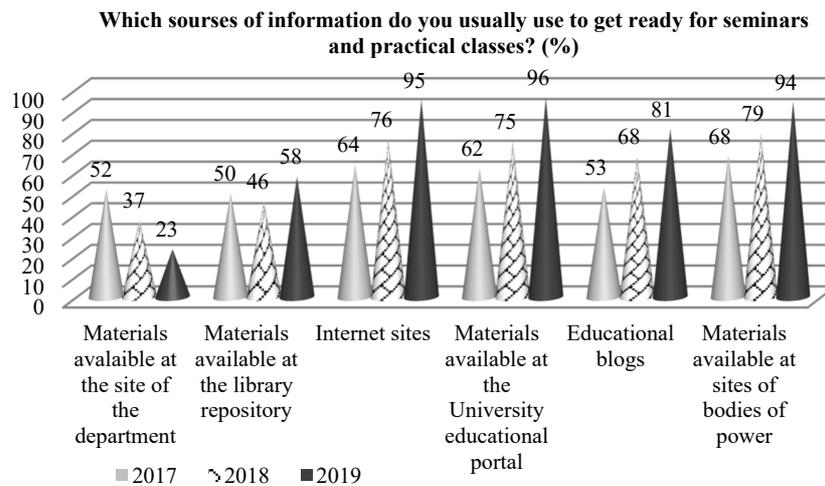


Fig. 2. Sources of information used to get ready for seminars and practical classes

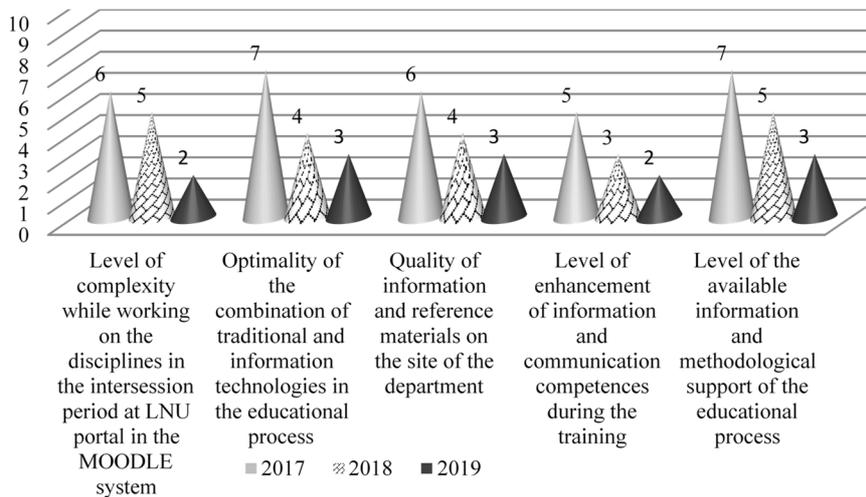


Fig. 3. Monitoring internal education quality assurance. Note: Assessment was performed on a 10-point scale from 1 (1 – optimal) to 10 (10 – not optimal)

Another evidence of a positive change in the educational process is the consistently high recruitment results for the master's program, which is 70–80 graduates a year. Compared to the fact that other graduate schools in the region recruit 10–12 students, it can be concluded that the master's program is highly appreciated by entrants, public servants management and it is competitive. The conducted research allows us to conclude that the main role in obtaining this result is played by the introduced model of the training system of masters of public service using Web 2.0. The main components of this model are presented in Fig. 4.

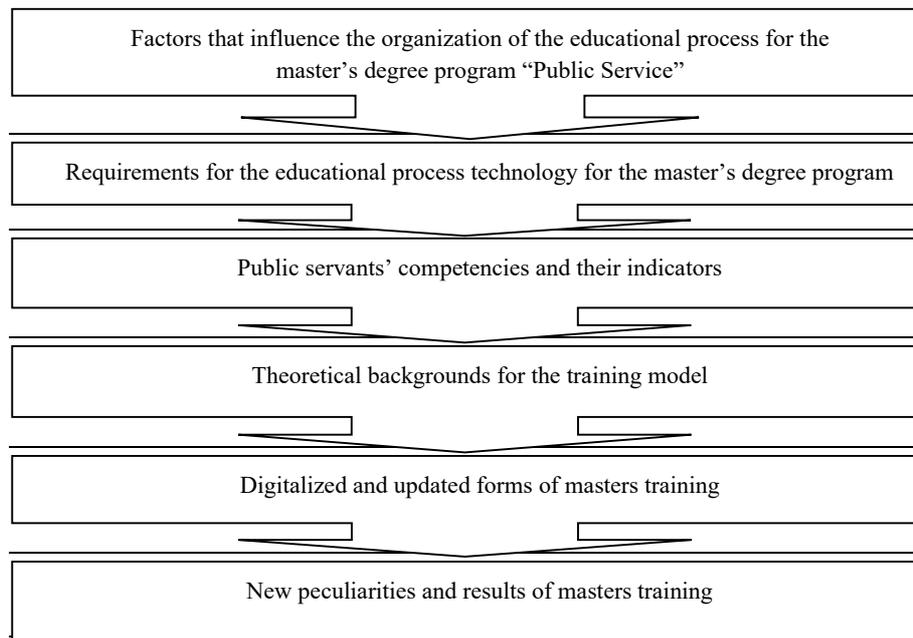


Fig. 4. Structural components of the model for training masters of public service with the use of Web 2.0

Generalizing the obtained results allowed singling out the key peculiarities of the simulated system of vocational training:

- change of functions and number of lectures, which should bear preparatory, overview character;
- development of a system of complex interdisciplinary tasks, forms of information fixation;
- use of Web 2.0 to obtain, capture, transform and produce information;
- vocational training has to be based on studying the practice of public service institutions, its modeling, students' group and individual work with information;
- introduction of students' group activities under the guidance of teachers;
- completion of educational tasks using electronic lectures, the information obtained during the study of public service institutions, the information obtained using Web

- 2.0 technologies, the information obtained during group project activities;
- organization of control and evaluation of learning activities in different form: defense of the developed components of educational content, complex tasks, projects, tests.

Implementation of the simulated training system may be prevented by: insufficient level of openness of the public service institutions, which makes the task of studying their activities more complicated; restrictions on the organization of interdisciplinary, collective forms of the educational process according to the traditional curriculum; complexity of taking into account the results of interdisciplinary, collective cases in the evaluation of masters' individual activity. That is why the problem of finding ways to overcome possible complications in the process of wider introduction of the new technology calls for its solution nowadays.

References

1. Ahson, S.A., Ilyas, M. (eds.): *Cloud Computing and Software Services: Theory and Techniques*. CRC Press, Boca Raton, London, New York (2011)
2. Amies, A., Sluiman, H., Tong, Q.G., Liu, G.N.: *Developing and Hosting Applications on the Cloud*. IBM Press, Upper Saddle River, NJ, Boston, Indianapolis, San Francisco, New York, Toronto, Montreal, London, Munich, Paris, Madrid, Cape Town, Sydney, Tokyo, Singapore, Mexico City (2012)
3. Babenko, V.O., Yatsenko, R.M., Migunov, P.D., Salem, A.B.M.: MarkHub Cloud Online Editor as a modern web-based book creation tool. In: Kiv, A.E., Shyshkina, M.P. (eds.) *Proceedings of the 7th Workshop on Cloud Technologies in Education (CTE 2019)*, Kryvyi Rih, Ukraine, December 20, 2019, CEUR-WS.org, online (2020, in press)
4. Blokland, K., Mengerink, J., Pol, M.: *Testing Cloud Services: How to Test SaaS, PaaS & IaaS*. Rocky Nook, Santa Barbara (2013)
5. Bondarenko, O.V., Pakhomova, O.V., Lewoniewski, W.: The didactic potential of virtual information educational environment as a tool of geography students training. In: Kiv, A.E., Shyshkina, M.P. (eds.) *Proceedings of the 2nd International Workshop on Augmented Reality in Education (AREdu 2019)*, Kryvyi Rih, Ukraine, March 22, 2019. *CEUR Workshop Proceedings* **2547**, 13–23. <http://ceur-ws.org/Vol-2547/paper01.pdf> (2020). Accessed 10 Feb 2020
6. Buyya, R., Broberg, J., Goscinski, A.M. (eds.): *Cloud Computing: Principles and Paradigms*. John Wiley & Sons, New Jersey (2010)
7. Carretero, S., Vuorikari, R., Punie, Y.: *DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use*. Publications Office of the European Union, Luxembourg (2017)
8. Fedorenko, E.H., Velychko, V.Ye., Stopkin, A.V., Chorna, A.V., Soloviev, V.N.: Informatization of education as a pledge of the existence and development of a modern higher education. In: Kiv, A.E., Soloviev, V.N. (eds.) *Proceedings of the 6th Workshop on Cloud Technologies in Education (CTE 2018)*, Kryvyi Rih, Ukraine, December 21, 2018. *CEUR Workshop Proceedings* **2433**, 20–32. <http://ceur-ws.org/Vol-2433/paper01.pdf> (2019). Accessed 10 Sep 2019
9. Gow, J.I., Sutherland, S.L.: Comparison of Canadian masters programs in public administration, public management and public policy. *Canad. Publ. Admin.* **47**(3) Autumn,

- 379–405 (2004)
10. Grosseck, G.: To use or not to use web 2.0 in higher education? *Procedia – Social and Behavioral Sciences* **1**(1), 478–482 (2009)
 11. Hmelo-Silver, C.E.: Problem-based learning: What and how do students learn? *Educational Psychology Review* **16**(3), 235–266 (2004)
 12. Honcharenko, S.: *Ukrainskyi pedahohichnyi slovnyk (Ukrainian Pedagogical Dictionary)*. Lybid, Kyiv (1997)
 13. Ivanova, H.I., Lavrentieva, O.O., Eivas, L.F., Zenkovych, Iu.O., Uchitel, A.D.: The students' brainwork intensification via the computer visualization of study materials. In: Kiv, A.E., Shyshkina, M.P. (eds.) *Proceedings of the 7th Workshop on Cloud Technologies in Education (CTE 2019)*, Kryvyi Rih, Ukraine, December 20, 2019, CEUR-WS.org, online (2020, in press)
 14. Johnson, E.B.: *Contextual Teaching and Learning: What It Is and Why It's Here to Stay*. Corwin Press, Thousand Oaks (2002)
 15. Iatsyshyn, Anna V., Kovach, V.O., Lyubchak, V.O., Zuban, Yu.O., Piven, A.G., Sokolyuk, O.M., Iatsyshyn, Andrii V., Popov, O.O., Artemchuk, V.O., Shyshkina, M.P.: Application of augmented reality technologies for education projects preparation. In: Kiv, A.E., Shyshkina, M.P. (eds.) *Proceedings of the 7th Workshop on Cloud Technologies in Education (CTE 2019)*, Kryvyi Rih, Ukraine, December 20, 2019, CEUR-WS.org, online (2020, in press)
 16. Katz, R.: *The Tower and The Cloud: Higher Education in the Age of Cloud Computing*. Educause, Berkeley (2008)
 17. Kazhan, Yu.M., Hamaniuk, V.A., Amelina, S.M., Tarasenko, R.O., Tolmachev, S.T.: The use of mobile applications and Web 2.0 interactive tools for students' German-language lexical competence improvement. In: Kiv, A.E., Shyshkina, M.P. (eds.) *Proceedings of the 7th Workshop on Cloud Technologies in Education (CTE 2019)*, Kryvyi Rih, Ukraine, December 20, 2019, CEUR-WS.org, online (2020, in press)
 18. Khrykov, Ye.M.: Modeliuvannia zahalnykh kompetentnosti derzhavnykh sluzhbovtziv (Modeling of general competencies of civil servants). Paper presented at the 3rd International Scientific Conference "The sustainable development of territories: problems and solutions", Dnipropetrovsk Regional Institute of Public Administration National Academy of Public Administration under the President of Ukraine, Dnipropetrovsk, October 1, 2012
 19. Kiessling, A., Henriksson, P.: Efficacy of case method learning in general practice for secondary prevention in patients with coronary artery disease: Randomised controlled study. *British Medical Journal* **325**(7369), 877–880 (2002)
 20. Korobeinikova, T.I., Volkova, N.P., Kozhushko, S.P., Holub, D.O., Zinukova, N.V., Kozhushkina, T.L., Vakarchuk, S.B.: Google cloud services as a way to enhance learning and teaching at university. In: Kiv, A.E., Shyshkina, M.P. (eds.) *Proceedings of the 7th Workshop on Cloud Technologies in Education (CTE 2019)*, Kryvyi Rih, Ukraine, December 20, 2019, CEUR-WS.org, online (2020, in press)
 21. Lavrentieva, O.O., Arkhypov, I.O., Kuchma, O.I., Uchitel, A.D.: Use of simulators together with virtual and augmented reality in the system of welders' vocational training: past, present, and future. In: Kiv, A.E., Shyshkina, M.P. (eds.) *Proceedings of the 2nd International Workshop on Augmented Reality in Education (AREdu 2019)*, Kryvyi Rih, Ukraine, March 22, 2019. CEUR Workshop Proceedings **2547**, 201–216. <http://ceur-ws.org/Vol-2547/paper15.pdf> (2020). Accessed 10 Feb 2020
 22. Lehner, W., Sattler, K.-U.: *Web-Scale Data Management for the Cloud*. Springer Science & Business Media, New York (2013)

23. Marinescu, D.C.: *Cloud Computing: Theory and Practice*. Morgan Kaufmann, New York (2013)
24. Modlo, Ye.O., Semerikov, S.O., Nechypurenko, P.P., Bondarevskyi, S.L., Bondarevska, O.M., Tolmachev, S.T.: The use of mobile Internet devices in the formation of ICT component of bachelors in electromechanics competency in modeling of technical objects. In: Kiv, A.E., Soloviev, V.N. (eds.) *Proceedings of the 6th Workshop on Cloud Technologies in Education (CTE 2018)*, Kryvyi Rih, Ukraine, December 21, 2018. *CEUR Workshop Proceedings* **2433**, 413–428. <http://ceur-ws.org/Vol-2433/paper28.pdf> (2019). Accessed 10 Sep 2019
25. Modlo, Ye.O., Semerikov, S.O., Shajda, R.P., Tolmachev, S.T., Markova, O.M., Nechypurenko, P.P., Selivanova, T.V.: Methods of using mobile Internet devices in the formation of the general professional component of bachelor in electromechanics competency in modeling of technical objects. In: Kiv, A.E., Shyshkina, M.P. (eds.) *Proceedings of the 7th Workshop on Cloud Technologies in Education (CTE 2019)*, Kryvyi Rih, Ukraine, December 20, 2019, CEUR-WS.org, online (2020, in press)
26. Modlo, Ye.O., Semerikov, S.O., Shmeltzer, E.O.: Modernization of Professional Training of Electromechanics Bachelors: ICT-based Competence Approach. In: Kiv, A.E., Soloviev, V.N. (eds.) *Proceedings of the 1st International Workshop on Augmented Reality in Education (AREdu 2018)*, Kryvyi Rih, Ukraine, October 2, 2018. *CEUR Workshop Proceedings* **2257**, 148–172. <http://ceur-ws.org/Vol-2257/paper15.pdf> (2018). Accessed 21 Mar 2019
27. Morkun, V., Semerikov, S., Hryshchenko, S., Slovak, K.: Environmental Geo-information Technologies as a Tool of Pre-service Mining Engineer's Training for Sustainable Development of Mining Industry. In: Ermolayev, V., Bassiliades, N., Fill, H.-G., Yakovyna, V., Mayr, H.C., Kharchenko, V., Peschanenko, V., Shyshkina, M., Nikitchenko, M., Spivakovsky, A. (eds.) *13th International Conference on ICT in Education, Research and Industrial Applications. Integration, Harmonization and Knowledge Transfer (ICTERI, 2017)*, Kyiv, Ukraine, 15-18 May 2017. *CEUR Workshop Proceedings* **1844**, 303–310. <http://ceur-ws.org/Vol-1844/10000303.pdf> (2017). Accessed 21 Mar 2019
28. Nechypurenko, P.P., Starova, T.V., Selivanova, T.V., Tomilina, A.O., Uchitel, A.D.: Use of Augmented Reality in Chemistry Education. In: Kiv, A.E., Soloviev, V.N. (eds.) *Proceedings of the 1st International Workshop on Augmented Reality in Education (AREdu 2018)*, Kryvyi Rih, Ukraine, October 2, 2018. *CEUR Workshop Proceedings* **2257**, 15–23. <http://ceur-ws.org/Vol-2257/paper02.pdf> (2018). Accessed 30 Nov 2018
29. Panchenko, L.F.: Methodology of Using Structural Equation Modeling in Educational Research. In: Ermolayev, V., Mallet, F., Yakovyna, V., Kharchenko, V., Kobets, V., Kornilowicz, A., Kravtsov, H., Nikitchenko, M., Semerikov, S., Spivakovsky, A. (eds.) *Proceedings of the 15th International Conference on ICT in Education, Research and Industrial Applications. Integration, Harmonization and Knowledge Transfer (ICTERI, 2019)*, Kherson, Ukraine, June 12-15 2019, vol. II: Workshops. *CEUR Workshop Proceedings* **2393**, 895–904. http://ceur-ws.org/Vol-2393/paper_411.pdf (2019). Accessed 30 Jun 2019
30. Petrenko, L., Kravets, S., Bazeliuk, O., Maiboroda, L., Muzyka, I.: Analysis of the current state of distance learning in the vocational education and training institutions. In: Semerikov, S., Chukharev, S., Sakhno, S., Striuk, A., Osadchyi, V., Solovieva, V., Vakaliuk, T., Nechypurenko, P., Bondarenko, O., Danylchuk, H. (eds.) *The International Conference on Sustainable Futures: Environmental, Technological, Social and Economic Matters (ICSF 2020)*. Kryvyi Rih, Ukraine, May 20-22, 2020. *E3S Web of Conferences* **166**, 10010 (2020). doi:10.1051/e3sconf/202016610010

31. Popel, M.V., Shyshkina, M.P.: The areas of educational studies of the cloud-based learning systems. In: Kiv, A.E., Soloviev, V.N. (eds.) Proceedings of the 6th Workshop on Cloud Technologies in Education (CTE 2018), Kryvyi Rih, Ukraine, December 21, 2018. CEUR Workshop Proceedings **2433**, 159–172. <http://ceur-ws.org/Vol-2433/paper09.pdf> (2019). Accessed 10 Sep 2019
32. Prykhodko, A.M., Rezvan, O.O., Volkova, N.P., Tolmachev, S.T.: Use of Web 2.0 technology tool - educational blog - in the system of foreign language teaching. In: Kiv, A.E., Soloviev, V.N. (eds.) Proceedings of the 6th Workshop on Cloud Technologies in Education (CTE 2018), Kryvyi Rih, Ukraine, December 21, 2018. CEUR Workshop Proceedings **2433**, 256–265. <http://ceur-ws.org/Vol-2433/paper16.pdf> (2019). Accessed 10 Sep 2019
33. Semerikov, S.O., Teplytskyi, I.O., Yechkalo, Yu.V., Markova, O.M., Soloviev, V.N., Kiv, A.E.: Computer Simulation of Neural Networks Using Spreadsheets: Dr. Anderson, Welcome Back. In: Ermolayev, V., Mallet, F., Yakovyna, V., Kharchenko, V., Kobets, V., Kornilowicz, A., Kravtsov, H., Nikitchenko, M., Semerikov, S., Spivakovsky, A. (eds.) Proceedings of the 15th International Conference on ICT in Education, Research and Industrial Applications. Integration, Harmonization and Knowledge Transfer (ICTERI, 2019), Kherson, Ukraine, June 12-15 2019, vol. II: Workshops. CEUR Workshop Proceedings **2393**, 833–848. http://ceur-ws.org/Vol-2393/paper_348.pdf (2019). Accessed 30 Jun 2019
34. Shapovalova, N., Rybalchenko, O., Dotsenko, I., Bilashenko, S., Striuk, A., Saitgareev, L.: Adaptive Testing Model as the Method of Quality Knowledge Control Individualizing. In: Ermolayev, V., Mallet, F., Yakovyna, V., Kharchenko, V., Kobets, V., Kornilowicz, A., Kravtsov, H., Nikitchenko, M., Semerikov, S., Spivakovsky, A. (eds.) Proceedings of the 15th International Conference on ICT in Education, Research and Industrial Applications. Integration, Harmonization and Knowledge Transfer (ICTERI, 2019), Kherson, Ukraine, June 12-15 2019, vol. II: Workshops. CEUR Workshop Proceedings **2393**, 984–999. http://ceur-ws.org/Vol-2393/paper_328.pdf (2019). Accessed 30 Jun 2019
35. Tkachuk, V., Yechkalo, Yu., Semerikov, S., Kislova, M., Khotskina, V.: Exploring Student Uses of Mobile Technologies in University Classrooms: Audience Response Systems and Development of Multimedia. CEUR-WS.org, online (2020, in press)
36. Tkachuk, V.V., Shchokin, V.P., Tron, V.V.: The Model of Use of Mobile Information and Communication Technologies in Learning Computer Sciences to Future Professionals in Engineering Pedagogy. In: Kiv, A.E., Soloviev, V.N. (eds.) Proceedings of the 1st International Workshop on Augmented Reality in Education (AREdu 2018), Kryvyi Rih, Ukraine, October 2, 2018. CEUR Workshop Proceedings **2257**, 103–111. <http://ceur-ws.org/Vol-2257/paper12.pdf> (2018). Accessed 30 Nov 2018
37. Verbitsky, A.A.: Contextual learning technologies in the system of continuous professional education. *International Journal of Continuing Engineering Education and Life-Long Learning* **1**(3), 263–268 (1991)
38. Zhaldak, M.I.: Kompiuterno-oriientovani systemy navchannia – stanovlennia i rozvytok (Computer-based learning systems are becoming and developing). *Nauk. chas. Nats. pedah. univ. im. M.P. Drahomanova. Ser. 2: Komp.-or. syst. navch.* **9**(16), 3–9 (2010)
39. Zheng, H.: A Virtual Learning Community Based on Cloud Computing and Web 2.0. *Intern. J. of Comp. Sc.* **9**, 361–366 (2012)