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INFORMATION COMPETENCY AS A BASIS OF PROFESSIONAL ACTIVITY OF THE TEACHER OF THE FUTURE

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Abstract

The problem of professional formation and development of the teacher of the future in the context of digitalization of education and knowledge economy requires more in-depth and targeted research. This work deals with theoretical substantiation, development and technologies of forming information competencys on the basis of the life cycle of teachers of the future knowledge against the background of global digitalization. The main research methods of research are comparative analysis of research in knowledge management and ICT competency development, expert assessments and statistical methods of data processing. The study concludes that knowledge management should serve as the theoretical basis for the organization of the educational process. The condition for the implementation of knowledge management theory in the educational process are information and personalised approaches.

Keywords

Teacher of the Future – Knowledge Management – ICT Competence – Information Competence

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Introduction

Today, the education system is undergoing profound changes due to the specifics of the development of modern society. On the one hand, the society is open to import a variety of knowledge, ideas and information, on the other, there is a transition to global digitalization. Daniel Bell understands modern society as a society based on information and electronic means that provide the technical basis for its development[1]. Peter Drucker[2] considers the high value of knowledge to be the main feature of modern society. In his opinion, knowledge becomes the 'fundamental social factor' that underlies economic development (knowledge economy). A significant priority of the state policy of most European countries is the foundation of digital economy, which is reflected in the regulations.

The allocation of these factors is very reasonable, since the existence and development of society in a digital economy focused on knowledge based capital depends more on the appropriate training of specialists to work in the information environment creating, replicating, transforming and using the knowledge gained.

Global trends in the transition to the digital economy and to a society, where knowledge becomes an important economic indicator, radically change the position of education. Modern period of professional education development is typical of digitalization. According to the report of Global Education Futures 'Education for a complex society' (2018), the digitalization of education is a 'megatrend that determines our future', the leading role in the formation of which belongs to teachers.

In digital education, as in many other sectors of digital economy, the multi-profile, 'convergent' teachers are becoming more and more in demand. Their formation and development is possible within the framework of formal, non-formal and informal education. These are the so-called teachers of the future. The main trends that describe the digitalization of education justify a change in the requirements for the teachers of the future, concerning their professional development in the background of digitalization of education. To improve the competitiveness, a teacher should be ready for professional activity in the era of global digitalization, that means, to work in a high-tech digital educational environment and to possess the technology of knowledge in a rapidly changing information. New requirements for the teacher of the future consider their professional development as a willingness to decide constantly arising new and unexpected problems that use an interdisciplinary approach. Currently, the state and society demand a teacher that seeks to update the dynamic set of their competencies through personalised continuing education flexibly adjusted to the ever-changing conditions.

Digitalization of education and knowledge economy determine the priority directions of pedagogical research in the field of training the future teachers regarding the requirements of professional standards: formation of ICT competency, knowledge management training, that is to carry out the search, identification, extraction, assessment, storage, and exchange of information.

[1] D. Bell, The coming of post-industrial society: A venture of social forecasting (New York: Basic Books, 1973).

[2] P. F. Drucker, Management Challenges for the 21st Century (New York: Harper Business, 1999); P. F. Drucker, Management: Tasks, Responsibilities and Practices (New York: Harper & Row, 1973) y P. F. Drucker, The Essential Drucker: The Best of Sixty Years of Peter Drucker's Essential Writings on Management (New York: Harper Business, 2001).

Trends in the digital transformation of vocational education require well formed ICT competency for the successful implementation of professional activities, since teachers are to prepare the younger generation for life and work in the modern information society. The relevance and significance of ICT competency including digital literacy is reflected in the new recommendations of the UNESCO 'UNESCO ICT Competency Framework for Teachers. VERSION 3' [3], corresponding to 'Transforming our world: the 2030 Agenda for Sustainable Development', adopted by United Nations General Assembly.

Global Education Futures and WorldSkills experts emphasize digital literacy as part of ICT competency and one of the main skills that a person needs in the future. Today this competency is one of the leading competencies in pedagogical activity at all stages of continuous education. A lot of works has appeared recently about the ICT competency of teachers in the framework of an innovative approach to education[4], revealing the possibility of using information technology in education[5] dealing with to the formation of ICT competency in future teachers of higher and secondary vocational education[6].

Analysis of development vectors of modern society and the features of a new knowledge-based digital economy concludes that in the conditions of transition to the information society, the requirements for educational results are changing. There is a shift in emphasis from 'a person who knows' to 'a person prepared for life'. However, the practices of higher education shows that education focused on the transfer of ready-made knowledge is not able to prepare a person for living in the modern information society. In classical education, the problem of training specialists of a new type with a stable and advanced level of professional and general culture, who are able to create new knowledge based on the available one remains out of sight. Considering the educational process as a process based on knowledge management allows preparing a person who is able to navigate in an information society and requires special study. There are a lot of works in the field of knowledge management theory. Most of them deal with the management of enterprises and organizations, as well as various business processes.

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[3] UNESCO official website. URL: https://en.unesco.org/themes/education.

[4] J. Kubricky & P. Castkova, “Teachers ICT Competence and Their Structure as A Means of Developing Inquiry-Based Education”. Procedia - Social and Behavioral Sciences, Vol: 186 (2015): 882–885.

[5] J. M. Suarez; G. Almerich; B. Gargallo & Aliaga, “Competencies in ICT of teachers and their relation to the use of the technological resources”, Education Policy Analysis Archives, Vol. 18 num 10 (2010). URL: http://epaa.asu.edu/ojs/article/view/755; S. Rajeswari & Dr. N. Amutha Sree, “Teaching Competence of Teacher Educators’ and Attitude Towards ICT”. International Journal of Computational Research and Development, Vol: 2 num 2 (2017): 27-31; D. Galanouli; C. Murphy & J. Gardner, “Teachers’ perceptions of the effectiveness of ICT-competence training”. Computers & Education, Vol: 43 num 1-2 (2004): 63–79. URL:https://doi.org/10.1016/j.compedu.2003.12.005 y F. Fan; Y. Zhang; B. Chen et al., Exploring the Relationship between Teachers' ICT Competency and Usage of ICT in Elementary and Secondary Teaching Practice. In: International Conference on Educational Innovation through Technology (EITT) (Tainan, 2016) URL: doi.org/10.1109/EITT.2016.37

[6] M. Simpson; F. Payne; R. Munro & S. Hughes, “Using Information and Communications Technology as a Pedagogical Tool”. Who educates the educators?, num 25 (3) (2010): 247-262. URL: https://doi.org/10.1080/02607479919538; S. A. Nurhabibah; H. Yanti; Y. Z. Miraj & Yannuar, Analysis of ICT Literacy Competence among Vocational High School Teachers. In: IOP Conf. Series: Materials Science and Engineering, Vol. 306 (2018) URL: doi.org/10.1088/1757-899X/306/1/012097 y F. Chen; N. V. Gorbunova; A. R. Masalimova & J. Bírova, “Formation of ICT-Competence of Future University School Teachers”, Eurasia Journal of Mathematics, Science and Technology Education, num 13(8) (2017): 4765-4777. URL: doi.org/10.12973/eurasia.2017.00963a.

The most significant works on the research topic are the works by Meliha Handzic[7] , Denise A. D. Bedford[8] , Jennifer Rowley[9] , Fahriye Altınay[10] et al. There works focus on the implementation and evaluation of knowledge management strategies in higher education, in distance education and in the general lifelong learning model. The comparative analysis of the above studies shows that there are no works that present interdisciplinary, integrative studies on the formation of ICT competency and training of specialists who can manage knowledge. The problem of professional formation and development of teachers of the future in the context of digitalization of education and knowledge economy requires more in-depth and targeted research, whis is reflected in the relevance of this study. The aim of this research is theoretical substantiation, development and approbation of technologies of forming information competency in teachers of the future in the background of digitalization of education. The main objectives of this study are the following: 1) to determine the theoretical aspects of educational process in the knowledge economy on the bases of the analysis of works about knowledge management; 2) to identify and theoretically justify the structure of information competencies, the ways of forming ICT competency in teachers of the future; 3) to develop and test the technology of forming information competencies on the basis of lnowledge life cycle.

Materials and methods

This work presents the main issues of information competence of teachers of the future by reviewing the main research in this field. The theoretical part considers information competency from two interrelated viewpoints: formation of ICT competencies in teachers and the use of knowledge management theory. The practical part of this work considers the implementation and evaluation of forming the information competence in future teachers. The method of expert assessments of representatives of employers and universities (on the example of universities of the Siberian and Far Eastern Federal Districts of the Russian Federation) carried out the ranking of information competencies according to their significance. The study involved employers from education, culture, social services, and law enforcement agencies (112 people), developers of educational programs and teachers (89 people), and master's students (97 people). The training experiment also helped to identify the formation of the skills to work with information in master's students. The results were processed by statistical methods.

Results and Discussion

The need to correlate modern education with the level of development of modern society and the requirements for an educated person determines the modernization of

[7] M. Handzic; J. S. Edwards; S. Moffett et al., “Five Ws and one H in knowledge management education”, VINE Journal of Information and Knowledge Management Systems, Vol: 47 num 4 (2017): 438-453. URL: https://doi.org/10.1108/VJIKMS-12-2016-0075.

[8] D. Bedford; M. Georgieff & J. Brown-Grant, “Lifewide, lifelong comprehensive approach to knowledge management education – emerging standards”. VINE Journal of Information and Knowledge Management Systems, num 47(4) (2017): 467-489. URL: https://doi.org/10.1108/VJIKMS-12-2016-0068.

[9] J. Rowley, “Is higher education ready for knowledge management?”, International Journal of Educational Management, Vol: 14 num 7 (2000): 325-333. URL: https://doi.org/10.1108/09513540010378978

[10] F. Altınay, et al., “A study of knowledge management systems processes and technology in open and distance education institutions in higher education”, The International Journal of Information and Learning Technology. 2019. URL: https://doi.org/10.1108/IJILT-02-2019-0020.

vocational education. Some works[11], reports and programs of international organizations[12] indicate the most significant trends in the development of vocational education:

- continuing education: people learn throughout their lives;
- training of specialists who are able to navigate in the information environment, to generate new knowledge;
- growing influence of modern information technologies on the ways of learning, working, communicating, and living;
- the use of teaching methods involving a more active student's position in the learning process;
- shift of the educational paradigm towards the use of models of online training, mixed learning, and active interaction of participants into the educational process;
- changing role of a teacher: from being the translator of knowledge teachers turn into moderators (navigators, coaches, assistants) of the educational process.

The analysis of the selected trends in the development of vocational education allows stating that currently there are significant changes in higher education due to the requirements of the information society. They lie in training the specialists ready for self-education, self-development, and self-improvement.

Education focused on the transfer of ready-made knowledge is not able to prepare a person for living in the modern information society because it keeps the problem of preparing specialists with a stable and advanced level of training, who not only have knowledge, but also are able to create new knowledge, out of sight. Assuming that educational process is based on knowledge management that prepares a person who is able to navigate in an information-overloaded society, this task requires special study.

Knowledge-based development strategies are not limited to investments in human capital to improve the quality of education, but are considered in a broader sense. Today, the quality of education is determined not by the level of education, but by the quality of the personality formed in the course of education. 'Society needs people who can perform professional activities in changing conditions, who can influence the situation and change its state and development. Only a person who owns the technology of gaining knowledge is capable of creating new knowledge, scientific theories and concepts'[13].

Finding answers to questions how to extract knowledge from the sea of internal and external information in the most efficient way, how to accumulate it most correctly and how to apply and transmit it stimulated the development of a special direction in the knowledge economy: knowledge management and concepts of 'a man of knowledge[14] and 'knowledge

[11] D. Badarch & B. A. Sazonov, Actual issues of international harmonization of educational systems: Monograph (Moscow: Byuro YUNESKO v Moskve: TEIS, 2007) y C. DeLuca, Promoting inclusivity through and within teacher education programmes, num 38 (5) (2012): 551-569. URL:https://doi.org/10.1080/02607476.2013.739792

[12] J. Delor, Learning: The Treasure Within. Report of the International Commission on Education (Moscow: UNESCO, 1997) y J.L. Delor, Education un tresor est cache dedans (Paris: UNESCO, 1996).

[13] M. B. Liga, & I. A. Shchetkina, Quality of life: organizational and managerial aspect: monograph (Novosibirsk: Nauka, 2011).

[14] M. B. Liga, & I. A. Shchetkina, Quality of life: organizational and managerial aspect: monograph (Novosibirsk: Nauka, 2011).

worker'[15]. Despite numerous works in this field, the studied theory is at the initial stage of formation and development. It is robably due to the ambiguity of understanding the term 'knowledge management'.

For the first time the concept of knowledge management was introduced into science in 1986 by Karl Wiig. It became widespread in the 90s of the XX century[16]. Since then, this direction is actively developing. There are different approaches to the definition of knowledge management since they focus on different aspects of the concept. The interpretation of the concept is diverse and ambiguous: it is a concept, a discipline, a process, a phenomenon and a strategy. Knowledge management can be a technology, an idea or a human resource. The analysis of the presented definitions allows revealing the essence of the knowledge management process. *Knowledge management* is a dynamic, continuous process that includes related sub-processes of different nature (search, identification, extraction, evaluation, storage, knowledge sharing) that make up the life cycle of knowledge. The processes are implemented with the use of human resources and information technology.

Until recently, the term 'knowledge management' was considered only from the perspective of management economics and management sociology. The theory of knowledge management became widespread in other fields at the beginning of the XXI century. Today, it has penetrated into all spheres of human life. Education is no exception. The education system, being one of the most important spheres of social life, is influenced by all the processes taking place in it, especially if these processes relate to the knowledge that makes up its reason for existence. Knowledge in post-industrial society acquires the characteristics of integrity, cross-course nature, multidimensionality, and dynamism.

In the modern information society, human capital becomes a key component of any functioning system. The education, acting as one of the main institutions of personality formation, faces the task of training specialists who are able to navigate in the information environment and to generate new knowledge. Therefore, it is possible to consider the phenomenon of knowledge management as a common name for techniques that organize the activities of the subjects of the educational process aimed at maintaining information retrieval, obtaining, structuring, generalization, storage, and transfer of knowledge, ensuring the full knowledge life cycle. These methods form the framework that is able to train specialists whose competitiveness determines the quality of education received.

There are two approaches that are somewhat complementary in the organization of the educational process:

1) information approach meaning creation and maintenance of information systems to identify information, create, process, store, and provide knowledge. In terms of higher education, this approach is aimed at the development of information technology, the formation of the ability of students to efficiently use the existing information and generate new knowledge based on it;

[15] P. F. Drucker, Managing in the Next Society (Butterworth Heimeman, 2002).

[16] B. C. Towe; V. Pizziconi & K.M. Wiig, “Knowledge Management: Where Did it Come From and Where Will It Go?”, Expert Systems with Applications, Vol: 13 num 1 (1997): 1-14. URL: doi.org/10.1016/S0957-4174(97)00018-3 y K.M. Wiig, “Knowledge Management: An Introduction and Perspective”, Journal of Knowledge Management, num 1 (1997): 6-14. URL:doi.org/10.1108/13673279710800682/

2) personalized approach aimed at extracting knowledge, efficient use of knowledge, and its formalization for general access. In universities, this approach is related to the creation of an information educational environment focused on the generation of new knowledge. In other words, it is an environment that considers knowledge to be a value. Within this approach, personal experience, intuition, reflection, and the presence of a contextual educational environment become specially relevant.

The selected approaches of knowledge management keep in line with the general trends in the development of acquisition and transfer of knowledge (informatization and personification), identified in the Kronberg Declaration. They introduce the concept of information and educational environment. This concept means software and telecommunications and pedagogical space with a single technological means of conducting the educational process, its information support and documentation in the Internet space. The information educational environment has a new system of 'man-information' interaction, in which knowledge is considered in its development, in its life cycle, but not as a phenomenon.

Thus, the conducted research concludes on the following:

- knowledge management, being the most important factor in improving the effectiveness and efficiency of training, should be the theoretical basis for the organization of the educational process;
- the condition for the implementation of the theory of knowledge management in the educational process are information and personalised approaches that create an information educational environment, determine the conditions for the integration of priority areas of pedagogical research in preparing future teachers (the formation of ICT competency, training a specialist who can manage knowledge).

In the UNESCO medium-term strategy (UNESCO official website) states meeting the need for teachers ready to work in a high-tech educational environment to be a basis for the further development of the education system. The establishment of the digital economy and digital education are important priorities of the state policy of the Russian Federation.

The significance of ICT competency, identification and theoretical study of the structure of information competency, and ways of forming the ICT competency in future teachers is justified by international and national documents, including the federal strategic documents of the Russian Federation (UNESCO, 'UNESCO ICT Competency Framework for Teachers. VERSION 3'), Resolution adopted by the General Assembly on 25 September 2015 'Transforming our world: the 2030 Agenda for Sustainable Development', Global Education Futures Report 'Skills of the future', national program 'Digital economy of the Russian Federation' and others). The analysis of these documents presented the evolution of the education system in the early XXI century (Table 1).

Characteristics of education	*Education 1.0. (2000s-2010s)*	*Education 2.0. (2010s -2020s)*	*Education 3.0. (2020s -2030s)*
Content	Dictated	Socially constructed	Socially constructed and updated according to context
Technology	Confiscated at the classroom door (digital refugees)	Cautiously adopted (digital immigrants)	Surrounding digital universe (digital natives)
Knowledge transfer	From teacher to student	From teacher to student and from student to student	From teacher to student, from student to student, from student to teacher
Schools are located	In the building	In a building or network (via PC)	With the advent of mobile devices – anywhere
Parents see schools as	A place where they take care of their children	A place where they take care of their children	A place where they can also learn something
Hardware and software in schools is	Expensive and is not used	Open and available at a lower price	Available at a low price and used purposefully

Table 1
Evolution of the education system in the early XXI century

Consideration of the evolution of the world education system suggests that Education 2.0. is typical of formation of self-identity; focus on initiative, willingness and ability to technological innovations; high social activity and responsibility; ability to quickly adapt to new challenges. The active use of ICT in the educational process requires teachers to learn completely different approaches to the organization of the educational process, which involves changing the role of the teacher from a simple translator of knowledge to the designer of the educational process. Therefore, a teacher within the educational system 3.0. not only teaches, but also is designs, adapts, manages, and evaluates the educational environment, including both electronic materials and various educational activities, as well as uses completely new educational technologies in the educational process. Education 3.0. is open for change, all of its participants cooperate in the educational process. During the educational process itself, the students create rather than reproduce knowledge, share new ideas, synthesize them, and benefit from them.

Transition from Education 2.0. to Education 3.0. is accompanied by the formation of a new socio-cultural education environment; active use of mobile devices, applications, tablets; the development of training using educational games on various media; emergence of personal educational space, which is a collection of resources and content selected by students for individual work. All this determines the need to develop the technological literacy of the future teacher including the knowledge of information and communication technologies. The use of new ICT technologies in education implies a new role for teachers, new educational methods and new approaches to training teachers. The efficiency of the integrating information technologies into real classrooms depends on the ability of teachers

to structure the learning environment in a new way in order to combine new technologies and new pedagogy – digital didactics[17]. Its main directions are:

- technologies of using electronic devices (cellphones and tablets) that require a more active student's position in the learning process;
- digital ergonomics (reading on electronic devices, text file formats, transition from 'passive' reading to 'active' one, etc.);
- efficiency of individual digital activities (online training, mixed training, automatic homework check, educational games, narrowly focused educational applications, etc.).

To train the teacher of the future to design an information and educational ICT-based space and to use its results in the educational process requires a lot of time. There are three main approaches to learning that are necessary to use ICT more effciently:

- the first approach is development of technological literacy. Its main provision is to provide the teacher with the opportunity to use ICT for more efficient development of knowledge in the process of learning and self-education;
- the second approach is deepening the knowledge. It allows the teacher acquiring more in-depth knowledge about professional training and to apply it in solving real complex problems;
- the third approach is creation of knowledg. It provides opportunities for future teachers to gain skills in the production of new knowledge that are necessary for a more reasonable implementation of their pedagogical tasks.

The selected approaches show the structure of ICT competency education of teachers of the furute in the Education 3.0. system, which divides competencies related to the use of ICT in the educational process into three levels. Each of them has six aspects[18].

At the first level ('Obtaining knowledge'), the teachers use technology to complement traditional classroom work. At this level, teachers have basic digital skills, the ability to select and use software, web content, and use ICT to manage classroom data and improve their own skills.

On the second level ('Development of knowledge'), teachers go to advanced use of digital technologies, they change their teaching methods and the students' work. The teaching process is student-centered, the role of the teacher is to structure the assignments, to help students understand the material, and support their collaboration in project activities. Educators can use open digital tools designed specifically for a specific subject area: for example, visualization in science subjects, data analysis tools in mathematics, role-play modeling tools in social sciences. The teacher knows how to contact experts or collaborate with other teachers to continuously improve their skills.

At the third level ('Creation of knowledge'), there occur a transformation where teachers and students create knowledge themselves and develop innovative strategies that

[17] V. I. Blinov et al., Draft didactic concept of digital vocational education and training (Moscow: Izdatel'stvo 'Pero', 2019).

[18] Education: a hidden treasure. Report of the International Commission on Education (Moscow: UNESCO, 1997); Higher education in the XXI century. Approaches and Practical Measures: World Conference on Higher Education (Paris: UNESCO, 1998) y UNESCO official website. URL: https://en.unesco.org/themes/education.

operate at the highest level. Teachers with competencies at the knowledge creation level are able to develop ICT-based learning resources and educational environments, use ICT to create knowledge and develop critical thinking in students, support the continuous process of reflective learning, and organize knowledge communities for students and colleagues. At the same time, teachers play a leading role in the creation and implementation of a specific educational organization as an innovative community of continuous learning with the support of ICT.

Each level presents the same aspects of the educational process, such as the role of ICT in educational policy, evaluation of educational results, pedagogical practices, digital skills, organization and management of the educational process, and teacher's professional development. However, from level to level the degree of complexity and skills necessary for the use of technology to achieve educational goals increases.

Comparative analysis of the levels of ICT application in the educational process and the implementation of the full life cycle of knowledge stated their coordination on the main aspects. It justifies the need for the integration of pedagogical research in digitalization of education and the knowledge economy in the training of the teacher of the future.

Currently, the society seeks teachers who are committed to a dynamic update of their competence[19]. The training of such teachers requires a change in the content and technological aspects, which is carried out within the framework of the third task of this study. Speaking about the content of professional training of the future teacher in the conditions of digital education, the following features form the basis for this aspect:

1) A holistic, systematic view of the educational process in the unity of formal, non-formal and informal education.
2) Training based on interdisciplinary and supra-disciplinary approaches.
3) Training in communication, joint activities and cooperation of all participants of education.
4) Personalization of educational activities that allows determining the strategy and pace of learning, to construct one's own knowledge, to make independent decisions (what to study, how to study and what resources to use).
5) The process of education, taking place at any time, anywhere, at a suitable pace and sequence of studying subjects and activities.
6) Practice-oriented education, that is, learning is meaningful and personal-significant relevant to future professional activities.
7) Construction of new knowledge occurring in the activity (project, research, etc.).
8) The use of personal mobile devices that create a personal educational space, an adaptive learning environment that allows future teachers achieving better educational results faster and more effectively.
9) Adaptability of training systems personalised to the needs of future teachers.

[19] S. E. Starostina; N. A. Kazachek & J. S. Tokareva, “The development of the education quality assurance system in the context of socio-economic growth of the cross-border region”, IEJME: Mathematics Education, Vol: 11 num 9 (2016): 3289-3300 y M. Tina, “Page Common pressures, same results?”, Recent reforms in professional standards and competences in teacher education for secondary teachers in England, France and Germany, num 41 (2) (2015): 180-202. URL:https://doi.org/10.1080/02607476.2015.1011900

Realization of the technological aspect is carried out through the use of information and personalised approaches that create an information educational space. It is possible to understand the limitations of their own knowledge, the acquisition of skills to generate new knowledge, the use of techniques that organize the activities of the subjects of the educational process. It should be noted that modern vocational education involves the use of active forms of training: role-playing games, project methods, case technologies, and other teamwork forms of quasi-professional and professional activities. To obtain an effective result (the teacher of the future), it is necessary to build and implement a certain logic of using all available potential of educational technologies and active forms of education. This study considers stages of knowledge life cycle (*Identification Acquisition* (the formation of 'zero level knowledge') *Development* (generalization and abstraction leads to 'first level knowledge'; addition leads to the stage of forming 'second level knowledge') *Preservation Transmission)*. The selection is due to the correlation of structural components and levels of ICT application in the educational process with the processes that ensure the implementation of the full knowledge life cycle. Figure 1 shows the correlation of knowledge life cycle processes and the structural components of information competence.

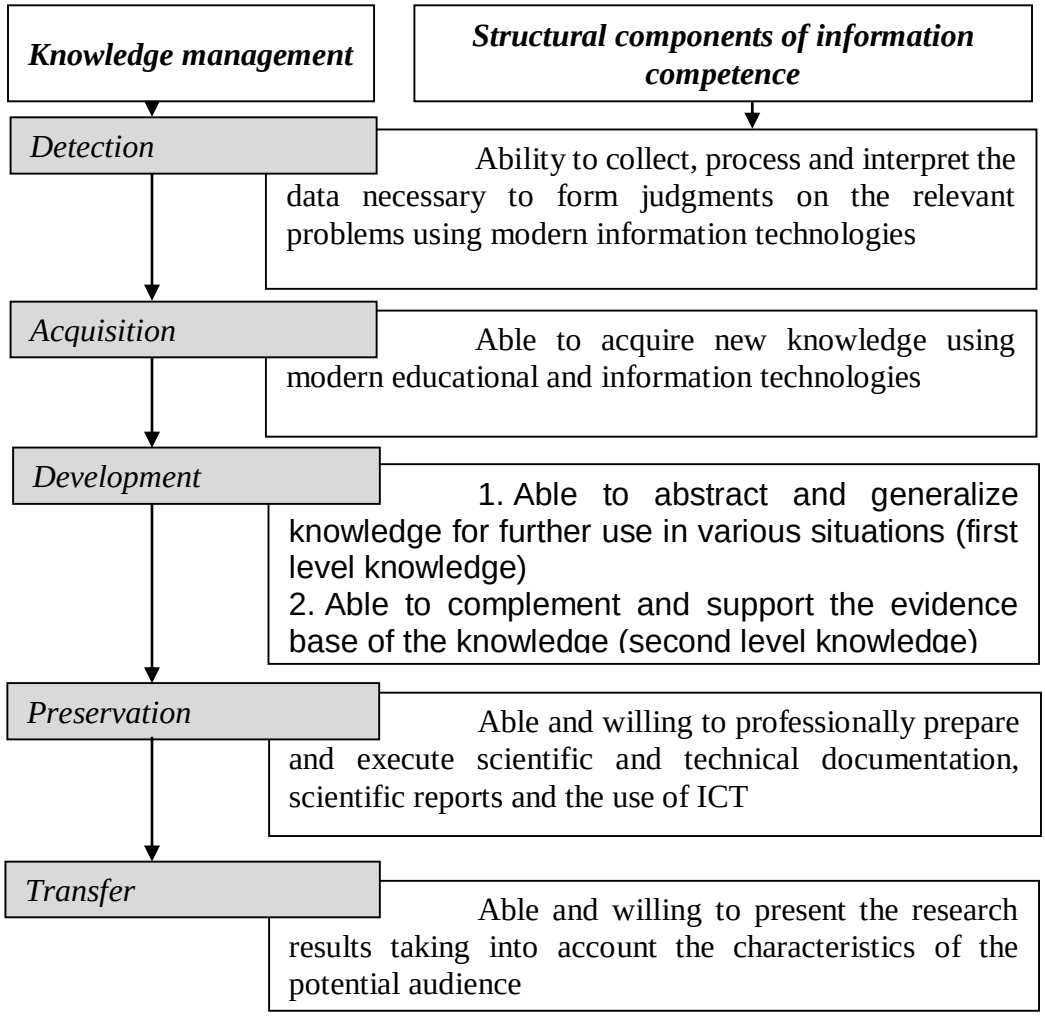

Fig. 1
Correlation of knowledge life cycle elements and the structural components of information competence

The formation of a set of information competencies based on the selected stages of knowledge life cycle. The procedure was tested in the universities of the Siberian and Far Eastern Federal Districts of the Russian Federation during the realization of educational programs for the training of future teachers. 97 undergraduates in the pedagogical direction of training from the universities of the Siberian and far Eastern Federal districts of the Russian Federation participated in the experiment. Assessment of the formedness of information competencies in future teachers was carried out through the performance of tasks on working with information, modeling the situations of professional activity, reflection of their own professional development, and inclusion of undergraduates in project activities. To assess the formation of information competencies, this work used the matrix of compliance of learning outcomes and diagnostic tools, including forms, methods, tools and indicators of evaluation. The formation of the studied competencies in undergraduates was determined by having all of their components present (information, functional, motivational competencies) and complying with all evaluations. Analysis of the results of the experiment drew a number of conclusions. Information educational space provides the focus of the educational process on maintaining information search, acquisition, structuring, generalization, storage, and transfer of knowledge, ensuring the realization of the full life cycle of knowledge. The growth of information competency of students, whose educational process was based on the life cycle of knowledge by including a special module in the training is clearly seen (Figure 2). Evaluation of the process and results of project and research activities was carried out on the basis of such indicators as scope of authority and responsibility, complexity of activities, and knowledge intensity of activities by using statistical methods. It allowed to estimate the level of achieving professional tasks related to ICT (Figure 3).

The experimental data allowed drawing a number of conclusions.

- The introsuction of tasks to work with information allows future teachers to acquire a higher level of achiecing professional tasks related to information competency.
- In course of preparing and carrying out the mini-research, project works and their defense, the research position of future teachers has been successfully formed. The information competencies have also developed.
- Regular project tasks and mini-research works related to the future profession allows mastering analysis and synthesis, generalization. and systematization of information.

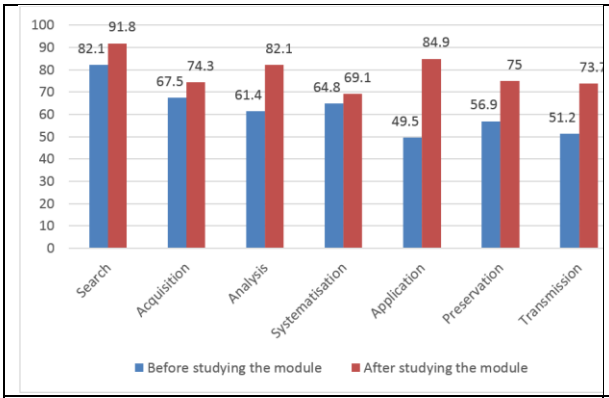

Fig. 2. Acquired skills of working with information (%)

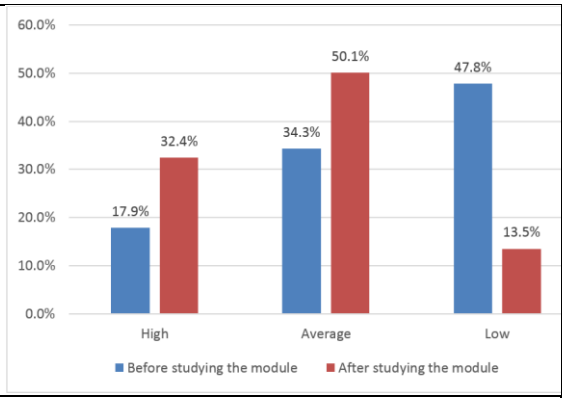

Fig. 3. Level of achieving professional tasks related to information culture (%)

The second vector of the experiments was aimed at assessing the importance of information competency of future teachers. The study involved employers from education, culture, social services, and law enforcement agencies (112 people), and developers of educational programs and teachers (89 people) from the Siberian and Far Eastern Federal Districts of the Russian Federation. The method of expert assessments carried out by representatives of employers and representatives of universities assessed the importance and ranking of information competencies according to their significance (Table 2).

Information competencies	*Employers*		*Universities*	
	%	*Rank*	*%*	*Rank*
Practical knowledge of computer and other information technologies	64.6	1	75.8	1
Ability to make critical judgments about Internet information, media, and advertisements	35.4	4	65.7	4
Understanding the strengths and weaknesses of high technology	25.5	5	38.4	5
Development, analysis and processing of knowledge from different sources of information	46.2	3	74.7	2
Understanding the ever-growing flow of information	50.9	2	68.7	3
Average	**44.5**	**-**	**64.7**	**-**

Table 2
Information competencies

Experts from employers representatives believed the information competencies are not so important: 44.5% of employers surveyed think that competency is a priority. However, today the need for knowledge of information technology is expressed by all representatives of the labor market. According to the majority of employers, only one competency – practical computer skills (64.6%) - is mandatory for the professional development of a future specialist, and this is the minimum required by employers.

The universities representatives stated that much more information competencies are required for comfortable existence in the information society. University experts rated all structural elements of information competencies higher than the representatives of the real economy. The most noticeable differences between the employers and employees of universities are about their attitude to 'the ability to make critical judgments about Internetinformation, social media, and advertisement'. A large share of the universities' experts believes that this ability is necessary (65.7% against 35.4%). Experts from the universities also proposed adding following to the list of necessary information competencies: skills in specialized software products; perception of the environment as a single information space; understanding that the computer is a means, not a goal; independence in case of the collapse of information systems. Thus, the results of the experiments justify that the proposed method of forming the information competencies in future teachers on the basis of the life cycle of knowledge contributes to the achievement of the expected educational results (formation of information competencies). It also confirms the idea that the teacher of the future (teacher of Education 3.0) should not only teach, but also be able to design, adapt, manage and evaluate the educational environment including both digital materials and various educational activities, as well as to use completely new educational technologies in the educational process.

Conclusion

In the XXI century, knowledge has become the dominant means of achieving high socio-economic results. 'The era of encyclopedic scientists and universal thinkers is irretrievably a thing of the past now. ...The main thing is not to have information, but to know; not only know, but to to be able to find and quickly extract the required knowledge from encyclopedias or from the Internet. The main thing is to be able to find the way to knowledge, the way to a solution and be able to take the first steps on this way'[20]. In modern information society, the teacher becomes a key link of the educational system that prepares a person who is able to navigate in the information environment and to generate new knowledge. Therefore, the formation of information competencies of future teachers is a priority task of higher pedagogical education. The results of this work are of theoretical and practical importance. It is significant theoretically since its aim is to determine the key foundations (personalized and information approaches) of organizing the educational process in the context of digitalization of education and the knowledge economy, to identify and justify the structure of information competencies of the teacher of the future. The practical significance of this work lies in proposed method of forming the studied competencies on the basis of knowledge life cycle. The results of the work can be used in the educational process of higher education. The validity and reliability of the results and scientific findings is provided by the used research methods that are adequate to the purpose and objectives of the study; methodological validity of the research provisions; representativeness of the sample volume based on the results of experiments, a combination of quantitative and qualitative analysis of research materials; testing and implementation of the main results of the study.

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