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Continuous development of teachers' ICT competence through formal and informal advanced training

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Abstract

The State Program of the Russian Federation "Development of Education" for 2013-2020 [4]has set the task of forming an effective system of continuous professional development of teachers. The most important component of this development is the continuous improvement of ICT competence of teachers.

The aim of the study is to justify a model for the continuous development of ICT competence of teachers through formal and informal skills development in the field of ICT.

The research describes a model for the continuous development of ICT competence of teachers through the formation of individual educational routes. The components of individual educational routes, their content for the formation of all-use, pedagogical and subject-pedagogical ICT competence are substantiatedin this article. Practical recommendations are given for organizing formal advanced training on the basis of relevant institutions of advanced training, building a system of tutoring, using the potential of networking pedagogical communities.

Materials and Methods

– theoretical and methodological analysis of domestic and foreign methodological literature, scientific articles and publications on the problem concerned;

– study and synthesis of domestic and foreign projects on the formation of ICT competence of teachers;

– application of methods of generalization, comparison and forecasting.

Results

Comparison of the requirements for ICT competence of students and teachers stipulated in the Federal State Educational Standards of General Education and the professional teacher's standard has been performed. The analysis of existing tools for assessing the ICT competence of teachers has been conducted. Based on the analysis of existing tools we have developed a new approach to the diagnosis of ICT competences. The results of diagnostics make it possible to build individual educational routes for the development of ICT competence of teachers. The inclusion in the individual educational routes of teachers networking services (Web 2.0) is justified. The need to use these services in the educational process is discussed by domestic and foreign scientists.

A model of the continuous development of the teacher's ICT competence through formal and informal professional development is described in the article. The model consists of advanced training for teachers in the field of ICT, a system of tutoring support on the basis of educational organizations, providing support within the networking pedagogical communities. Particular attention is paid to the methodological support of the development of ICT competence of teachers within the framework of school information and educational environments.

Key words: continuous education, ICT-competence of a teacher, professional teacher's standard , diagnostics, formal training, informal training, information and educational environment, tutoring support, networking community

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Introduction

The issue of the content of ICT competence of teachers, its connection with the formation of the information and educational environment of the modern school in recent decades has been the subject of numerous studies: T.A. Boronenko [1], I.G. Zakharova [5], A.A. Kuznetsova [15], I.V. Robert [20], A. Yu. Uvarova [23], E. K. Henner [26], A.J. Begum [29], and others.

The requirements for the teacher's ICT competence are stipulated in two documents: The Federal State Educational Standards of General Education at all levels [24] and the professional standard of a teacher [17]. The list of skills that make up the ICT competence of the graduate of the secondary school is proposed in detail in the interdisciplinary Program for the Development of Universal Learning Activities, which includes the formation of the competencies of students in information and communication technologies, educational research and project work[19].

Only a teacher, who has a sufficient level of ICT competence, can form the ICT competence of the learner. Today, the concept of ICT competence of a teacher is defined by the teacher's professional standard [17]. The approaches were developed by SM Avdeeva [28], ME Vaindorf-Sysoeva [3], AA Kuznetsov [15], AK Skuratov [21], HS Kim [32] etc.

The purpose of this study is to substantiate the model of the formation of individual routes for the continuous development of ICT competence of teachers based on the results of diagnosis of certain ICT tools and services, various ways of using ICT in classrooms.

Literature Review

There are various interpretations of the concept of "ICT-competence of a teacher" I.V. Robert under the ICT competence of the teacher understands the possession of ICT competence. In turn, the ICT competence of the teacher is inextricably interrelated scientific and pedagogical areas: teaching a subject with ICT; implementation of information activity and information interaction between the participants of the educational process using the potential of a distributed information resource of local and global computer networks; automation of information and methodological support of the

educational process and organizational management of the educational institution based on ICT [20].

AA Kuznetsov and his colleagues in [15] argue that the ICT competence of the teacher is a complex concept that is viewed theoretically as a certain way of life activity, and in the methodological aspect it includes the purposeful effective application of technical knowledge and skills in reality . TA Boronenko under the ICT competence of a teacher understands the ability to choose information and communication technologies consciously to obtain subjectively or objectively new scientific and pedagogical knowledge and scientific knowledge for the purpose of investigating and solving practical problems [1].

What are the requirements to ICT competence of teachers taking into account a rapidly changing situation in the field of computerization of education then?

In 2011, UNESCO summarized all the world experience and approaches to the structure of professional ICT competence of teachers [38]. The structure of ICT competence of teachers and the requirements for their preparation in accordance with UNESCO recommendations are discussed in detail in [30; 32; 37; 39].

Recommendations given by UNESCO served as a basis for introducing the concept of professional ICT competence of a teacher, stipulated in the professional standard of a teacher [17]. The standard contains a three-level model for the formation of the teacher's ICT competence, which includes: all-use ICT competence; pedagogical ICT competence; subject-pedagogical ICT competence (reflecting the professional ICT competence of the relevant field of human activity). This approach allows us to speak about the continuous process of forming the ICT competence of a teacher, its gradual qualitative increment, which should be the basis for building a formal and informal ICT training.

The problem of forming the teacher's ICT competence in the context of the professional standard requirements is discussed by TA Boronenko [1], VB Klepikov [9], LA Shevtsova and GA Kruchinina [27].

It is noted in the professional standard that the professional ICT competence of a teacher is revealed in the educational process and evaluated by experts, usually in the course of monitoring the teacher's activity and analyzing its fixation in the information environment. What tools can experts use to monitor the development of the teacher's ICT competence?

It's necessary to draw your attention to the research conducted by S.M. Avdeeva and her colleagues from the Center of Information Technologies, Resources and Networks of the Federal Institute for the Development of Education [28]. The authors analyzed the known approaches to the assessment of the ICT competence of a teacher. ISTE Standards and UNESCO ICT CFT, offered their own approach to the analysis of pedagogical activity based on the requirements of the professional standard of a teacher. They have determined cross-cutting principles of ICT application , to observe them is the basis for assessing the teacher's ICT competence: the priority of health and safety of participants in the educational process; observance of ethical and moral norms of interaction, including the information and educational environment; cooperation and constructive interaction of all participants of the educational process, including teachers, students, parents, administration members. Documents prepared in the course of the study of the Federal Institute for the Development of Education are discussed by the pedagogical community on http://ictlit.com/teacher.

Materials and Methods

The methodological basis is:

- theoretical and methodological analysis of domestic and foreign methodological literature, scientific articles and publications on the problem concerned;

– study and synthesis of domestic and foreign projects on the formation of ICT competence of teachers;

– application of methods of generalization, comparison and forecasting.

As for the diagnostic apparatus to determine the levels of ICT competence of teachers, today such tools are not available, and the professional standard of the teacher proposes to identify professional ICT competence by monitoring the activities of the teacher in the educational process. Therefore, the authors recommend testing the skills of teachers using certain ICT tools and services in order to form a system of formal and informal professional development in the field of ICT; various models of ICT application in lessons ("1 student: 1 computer", "education outside the classroom", BYOD (Bring your own device), "flipped classes", "change of working areas", etc.); arranging project work using ICT; using knowledge and electronic educational resources in their subject area. To do this it is necessary to prepare diagnostic maps, test tasks, self-evaluation and mutual evaluation of educational products created in the course of professional development.

The diagnostic tools helped to substantiate a new model for the formation of individual routes for the continuous development of ICT competence of teachers.

The model is based on :

- ideas of the system approach, which allows to build a system of continuous formation of ICT competence through the system of advanced training courses in the field of ICT, using remote technologies; tutorship support of educational organizations; providing support in the framework of scientific and project activities at schools; formation of networking pedagogical communities;

- a modular principle that includes, along with training courses on mastering the basic skills of ICT tools, various courses that expand the educational trajectory to meet professional deficits;

- Individual and differentiated approaches that help every teacher to build an individual route for the development of his ICT competence.

Results

The ICT competence in our research means the teacher's ability and readiness to manage professional activity based on the professional use of information and

communication technologies; to provide information interaction among all the participants of the educational process. This definition does not contradict the description of professional ICT competence stipulated in the teacher's professional standard [17].

Comparison of the demands on ICT competence of learners stipulated in the Federal state educational standards of general education [24]and professional teacher's standard[17]has revealed their interrelation and interconnection. For example, students should use various ways of searching information on the Internet. All-user ICT competence of the teacher includes searching skills used for the Internet and databases, systematic use of skills in everyday and professional contexts. The subject-pedagogical ICT competence comprises knowledge of the quality information sources of the subject matter and historical documents.

For instance, according to FSES learners have to interact in the educational environment an organization. A teacher has to provide such interaction due to the professional teacher's standard.

Comparison of the demands on ICT competence of learners and teachers helped us to develop diagnostic materials for teachers to assess the skills of using ICT tools and services; to provide support on the formation of individual educational routes for the development of ICT competence.

The research has revealed that 65% of the participants can use Microsoft Office at the level of simple skills (they can type text, perform low-level formatting, insert simple tables, pictures, save and print documents); use Excel at the level of simple arithmetic operations, can draw a diagram, create simple multimedia PowerPoint presentations, using text, images and animation), 22 % of participants are at the advanced level (in Word they use different styles, footers, complex tables, lists, tabbing etc., break a text into columns, can change the layout of pictures, search for and replace words, etc. In Excel they can enter complex formulas, use absolute and relative addressing, change the font, color and size of cells, delete, add , hide columns and rows, use auto filters, draw

diagrams, can insert various objects into the presentation, customize various slide transitions, animation, etc.) 13 % of learners have few skills, even simple formatting operations are too complex for them.

Similar data were obtained assessing the skills of searching for information on the Internet, working with e-mail, using school information systems, etc.

Answering the question about the necessity of applying ICT at school 46 % of respondents agreed that it was compulsory; 41 % thought that it was possible but not necessary ; 13 % considered it unnecessary. 32% said that they always used ICT in the educational process; 52 % used it from time to time; 16 % did not use it at all. Responding to the question about the systemic use of information and communication technologies in educational process 20% of the respondents gave a positive answer; 67 % answered negatevely; 13 % found it difficult to answer. 66% of teachers positively evaluated the influence of ICT on the educational process of; 12 % noted insignificant effectiveness; 22 %. as was noted by 12% of respondents did not answer this question; 72% of respondents thought that the efforts of teachers had to be supported by the administration of educational organizations, 24% did not feel it, and 4% noted a negative attitude towards their endeavors.

About 30% of teachers who participated in the surveys noted their participation in remote conferences, master classes, webinars, and other networking events. 26% of teachers said that they used ICT in extra-curricular activities; 15% of respondents took part in networking projects with their students;12% participated in other networking events .

Analysis of the demands on ICT competence of learners and teachers, stipulated in the Federal State Educational Standards of General Education and the professional teacher’s standard; analysis of drafts and projects on ICT competence of teachers; examination of ICT skills of teachers allowed us to propose a model for the continuous development of ICT competence of teachers through individual educational routes (see table). To develop the ICT competence of teachers, it is proposed to use formal and

informal training: through tutorial support, colleagues' experience, self-education, interaction in pedagogical communities, practical activity within school information and educational environment.

Model of continuous development of ICT competence of teachers by forming individual educational routes

Components of individual educational routes for the formation of ICT competence	ICT-competence of a teacher		
	All-use	Pedagogical	Object-pedagogical
Formal training on the basis of institutions of advanced training, using remote technologies	use of interactive equipment in class, making effective computer presentations; studying the basics of video editing; gaining skills on how to search information on the Internet, studying modern Internet services, gaining skills to use public services in	Gaining skills to conduct classes Using e -textbooks, mobile technologies, blended learning; learning how to use ICT forms of assessment, making portfolio, mastering the methodology of using networking services, acquainting with innovative lesson models with ICT, how to conduct research and do projects using	Mastering the specifics of ICT applications in different subjects, for example, Informatics and robotics, use of geocaching in Geography classes , digital measuring devices for natural sciences

	electronic form	ICT	
Tutor support of ICT competence of teachers on the basis of educational organizations	Conducting training on "Information technology" by tutors at schools	Consultations, methodical seminars, methodological guidance competitions run by tutors	under the guidance of tutors of Doing projects, conducting demonstration lessons; taking part in competitions at various levels; mastering the role of a tutor; accumulating of advanced pedagogical practices under the tutors' guidance
Analyzing colleagues' experience	Attending demonstration lessons using ICT, studying the experience presented in journals and the Internet	Participation in webinars, master classes, methodological projects, etc.	Analysis of various pedagogical practices of ICT application on various educational portals and online communities
Interaction through pedagogical networking communities	Mastering the skills of working in various networking pedagogical communities	Active participation in the work of the networking pedagogical communities (talking	Participation in collaboration work within the subject networking communities,

	(usually as reader)	about different issues, sharing experience with other teachers etc.).	collaborative work on educational products
Self-education	Mastering the basic skills of using ICT in various mass open online courses (MOOC), assisting students	Self-mastering of ICT tools and services with the help of teaching materials and information resources	Self-mastering ICT tools and services focused on a relevant subject
Work in school information and educational environment(IEE)	Getting the basic skills of interaction with students, parents, colleagues through school IEE	Providing in-class and out-of-class activity in the framework of school IEES	Planning, organizing , analysing of educational activities; interaction with students, parents, colleagues within the framework of school IEE

It is obvious that individual educational routes for teachers should include the didactic capabilities of social networking services (Web 2.0 services) that significantly expand the arsenal of teaching tools necessary for solving pedagogical problems at various stages of the educational process. Their accessibility is often one of the main factors that motive teachers to introduce innovative technologies. The use of networking services in education is discussed in numerous studies [8; 18; 31; 33-36; 40; 41].

From a large number of networking services of in- classroom and out-of-class activities that are used to do project and research work the use of hypertext creation services are the most justified ones ; services that are used to edit text documents, tables,

presentations; on-line visualization services (for creating clusters, mind-maps, timelines, infographics, etc.); virtual boards; geoinformation services; file storage; video services; various organizers, etc.

It is important to study capabilities of ICT tools and services as an instrumental basis for project technology [12]. It should be noted that in the continuous development of ICT competence of teachers, e-learning and distance education technologies play an important role [6].

Formation of ICT competence of teachers can take place under the guidance of tutors at schools. Tutoring as the original philosophy of education and the leading form of organizing the educational system goes back to medieval European universities of the 12th-14th centuries.

The aim of a tutor is to create an educational environment that will allow students to obtain knowledge and skills independently learning in a mode convenient for them. [10]. To form ICT competence of teachers, the following forms of tutoring assistance are possible: conducting classes together with teachers at schools, mastering various models of ICT application in the educational process; providing master classes, demonstration lessons, methodological seminars, methodological guidance competitions; drawing teachers' attention to remote forms of self-education, inviting them to pedagogical communities [2; 7].

In recent years, various informal models of professional development have been applied. The difference between informal and traditional training is that it does not lead to compulsory certification. However, it meets the teacher's need for self-education, expands his/her general cultural level and broadens teacher's knowledge.

In addition, focus on issues of public and professional recognition of results serve as a motivating factor [16].

Various professional associations of teachers, the exchange of pedagogical experience, self-education are all models of informal professional development. Training based on the experience of colleagues is described in this article. [13].

Various networking professional communities are the examples of informal models of professional development. Networking communities are excellent platforms for holding remote pedagogical conferences, competitions, and master classes. It is a platform for sharing experiences, exchanging ideas on topical pedagogical problems, and distance counseling. Professional communities provide opportunities for growth, professional self-realization of a teacher, who can post some methodological materials, lesson plans, as well as, the results of pedagogical experiments. At the same time, a teacher can get a personnel assessment and recognition from his colleagues. The role of the networking pedagogical community as a platform for informal teacher development is discussed in a number of works [14; 16; 22].

The system of advanced training is assigned an important role in the formation of ICT competence of teachers. But if a teacher who comes back from the advanced training courses does not have an opportunity to implement the acquired competences in his educational organization, if school does not have the appropriate information and educational environment, if there are no people who can be contacted for support, then the results of the professional development may be low. To a large extent, the formation of ICT competence is determined by the conditions in which the professional activity of the teacher is carried out, that is, the level of the formation of the information and educational environment of the school.

The new educational standard of general education has made educational organizations responsible for meeting the requirements for the formation of information and educational environment: "Information and methodological conditions for the implementation of the basic educational program of general education should be provided by modern information and educational environment" [24]. The level of development of the information and educational environment of schools makes demands on the teacher's ICT competence. And the higher the ICT competence of teachersis , the more creative, safe, open is the information and educational environment of school. Conversely, a high level of the formation of the information and educational

environment imposes corresponding requirements on the ICT competence of teachers [9; 11; 25].

The development of ICT competence of teachers takes place through self-education. There are a lot of opportunities today: the use of relevant information resources, training videos, participation in various mass open online courses (MOOC), seeking help from students.

Discussion and Conclusions

The aim of the modern school is to transfer a learner to the self-development regime. This directive is clearly reflected in the Federal state educational standard of general education at all levels. FSES makes great demands on general education to meet personal, subject and meta-subject results. One of the main meta-subject results in the Federal state educational standard of general education is « formation and development of competence in the sphere of information and communication technologies" Only a teacher with a high level of ICT competence can form ICT competence of a learner.

The demands on ICT competence of learners and teachers are stipulated in the Federal State Educational Standards of General Education and the professional the teacher's standard. The study of innovative practices in the formation of ICT competence of teachers and the results of diagnostic materials of teachers' ICT skills allowed to document the model of continuous development of ICT competence of a teacher through formal and informal professional development, its formation in information educational environment. The model suggested consists of a task list to obtain ICT skills. These tasks can be tackled by advanced training in the field of ICT with application of remote educational technologies, tutorial support on the basis of educational organizations and networking pedagogical communities. One of the most important roles in the development of ICT competence plays the methodological support within the framework of school information and educational environments.

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