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DISTANCE LEARNING TECHNOLOGY AS TOOL FOR MONITORING AND IMPROVEMENT OF ICT-COMPETENCE OF TEACHERS OF COMPUTER SCIENCE

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Abstract

In the article considered components of the information and communication competency computer science teachers, the proposed criteria for evaluation of formation of the information and communication competency computer science teachers, tools and results of the leading monitoring of the level of formation of the information and communication competence among computer science teachers Mykolayiv region, lysed due to insufficient training of science teachers and the ways to overcome this problem.

Keywords

information and communication competence, digital competence, professional development, professional competence of teachers of computer science, teachers' advanced training

Introduction

Today's society is at the stage of formation of a global knowledge community. In the foreground there is a human factor, because people are both owners, creators and consumers of knowledge, and informatization of all spheres of human activity is a key factor of structural social change. To solve socio-economic problems successfully we need to provide high quality education at all levels without exception. The task of modern teacher – is not only to give knowledge according to the curriculum, but to form in pupils the vital skills to work with information: searching, collecting and processing the necessary data and knowledge, the ability to interact effectively, preserve and present the results of their work. The growing need for information, technology and visual literacy of school leavers, understanding that students have changed and educational practices have not changed, it requires a significant number of teachers who have practical skills in using information and communication technologies, that are defined by international academic communities and organizations. (Badarch Dendev, 2013)

The high level of information and communication competence of teachers of computer science is the key to effective use of information and communication technologies in the institution, is one of the most important indicators of the success of its activity and also a prerequisite to further improve of the professional competence.

Distribution of digital technologies contributes to the transformation of learning to continuous one, individually-oriented, flexible and dynamic process. UNESCO pays special attention to the development of high-tech educational competencies and skills of the XXI century by the means of modern information and communication technologies.

Theoretical basis

Over the past few years there is carried out a study that examines how technology really affect the educational standards and processes, for education in general, how to use modern information technologies to create competencies that are required for modern life and future. (Mishra & Kereluik, 2011; Voogt & Pareja Roblin, 2012).

Analysis of national research that are concerning the determining of list and content of professional competence of teachers, particularly teachers of computer science(V.U. Bykov, L.I. Bilousova, M.I. Zhaldak, N.V. Morze, S.A. Rakov, O. M. Spirin, M.P. Lapchyk, G.V. Lunyova, Rams'kyj U.S., T.V. Tikhonova et al.) makes it possible to conclude that the formation of professional competence of the teacher envisages the earning fundamental knowledge on learning subject, technique of training, didactics, psychology, education, development of teaching skills related to the actions of teachers in various educational situations, formation of necessary personal qualities, communication skills, presence of need to self-improvement and self-development (Galdak M.I., Ramskyj J. S., Rafalska M. V, 2009).

Despite the considerable number of works devoted to the preparation of future teachers of computer science and the formation of professional competencies, there are many questions remain unresolved, including the need to study such issues as methodical preparation of teachers of information science, and improvement of their professional and information and communication competence.

Problem statement and research questions

Actuality of the study caused by the following factors:

- constant development of information and communication technologies, increasing of their educational potential and accordingly increasing of the requirements of professional competence of teachers of information science;
- constant updating of the structure and content of the subject "Information science" requires from teachers independent acquisition of new factual material and leaves aside the question of methods of teaching the subject;
- need for the formation and development of self-learning skills, self-organization and personally professional development of teachers;
- absence of a system of objective criteria and methods for monitoring and assessing the quality of training of teachers of information science.

The aim of the study is to establish the actual level of information and communication competence of the teachers of computer science in secondary schools of Mykolaiv region, determination of the capacity's level of teachers to solve everyday practical problems associated with the use of integrated information and communication technologies, issues in professional activities of teachers of computer science and their solutions.

Introduction the computer science to the 2nd and 5th form has increased the number of teachers who teach information science, but do not have the appropriate special education and sometimes have only the user's skills. The teacher's activity is the main determinant of student achievement in the particular subject area. Due to the effective use of technologies in the learning process, students can acquire a range of competences, including informational. Firstly teachers must help to develop these competencies, who are themselves possess these competencies and be willing and able to perform activities associated with their formation (ISTE Standards Computer Science Educators, 2011).

Thus, the proportion of teachers who do not have special education in computer science in the past academic year in secondary schools of Mykolaiv region has increased to 56%. Therefore, in Mykolaiv region in November 2013 on the basis of Mykolaiv Regional In-Service Teacher Training Institute was launched the regional experiment "Improving ICT-competence of the teachers of computer science in conditions of constant education".

In 2014 and 2015 were carried out monitoring research of the level of information and communication competence of the teachers of computer science in secondary schools of Mykolaiv region in 2014. The participants of monitoring were 493 teachers of computer science of secondary schools in Mykolaiv region, representing 85.7% of all teachers of computer science in the Mykolaiv region.

The study was based on the structure of information and communication competence of teachers of computer science (table 1), which was developed on the basis of recommendations of UNESCO "UNESCO ICT Competency Framework for Teachers"[4] and "Guidelines on Adaptation of the UNESCO ICT Competency Framework for Teachers"[5]. ICT-CFT project is aimed at teachers of primary and secondary schools, but the approach can be applied to all levels of education. It is obvious that for different categories of pedagogical staff competence in the field of information and communication technologies can and should vary in content. In particular, information and communication competence of teachers of computer science should differ significantly from the information and communications expertise to other teachers in volume, depth and systematic knowledge in the field of information technology. After all, information and communication technologies, the hardware and software of the teachers of computer science are the part of the curriculum content and the use of ICT in the educational process, a combination of traditional forms of learning activities of students – is a necessary condition for teaching computer science in school.

Leaving the UNESCO proposed approaches to teachers of information science, it is possible to combine activity modules of the proposed structure of ICT competence and present it as follows (table 1):

- Ideological component (module "Understanding ICT in Education")
- Technological component (modules association "Curriculum and assessment" and "Information and communication technologies")
- Organizational and methodological component (modules association "Pedagogy" and "Organization and administration")
- Self-educational component (module "Teacher professional learning")

	TECHNOLOGY LITERACY	KNOWLEDGE DEEPENING	KNOWLEDGE CREATION
Ideological component	<ul style="list-style-type: none"> • Understanding the basic principles of using ICTs in teaching; • Understanding the information and ICT in education, science and society 	<ul style="list-style-type: none"> • Understanding the essence of "information culture" • Knowledge state documents about ICT in education • Ability to prove expediency of using ICT 	<ul style="list-style-type: none"> • Knowledge of patterns and problems of development and the information society • Initiation of innovation on the use of ICT in school
Technological component	<ul style="list-style-type: none"> • Basic knowledge of 	<ul style="list-style-type: none"> • Knowledge that go 	<ul style="list-style-type: none"> • Consultation on

	<p>computer science (knowledge of digital devices, systems, and networks, modern knowledge high-level programming language, principle of constructing correctly functioning programs involving simple and structured data types; compound boolean expressions; and sequential, conditional, and iterative control structures)</p> <ul style="list-style-type: none"> •using digital devices; •basic ICT skills; •Knowledge of educational standards and curriculum; •knowledge of the curriculum standards for their subject, •knowledge of standard assessment strategies. 	<p>beyond the limit of basic knowledge on the subject)</p> <ul style="list-style-type: none"> •Effectively use network resources •Effectively use, manipulate, and explain various external data stores: various types (text, images, sound, etc.), various locations (local, server, cloud); •Effectively use a development environment •Ability to create complex real-world problems; •using elements collaborative problem- and project-based learning knowledge of formative assessment tools; •using formative assessment tools 	<p>the optimal choice of ICT and network services to solve educational problems</p> <ul style="list-style-type: none"> •Ability to create complex practical problems aimed at self obtaining knowledge and acquire new skills and competencies •plan and implement educational projects with their students •Describe the assessment criteria in accordance with the goals and objectives of educational projects, practical problems
Organizational and methodological component	<ul style="list-style-type: none"> •knowledge that ICT can be used and how •using ICT in the classroom •using of ICT in different stages of lesson 	<ul style="list-style-type: none"> •Plan and teach computer science lessons/units using effective and engaging practices and methodologies (Knowledge of the main provisions of collaborative problem- and project-based learning, student-centered learning) •Design and implement developmentally appropriate learning opportunities supporting the diverse needs of all learners 	<ul style="list-style-type: none"> •A variety of networked devices, digital resources, and electronic environments are used to create and support this community in its production of knowledge and its collaborative learning •ability to choose optimal methods for studying •correction of deviations students from their educational path; •teacher is a learning facilitator

Self-educational component	<ul style="list-style-type: none"> •Ability to use web-resources for the selection of educational information, problems • using network educational resources to search for information 	<ul style="list-style-type: none"> •using digital educational resources for oneself •Ability to create educational network resources •Consult colleagues about the use of ICT •regularly shows other teachers how the uses ICTs to enable students to generate knowledge 	<ul style="list-style-type: none"> •yourself study using open educational resources, •Identify and participate in professional computer science and computer science education societies, organizations, and groups that provide professional growth opportunities and resources •use ICTs to consult with experts, and collaborate with other teachers to support their own professional learning
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Tab 1: The structure of ICT-competence of computer science teachers

According to the developed structure for determining the level of information and communication competence of teachers of information science, it was formed four groups of criteria which provided evaluation:

- understanding of the essence of the concept "information culture" and knowledge of the key public documents related to implementation of ICT in education (ideological component);
- basic knowledge of computer science and skills of work with systems, software and digital devices (technological component);
- knowledge of methods of teaching information science, the main provisions of pedagogy and skills of using of ICT at different stages of the lesson (organizational and methodological component);
- skills to use and create digital educational resources for their own education, dissemination of experience in applying of ICT, communication with colleagues (self-educational component).

Methods of research

It was used the method of questioning and testing to collect the necessary information. The maximum number of points that can be obtained during the monitoring period is 195 points and is represented in qualimetric model (table 2).

Testing was conducted on a platform of distance learning «Moodle» <http://monitortest.moippo.org.ua/>, for each participant of the test were prepared the personal login and password and set a schedule of participation in the research process.

Components	Assessment Tools	The maximum
Ideological component	The survey	10 (5 %)
Technological component	The survey, testing, practical problem solving	93 (48 %)
Organizational and methodological component	The survey, practical problem solving	81 (42 %)
Self-educational component	The survey	11 (5 %)

Tab. 2: Qualimetric model Components of the structure of ICT competence of computer science teachers

Implementation of combined practical task to determine the professional competences testified of the level of teachers' practical skills to use the information technologies. In addition, the proposed tasks allowed to assess methodological preparation of teachers.

The survey was carried out by the using of questionnaires based on the service Google Drive with a tool Google. The survey was anonymous, that allows asserting about the objectivity and honesty of the received responses. It was received the data set by questioning and testing, which allows to compare the results of self-assessment and actual results. It revealed that the most teachers of computer science estimate biased their own level of informational competence. The results of self-assessment are much higher than the test results (mean value of difference is the 30%).

Data analysis and results

Monitoring Results 2014

In Mykolaiv region at the beginning of the 2013/14 school year, from the 575 teachers who taught computer science in educational establishments of the region, the 56% did not have adequate special education, 36% of respondents had experience in teaching computer science less than 5 years, 39% were raised their qualification in computer science for past 5 years, 38% had no certificate in teaching modern ICT and using of ICT in the educational process.

Only 6% of surveyed teachers were able to give correct answers to 80% and more of the test, and about 50% of teachers were not able to give the correct answers more than for half of the questions. The average result for the test is 51.1 points out of 100 maximum possible. Average of test results looks as follows (fig. 1) and indicates a lack of certain theoretical knowledge on the subject in a significant number of teachers.

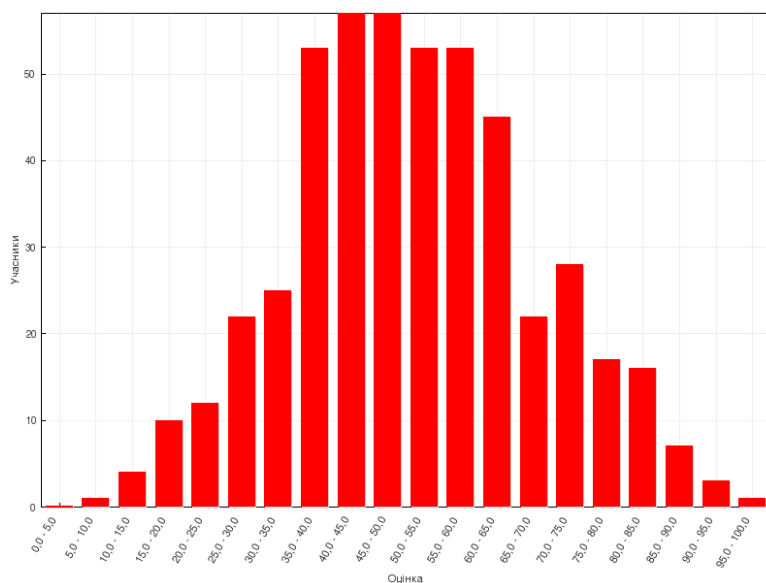


Fig. 1: Test results of the teachers of information science (2014)

The most difficult were questions about the theoretical basic knowledge of information science, such as information, informational processes, algorithms, objects, and questions regarding the operating system, spreadsheets and databases. As it turned out, the problem of determining the manifestation of information human culture offered in specific circumstances was also difficult. A significant number of teachers of computer science are not have basic knowledge of algorithms and programming.

Some teachers reported that they did not have time to answer all questions because of the low-speed of Internet in the facility. According to the survey, 26% of schools have high-speed Internet access from multiple computers, 39% have access to low-speed Internet from multiple computers, and 28% have access to the Internet from only one computer.

Low speed of Internet, overloading teachers prevent 21% of interrogated teachers that use a variety of online resources in the educational process, and 35% do not use online resources in their work about.

The following situation is also causing the anxiety, 35% of the teachers of computer science do not communicate with colleagues at professional forums and communities due to lack of time and lack of connection to the Internet. The vast number of teachers use the Internet to search the material for their lessons and to communicate in social networks, only 13% of respondents placed teaching materials on Web-resources, 21% have their own training/methodical website or blog, but the frequency of records is low.

Lack of constant communication with colleagues, exchange by ideas and best practices hinders professional development of teachers, especially in the modern world.

The most difficult for teachers was practical work, which was composed of professional competency tasks. Poor knowledge and lack of technological skills in working with electronic presentations and environment for processing tabular values are clearly evidenced in the performance of these tasks. Fully or partially were completed the tasks of practical work by 84% of the teachers. Text document could create 81.6% of the teachers, 79% passed the monitoring, presentation to the desired stage of the lesson and spreadsheet - 73.7% of the teachers.

During the fulfillment of the task to create a text document it was about 20% of the teachers who couldn't decide the key concepts of the lesson, choose the form of organization of students in class. 7% of teachers instead of the proposed tasks (answers to certain questions) submitted abstracts of the lesson on the subject of other teachers that are on the Internet. We can also note the difficulty in processing text document (diverse nature and many-coloring font, "not readability" of the created document). It were presented links to Internet resources in some papers, but the information on Web pages had no relation to the training topics and did not meet the requirements of the job.

While performing the task to build charts and graphics with given tabular data that was revealed that some teachers do not understand the purpose of diagrams of different types, can not present the data in graphic form, apply statistical functions for data analysis.

While performing tasks for creating computer presentations the teachers often do not adhere to the requirements of the pedagogical design. For about 40% of teachers it was difficult to isolate a part of the curriculum slide.

Simultaneously with testing, it was proposed for teachers to rate their own knowledge of the specific topics of the course. After analyzing respondents' answers should be noted that self-esteem of teachers coincides with the results of testing only for specific topics. For all other themes observed overestimation of their own self-teacher (figure 2).

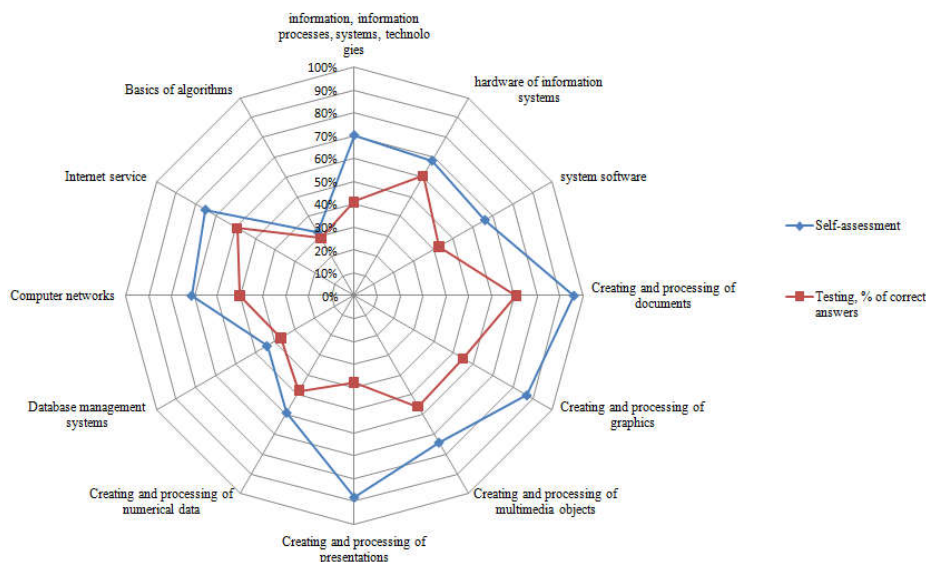


Fig. 2: The comparison of test results from self-evaluation of the teachers

As for the question about the frequency of teachers' advanced training in information science, the 38% of respondents indicated that it's enough to take courses 1 time in every 5 years. The remaining teachers wishing to pursue advanced training in computer science more than 1 time in 5 years due to the rapid development of information technology and changes in training programs in information science, but consider that it is necessary to reduce the duration of such courses. The most convenient for teachers of computer science was manifested the training on short-term eye or distance courses and annual participation in seminars, trainings, workshops and more.

Ways of formation of Of ICT competency science teachers based on data start monitoring research

During the years 2014-2015 methodical work with teachers was oriented to personal professional needs of teachers, establishment of new forms of lifelong education for teachers.

In order to support the blended form of teacher training at the portal of the Mykolayiv Regional Institute established distance learning platform Moodle. Teachers and teacher's trainers of Institute developed and placed distance courses on the platform Moodle (do.moippo.org.ua) for listeners of extension courses of blended learning and mini distance learning courses for teachers to study different themes from school course of computer science.

In Mykolayiv Regional Institute courses computer science teacher training and between the treatment courses period was conducted familiarization of teachers with species didactic possibilities and ways of using modern Web 2.0 services in the educational process, introduced elements of training in cooperation, interaction in a team with colleagues through online means organizations interactive cooperation (websites, blogs, services Google, Wiki environment and community, map knowledge, etc.) created professional teacher community. During the training sessions and master classes on the use of Web 2.0 service science teachers not only improve their information and communication competence and skills and develop the collaboration skills, communicability and self education, the ability to identify problems and (ways of their solution) and solutions, responsibility. Because teachers from their own experience master methods and ways of formation of competencies that are necessary in modern society.

Monitoring Results 2015

In 2015 was held the next monitoring. The main purpose of monitoring research in 2015 - enable the teacher to independently check their knowledge and skills and compare their professional level with modern requirements for teaching computer science.

There are 497 teachers of computer science of secondary schools of Mykolaiv region that was involved in research. Test results demonstrate improving knowledge teachers of subjects, especially on the topics "Creating and processing of multimedia objects", "Basics of algorithms", "Information. Information processes, systems and technologies." The average result for the test was 64.1 score out of 100 possible maximum. Distribution of teachers by amount of points are presented in Figure 3.

Among the reasons for the rapid increase in the number of answers 85-100 points are the following:

- self-treatment of materials by teachers for a thematic evaluation of students, their use in the educational process;
- cooperation and collaboration of teachers in some areas during the passage of the monitoring study.

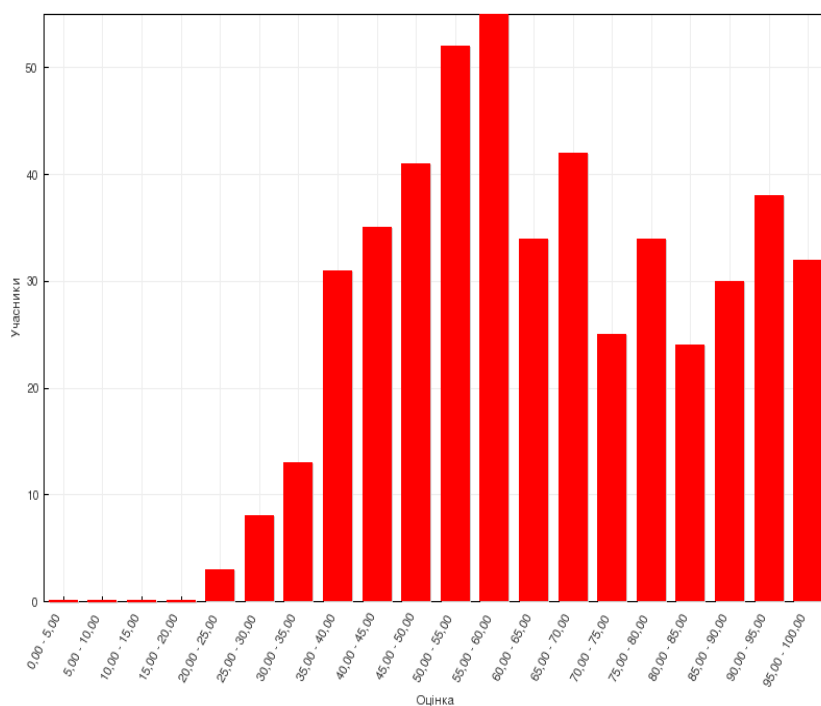


Fig. 3: Test results of the teachers of information science (2015)

Like in the previous year, for teachers was the most difficult practical work, which consisted of professional competence problems. Fully or partially completed the task of practical work 74% of teachers. The mind map or text document created 57% of the teachers that were monitoring, the lesson presentation - 53%, student publication - 51%, and the requirements and criteria for evaluating student work pass of only 38%.

Should be noted that more than a third of teachers who perform practical work, presented a mind map, through its various construction services.

Many science teachers said that thanks to the monitoring task they met with tools such as mind maps and mastered services of their construction.

Compared to the previous year the positive aspect was that almost all the presentations have been decorated with themes of presentations and compliance with the same style. More difficult was the situation with the creation of comments to slides (teacher's explanation of new material) and formulation of a problem for students at the beginning of the lesson. About 20% of teachers have made comments to a presentation slide, about 15% of teachers use educational material to explain the elements of problem-based learning.

Almost all participants of monitoring study correctly identified the information technology student to perform tasks more difficult was the definition of information products - publication (electronic version of the wall newspaper, electronic newspaper, a computer publishing, text document). But there were also quite unclear definition of information product that offers to create disciples, such as "Information products have the data necessary for the student explanation, comprehension, understanding, is the result of its information activities" "information products - vital importance of water", "information products in this work is water, which is important for the human body." The most difficult task turned up was in which teachers needed to determine the information product, add a formal requirements for it, to make the criteria for evaluating the work of students and determine the time it takes a student to complete the task. Only 17% of teachers could correctly define what is information

product, put demands on him and offer evaluation criteria. The problem for some teachers turned up was determine the time for students to complete the task. It is not clear what criteria guided the teachers for themselves that determined the time on the job less than 12 minutes. Because disciples needed during this time - to read and analyze 2/3 printed page of text, select necessary information and spread it in the appropriate columns, issue a text document, adding images and headlines. Exactly this task highlighted the lack of readiness of teachers to self-assembly competence tasks for students, which is one of the consequences of permanent use of the vast majority of teachers prepared methodical manuals printed with standard tasks for pupils and criteria proposed to them. There needs to study reasons for the refusal of some teachers to perform practical tasks of monitoring, although at this year's tasks was given much more time than compared to the past. In our opinion, the main factors reluctance of teachers to perform tasks is the inability to take account of the results of monitoring of teachers during the regular certification and skills not formed self education. The survey results highlighted the lack of willingness of teachers to self- assembly of competency assignments for students and develop criteria for their evaluation and insufficient formation of self education skills. This can be explained by the constant use of ready tasks and criteria, lack of experience combined self-assembly tasks and development criteria.

Conclusions

The main reason for biased assessment of the teachers own level of competence in the information area is the low level is professional training of teachers and lack of knowledge on assessment of student achievements in information science. That is a significant part of teachers of computer science who participated in the study did not examine students work on specific criteria, based on a subjective assessment.

After analyzing the responses to the question "What are the factors that impede the development of your ICT competence" can identify other factors:

- lack of basic professional education;
- overloading of teachers of computer science by additional responsibilities as a result of lack of time for self-education;
- small number of hours to study the subject information science;
- lack of facility to connect to high-speed Internet;
- linear coursework model of teachers' advanced training (1 time in every 5 years) does not match the current pace of development of ICT and changes in the curriculum of computer science.

It should be noted that the low level of theoretical and practical knowledge in computer science affects the quality of teaching the subject and the formation of information culture of pupils not only in high school, but in elementary, and middle tier. Analyzing the results of the study, we can conclude that the problem of raising the level of information and communication competence of teachers of computer science is relevant. Information and communication competence of teachers of computer science is a determining factor of formation ICT-competencies of pupils and a prerequisite for further professional development. This requires changes in the content and in traditional forms, in the methods of current system of teachers' advanced training, focus on personal professional needs of teachers. The results of the study are the starting point for the formation of educational goals of the system for teachers of informatics field. The need for a systematic updating of knowledge and skills of teachers, the formation of necessary professional competence require reforming of the system of teacher training, particularly teachers of information science.

The introduction of distance learning technologies in service teacher training has great prospects, encourages teachers to search for and analysis of information in the context of the subject area of informatics, creates favorable conditions for the professional development of science teachers, the implementation of the principle of "lifelong learning".

Research results underlie the educational goals of the Region system service teacher training of computer science. To ensure high quality education at all levels, without exception, perhaps only in the presence of stable quality system of continuous professional development of teachers compulsory introduction of distance learning technologies.

Acknowledgement

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