

# Monitoring of the Educational Process with the Use of Information and Communication Technologies: A Case Study in Computer Science

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## ABSTRACT

The main goal of the present paper is to get a feedback of the Computer Science lessons in order to introduce consecutive changes in Computer Science curriculum for enhancing the efficiency of the educational process. One of the prospective ways of solving such a problem is the use of information and communication technologies that help searching for an option for enhancing the efficiency. The aim of the current research is to develop monitoring of the educational process at the Computer Science lessons with the use of information and communication technologies and the implementation of the process concerning teachers' deliberate acquirement of monitoring skills. The essential method is monitoring that can improve the state of schooling at the Computer Science lessons by means of identifying problems and deliberate individual work. The paper deals with the step-by-step algorithm of the monitoring implementation at the Computer Science lessons. This algorithm includes the following stages: introductory and motivational, reproductive self work, productive self work and final stage. The peculiarity of monitoring is its traceability of the educational process, a phased examination and progress assessment at the Computer Science lessons. The implementation of phased monitoring at the Computer Science lessons aims at classroom management, the development of educational work and impartial progress assessment.

**Keywords:** monitoring, monitoring of the educational process, information and communication technologies

## INTRODUCTION

### The Timeliness of the Research

Modern graduates must have sufficient fundamental education to be able to build on this foundation new knowledge in accordance with the new conditions. Computer Science is one of the foundations that are laid at school (Lebedeva et al., 2018). Limits of the use of information and communication technologies in our life and human activities are constantly expanding. That means that the requirements to the quality of teaching have been increasing. At the same time, the rapidly increasing information flows in the modern world and the need for its processing require the introduction of new information technologies into the educational process at the Computer Science lessons not only at the training stage, but also at the stage of academic performance rating. However, during the teaching process teachers and students do not have a complete picture of students' progress despite the comprehensive facilities. Traditional assessment system of students' knowledge because of its organizational

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#### **Contribution of this paper to the literature**

- There is phased monitoring of the Computer Science lessons intending diagnostics, analysis of successfulness of the implementation of every stage at classes and a timely correction of all its components. Teaching activities in monitoring allow implementing a qualitative approach to the educational process.
- A plan for the use of information and communication technologies based on the objectives of each stage of monitoring at the Computer Science lessons and at the whole lesson with the aim of individualization and differentiation of training is proposed in the article.
- Educational program is designed for teachers to understand the content of monitoring of the educational process with the use of information and communication technologies involving teachers in interactive communication for creating their own trajectories during methodological work is developed.

capabilities and technological features cannot supply the needs of the community (Rozhina & Baklashova, 2018). The results are not complete and they are very difficult to be used for getting objective quantitative and qualitative indicators allowing controlling the quality of education. Computer Science is an exact science and has a clear algorithmic construction and possibility of reasonably accurate measurement of knowledge, abilities and practical skills of the students.

The effectiveness of Computer Science teachers depends on the way they perform the functions of controlling the results and provide objective feedback which is expressed in the structural orderliness and direct all activities and all participants of the educational process to the achievement of certain results and making operational decisions on the training situation. The use of information and communication technologies will contribute to change control methods towards actuation of the educational activity, developing their consciousness, independence, individualization and interactivity.

Phased monitoring of the educational process at the Computer Science lessons with the use of information and communication technologies must be implemented for realizing this approach. Monitoring of the educational process at the Computer Science lessons is the procedure of traceability of educational results with the use of information and communication technologies throughout the system of control, information gathering and its processing. This system is a set of indicators analyze and role play the educational process which is aimed to the achievement of specific goals.

The use of information and communication technologies for implementation of monitoring the educational process at the Computer Science lessons gives the opportunity of immediate feedback. It reduces the time spent on unproductive mechanical work, gives time for teachers' to work in a creative way, allows to monitor students' are mastering basic knowledge and skills. It corrects the learning process at the same time personalizing it. The use of information gives opportunity to automatize a major part of the processes ensuring assessment activity - from preparing and measuring materials to assessing the students' learning results. (Kaptelinin, 1999; Mayer & Moreno, 2003; Schunk, 1982; Sorden, 2005; Tuninga & Seinen, 1995). Getting information concerning the progress of the educational process using communication technologies gives us understanding of its essence way better, giving us a chance to make adjustments if needed. Thus, monitoring provides a timely opportunity to interfere in the mechanisms and regularities of the educational process or personal development.

### **Goals and Objectives of the Research**

The main goal of this article is to develop phased monitoring of the educational process at the Computer Science lessons with the use of information and communication technologies. The main objectives would be the following: to study the possibilities of information and communication technologies for monitoring of the educational process; to implement appropriate stages of organization and to implement monitoring of the educational process at the Computer Science lessons with the use of information and communication technologies; to study pedagogical experience of teachers, revealing their relations to the systematic traceability of the educational process and their belief in the need for its implementation; to go through new ways of the theory of pedagogical monitoring, the use of information and communication technologies in the methodical activity of a teacher.

## **MATERIALS AND METHODS**

### **Methods of the Research**

Monitoring of the educational process at the Computer Science lessons has been used as the main method. The implementation of this method includes such stages as introductory and motivational, reproductive and productive independent work of students. The effectiveness of implementing phased monitoring at the Computer Science

lessons is determined by the degree of the use of information technologies and implementation of joint monitoring activities of teachers and their students ensuring the co-evolution of their monitoring abilities.

Phased monitoring involves diagnostics, analysis of successful implementation of training classes and timely correction of all structural components (Pyl, 1989). Pedagogical expedience of the use of information and communication technologies at each stage of monitoring of the educational process at the Computer Science lessons is determined by the aims and contents of each stage and is based on the methodological purpose of this or that software (PC). Teaching activities in monitoring at the Computer Science lessons with the use of information and communication technologies allow implementing a qualitative approach to the educational process.

At each stage of monitoring of the educational process the most important methodological goals during the effective use of information and communication technologies would be the following:

1. Individualization and differentiation of process of training (for example, using the individual educational trajectory).
2. Feedback control and problem solving as a result of the study (to state the causes of erroneous actions of the student and to represent some of them on the computer screen) and assessment progress.
3. Self-monitoring and self-correction.
4. Perform trainings during the process of learning and students' self-study.
5. The release of study time due to the doing computationally-intensive tasks and activities associated with the computational analysis on the computer.
6. Computer visualization of educational information (first, the studied object (a visual representation of the object, its parts or its models, and if necessary, showing it from all angles, in detail with the ability to show the internal relationships of the constituent parts on the screen); second, the investigated process (a visual representation of the process or its model on the screen including some hidden elements in the real world, and if necessary, in development, in temporal and spatial motion, graphical representation of interpretation of the patterns of the studied process).
7. Modeling and simulation of studied or investigated objects, processes or phenomena.
8. The laboratory work in the simulated conditions via the computer program of real experience or experiment.
9. The creation and usage of databases required in training activities and providing access to information network.
10. Enhancing learning motivation (e.g., by visual means or game situations).
11. Introducing a training strategy to the students.
12. The development of a certain kind of thinking (visual-imaginative, theoretical, etc.).
13. Formation of skills to make the best decision or alternative decisions in a difficult situation.
14. The formation of culture of training activities and information culture (for example, by means of systematic work on texts, databases, presentations, integrated custom packages).

The didactic potential is taken into account whenever we select information and communication technologies. ICT is used comprehensively in accordance with the content of the training material, objectives of the monitoring phase of the training process individually and in general. The teacher also carries out the selection of software used in the classroom. In the absence of the required ICT learning, the teacher creates new learning tools that enhance the effectiveness of learning.

The use of monitoring at the Computer Science lessons allows the teacher to perform as a facilitator and as a consultant based on objective information through the direct management of the process of students' acquirement of the educational material using information and communication technologies. The use of monitoring allows implementing a qualitative approach to the educational process, working in subject-subject relations (Asadullin, 2016; Louie, Drevdahl, Purdy, & Stackman, 2003), eliminating the psychological barrier of uncertainty in own forces while working on the PC, generating the willingness and the need to analyze and evaluate own activities as well as to apply information technology for solving professional and personally important problems (Bundick, Quaglia, Corso, & Haywood, 2014; Shaffer, Nash, & Ruis, 2015).

The main goal of the educational process is to master knowledge and skills not lower than at a predetermined level. The difference in educational results will take place outside the requirements for obligatory learning results.

The process of learning is not simply the result of teachers' work and students' reactions but a complex of combined efforts, their unification for achieving joint objectives and solving co-joint tasks. Striving to the rational activity and economical actions of the students is the strategic intent that underpins the plan of the learning process in the framework of monitoring of the educational process using information and communication technologies.

The set of methods for students' influence, searching modes of their work, selection of options, the conversion of an educational material into an accessible one for perception, understanding and appreciation of the elements (Edmunds, 2008), the organization of the gradual formation of the cognitive activity are provided by phased monitoring of the lessons.

### **The Research Phases**

The organization of monitoring the educational process at the Computer Science lessons with the use of information and communication technologies was set to solve three main sets of tasks.

The first set includes the formation of various groups according to the intellectual and practical skills that are necessary for the successful implementation of each stage of the educational process at the Computer Science lessons with the use of information and communication technologies. This set of tasks was also aimed at updating of professional experience and teachers' creative potential.

The second set is designed in such a way that teachers, who acquainted with foreign and Russian experience in monitoring of educational process at the Computer Science lessons. This way the results of national and international comparative studies such as (PISA, TIMSS, etc.) will gain personal, motivational-valued attitude to the systematic tracking of the educational process using information and communication technologies and become convinced of the necessity of its implementation.

The third set is connected to the system of knowledge that reveals the essence, structure, functions and methods of implementation of pedagogical activity in e-learning and also the essence of monitoring and its role in professional activity of the teacher, methods and forms of its implementation in remote collaborative activities with students.

## **LITERATURE REVIEW**

The analysis of psychological and pedagogical literature gave us an idea that there was a certain amount of knowledge that was necessary for the formulation and solution to the problem being studied in modern science. In this research we analyzed local and foreign experience in the use of information and communication technologies in professional activity of the teacher.

The use of information and communication technologies in professional activity of the teacher is explained by the fact that they provide not only high-level visibility and allow organizing various forms of pedagogical interaction. They transfer the necessary complex of didactic materials in electronic form that enriches traditional forms of educational activities, improve the efficiency of educational systems, the quality of training students in general (Chen, 2011; Khan, Bibi & Hasan, 2016; Pange, 2004; Robertson, 2003). The quality of students' training characterizes the result of educational activity – the level of readiness, but also the factors of this result, which depends on the purpose of education, content and methodology of organization and technology. All of the mentioned characteristics are the characteristics we consciously influence on and that are necessary to be managed (Burbules, 2004; Cochran-Smith, 2003; Csapo, 2007; Hollins, 2011; Hsieh, Law, & Shy, 2011; Nair, Webster, & Mertova, 2010; Wang, Lin, Spalding, Klecka, & Odell, 2011). Development and foundation of monitoring as a system for tracking the educational process and improving its quality, objectives, tasks, implementation mechanisms and indicators are disclosed in the works written by Richards (1988), Bedesem and Dieker (2013), Ghatala (2011), Ballou and Springer (2015). The establishment of a system of educational monitoring provides an objective assessment of the level of training and quality of students' knowledge. Analysis of the results of educational activity makes it possible to identify ways of overcoming results that have to be improved in education quality (Näykki, Järvenoja, Järvelä, & Kirschner, 2017; Seo, McGrane & Taherbhai, 2015; Usova, 2002).

## **RESULTS**

### **Phased Monitoring of the Educational Process**

In this part we will discuss the monitoring system of the educational process at the Computer Science lessons.

All learning activities are normally divided into 4 main stages: introductory and motivational stage (questionnaires, goal-setting, regulation, organization, independent work); reproductive independent work of students; productive independent work of students; the final stage. Each of these stages use information and communication technologies.

The progress of the classes has been defined with the help of a qualitative implementation of each stage that had been monitored, diagnosed, predicted and adjusted in a certain way. Information about each stage at the training sessions allowed the teacher to analyze the way the tasks that had been developed at different stages of

**Table 1.** Indicators of implementation of each stage

Stages	Steps	Teachers'/students' activities	Indicators
I stage	1 step	Questionnaire, presentation of the goal, objectives and structure.	Positive attitude to the process of learning, students' judgments about the upcoming activities, they are interested in the studied subject.
	2 step	Goal-setting and regulation.	Students take up the goals: mainstreaming them into the activity.
	3 step	Presentation of the topic to the students, explanation of the algorithm of their independent work.	The questions, difficulties, inaccuracies among students concerning the implementation of independent work.
II stage	4 step	Management of students' independent work/ their independent work itself at the reproductive level.	Difficulties in doing tasks at the reproductive level, the total number of done obligatory assignments.
III stage	5 step	Management of students' independent work/ their independent work itself at the productive level.	Difficulties in doing tasks at the productive level, the total number of done assignments during a certain period of time.
IV stage	6 step	The regulation and assessment, analysis of the results through the category of educational goals in cognitive area/regulation and assessment.	The number of points in accordance with each module; the mark of a 5-point scale; discussion of results, aftereffect.

the educational process corresponding to the goals. At the same time it gave us opportunity to test the level of knowledge and depth of proficiency in skills based on the testing at the reproductive and productive levels. Some changes have been made in the case of deviations. The ability to design a system of monitoring at the Computer Science lessons, to define the place of each lesson in achieving joint goals and objectives, to communicate effectively with students, to use information and communication technologies effectively provided the achievement of high quality education.

We pointed out indicators of successful implementation of each stage of the lesson to make it possible for teachers to work with monitoring data of each stage (Table 1).

The first step of the introductory and motivational stage is a questionnaire survey with the purpose of obtaining information about the needs, attitudes, motives, i.e., willingness of students to study Computer Science.

Students can have a look at the program of the subject at the beginning of their independent work, its structure and main tasks on their e-mails or on a personal site of the teacher in order to orient themselves on the sequence of the problem study and the plan of their individual learning activity.

The second step "Goal-setting and normalization of the educational process" is necessary for the complete planning, task performance and independent work assessment.

The most important element of the monitoring structure of the educational process of the Computer Science lessons is to specify the objectives of the school subject through the levels of learning. In our work we formulated the goals of the process of learning as the results of the mentioned process expressed in the students' activity. The goals formulated in such a way meet diagnostic requirements.

A clear system of educational objectives in the cognitive area is used to implement this idea in the theory of educational monitoring. The hierarchy of levels of learning by Bloom (1956): knowledge, comprehension, usage, analysis, synthesis, and estimation - is a most effective to use. This approach to goal-setting allows us to finalize the results of students learning, organizing flexible learning process, allocating the required levels of mastering the content of the subject by all the students and taking into account the individual needs of students.

The content of the school subject "Computer Science" was concretized through the learning objectives according to the levels of learning (Bloom, 1956) (Table 2).

**Table 2.** Goal-setting and normalization of educational activity of students at Computer Science

The levels of learning of educational goals	Students' activities	Points (the range of estimated figures)
Knowledge	Name the possibilities of the PC as a means of information, communication, organization, professional activity, leisure	Up to 2
	Name the rules of working on the PC	Up to 1
	Name basic PC devices	Up to 1
	Enumerate the order of turning the PC on	Up to 1
	Start a necessary program	Up to 1
	Finish work with the program	Up to 2,5
	Turn the PC off	Up to 1
	Save a document in a personal folder, on the flash drive	2-6
	Name the need for utility key	3-8
	Find various symbols on the keyboard	1-4
	Use the cursor	2-6
	Use the computer mouse	2-6
	Name the functions of the left and right buttons of the mouse	2-6
	Recognize the necessary command according to its icon	1-4
	Name the rules of text entering	2-5
Name the basic rules of drawing	2-5	
Comprehension	Recognize and responds to computer messages	2-5
	Create a text document in different ways	4-10
	Create a graphic document in different ways	4-10
	Save information in different ways	4-10
	Open the program for working with a necessary document	2-7
	Open text and graphic documents	2-5
	Edit text and graphic documents	4-10
	Interpret teacher's task before doing it on the PC	5 -11
	Show different possibilities of PC to do a particular task	7-12
	Explain why he/she worked in a certain order	2-7
Usage	Help another student in doing task	3-8
	Follow the rules of working on the PC	3-8
	Use various formatting attributes of symbols and paragraphs when editing documents	11-17
	Carry out the most rational number of actions while doing a task	11-17
	Prepare enumerated, marked and multilevel lists	11-17
	Create and complete a table	11-17
	Demonstrate various options for preparing tabular data	11-17
	Print the document	1-4
	Use graphics of the text editor when creating schemes and charts	11-17
	Use ready graphic objects of the text editor when editing documents	11-17
Analysis	Use objects created in other applications while preparing documents	11-17
	Enumerate the capabilities of the text editor	1-4
	Enumerate the capabilities of the graphics editor	1-4
	Name the advantages and disadvantages of the graphics editor in certain situations	9-13
	Compare graphics capabilities of a word processor with the capabilities of the graphics editor	9-13
Synthesis	Suggest some options of preparing documents using various effects	10-14
	Suggest different ways of presenting information	10-14
	Combine different actions on the PC while preparing a new document from various documents on the proposed structure	11-15
	Complete a task in the graphics editor	11-17
	Complete a task in the text editor	11-17
Estimation	Complete a task using graphics, text editors and spreadsheet	19-25
	Consider the significance of using a computer in professional activity	9-13
	Discuss the prospects of computer application both in professional and personal life	17-23
	Consider the computer as a source of information, communication, means of recreation, i.e. from the point of personal needs	19-25
	Discuss the importance of using the computer in professional activity and personal life	17-23

The optimization of the educational process has been made taking into account the following goals:

- educational modules have been developed from the point of view of regulation time as well as in points. :  
 "Information and information processes" - 4 hours (22 points); "PC key information " - 4 hours (25 points);  
 "Paint" - 6 hours (40 points); "Word" - 20 hours (55 points); " Software System " - 4 hours (30 points);  
 "Windows graphic environment" - 4 hours (25 points); "MS-Excel spreadsheet " - 10 hours (45 points);  
 "Creating PowerPoint presentations" - 14 hours (25 points); "Computer communications" - 4 hours (20 points);

- electronic textbooks, reference materials, handouts have been developed, textbooks and reference books that students needed for independent work had been selected for the informational support of the educational process;
- training exercises that help to organize the students' work at reproductive and productive levels have been developed to practice skills on the PC.

The teacher is not enough to develop goal-setting tools. It is of a vital importance to achieve adoption of the goals and standards between students. Discussion of goals, methods and forms of work, opportunities of PC for the formation of needs and motivations among students have been introduced at this stage for the adoption of goals and standards. The discussion was held on the problem of goals and standards and their adoption in the form which they had been offered by the teacher. We should mention the fact that the quality of the whole educational process depends on the quality of this very important step.

The teacher goes over to the third step - introducing the topic of the lesson - as soon as students understand the objectives and norms. Students have been provided with the necessary information and handouts in electronic form with the major theoretical lay outs on the topic, exercises based on this theoretical material, control tasks.

After the discussion in a form of a dialogue the algorithm of personal work that students had to comprehend for completing the task. The discussion presupposes "good" students until everybody understands "what?", "what for?", and "why?" they should do it. This discussion continues until all the issues and difficulties are sorted out and only after that the teacher can pass on to the second phase of monitoring. This discussion gives us a chance to identify all the difficulties and mistakes between the students before they start their personal work.

At the second stage - the stage of personal work, the activities are designed so that to control personal work by teachers (the fourth step). We considered teaching activities at this stage as a good help and support to students in order to complete their tasks successfully. Online or off-line consultations can be provided.

Students activity is reproductive by nature, they do their task according to the algorithm based on the information received as well as the basic skills PC practice. Tasks at this level correspond to knowledge, comprehension and usage.

As soon as the task is complete, students have an opportunity to conduct self-monitoring and self-checking procedures. They are to compare the results with the model presented in the electronic handouts. The problems can occur even if one follows the algorithm, so the teacher assists and consults those students who have difficulties and helps them in their personal work. Students are provided with a new task to complete as soon as all the problems or difficulties are sorted out.

The teacher admits those students who managed to complete the tasks without any difficulty to the current control/self-control. The teacher and students find out using the categories of educational objectives in the cognitive area whether students developed their PC skills and whether they can complete a more complicated tasks. If students are unable to complete the task, they are to return to the revision of the material.

Understanding the control tasks means that the teacher allows students to work independently at productive level (third stage, fourth step). The teacher controls personal work implementing tiered differentiation through ranking tasks according to the categories of educational objectives in cognitive area - analysis, synthesis and estimation.

At this stage mistakes can be avoided with the help of a teacher, the number of tasks that student can complete is unlimited. Time is the only parameter that we have to take in to consideration. That's why this help and consultation allow student to return to personal work only within given period of time. After tackling problems he/she gets a new task of productive level and continues to work personally until he/she satisfies the needs of the assessment.

As soon as a task is completed students present their work to the teacher. Students analyze the task and make corrections together with the teacher.

The main task here is to analyze completed work thoroughly and do a short-term forecasting: give the student the same task on the PC or give a student a more difficult task.

Students analyze the task and make corrections together with the teacher. Students can do an extra task to get some extra points if they are not satisfied with the results. The key factor is time. Teachers can offer students to complete different tasks encouraging their personal work in case they have extra time.

Teacher passes over to the final control as soon as the time is over. The student works personally without any help from the teacher or other students. After completing the task the student sums up his/her points and calculates the rating after learning the topic.

Together with the teacher students find out which topics are left. In case they have any, the student returns to the first step and do all these tasks on the new topic again. If there are no topics left and time is out, the student and the teacher pass on to the final stage.

**Table 3.** Regulation of educational activity

Type of activities	Points
Answering the question	3
Giving an answer with the use of additional information	4
Analysis	5-15
Abstract, summary, review, report	7
Solving the task in a written form as in an example	4
Independent work	8
Test	11
The student noticed a mistake and offer the possible answer	2
Solving a problematic task	12
Homework	2
Preparing visual materials	5-15
Taking part in Computer Science competitions	15
Making addition	2
Assistance to a student	2
Making a report based on the material	11
Making a crossword	3
Reflection	5
Making a report based on the information which was practically reviewed	10
Making a plan	5

**Table 4.** Coefficients which are used while assessing practical work and oral survey

Practical work	
Correct and early completing the task	1,2
The task is completed without any remarks and not lately than a deadline	1
The task is completed in time with 1 remark	0,9
The task is completed in time with several unimportant drawbacks	0,8
The task is completed in time with 2-3 remarks, additions or out-of-time without any remarks	0,5
Uncompleted task	0
Oral answer	
Answer without any remarks and with the use of additional information	1,2
Answer without any remarks	1
Answer with an unimportant drawback	0,9
Answer with several unimportant drawbacks	0,8
Answer is quite correct but there are several drawbacks which don't influence the understanding of the issue	0,7
There are some elements of the correct answer	0,5
No answer or wrong answer	0

The aim of the final control is to identify the level of acquisition of skills while working on PC.

The teacher checks how the results coincided with the goals through the categories of educational goals in the cognitive area. The comparison was made on the basis of information after current and final controls. The final figure is calculated on the regulatory basis summing up all the points while checking additional tasks, final control task and the system of coefficients that allow organizing not only quantitative but also qualitative control can be seen (Tables 3, 4).

The final point transforms in to the grade of a 5-scale basis. All the results are collected in a database and shown in the table of learning achievement for each student. The minimal point for each learning module is an obligatory level of learning this module. The regulation and assessment have been discussed with students. It is more important for those students who didn't manage to get minimal points. The teacher discussed with students the results of the regulation of the educational process, mistakes, time spent in order for the students to continue this work during the off-school hours. Students understand their final grade because they can monitor their results during the whole educational process and reflect on the regulatory basis.

Teacher makes corrections during the educational process. Teacher analyses the information during the whole process of education, monitors the difficulty of completing tasks. Teacher forecasts variable blocks which students can learn further on, forecasts the organization of the educational course for the next group taking into account the difficulties that have been disclosed in the previous assessments. He corrects the goals, regulations, tasks for self-work, methodology and forms of the educational process to increase the effectiveness of Computer Science learning.



That's why passing on the first stage of monitoring means the beginning of the new cycle of monitoring where teacher defines norms, tasks, difficulties, time etc.

### **Usage of Information and Communication Technologies**

Let's move over to the usage of information and communication technologies (ICT). Due to the fact that the realization of each stage of the educational process happens at Computer Science, the plan to use ICT is made according to the goals of each stage and the whole lesson.

The development of monitoring at the Computer Science lessons with the use of ICT includes the following stages:

1. Preparatory stage. At this stage a didactic goal is determined with the orientation to achieving the results (formation, consolidation, generalization or improvement of knowledge; formation of skills; learning control, etc.).

The need for ICT or Internet in the educational process is based on the pedagogical objectives of the lesson. The main objectives of ICT use: the possibility of presenting unique information materials in a multimedia form (movies, models, tables, charts, etc.); visualization of the studied phenomena, processes and relationships between objects; formation of skills of information search activities; the need to work with models of the studied objects, phenomena or processes in order to research them online, the use of ICT as an additional source of information.

Informative stage. Multivariate analysis and selection of electronic educational resources are based on the formulated requirements for the electronic educational resources on the didactic goals and methodic assignment. The form of the lesson and the key structural elements of the lesson are selected. More detailed analysis (improvement or upgrading) of electronic resources is conducted at this stage, the accompanying documentation is studied, the efficiency of the resource is predicted, the method of conducting a lesson is determined and principal activities of working with the resources in the educational process are developed.

Operational stage. Specification of functions of ICT and ways of their realization have been made at this stage. Different ways students interaction with electronic resources have been chosen; a detailed planning of the lesson has been carried out.

The purpose of ICT usage; the duration of the particular stage; a form of organization of students' activity using ICT; functions of the teacher and teacher's principal activities; form of the intermediate control with the use of ICT are determined for each of the stages of realization of monitoring of the educational process at the Computer Science lessons.

At the stage introduction and motivation (questioning, goal-setting, regulation, organization, independent work), one of the goals is to organize students to implement productive work, to consolidate knowledge that was used previously. The main ICT tools being used would be the following- presentations, e-learning resources (audio and videos) and interactive exercises for material assessments.

The main ICT for personal work of the students would be interactive presentations and discussions, Internet access (for getting additional information); diagrams, tables, interactive exercises, simulators, virtual labs with special software tools or modeling in MS Excel, computer experiment, computer simulations, problem solving, development of a short-term project using MS Power Point, MS Publisher, MS Word, Notepad.

At the final stage the main activity of ICT is a test implementation in order to consolidate the knowledge and develop the ability use it in professional work.

During this process students work using the computer with various educational software installed (supervising, coaching, demonstrative, learning), complete tasks with the use of text and graphics editors, calculate and recalculate using spreadsheets, use databases and a database management system, use electronic textbooks and manuals. Thus all students will have a great opportunity to work at the lesson at their own pace and the teacher can work with each student individually.

### **The Structure and Content of the Educational Program for Teachers**

"Monitoring of the educational process at the Computer Science lessons with the use of information and communication technologies" education program for teachers has been developed for successful implementation of the above mentioned blocks.

For successful implementation of the program it is highly recommended for teachers to have practical experience of (teaching and (or) managerial) activities with the use of ICT, understand the need for changes in the modern education, have PC skills and know how to search information in the Internet. They should be ready to accept new ideas and implement them.

The above mentioned program is designed to assist teachers in adapting to new conditions of professional activity in the field of education. The program is focused on the development of monitoring of the educational

process at the Computer Science lessons in the educational establishment. The program includes a number of lectures where the minimum of necessary theoretical information (definitions, approaches, international experience) is discussed. Seminars with specific examples and situations (from the teachers' practice) aimed at the gradual development of the program of monitoring of the quality of education in the system of e-learning by each teacher have been presented as well. Teachers provide students with everyday practice to clarify certain issues. The program can be mastered by any teacher because it is written on a modular principle where each module represents a complete unit of information, including training objective, guidelines, indicative framework for action and means of control (self-control).

Teachers who understand this program successfully:

- a) gain an impression of:
  - the monitoring as the informative basis of making decisions in educational management and of contemporary practice of education quality monitoring;
  - possibilities of monitoring as a leading means for managing education quality and choosing the strategy to develop pedagogical activities with the use of ICT;
- b) learn how:
  - to formulate the problem of analysis of development trends in pedagogical activities with the aim of designing an optimal monitoring program for the educational process at the Computer Science lessons;
  - to determine the sequence and content of steps in the development of program of monitoring of educational process with the use of information and communication technologies in practice;
  - to develop a methodology of monitoring, analyze results, and present the resulting information in the appropriate forms;
  - to determine the content and field of managerial decisions which are made using information obtained during the monitoring of the educational process at the Computer Science lessons;
- c) develop:
  - the sequence of managerial decisions made in conditions of transformation of pedagogical activities using ITC in education quality management on the basis of reliable information obtained during the monitoring;
  - the program of monitoring of the educational process in educational establishments taking into account the specific conditions of educational activity;
  - methodological package for monitoring of the educational process with the use of ITC including the tools and methodology of analyzing the results, local projects, information materials.

During the program development teachers are offered the following typical tasks: to analyze information; to prepare methods of monitoring; analyze practical experience of educational establishments, presentation of the results.

Personal oriented technologies that allow us to take all the teachers' requests are necessary to use during the program mastering. The main organizational forms would be lectures and practical lessons in the form of seminars, "round tables", group work and debates. Teachers work with the information personally during the task completion. The main mechanism of achieving the objectives of the program is to work with the cases which include professional orientations of teachers of different categories.

Duration of the program is 64 hours. Contact hours 30. Self work- 34. Computers and access to the Internet are necessary for successful mastering of the program.

The final control of the learning system is carried out through the presentation and public expertise.

### **Implementation of Educational Programs for Teachers**

Teachers use the materials and make presentations on the main routes of search and achievements in Russian and foreign pedagogy, in the field of education quality and e-learning during the academic year. Teachers analyze publications in magazines and materials in the Internet, participate in conferences, systematize their own experience, identify reserves of improving quality of education creating their own methods of monitoring federal state educational standards.

During the work on this program teachers were engaged in interactive communication. Lessons have been organized by the methodists and colleagues who wish to share their positive educational experience. Teachers who participate in distance learning and implement tests systematically. There were teachers who had already mastered the monitoring of the quality of education in e-learning and they were involved as developers of the lessons for their colleagues. They have been offered to work according to their own plan and sometimes they share the results

of activities with their colleagues. Teachers organize creative meetings, presentations, seminars, problem solving sessions ("Let's reflect..."), business and role games, trainings on different issues raised, "round tables" with different experts as speakers. This will provide any teacher with the possibility to improve and enhance its knowledge and skills through experience, understanding of the material on quality monitoring of education and using ICT. It will give opportunity to express their opinion, to share new knowledge and values, go through methodological findings with their colleagues.

Interaction created the atmosphere of goodwill and mutual support that contributed to the development of cognitive activity of teachers turning it into higher levels of cooperation.

Interactive forms of work allowe teachers to choose educational route (Khuziakhmetov & Sytina, 2016) in a certain direction (of adaptive type, educational and creative orientation) depending on the level of readiness of implementing the quality monitoring of educational process using e-learning technologies and the implementation of step-by-step algorithm of pedagogical interaction. This was also possible with the help of the methodical service that studied the educational needs for teacher. The implementation of monitoring activities in the system of e-learning evaluated together the resources of the educational establishment. It also formed a system of personal relations of the teacher to the development of e-learning technologies. Methodists provided methodological support of each trajectory of the teachers development.

## DISCUSSIONS

During the study of the educational process we pointed out disadvantages in methodical service's work with teachers on the organization of monitoring the educational process. We talk about the level of the object related to the passive learning methods which didn't allow us to create our own educational trajectory. Teachers do not associate the achievement of the results with the quality of the educational process. Teachers give priority while assessing the objective result of the learning activities of students. The subjective result expresses itself in the significance of the outcome for the learner's subjective satisfaction with the result, his/her psychological efforts (the cost of its efforts, the ratio of the capabilities of the student and his/her real success, matching the student's ability and efforts when performing this task).

Monitoring of educational process involved teachers in interactive communication, to create its own educational trajectories during a methodological work. Implementation of the step-by-step algorithm of pedagogical interaction allows each teacher to choose educational route in a certain direction (of adaptive type, educational and creative orientation) depending on the level of readiness to use monitoring systems during the lessons.

Phased monitoring of the lesson presupposes diagnosis, analysis of successful implementation of the stages and time correction of all structural components. Teaching activities in monitoring of the lessons allow us to implement a qualitative approach to the educational process. The effectiveness of the lessons was defined with a qualitative implementation of each stage that was monitored, diagnosed, predicted and adjusted. Joint monitoring activities of the teacher and the student provided a parallel evolution (co-evolution) of skills monitoring of the teacher and the student.

New questions and issues appeared during the research. The problem monitoring skills formation using e-learning technologies among future teachers at high school is of a great importance. It is necessary to continue the research of developing methods for the implementation of monitoring of the educational process using e-learning technologies in training and postgraduate education.

## CONCLUSION

Multiple use of monitoring of the educational process at the Computer Science lessons with the use of information and communication technologies can improve the learning process in a very good way. It can develop educational activities and contribute to the objectiveness of the assessment of learning results. Analysis of the obtained results during the monitoring at the Computer Science lessons help us to solve several important tasks: we talk about the tasks that are difficult for students; priorities in the work of the teacher with this or that student; working with individual data gives the opportunity to monitor the percentage of the task completion.

At the same time the monitoring of the educational process at the Computer Science lessons gives us a chance to asses: dynamics of the formation of the student during a certain period of learning, possibility to constantly adjust the work of the teacher based on the analysis of the dynamics; the opportunity for the teacher to know and to influence the strengths and weaknesses of the student and the whole class; systematic control of the quality of knowledge acquired by students taking into account individual abilities of students. An organized joint monitoring activity of the teacher and students will set parallel evolution of skills monitoring leads to the formation of adequate self-appraisal through self-examination. Learning process teachers can predict the success of the exam on the subject with the use of the training classes in preparation for the state exam and control tasks of A, B, C levels. The

use of information and communication technologies during the implementation of monitoring of educational process makes the process of learning more comfortable for students. Usage of the technologies such as animation, video and sound make studying events and phenomena more visible and therefore available for students. The use of ICT in monitoring of educational process allows teachers and students to arrange their working time in the classroom the way they want. Pre-prepared information for the lesson appears in the right time and in the aesthetic form. The saved time in the classroom can be used to increase the amount of information or training exercises. There is a need in the training of teachers for this activity during the introduction into the educational process and step-by-step monitoring. The educational program "Quality monitoring of education with the use of information and communication technologies" has been designed to assist teachers to adapt themselves to new era of professional activity in the field of education. The program is focused on the development of monitoring of the educational process at the Computer Science lessons in the educational establishment.

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