

# Formation of ICT Competencies of Postgraduate Students of Teacher Education Based on Interactive Techniques

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## Abstract

The given paper presents research for the formation of ICT competencies of postgraduate students of teacher education through interactive teaching techniques. Training of postgraduate students of teacher education is carried out in accordance with the requirements of the competence-based approach. It is one of the priority areas of IT-based management of higher education. By competence we mean the ability of a learner to apply knowledge and skills, job competency centered personal skills and experience in a certain area of life activity. Competence is thought of as a combination of professional knowledge and skills, ways of professional activities, certain competences mastery, including information and communication. Hence, one of the most important components of the professional competence of a future teacher is the competent use of ICT tools in solving professional and teaching problems. Currently, teachers have the opportunity to implement their job competence following modern information and communication technologies and interactive teaching techniques by means of the Internet network resources. In our study, the criteria for the formation of ICT competencies are formulated: students' awareness of the importance of ICT for education; technologies and means of processing textual,

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numerical and graphical information mastery; teamwork in the information and educational environment; skills in presentation and communication management of the educational process; the involvement of students in the educational process by means of interactive methods. According to these criteria, we have developed a methodology in teaching of masters to be following the teaching techniques, the results of which are proved in the findings.

Keywords: higher education, postgraduate students of teacher education, the formation of ICT competencies, information technology, interactive teaching techniques.

## 1 Introduction

The urgency of the research is that the higher education system is to provide a background for training competent specialists to be engaged in a modern information society. Therefore, one of the priority educational concerns at the university is the use of modern information and communication technologies and interactive teaching techniques, and specifically in training of postgraduate students of teacher education. Interactive training technologies enable to get new knowledge, develop students' learning and cognitive activity, promote high forms of interaction: cooperation and partnership. The training of post graduate students who have ICT knowledge and skills and interactive methods of professional activity enables them to realize creative self-fulfillment in the information society. This is the main concern of modern teacher education. Interactive teaching technologies are focused on the formation of skills to carry out different kinds of independent and practical activities to collect, process, store, transmit, and produce educational information. The specifics of information technology aim to get used to a dynamically developing IT field, develop job competency, implement the principles of integration of national educational systems.

Currently, in many countries, the European Framework for the Digital Competence of Educators (DigCompEdu) is widely used. It is based on a systematic approach to support the development of digital competence for educators at all levels of education, from early childhood to higher and adult education. Meanwhile, the framework includes non-formal, general and vocational education and training, as well as education for people with special needs. Developing digital competencies of educators makes it possible to fully use the potential of digital technologies to improve teaching and learning, prepare students for life and work in a digital society [Red17].

In Russia in the preparation of future masters of pedagogical education, the teaching staff in their activities is to be guided by the requirements of the Federal State Educational Standard (FSES) in the field of training 44.04.01. Teacher education, the level of training - Master. According to the requirements of the Federal State Educational Standards for mastering the educational program for postgraduates it is necessary to form the following cultural and professional competencies: the ability to carry out activities in various fields by means of resource information databases (GC-4); the ability to acquire independently and to use new knowledge and skills following information technology, that includes those not related to professional activity field (GC-5); the ability to design forms and methods to control quality of education, various types of testing and measurement materials following information technologies and taking into account domestic and foreign experience (PC-9); willingness to use modern information and communication technologies and mass media to decide professional concerns (PC-20) [FSES15].

Thus, the analysis of the quality of training of postgraduate students of teacher education in Russia following the Federal State Educational Standards shows the great opportunities for the formation of a high level of ICT competence of masters to be. ICT-competent masters of teacher education are able to develop teaching materials in an open information and educational environment; provide effective teaching support in the educational process; to carry out pedagogical interaction of the subjects of the educational process by means of modern information and communication technologies.

## 2 Research Objective

The aim of the research is to study the process of formation of ICT competencies of postgraduate students of teacher education through interactive teaching techniques. In the training of post graduate students of

teacher education in the discipline "Information technologies in professional activities" the learning outcomes are knowledge and skills necessary for the development of ICT competencies.

The authors suggest that deciding the concerns of forming ICT competencies of masters to be by means of new interactive teaching techniques in the discipline "Information technologies in professional activities" will enable future specialists to master: 1) basic information technologies when compiling, processing and forming information databases; 2) the main means of obtaining, storing and processing information to form information databases; 3) methods of comprehension and critical analysis of scientific information, the use of resource-information bases for the implementation of professional activities; 4) the rules for the use of modern diagnostic technologies and evaluation of learning outcomes, various types of testing and measurement materials; 5) forms of education quality control by means of ICT.

### 3 Method Development

The methodological basis for our research was a system-based approach to education as a general scientific methodology for researching systems (R. Akoff, V.G. Afanasyev, H. Wissema, A.I. Prigozhin, B.A. Raizberg, etc.), a system-activity approach in Master training (A.G. Asmolov, B.S. Gershunsky, T.G. Vizirov, E.G. Yudin, and others); personality-activity approach in the management of the educational process (A.V. Borovskikh, De Kaluve, L.G. Peterson, N.Kh. Rozov, T.I. Shubina, and others); competence-based approach to learning (M.A. Bocharnikova, V.A. Dalinger, A.N. Dakhin, I.A. Zimnyaya, O.E. Lebedev, etc.); an integrated approach to the delivery of educational material (S.O. Bryzgalova, N.N. Malofeev, FLL. Ratneo, N.D. Shmatko, etc.); information technology approach (V.P. Bepalko, E.I. Mashbits, E.S. Polat, P.I. Obraztsov, etc.). The theoretical understanding of usage of information technologies in education is highlighted in the works of A.A. Andreev, M.V. Moiseeva, E.S. Polat, M.Yu. Bukharkina, M.I. Nezhurina, A.V. Khutorskoy and others; conceptual issues of designing and developing interactive training materials based on information technologies were considered by T.P. Voronina, S.M. Lesin, D.A. Makhotynym, I.V. Robert et al.; theory and methodology of pedagogical research - Yu.K. Babansky, V.V. Kraevsky and others.

In our study, we relied on international and domestic normative sources that moderate the structure of digital competence of educators [Red17]; to the requirements of the Professional Standard Teacher [Prof15], state educational standards (SES) in the direction of training 44.04.01. Pedagogical education, the level of training - Master. Peculiarities of the information and educational environment (IEE) to enhance cognitive activity and develop creative abilities of masters are considered in the work of T. Vizirov [Vizir13]. Interactive technologies of student - teacher interaction in IEE as an open pedagogical system are viewed in the works of A.G. Asmolov, A.L. Semenov, A.Yu. Uvarov [Asm10], E.G. Skibitskiy, [Skib09], V.N. Kormakova, A.G. Klepikova, E.N. Musaelyan et al. [Korm18]. The findings of scientists on this issue are unanimous: the use of IEE greatly expands the possibilities of teacher - student interaction, allows the teacher to use interactive educational technologies more, enhance the students activities, organize virtual student student and student- teacher interaction, arrange training sessions in various interactive forms, apply independent procedures for assessing learning outcomes. Many scholars agree that the use of interactive teaching methods activates the activity component of classes [Vygot00], increases students' interest in studying a particular academic discipline, encourages activity, motivates success [Nikol02], [Les13]. According to foreign scientists, it is necessary to choose such interactive teaching methods that help students achieve their educational goals [Pran15],[Flor00]. The use of gamification as a set of tasks and / or rewards allows to motivate students to be active in acquiring the necessary practical experience (Dr. Arne May, Donald Clark, Zichermann, Erica Lasola-Caramol, Pranjalee Lahri) [Don15], [Eric16].

When developing a methodology to recognize the level of ICT competence development, the authors proceeded from the fact that the progress of educational technology is determined by the criteria of its effectiveness. Proper definition of performance criteria determines the success of the task and the scientific validity of the findings. It can be represented on the ground of experimental data that are reflected in quantitative indicators. In accordance with the European Framework for the Digital Competence of Educators (DigCompEdu), the requirements of the Professional Standard Teacher [Prof15], the UNESCO recommendations on the structure of ICT competence of teachers [Struct11], we represented the following criteria for the development of ICT competencies: students' awareness of the importance of ICT for education; technologies and means of processing textual, numerical and graphical information mastery; the interaction of key-players of the educational process in the information educational environment; skills in presentation and communication management of the educational process; the students' involvement in the educational process through the use of interactive method.

The study showed that a high level of ICT competencies mastery can be achieved through the use of the

following interactive teaching techniques and pedagogical technologies: 1) collaborative learning (Google+); 2) teamwork on the Internet (web-quests); 3) interactive learning games, Case-study; 4) involvement in gamification and storytelling learning. The applied interactive teaching techniques contributed to the maximum involvement of future masters of teacher education in creative educational and professional activities, the development of students' skills in teamwork, in innovative projects; allowed to rethink the experience of using student-centered learning, to be more adoptive to innovative ideas and methods. Emotional contacts of students, communicative skills of educators in joint efforts with students, skills to organize teamwork, and further creative self-fulfillment of masters in professional and educational activities made up the activity and competence basis for interactive teaching methods.

## 4 Discussion

Having reviewed research literature, theoretical base, and methodology of the study, the authors made the assumption that professional competencies mastery can enable postgraduate students to improve their ICT technology level, to implement them in professional and educational activities. Currently, the problem of education is the problem of a teacher, who is a weak link in terms of information technology [Kuvsh16]. However, we state that a teacher still remains the main link responsible for the content, organization, efficiency and quality of the educational process [Bogor14]. This enables the teacher to use new interactive techniques and forms of interaction with students, to fulfill creative potential in order to improve the quality of the educational process.

It is important to note that training of postgraduate students of teacher education to be engaged in modern information technology society is in the new information and educational environment, which strengthens cognitive activity and the development of students' creative abilities, willingness for self-development [Vizir13]. The informational and educational environment allows a teacher to use extensively interactive educational technologies, to strengthen the thinking activity of postgraduate students, to organize virtual student-student and student-teacher interaction, to deliver lectures in various interactive forms, to apply independent procedures for evaluating learning outcomes. Interactive methods of teaching imply innovative logic of the educational process "from the formation of new experience to its theoretical understanding through application". We present thorough characteristics of interactive teaching methods that were used in the study.

The practice of team based work system on the Internet contributes to the formation of competence - the management of the educational process [Prof15], through which the students systematically interact, succeed in a controlled information space. As a tool for joint efforts, we used Google+ as an environment for organizing the networking of those who were engaged in the educational process in off-line and on-line modes. For example, the usage of the Classroom tool allowed us to create a community and organize the students interaction in a specific professionally-centered environment. The students had the opportunity to develop and improve communication skills, to show creativity and get timely feedback from fellow students and teachers. Each of them could create his or her own Classroom and try on the role of a teacher while organizing a virtual educational process with the essential elements of feedback: a forum, Google Form, tasks and still other (Figure 1).

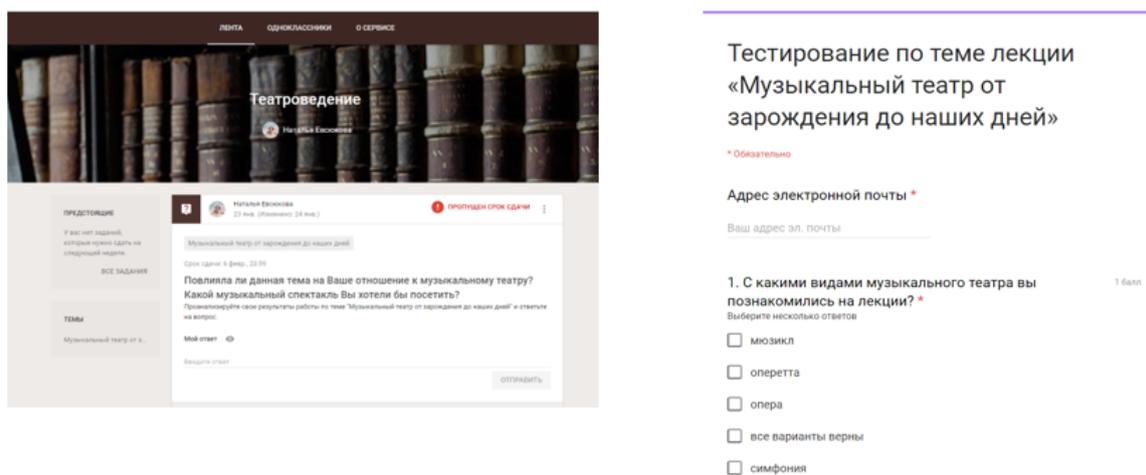


Figure 1: Work product Drama in the Classroom

The strength of the given tasks is the formation of a style of activity that is hinged on co-creation, joint efforts

of a teacher and students.

Collaborative learning is a method that involves the cooperation of learners in groups. This way they succeed in learning when interacting with each other. Organizing and conducting group work in a telecommunication environment, collaborative learning as co education, is a result of which students work, collectively constructing and producing new knowledge [Mois04], [Polat10]. Cooperation technologies in collaboration include a web quest, an inverted class, a group puzzle (the mosaic method), a rotation, etc.

In the training, we used the web quest technology that provides the following opportunities: arousing students' interest in studying a particular academic course; use for the perception of various types of information (textual graphics, video and audio); presenting a variety of case problems, etc. [Nikol02]. The usage of interactive teaching methods helps students to fulfill practice-centered tasks, to enhance the training session [Vygot00]. Following the teachers instructions, masters to be search for necessary materials on the Internet and address teaching situations. They take a liking to try on the roles that this or that quest implies, to follow the tasks proposed in the quest. As a reflection, students either come up with their own web pages on this topic, or other creative outputs in electronic, printed or spoken form. The output of post- graduate students in creating their own web-quest is shown in Figure 2.



Figure 2: Work product on the creation of the Web-Quest "On computer networks")

Interactivity (as applied to information technologies) is the ability of an information and communication system to respond differently to any user actions in active mode. The use of interactive technologies in training allows the learner to be closer to the course content, to include it in the pedagogical environment, to encourage activity, to motivate the students to get success. The usage of design tools for individual, group and collective activities, roles and events visualization is one of the important teacher competencies. Therefore, the teacher has to take into account each students' interests and needs. The usage of interactive services with the active involvement of students in the teaching and learning activities was a part of our methodology. Interactive web services 2.0, LearningApps (<http://learningapps.org/>), Wizer.me (<http://app.wizer.me/>) contain interactive tasks that enable a teacher provide feedback to learners in no time.

Here, the attention of the postgraduate students is drawn to the fact that the use of such services in teaching will provide an opportunity to create their own classroom (to work with students) and application software for stored exercises. In the classroom, a teacher can create accounts for the students or ask them to perform interactive tasks. In the application software, you can collect all the developed tasks and share them with other students (Figure 3). Such assignments may be included in the training content, in a formative or final assessment. The tasks compiled by means of such services can be offered to students as home assignment, the class has the opportunity to spend time on correcting mistakes related to these tasks. These services can also be used to create various didactic materials, in games, contests, to fill a portfolio, etc.

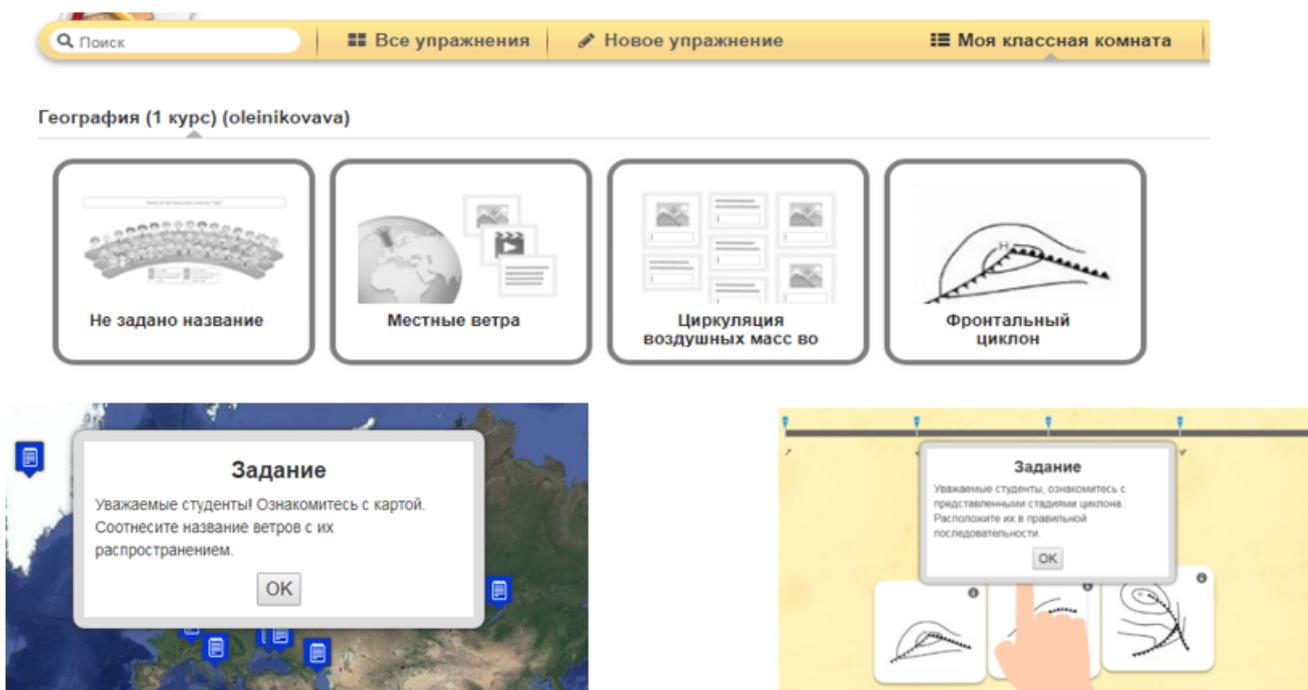


Figure 3: Interactive tasks in LearningApps

According to foreign researches, involvement in learning is characterized by physical (behavioral) and mental activity. Primarily, to provide the students with an interesting lesson it is necessary to pay attention to mental activity, i.e. to choose interactive teaching techniques that enable the students to get new knowledge and skills [Pran15]. In this context, the authors concerned themselves with the use of gamification in learning as one of the modern form in education. Individual elements are added to the planned learning process that depends on various factors, such as the group's level of training, a special event, etc. The lesson can or cannot have game elements. The learning process that is based on the game enables the students to produce a desired effect. Game-based education as a simple set of tasks and / or rewards greatly motivates the student to perform certain actions. Consequently, the students get opportunities for self-fulfillment in quizzes and problem games, which motivates them to get necessary real-life experience.

In respect to our methodology, gamification came into fruition on the basis of a set of interactive tasks with their staged implementation (Figure 4). The fulfillment of such tasks by the postgraduate students made it simple to move from a *laissez faire* to assertiveness and progress in getting the educational experience [Don15].

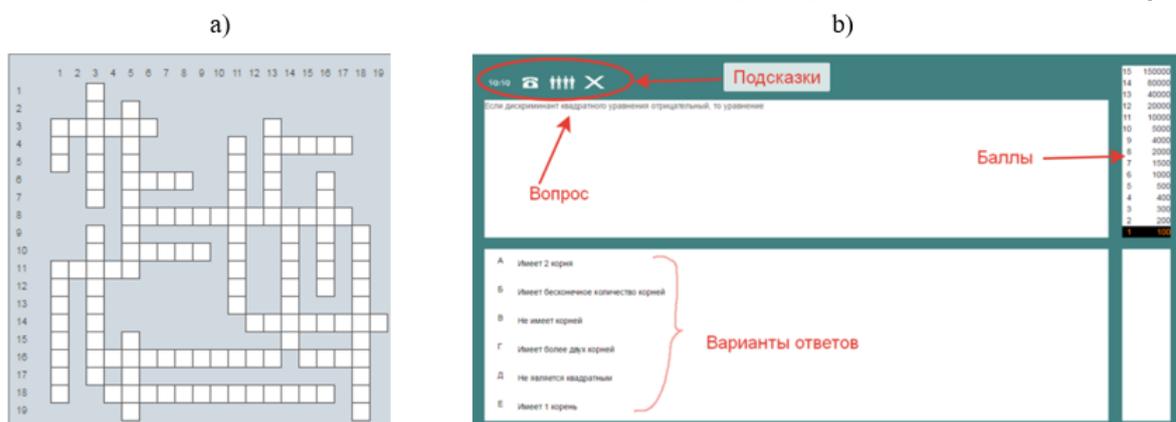


Figure 4: Game - based education: a) Crossword puzzle, b) Game Millionaire

One of the areas of gamification is storytelling, a pedagogical technique developed on the use of stories with a certain structure which aims at doing academic tasks of learning, mentoring, development and motivation [Erm16]. The authors distinguish two main types of pedagogical storytelling: classical and active. In the classical

storytelling, the teacher gives the students specific teaching information such as rules, theory, explanation, experiments, laws, etc., couched in a vivid memorable story. In the active storytelling, the students follow the teachers recommendations and make up stories themselves; simulate various teaching cases and ways to decide them; analyze teaching cases independently or with the help of a teacher. Storytelling gives is efficient in cases when it is important to get the information across to the students, to motivate them. When the case is couched in a visual form, the result of its impact increases. Therefore, the visual storytelling (Digital Storytelling) is one of the powerful learning tools that allows not only to get the information across, but also to earn an emotional response.

The technology of engaging in learning based on Digital Storytelling provides to: develop imagination and creativity; build trust and empathy based relationships; overcome the fear of public speech; learn storytelling through first -hand experience; sublimate own feelings, get rid of the psychological burden. The academic literature reports several types of creating visual stories [Pop18]: 1) In a chronicle history a teacher makes up a story, for example, about the inventor of the first computer ..., about the first antivirus programs ..., what the first book was like..., or how first robot appeared... etc 2) A story about the process Enables the teacher to tell about the process of making anything - from the simplest programs to the most complex devices. But this can be a story, even an imaginary one, about the first experience of creating something, before the first successful project, etc. The main thing is that the story is emotional. 3) When I was a child ... In the story the teacher can tell about what shas reached when he was at the students age, neither belittling nor exaggerating his or her merits. Such stories inspire students to succeed, to believe in themselves, to increase diligence in new knowledge mastery. Such stories made up by postgraduates during the study of the course "Information technology in professional activities," which can easily "fit" any lesson, are presented in Figures 5-6.

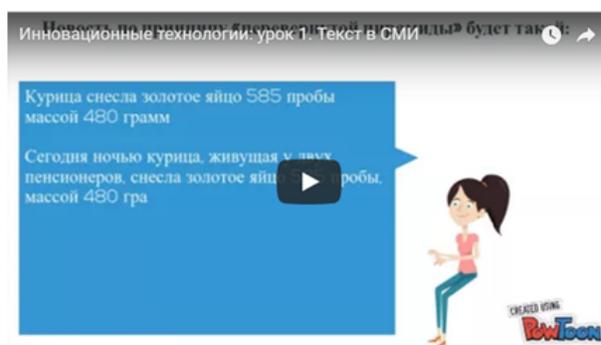


Figure 5: The story made using PowToon service



Figure 6 :The story made using Storybird service

## 5 Findings

The study of the formation of ICT competencies of postgraduate students of teacher education at Belgorod National Research University (Russia, Belgorod), Belgorod University of Arts and Culture (Russia, Belgorod), and North - Caucasus Federal University (Russia, Stavropol) were based on observations, surveys of postgraduates, testing the retained knowledge of students, implementation of practice-centered tasks. For example, diagnostic assessment of 174 first- and second-year postgraduates of Teacher's Institute of Belgorod National Research University, a first year postgraduates of Belgorod University of Arts and Culture and a first year students of North - Caucasus Federal University put in the following performance. Respondents' replies differed in relation to the process of ICT competencies mastery. At the same time, it is necessary to state that all post-graduates were unanimous in their opinion that practical tasks encouraged them in learning activities, stated the reason for creative self-fulfillment and involved in the learning process. The majority of respondents noted that they had changed their attitude towards innovative methods and technologies and intended to use ICT tools and interactive teaching techniques in the future. 44.25% of respondents admitted that all practical tasks were feasible and increased their information competence, 53.45% of respondents mentioned that it was interesting, despite the difficulties they faced when carrying out certain tasks. Practical tasks did not arouse interest and did not affect the level of professional competencies mastery in 1.72% of respondents. Only 0.57% of students felt bored as the tasks were too easy for them to complete (Figure 7).

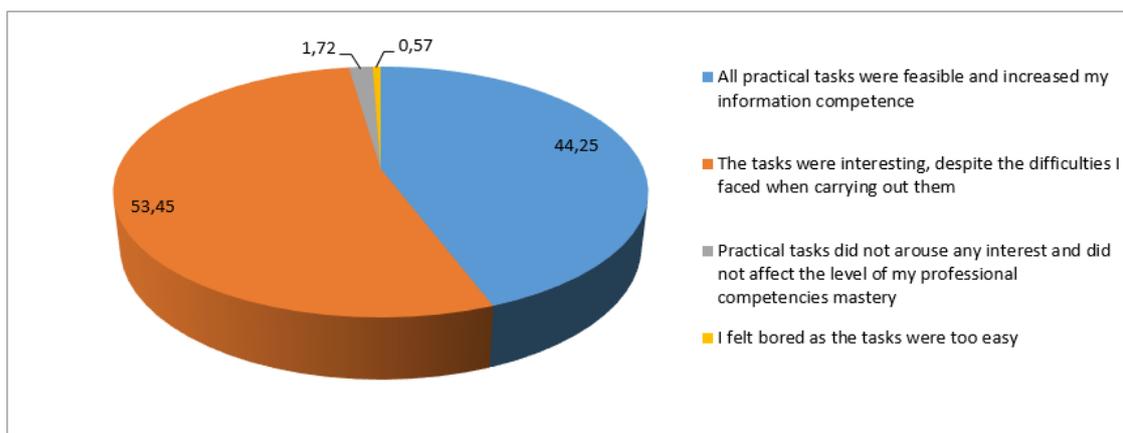


Figure 7: The results of the survey of postgraduates of teacher education on the importance of ICT tools and interactive teaching techniques in professional activities

The authors tested the retained knowledge of postgraduates in order to obtain an independent assessment of the students progress as part of knowledge assessment. The diagnostic assessment of the retained knowledge reflects the indicators of the formation of ICT competences of post- graduate students of teacher education in studying the course unit "Information technology in professional activity." Testing took place in the Pegas e-learning system of Belgorod National Research University on the basis of a previously developed test tasks which were created by the authors of the course unit. Comparative analysis of indicators of ICT competence development at the beginning and at the end of the study showed that, in general, post-graduates improved their ICT knowledge and skills. They were ready to process textual, numerical and graphical information, to organize joint activities in the information educational environment and creative self-fulfillment (Figure 8).

As it can be seen in Figure 8, according to all criteria, there is a positive tendency in the formation of ICT competencies. The data were obtained when testing the retained knowledge of students (comparative analysis at the start of the study). Thus, out of 174 post-graduates 13 % increased the level of awareness of ICT importance in education, the level of technologies and means of processing textual, numerical and graphical information mastery - 14%. The 25% increase in the value of the criterion of key-players of the educational process in the information and education environment indicates that the post- graduates have gained knowledge about the new possibilities of the Internet network resources based on collaboration, the ability to work in a team, and the teacher student interaction.

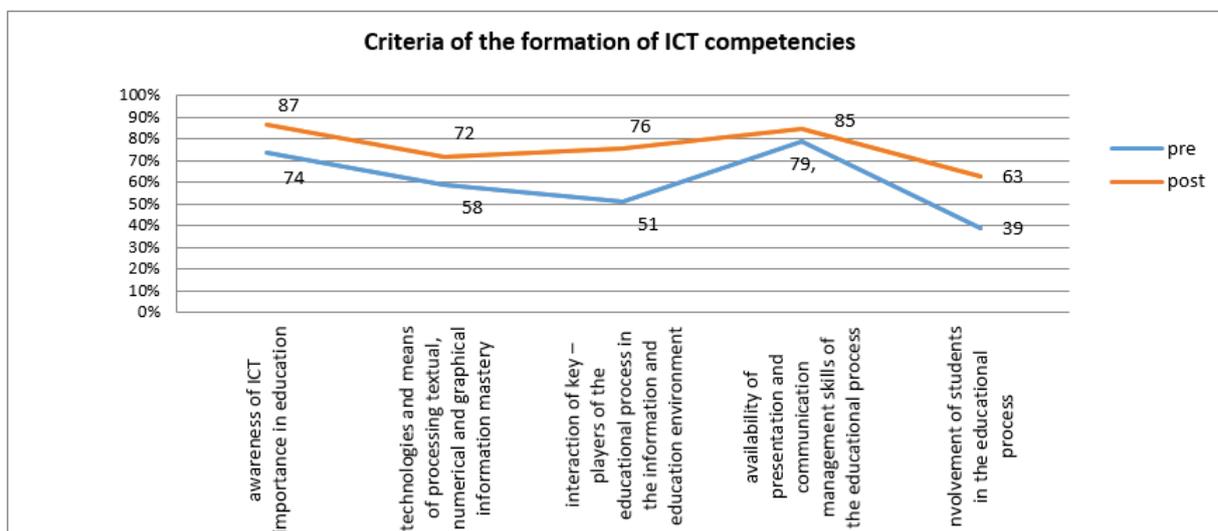


Figure 8: Testing results of postgraduate students of teacher education at the start and at the end according to the criteria of the formation of ICT competencies

The increase of the criterion availability of presentation and communication management skills of the educational process was 6%. This is due to the fact that the majority of post-graduates, being aware how make

presentations, found out new possibilities for themselves and created various situations to decide pedagogical problems effectively. It was proved that interactive teaching methods encourage learners to simulate various professionally - centered situations, to find out ways for creative self-fulfillment. This is proved by the increase of the criterion "involvement of students in the educational process" by 24%.

However, the survey of postgraduates represented in the study of universities show that there are some different preferences in the ways of arranging joint activities in the information-educational environment and organizational-communication interaction. So, for example, undergraduates of the Belgorod State National Research University prefer the combined education, which allows learners to attend classes in the real classroom or virtually, by connecting to the learning process through a webcam online. Whereas the postgraduates of the North - Caucasus Federal University prefer a mixed study using distance learning technologies. At the same time, the students in the Belgorod University of Culture and Arts prefer direct visual and auditory contacts. It emerged that these differences are related to the specifics of the future professional activity of postgraduates.

## 6 Conclusion

The obtained findings prove the achieved research goals and show that by means of interactive teaching techniques the postgraduate students of teacher education got a high level of ICT competencies mastery. The use of interactive teaching techniques: collaborative learning (Google+), teamwork on the Internet (web-quests), interactive learning games-tasks, Case-study, learning through gamification and storytelling contributed to mastering the learning outcomes. In arranging joint activities in the information-educational environment of the university and organizational-communication interaction, it is necessary to take into account the specifics of future professional activities of students.

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