ICT in Professional Education of Future Primary School Teachers: Modeling of Scientific and Research Work

Yevheniia Spivakovska [0000-0002-7974-4736], Tetyana Vinnyk, Liudmula Perminova and Vera Kotkova [0000-0002-1537-0923]

Kherson State University, 27, Universytets'ka St., 73000 Kherson, Ukraine
spivakovska@ksu.ks.ua, tanya.vinnik@gmail.com,
LPerminova@ksu.ks.ua, verakotkova84@gmail.com

Abstract. The usage of ICT has become an integral part of the learning process. It provides such benefits as improving learning efficiency, developing thinking culture, sharing knowledge and collaborating in the fast-paced digital society.
The article is devoted to summarize the pedagogical conditions for future primary school teachers' research competences formation with the usage of ICT in education. The results of the survey of students' usage of different ICT are analyzed. The basic directions of modern students' scientific work are analyzed. The main directions of students' research work are discussed. On the basis of the analysis of students' usage of the ICT in scientific work, a five-step model of activity was created and tested, in particular, research planning, information phases, experiments, analytics, as well as the stage of project execution and presentation of research results.

Keywords: ICT, scientific work, research work, professional pedagogical education.

1 Introduction

Modern education of a teacher requires the students to do special research work and to become a professional with a set of research skills. It is also applied to primary school teachers due to the fact that the qualifications directly depend on the level of professional training as well as on the condition of the formation of research skills.

The problems of future teachers' scientific training have been reproduced in many Ukrainian and foreign studies. However, today there is no exact term of 'students' research activity'. It is a complicated synthesis of learning and student's new experience in the educational environment with a pedagogical direction. Research work means the process to form search skills and knowledge, scientific language the all these make a teacher ready to do his or her professional activities. It also contributes to the effective performance of professional functions, and is one of the criteria for qualifying a teacher, his readiness for self-development and innovations.

It should be noted that in today's conditions, the use of information and communication technologies has become an integral part of any sphere of human activity in

particular of education. Modern information tools provide students with a wide range of multimedia, electronic and Internet technologies as a result the ability to conduct, collaborate and share their research.

2   Ukrainian scientific works of students' researches.

There is a new educational paradigm in Ukraine. Its ideas are intended to train specialists who unite both a competent worker and a researcher, who is capable to do his job in the conditions of continuous change of knowledge about the world. According to the overwhelming majority of scientists, the problem of professional competence of university graduates, and especially their preparation for scientific research, is actualized in the context of the transition to the information society.

It becomes axiomatic that the competence of a specialist researcher is one of the main conditions for his successful professional activity. Thus, O. Spivakovsky, L. Petukhova, N. Voropay and V. Kotkova emphasize the necessity of creating the informational-communication pedagogical environment, which ensures the positive learning motivation in today's informational and educational conditions [6].

The implementation of information technology in various fields of modern education system is becoming more and more complex and challenging [2].

A particular problem of the professional training of pedagogical workers is the optimization of informatization of higher education. The researchers singled out the main objectives of teachers' training within informatization of education [4]:

— to make the ideas about the role of computerization of higher education, types of information technologies and methods of their application;
— to introduce the positive and negative aspects of the usage of information technology in education;
— to study the experience of the using of information technologies in universities;
— to develop the personal information culture.

Thus, L. Petukhova notes that the traditional educational process does not ensure the formation of informational competence. It is the key competence for future specialists. The education is not effective unless it is aimed primarily to overcome the following difficulties:

— gaps in previously acquired knowledge;
— insufficient information culture;
— inability to choose the right mode of work and rest;
— lack of skills for independent study of the material;
— lack of skills for control their knowledge and skills;
— lack of systematic control of activity;
— insufficient self-esteem of their capabilities;
— insufficient number of consultations allocated to each of the disciplines of the pedagogical cycle;
— insufficient level of development of research skills;

— low level of development of abstract and analytical thinking and creative abilities of students, etc. [8].

At the same time, the analysis of special literature shows a fairly large number of works that raise the issue of ICT usage in student's learning activities, in particular research. The availability of an adequate informational and pedagogical environment facilitates the assimilation of a large amount of information, which is important in the context of intensive development of scientific and technological and social progress, where knowledge is updated every 3-4 years with a clearly defined rate of reduction of this process.

At the same time, the analysis of literature shows a large number of works that raise the question of using ICT in the students' learning activity, particularly in research. The availability of an adequate informational and pedagogical environment facilitates the assimilation of a large amount of information, which is important in the context of intensive development of scientific and technological and social progress, where knowledge is updated every 3-4 years with a clearly defined rate of reduction of this process. The availability of an adequate informational and pedagogical environment facilitates the assimilation of a large amount of information, which is important in the context of intensive development of scientific and technological and social progress, where knowledge is updated every 3-4 years with a clearly defined rate of reduction of this process.

On the basis of the analyzed literature it can be argued that the timely and correct use of innovative educational resources in the educational process and research work, the constant interaction of the student and the teacher in the information and communication pedagogical environment will lead to the improvement of the quality of educational services, and to the increasing of students' preparedness level to study higher education, improve the quality of educational services provided by higher educational institution. Consequently, in the context of the dynamics of modern society, the future teacher should be prepared to acquire and comprehend new information, its improvement and application in the educational process by means of innovative technologies.

3 The investigation of ICT usage in students' researches

The teacher's professional training is carried out not only in the process of learning the theoretical course, but also in the course of educational work by tools of pedagogical practices, students' participation in research activities.

Of course, each kind of work has a research nature, and all types of educational activities of the higher education institution influence on the formation of research skills of future teachers. High level of professional training requires a clear organization of educational work, which provides a search and problem approaches to its implementation. First of all, it refers to the methodological substantiation of the educational process, that is the system of initial positions and methods of organizing theoretical and practical educational activities in modern conditions.

Conducting research on this issue determines the use of both theoretical and empirical research methods. Thus, studying the readiness of students to use information

technology in scientific work is impossible without analysis, comparison and synthesis, an abstract approach to determining the basic laws of the use of information technology, a logical approach to describing their possible implementation of innovative educational methods. The main means of obtaining results are conducting questionnaires and analysis of indicators of readiness of students of pedagogical specialties of higher educational institutions of Ukraine to use information technologies in the educational process and research work. As known, the Ukraine's Higher Education Institutions use information technologies in the educational process and research work.

ThisresearchwasconductedonthebasisofthepedagogicalfacultyoftheKhersonStateUniversitywithintheframeworkofresearchwork. It included a series of surveys aimed at researching various aspects of ICT use by students. It should be noted that the material base of the faculty is at the necessary and sufficient level. Students have access to the computer classes; each classroom is technically staffed.

The questionnaire received answers of 100 respondents who are students of the 4thyear of the Pedagogical Faculty of Kherson State University, specialty "Elementary education", "Preschool education". In order to determine the basic level of use of ICT by students, we have identified quantitative and qualitative indicators, which made it possible to predict future psychological and pedagogical measures for forming the readiness of the use of technical means.

It is important to monitor the dynamics of the use of modern information technologies and their impact on the quality of educational services, because this is the way we get an opportunity to analyze the state of the functioning of the education system as a whole and determine the prospects for its development, which are taken into account in the process of formation of the state policy in the field of education.

The results were compared with the results of the research of 2015/2016 years, which was conducted among the students of pedagogical specialties [5]

Based on the results, you can see a dynamic picture of the use of ICT by students of the Pedagogical Faculty of the Kherson State University. The difference between the level of use of ICT at the beginning of study at the end is shown in Fig. 1.
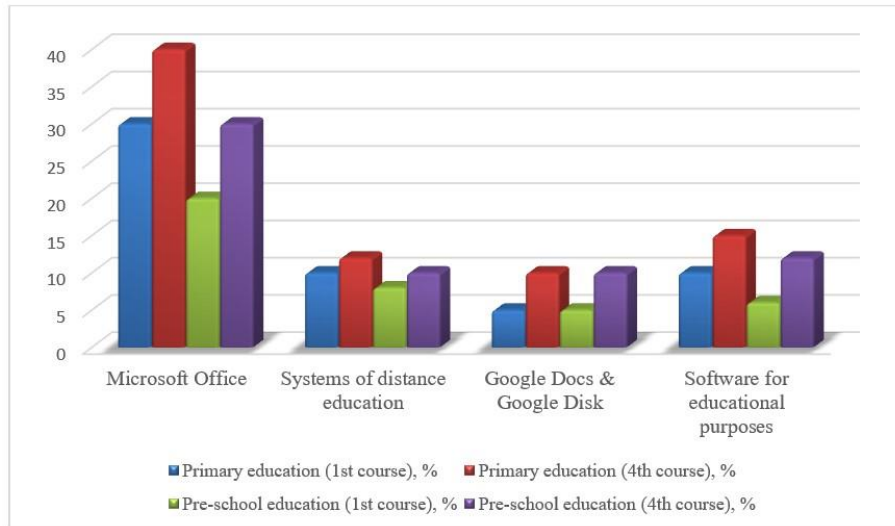
Fig. 1. Use of different types of ICT by students of the Pedagogical Faculty

Based on the results, we can state that the level of intensity and quality of ICT application by students of pedagogical specialties increased during the period of study at the university.

At the same time, since the third year of education, students are became actively involved in various types of research, which requires them to apply innovative communication technologies and appropriate actions.

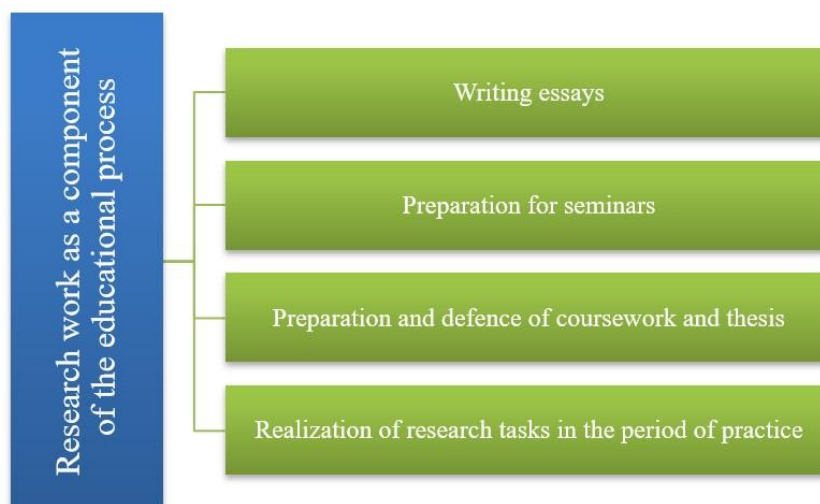Let's consider the main directions of students' research work(Fig. 2, Fig. 3).

Fig. 2. Main directions of students' research work in educational process
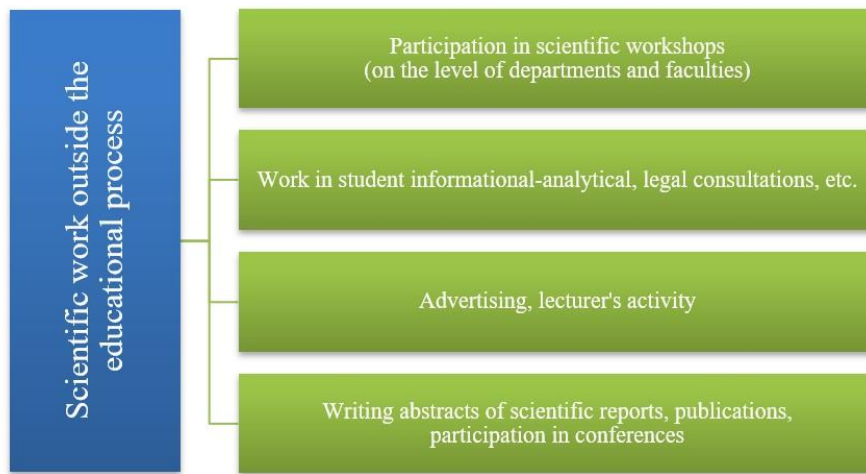
Fig. 3. Main directions of students' research work outside the educational process

As is known, the most traditional means of formation of research competences include lectures, seminars, practical and laboratory work. The specific load of a lecture in the course of scientific work of a teacher is to attract students to creativity, to increase their interest in research. This is realized by providing a problematic nature of teaching the material, an optimal combination of traditional and innovative teaching methods. As a result of the survey of students of the Pedagogical Faculty of Kherson State University, lectures, discussions, lectures, press conferences, lectures-visualizations, lecture-round tables, problem lectures, etc. proved to be effective.

The results of our research confirm that in the system of scientific and cognitive training of students a significant place should belong to the creative nature of the organization of seminars and practical classes, the main purpose of which is the formation of skills of practical application of theoretical knowledge, the ability to use them in future professional activities. By means of specially developed creative tasks the ability to laconic and logically express own opinion develops, the skills of the search and processing of information are formed. Inclusion of elements of experimental search, creation of situations for intensive development forms an interest in scientific work and skills of the collective activity of the future teacher.

The most effective organizational forms include seminars-discussions, colonial seminars, workshops, consultations, independent work, as well as game techniques, competitions, round tables, debates, etc. A prerequisite for improving the level of student research is the use of active methods, which include role games, psychological sketches, modeling, etc. Special mention should be made of the development of mini projects during the classes themselves and individual and group projects that are being developed outside of the auditorium. Their potential opportunities ensure the search character of learning, the intensive development of scientific knowledge of students, prepare for creative professional activities, independent acquisition of the necessary information base [8].

Unfortunately, a significant number of students do not possess the skills of the search and processing of scientific information, does not have a clear idea about the structure of scientific works, the problem is the adequate selection of research methods. Thus, there is a need to create favorable conditions for the implementation of the readiness for the use of innovative communication technologies, based on beliefs and clear value orientations, in which the motivational component is considered as the person's quality, on which the person' attitude to his behavior and activity depends.

It should be noted that there is need for wider involvement of future teachers in "optional" forms of research, such as participation in scientific laboratories, unions, exhibitions, competitions, contests, scientific seminars [1, 5, 7].

The introduction of ICT into the research work of students is possible at each stage of the research. Thus, for example, student research during the writing of scientific papers in general form can be submitted in the form of an active model consisting of five stages:
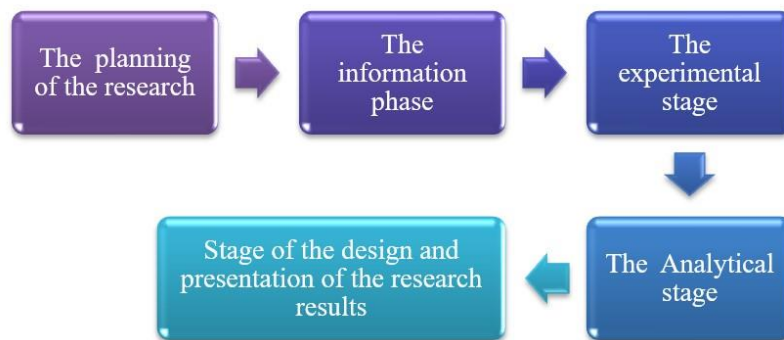

Fig. 4. Stages of students' scientific work

Let's describe the possibilities of using ICTs at each stage (Fig.4).

1. The planning of research (selection, study and synthesis of scientific and statistical information, consideration of possible directions of research and their evaluation, choice of study direction, justification of the accepted direction of research):

— Information systems and resources (search engines, electronic catalogs and repositories)
— MindMeister, Mindomo, MAPMYself, Spinscape, Text2MindMap, VivaMind, and other software for creating mental maps.

2. Information phase (search and selection of information, accumulation of various facts concerning the subject of research received by other scientists)::

— search engines (Google, Rambler, Bing, Yahoo! etc.)

— electronic catalogs and repositories (Electronic Catalog of the Vernadsky National Library, ELibUkr, Scientific Electronic Library of the Periodicals of the National Academy of Sciences of Ukraine, DissForAll, DissCat, etc.)
— Internet bookmarking services (Google's built-in service, Pocket, Streme, Saved.io, Memori, Xmarks, etc.).
— online data warehouses (Google Docs, DropBox, Mega etc.).

3. Experimental stage (staging and conducting an experiment for obtaining own facts, new knowledge about the subject of research)
4. Analytical stage (analysis of all acquired facts about the subject of research, their generalization, interpretation, allocation of correlation and causal relationships, justification of regularities, etc.):

— special computer programs for the receipt and processing of analytics and its presentation in graphical form
— Feedback services
— digital devices
— Information systems and resources (search engines, electronic catalogs and repositories)
— online storage (Google Docs, DropBox, Mega, etc.)

5. Design and presentation of research results:

— Text editors for presentations and videos (MS PowerPoint, ProShow Producer, OpenOffice.org Impress, Corel Show, etc.).
— Internet resources for placing research results (YouTube, Web pages of the research group, etc.).

To summarize, it can be argued that there is a real opportunity for a modern high school to participate in research work with the help of using certain types of legal training for future primary school teachers. But the students' lack of experience is the reason of learning without enthusiasm, without getting any satisfaction from the exercises. Often it can be caused by the lack of motive for scientific research, the absence of professional orientations, the instability of the desire for knowledge.

In our opinion, the lack of interest in independent creative activity of students is caused by:

— their low informativeness about types of scientific activity in higher education;
— organization of the educational process on the laws of simple reproduction of
— knowledge and skills;
— optional participation in extra-curricular research work;
— lack of a system of encouragement for scientific research;
— insufficient level of scientific and pedagogical preparation of a part of teachers (absence of the necessary "scientific school")

The negative aspect in students' scientific training is a formal approach to the choice of the subjects of course and thesis, the reluctance and the inability to conduct

an experimental phase of the study. the consequence is the unsystematic nature of special knowledge, insecurity in their forces, passivity, weak motivation for scientific research [3, 4].

We were interested in T. Vakolya's study, conducted on the basis of the pedagogical faculty on the problems of forming the research competence of future teachers of elementary school. The author has proved that the formation of research competence should take place in stages: diagnostic-prognostic, informational, practical, creative-heuristic.

Diagnostic-prognostic (1 course) -occupied with collecting the necessary information about the first-year students, studying the motivational palette, diagnosing the levels of formation of scientific research knowledge and skills of students. The second - informational (2 year) - carried out intensive accumulation of experience in acquiring scientific information, system of research knowledge, preparation for independent research, acquaintance with research methods and forms of scientific work in higher educational institutions, development of reflection. The third - practical (3 course) - provided the experience of methodology of pedagogical search, methods of transformation of pedagogical activity, which are transformed into creative projects, systematization of experience of practice, registration of scientific products, introduction of the results of independent scientific research, formation of personal qualities. The fourth - creative-heuristic (4 year) - envisaged the student's awareness of the objective way of professional activity, the ability to reflect, readiness for self-improvement on the basis of self-analysis and the synthesis of individual properties and acquired pedagogical experience, readiness to simulate future professional search activity. At this stage, the systematization of the acquired research knowledge and skills [4] was completed.

This approach allows students to purposefully accumulate the necessary research skills. Naturally, the involvement of students in research activities is preceded by their familiarization with methods and methods of scientific research, the ability to collect material, work on literature, the use of scientific apparatus.

The main thing in teaching is not learning a huge array of information, but the ability to independently acquire it, purposefully work with it, choose the necessary knowledge, have a mechanism for systematically replenishing and updating your own thesaurus.

At the same time, the productivity of research activities at the specified stages depends on the quality of use of information and communication technology, which is a means of positive self-realization of the student in education.

As a result of the diagnosis, the following results were obtained (Table 1, 2).

Table 1. Characteristics of students' readiness for carrying out of pedagogical researches on a control slice (in percent)

Criteria	Levels								
	High			Medium			Low		
	К	E	D	К	E	D	К	E	D
Research knowledge and skills	3,7	15,2	11,5	25,3	60,4	35,1	71,0	24,4	46,6
Motivational orientation	9,8	20,9	11,1	30,6	53,2	26,2	59,6	25,9	33,7
Research qualities, productivity of activity	7,6	18,3	10,7	32,4	50,0	17,6	60,0	31,7	28,3
Communicative	4,7	16,8	12,4	21,7	51,3	29,6	73,6	68,1	5,5
Reflexivity	7,2	21,8	14,6	28,4	49,7	21,3	64,4	28,5	35,9
On the average	7,1	19,0	11,9	29,2	53,3	24,1	63,7	27,6	36,1

Where:
K - control group;
E is an experimental group;
P - difference in indicators.

Table 2. Characteristics of students' readiness for conducting pedagogical researches on the results of the forming stage of the experiment (in percentages)

Criteria	Levels								
	High			Medium			Low		
	K	E	D	K	E	D	K	E	D
Research knowledge and skills	12,8	25,1	12,3	30,2	55,1	24,9	57,0	19,8	47,2
Motivational orientation	16,0	34,0	18,0	35,8	55,2	19,4	48,2	10,8	37,4

Criteria	Levels								
	High			Medium			Low		
	K	E	D	K	E	D	K	E	D
Research qualities, productivity of activity	15,8	36,2	20,4	40,5	55,4	14,9	43,7	8,4	35,3
Communicative	11,2	31,6	20,4	32,1	54,2	22,1	43,3	14,2	29,1
Reflexivity	11,6	40,1	28,5	40,3	55,0	14,7	48,1	9,6	38,5
On the average	14,0	33,8	19,8	36,7	57,6	21,0	49,3	8,6	40,7

Consequently, the results indicate a significant increase in the indicators of the formation of preparedness for conducting pedagogical studies of future teachers of elementary school.

Looking forward to solving the problem of developing the research competence of future primary school teachers, in our opinion, the following directions can be considered: the further search of effective technologies and means of forming research competence; creation of more modern models of integration of research competence with other components of professional culture of students; studying and using the latest information tools; further study of ways to improve the quality of management of the process of forming the research competence and competence of the leaders of the scientific work of students, which in essence should be facilitators, in the form of tutors (changes of the outdated system of curatorial activity).

The research allowed to identify a number of contradictions in the pedagogical, methodological and scientific nature of the informatization of higher education. In particular, the contradiction between the orientation of pedagogical practice to the intensive process of informatization of higher education (the introduction of information and communication technologies in the educational process) and the lack of established generally accepted methodological and theoretical foundations of the process of informatization, its strategic prospects for development. Another contradiction is the presence of updated and improved technical means of training and the development of a methodology for their implementation in higher education.

4   Conclusions

Informatization of education is one of the main priorities in the development of higher education. It is a qualitatively new stage for the whole system of higher education, a promising direction for increasing the efficiency of the studying at a higher educational institution.

The analysis of students' usage of ICT resources in the learning and research makes it possible to assess its level as low. Thus, this indicates the need to increase the level of IT ownership, from high school and during studies in universities. The research revealed an imbalance between the opportunities of the university's information and communication pedagogical environment and the readiness of students to use IT resources from the beginning of education. One of the ways to increase the readiness of students to use information technology in the educational process and research work is to use computer communication tools, social networks, software such as Microsoft Office, Google Docs, etc.

The generalization of the necessary information and the results of our research shows that the problem of forming the research competencies of future primary school teachers is due to the influence of a number of reasons: the lack of substantiated recommendations for the development of scientific potential in the realities of social requirements, the educational process is not focused on the formation of research competencies as a component of professional training, not the possession of a part of teachers of higher education by the relevant conceptual and terminological apparatus, unmotivated students to vocational and scientific research, etc. The synthesis of training and obtaining the experience of conducting scientific research is the attraction to the search activity, the theoretical foundations of which are laid both in the process of mastering academic disciplines, and in practical implementation through the preparation and protection of abstracts, coursework and diploma papers, participation in problem research groups, student laboratories. The direct influence on the course of the algorithm of the educational process is the motivation of choosing a future profession, the availability of adequate introspection, the ability to predict the mechanism of professional growth and self-improvement. In the future, further exploration is the development of a model for the formation of the research competence of the future teacher of elementary school on the basis of the competency-axiological approach.

References

1. Andrievsky, B.M., Vinnyk T.O.: ICT as an Independent Component of Preparing Future Teachers of Primary School to Scientific and Professional Research. Information Technologies in Education, 23 (2015)
2. Andriyevsky, B.M., Petukhova, L.E.: Professional and scientific training of the future teacher of elementary school. Kherson, Aylant (2006)
3. Baseluk, V.G.: Formation of research skills of the head of general educational institutions in the system of postgraduate pedagogical education. Kyiv (2009)
4. Vakolya, T.I.: Formation of research competence of future primary school teachers in the process of training. Kherson (2014)
5. Spivakovska, E., Osipova, N., Vinnik, M., Tarasich, Y. Information competence of university students in Ukraine: Development status and prospects. 2014, Communications in Computer and Information Science, 469, pp. 194-216.
6. Spivakovskiy, A., Petukhova, L., Spivakovska, E., Kotkova, V., Kravtsov, H. Comparative analysis of learning in three-subjective didactic model. 2013. CEUR Workshop Proceedings 1000, pp. 236-251

7. Vinnik, M., Tarasich, Y.: Students Readiness to Use Information Technology in Universities Educational Process. Informational Technologies in Education, 23 (2015)
8. Perminova, L.A.: Didactic Preparation of Future Primary School Teachers by using ICT. Kherson (2017)