

FUTURE ENVIRONMENTAL SPECIALISTS' TRAINING FOR RESEARCH WORK BY USING INFORMATION TECHNOLOGY

I. Soloshych, S. Pochtovyuk

Kremenchuk Mykhailo Ostrohradskyi National University

vul. Pershotravneva, 20, Kremenchuk, 39600, Ukraine. E-mail: solo_ira@mail.ru

Purpose. The implementation of advanced information technologies in the regional economic and environmental condition study by future environmental specialists is becoming a necessary condition for the research competence formation efficiency and teaching quality improving in universities. **Methodology.** The following methods have been used in the study: general scientific analysis, synthesis, simulation; theoretical: the analysis of scientific, educational and methodical literature on pedagogy concerning the characteristics and methods of research competence formation and development as well as concerning issues of computer science and technique while taught to the environmental specialists and issues in their education; empirical: teacher's questionnaire, interview, students and teacher testing, the study of the students learning activities results, compilation of the personal teaching experience and experience of other teachers, pedagogical experiment. **Finding.** The relevance of this study is determined by the contradiction between the need to develop research competence in the future environmental specialists and the insufficient use of the educational potential of new information technologies in the educational system of students' education. The paper deals with the implementation of advanced information technologies in the regional economic and environmental condition study by future environmental specialists. Based on the environmental specialists' professional scientific activities analysis the groups of the expert professionally important qualities have been specified. The pedagogical software is implemented in the educational process, the use of which provides the conscious application of new information technologies in the process of solving research tasks, thereby increasing the level of future environmental specialists' professional training. The efficiency of the information technologies use in educational process ensures the increase of the research competence level. **Practical value.** Pedagogical software tool has been implemented into the learning process usage which ensures conscious application of advanced information technologies in the process of research problems solving, thereby increasing the level of their training. **Conclusions.** Summing up the results of our study the following findings have been drawn: in order to develop sustainable and professional skills of problem solving, it is necessary to strengthen the practical part of the teaching disciplines which demand systematic application of advanced information technologies in education process; the creation of educational programs must take into account the advanced information technologies integration in the content of the natural sciences disciplines, students' professional and practical training; implementation of new information technologies promotes the formation and development of research competence, of modern scientific ideas about the world, the human place and role in it.

Key words: research competence, economic and environmental condition, advanced information technologies, future environmental specialists.

ПІДГОТОВКА ЕКОЛОГІВ ДО ДОСЛІДНИЦЬКОЇ ДІЯЛЬНОСТІ З ВИКОРИСТАННЯМ ІНФОРМАЦІЙНИХ ТЕХНОЛОГІЙ

I. О. Солошич, С. І. Почтовюк

Кременчуцький національний університет імені Михайла Остроградського

вул. Першотравнева, 20, м. Кременчук, 39600, Україна. E-mail: solo_ira@mail.ru

Актуальність даного дослідження визначається протиріччям між необхідністю формування дослідницької компетентності у майбутніх фахівців-екологів і недостатнім використанням освітнього потенціалу новітніх інформаційних технологій у педагогічній системі підготовки студентів. Розглянуті питання впровадження новітніх інформаційних технологій при дослідженні майбутніми фахівцями-екологами економіко-екологічного стану регіону. На основі аналізу специфіки професійної наукової діяльності фахівців-екологів виділені групи професійно-важливих якостей фахівця. Впроваджено в навчальний процес педагогічний програмний засіб, використання якого забезпечує усвідомлене застосування новітніх інформаційних технологій в процесі вирішення дослідницьких завдань, що сприяє підвищенню рівня професійної підготовки майбутніх фахівців-екологів. Обґрунтовано ефективність застосування інформаційних технологій в навчальному процесі для підвищення рівня дослідницької компетентності.

Ключові слова: дослідницька компетентність, економіко-екологічний стан, новітні інформаційні технології, майбутні фахівці-екологи.

PROBLEM STATEMENT. The modern period of society development is characterized by the raise of acute problem of environmental management and comfortable environmental and generation economic future insurance. Hence there is an increase of the need for industrial and information society to train future environmental specialists, who not only have professional

knowledge and skills, but also are able to improve them by their own, which enables application of high-tech environmental technologies into manufacturing process.

Ukraine's integration into the world educational space has provided rapid growth of information flows, active upgrade of production technologies. It is known that 70 % of growth in gross industrial product of the

world leading states is driven by scientific technologies; hence the future specialists' research competence formation is a nationwide challenge.

One of the most important factors of the production intensification, waste-free technologies creation and environmental protection is the application of advanced information technologies. In this regard, future specialists require careful training in informational disciplines which can enable a systematic and effective resolution of environmental problems by using software.

Unfortunately, environmental specialists entering the competitive labor market with a wide range of professional knowledge don't have a well-formed knowledge system that is related to using them at work. The research competence is a prerequisite for the success of the professional competence training and development, the individual self-development mechanism. Current employer prefers professionals who are able to carry out professional activities competently, so the research competence formation is a factor of competitiveness in the labor market.

Competence and active approaches to the environmental and economic education are studied in the works by N. Bibik [1], I. Drach [3] and others. They highlight not the formation of student's abilities and skills, but the ability to solve problems arising in the development of advanced information technologies.

The economic and ecological condition of the region study is considered in the works by A. Nekos, I. Soloshych [5, 10], A. Pryshchepa, L. Klimenko [8] and others.

The above-mentioned works make up the separate aspects of research competency formation with the use of advanced information technologies. It has been revealed that the questions of advanced information technologies implementation in the study of economic and environmental condition of a region in order to form research competency in future environmental specialists have not become the subject of detailed research and still remains open and poorly understood.

EXPERIMENTAL PART AND RESULTS OBTAINED. The study object is the introduction of advanced information technologies in the environmental specialists' education process to form a research competence.

To achieve this goal it is necessary to solve the following tasks:

- to carry out theoretical and methodological analysis of scientific, pedagogical and methodological literature on the research problem;
- to identify the possibility of forming a research competence in environmental specialists;
- to determine the solution of which professionally oriented tasks allows create a research competence in the future environmental specialists;
- to develop and implement programs in the educational process for the economic and environmental condition of the region investigation on the basis of theoretical fundamentals.

The following methods have been used in the study:

- general scientific analysis, synthesis, simulation;
- theoretical: the analysis of scientific, educational and methodical literature on pedagogy concerning the

characteristics and methods of formation and development of research competence as well as concerning computer science issues and technique of its teaching to the environmental specialists and issues in their education;

- empirical: teacher questionnaire, interview, testing of students and teachers, the study of the students learning activities results, compilation of personal teaching experience and experience of other teachers, pedagogical experiment.

The methodological and theoretical basis of the study is based on a common didactic standpoints discussed in scientific papers by E. Grosheva [2]; concepts of formation and development of research competence, analyzed in the works of Y. Ryndina [9]; theory of information culture formation and advanced information technology usage in the educational process by M. Zhaldak [4].

The implementation of advanced information technologies in the economic and environmental condition of the regions study to the future environmental specialists training is becoming a necessary condition for improving the research competence formation efficiency and teaching quality in universities.

The goal of modern education is not only to provide future environmental specialists with complex knowledge and skills, but also to create the need for self-learning, continuous expansion and professional knowledge deepening, which is impossible without advanced information technologies implementation in the educational process. In our opinion, if the student «receives» knowledge in the educational process by himself, based on his own experience and does not receive it in complete form, he will seek for research activity in his future career.

The concepts used in the study are the following: «competence», «research competence», «new information technologies». Nowadays there is no unity on these concepts definition in the scientific literature. In this study, based on A. Hutorskoy approaches [11], the competence concept will be understood as «a set of interrelated personality traits needed for qualitative interaction with a preset number of objects or processes required for productive activities; and competence as knowledge of the relevant competence, which includes its personal attitude to itself and to the subject of activity».

Future environmental specialists' research competence can be defined as an integral description of the individual which is manifested as a willingness to take an active position in relation to their professional activity in order to transfer the semantic context of the activity from functional to creative.

Research competence formation requires environmental specialists to have such skills, as:

- ability to use research methods along with the modern methods of system scientific analysis, carry out procedures for scientific information processing and its systematization;
- comparison of different solving problem schemes and creation the ways of its solution;
- ability to select and formulate scientific novelty, theoretical and practical significance of the research, see

specific areas and implement research results into practice of environmental activities.

The domestic and international experience analysis [9, 11] enables to determine the role of research competence in the future environmental specialists education effectiveness improvement and enhance the self-identity process as a professional researcher in order to allow disclosure of their intellectual and creative potential; master the strategies and methods of scientific research and solving practical problems that intensify the process of self-identity as a professional researcher.

Advanced information technologies [2] is understood as the process that uses a set of tools and methods for collecting, processing and transmission of primary data for obtaining new quality information concerning the state of the object, process or phenomenon (information product). The usage of advanced information technologies comes to replace «paper» data bearer with electronic one. They provide the opportunity to combine the processes of study, consolidation and control on learning of studying material, which in case of traditional education are most often diversified. They also enhance motivation to learn and develop creative thinking.

The concept of advanced information technologies systemic use in education when preparing future environmental specialists has been implementing in Kremenchuk Mykhailo Ostrohradskyi National University for several years. In its implementation the following problems have been resolving: computer-oriented teaching economic disciplines and training; advanced information technologies application in students' scientific work; the development of new computer software.

The study analyzes the educational qualification characteristics (EQC) and educational and professional program (EPP) of Bachelor's degree, specialty 6.040106 «Ecology, Environmental Protection and Balanced Nature» [6] and EQC of Master's degree, specialty 8.04010603 «Environmental safety» [7].

Based on the professional environmental specialists' specific research activities analysis the following groups of the expert professionally important qualities have been determined:

- social (initiative, citizenship, ethics, responsibility);
- intellectual (erudition, intelligence professional formation, the world view ekocentricity);
- scientific information (research, information and self education culture of personality, the ability to analyze, systematize, assess environmental and scientific data);
- professional acmeological (ability to systematically develop and implement programs of scientific research and personal self-development based on professional reflection).

The methodological support analysis of research competence formation in environmental specialists has revealed that:

- the research methods content is presented in the form of general methodical, fragmentary;
- there is no systemic understanding of the future research professionals research activities stages; the research technical facilities description is provided selectively;

– explanatory, illustrative, reproductive methods of the educational process are used, which hinder the formation of scientific knowledge and skills in solving heuristic problems.

It has been determined that the future environmental specialists' basic competencies include:

- general scientific (the ability to create databases and use Internet resources);
- instrumental (skills in computer networks using software and programming);
- general practical (the ability to assess the condition of natural objects; use economic mechanisms of the natural resources protection and restoration; determine ecological, economical effectiveness of environmental measures, economic damages from environment pollution);
- specialized and professional (use theoretical knowledge on computer science to process observations of the environment data).

The list of disciplines in 6.040106 education specialty includes those where there are sections that require calculation automation. The presence of advanced information technologies allows perform ecological and economic calculation with minimal training, which plays an important role in shaping the knowledge required to explain the relevant economic and environmental condition of a region links; to perform research tasks.

Methods of local economic and environmental condition assessment give a comprehensive picture when researched elements of the environment occupies large areas, because the technical means of accumulation data on the economic and environmental condition of a region allow to get only mosaic information.

The system synthesis that combines features such as data collection by means of remote and contact methods, analysis and storage of content further processing is required to address the complex tasks on diagnostic of economic and environmental condition of the region. This system is capable of providing systematic monitoring and evaluation of economic and environmental condition of the region, allows carry out the predictive diagnostics to identify its elements changes under the influence of economic activities which becomes possible only when using the advanced information technologies.

Future environmental specialists' research competence formation organization implies students' participation in academic work during the period of study at the university.

At the junior courses students are introduced to scientific directions of departments, write essays, make presentations and reports on seminars and workshops, participate in student research contests and competitions.

In the second year during «The organization of scientific research in the field of environmental safety» discipline study, students learn contemporary methodological concepts, the scientific knowledge foundations and scientific research methods; improve the ability to search and process scientific information; learn to formulate the scientific research goals, objectives and findings.

Qualitatively new stage of environmental specialists'

scientific education is training on III-V years where they perform system tasks of research character, allowing consciously to choose the Bachelor's and Master's qualification topics, which becomes the result of their research activities at the university.

Future environmental specialists' research competency formation using the advanced information technologies is taught in the study of subjects: «Information and systemathology» (1st year, 2nd semester), «Computers and programming fundamentals» (2nd year, 1st semester), «Basic research in environmental security» (2nd year, 2nd semester), «Urban ecology» (3rd year, 1st and 2nd semesters), «Environmental Economics» (4th year, 2nd semester), «Methodology and organization of research» (5th year, 1st semester).

When studying information loop continuity subjects, consequence, scientological aspects and scientific sufficient level of future environmental specialists for use of the advanced information technologies are ensured.

In the second year, during the «Basic research in environmental safety» course study future environmental specialists formulate goals, objectives of the study, using methods of regression and correlation analysis, execute input data processing.

On the third course during the study of 2-semester «Urban ecology» discipline future environmental specialists study economic and environmental condition of the region assessment methodology [8] in the first semester. In the second semester students are given an independent creative research, to discover the natural resources potential of the chosen region (indicators of air, soil, water conditions and waste management).

In the fourth year, during «Environmental Economics» subject study, future environmental specialists characterize industrial-economic complex and the economic sphere of the region [12], gross domestic product; indices of industrial production, gross consumption; investments in fixed assets, the intensity of fixed assets renewal, the amount of scientific research, import and export of goods and services, and others.

It should be noted that the use of information technology has certain learning difficulties due to the fact that is not always possible to choose the necessary software tool which would match the purpose of training. And so, an application for economic and environmental condition calculation of a region has been developed as a part of the «Study of economic and environmental indicators of sustainable development in Poltava region» Master's research by the students of the Environmental Safety and Organization of Nature Recourses Department, the Department of Mathematics and Computer Science. The program implies indicators system selection and grounding, economic and environmental condition of a region index calculation and determination of environmental and economic problems priorities directions.

Key features and benefits of the program are:

- integration of maps and databases in one «Project»;
- database processing (search for objects selection parameters, data processing);
- imaging characteristics of study objects (relief, areas of businesses' anthropogenic impact;

- assess pollution of the atmosphere and hydrosphere);
- construction of ecological and economic status of the region maps, spatially distributed correlation coefficients and others.

The block diagram (Fig. 1) was designed while creating a program, which consists of a system of indicators to measure economic and environmental condition of a region using basic indicators (BI), connected in homogeneous groups (economic, environmental) and economic and environmental characteristics of the region.

The program runs in the following sequence: original task; data entry; calculation of areas' economic and environmental condition of the region. Support of economic and environmental condition of a region data uses intelligent computer systems (normative reference base; economic and environmental condition of a region database, methods of spatial visualization (GIS), a library of mathematical processing).

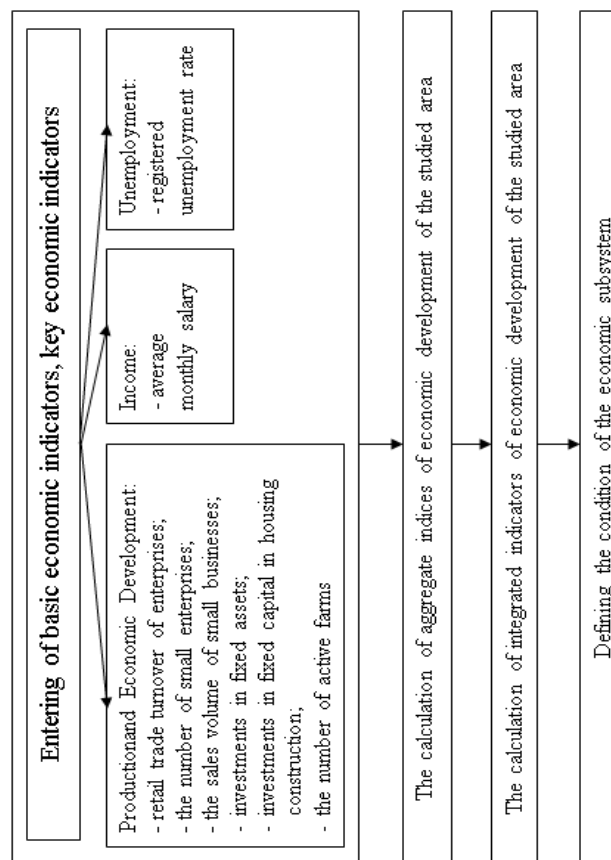


Figure 1 – Flowchart of using advanced information technologies in evaluation of economic and environmental condition of the region, developed by the authors

The program allows enter the necessary data, choose the parameter to calculate and obtain results on a state of economic and ecological system of the region (Fig. 2, 3, 4).

Future environmental experts are given research tasks, the best results are logged into a database, which enables the deepening of environmental and occupational knowledge using previous students' research for further writing of essays, term papers and diploma projects.

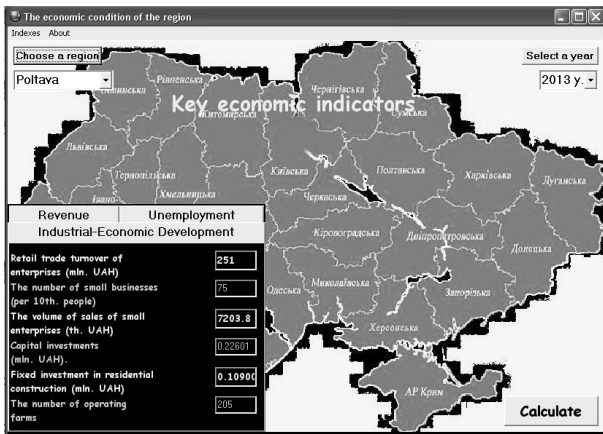


Figure 2 – Input data example

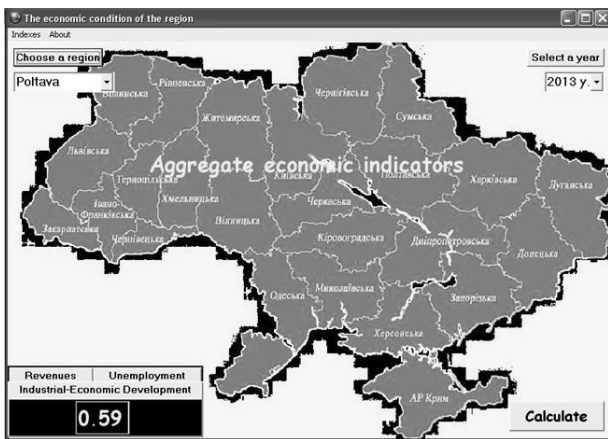


Figure 3 – Example of aggregated data calculation

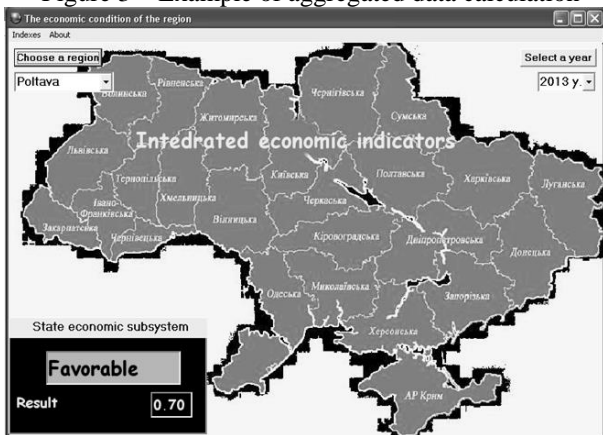


Figure 4 – Example of getting results in the program

Using of the Program future environmental specialists, taking their preliminary research data into consideration, have the opportunity to conduct environmental and economic analysis of the regions and develop a strategic plan to achieve their sustainable development in the process of their education.

CONCLUSIONS. Summing up the results of our study the following findings have been drawn:

- in order to develop sustainable and professional skills of solving problems, it is necessary to strengthen the practical part of the teaching disciplines demands systematic application of advanced information technologies in education process;

- the creation of educational programs must take into account the advanced information technologies inte-

gration into the content of the natural sciences disciplines, students' professional and practical training;

- new information technologies implementation promotes the research competence formation and development, modern scientific ideas about the world, the place and role of a human in it;

- pedagogical software tool was implemented into the learning process usage which ensures conscious advanced information technologies application in the research problems solving process, thereby increasing their training level;

Results and practical teaching experience demonstrates the need for further search for ways and conditions of the effective advanced information technologies implementation into the learning process in order to improve the environmental specialists' research knowledge and competence quality.

REFERENCES

1. Bibik, N. M. (2004), Kompetentnisniy pidhid: re-fleksivniy analiz zastosuvannya. Kompetentnisniy pidhid u suchasniy osviti: svitoviy dosvid ta ukrayinski perspektivi. Kyiv: «K.I.S.», 45–50 s
2. Hrosheva, E. P., Naumkyn, N. I. (2013), Motyvatsiya v innovatsiyi diyal'nosti. Mizhnarodnyy zhurnal prykladnykh i fundamental'nykh doslidzhen', № 2. 2013. URL: HTTP: // WWW. Sience-sd.com / 452-24041 (15.07.2013).
3. Drach, I. I. (2008), Kompetentnisny pidkhid yak zasib modernizatsiyi zmistu vyshchoyi osvity. Problemy osvity: nauk. zbirnyk. In-t innovats. tekhnolohiy i zmistu osvity MON Ukrayiny. Kyiv. 2008. Vyp. 57. 2008. 44-48 s.
4. Zhaldak, M. I. (2010), "Komp'yuterno-orientovani sistemi navchannya - stanovlennya i rozvytok" [Komp'yuter-oriyentovanoyi systemy osvity-stanovlennya i rozvytku], naukovy zhurnal M. P. Drachomanova Natsional'nyi pedahohichnyy universytet, nemaye. 9 (16), stor. 3-9.
5. Nekos, A. N, Soloshych I. O. Kompleksne otsynuyannya rozvytku oblasti yak skladova vprovadzhennya zelenoyi ekonomiky. (2014). Aktual'ni problemy ekonomiky: Naukovy ekonomichnyy zhurnal. 2014. № 10. 247251 s.
6. Osvitn'o-kvalifikatsiyana kharakterystyka i osvitn'o-profesiyna prohrama bakalavra, napryam pidhotovky 6.040106 «Ekolohiya, okhorona navkolyshn'oho seredovyshcha ta zbalansovane pryrodokorystuvannya». Haluzevyy standart vyshchoyi osvity Ukrayiny, zatverdzhenny nakazom MONmolod'sportu vid 27.12.2011 r., № 1543. Odesa: TES, 2012. 116 s.
7. Osvitn'o-kvalifikatsiyana kharakterystyka mahistra, napryam pidhotovky 6.040106 «Ekolohiya, okhorona navkolyshn'oho seredovyshcha ta zbalansovane pryrodokorystuvannya», spetsial'nist' 8.04010603 «Ekolohichna bezpeka». Haluzevyy standart vyshchoyi osvity Ukrayiny, zatverdzhenny nakazom MONmolod'sportu vid 17.06.2013 r., № 773. Odesa: TES, 2013. 107 s.
8. Pryshchepa, A. M., Klymenko, L. V. (2009), Metodychni rekomendatsiyi z rozrakhunku indeksu sotsio-ekonomiko-ekolohichnoho rozvytku rayonu. Rivne, 32 s.

9. Ryndina, Y. V. (2011), Issledovatel'skaya kompetentnost' v strukture klyuchevykh kompetentnostey budushchego pedagoga. Zhurnal nauchnykh publikatsiy aspirantov i doktorantov. №1. Rezhim dostupa: <http://www.jurnal.org/articles/2011/ped4.html>.

10. Soloshich, I. A. Organiz. nauchno-issledovatel'skoy deyatel'nosti budushchikh spetsialistov v oblasti ekologii kak osnova ustoychivogo razvitiya regiona. Sbornik nauchnykh trudov "Udržitelny rozvoj v kontextu rozvoje regionů, obcí a států" Česká budievitsy: Vysoka škola evropských a regionalnich studií, 2014, r. 57-66.

11. Khutorskoy, A.V. Rezul'taty fundamental'nykh i prikladnykh issledovaniy Instituta obrazovaniya cheloveka v 2011 godu. [Elektronnyy resurs] // Vestnik Instituta obrazovaniya cheloveka; 31.01.2012 g. – <http://idos-institute.ru/journal/2012/0131.htm/>

12. Shapar, A. H. Khazan, V. B., Mazharov, M. V. (2001), Metodychni pidkhody do vyboru ta obgruntovannya kryteriyiv i pokaznykiv staloho rozvytku riznykh landshaftnykh rehioniv Ukrainy. Dnipropetrovs'k: IPPE NAN Ukrainy, 98 s.

ПОДГОТОВКА ЭКОЛОГОВ К ИССЛЕДОВАТЕЛЬСКОЙ ДЕЯТЕЛЬНОСТИ С ИСПОЛЬЗОВАНИЕМ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ

И. А. Солошич, С. И. Почтовюк

Кременчугский национальный университет имени Михаила Остроградского
ул. Первомайская, 20, 39600, г. Кременчуг, Украина. E-mail: solo_ira@mail.ru

Актуальность данного исследования определяется противоречием между необходимостью формирования исследовательской компетентности у будущих специалистов-экологов и недостаточным использованием образовательного потенциала новейших информационных технологий в педагогической системе подготовки студентов. Рассмотрены вопросы внедрения новейших информационных технологий при исследовании будущими специалистами-экологами экономико-экологического состояния региона. На основе анализа специфики профессиональной научной деятельности специалистов-экологов выделены группы профессионально-важных качеств специалиста. Внедрена в учебный процесс педагогическое программное средство, использование которого обеспечивает осознанное применение новейших информационных технологий в процессе решения исследовательских задач, что способствует повышению уровня профессиональной подготовки будущих специалистов-экологов. Обоснована эффективность применения информационных технологий в учебном процессе для повышения уровня исследовательской компетентности.

Ключевые слова: исследовательская компетентность, экономико-экологическое состояние, новейшие информационные технологии, будущие специалисты-экологи.

Стаття надійшла 04.05.2017.