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**ASPECTS OF TRAINING ECOLOGY STUDENTS
USING INFORMATION AND COMMUNICATION TECHNOLOGIES****M.Y. Kupchak**

Lviv State University of Life Safety, Lviv, Ukraine

The paper discusses the areas of implementing information and communication technologies (ICT) in the educational process of training ecology students and the effect that they have on the fulfillment of innovative teaching functions with regard to the training of ecological professionals. The most efficacious information and communication technologies are pointed out. The distinguished general software tools included Internet resources, multimedia software packages, office software packages and educational software. The category of specialized software embraced geographic information systems (GIS) for various purposes, statistical software packages, software tools for analysis and forecasting of ecological processes, expert systems, information and reference systems. It was concluded that the combination of a large number of images, sound, graphic, video and animated materials by using educational e-resources is of a special importance for training ecology experts.

Key words: innovative education technologies, information and communication technologies, ecological education, training of ecological experts, expert systems.

Introduction. The contemporary stage of civilization development is marked with the acute problems of natural resource management and the need to ensure a comfortable existence for future generations, which leads to a conclusion that education ecologization should be defined as a major paradigm of reaching sustainable development. From this perspective, the

issue of ecological education improvement is gaining importance, and the need for enhancing the quality of ecologists' training is growing, since their professional activity is directly connected with natural resource preservation, renewal and use [1].

Formation of a new, ecobiocentric world view requires a different level of education, comprehension of larger information volumes and higher-quality generalizations. One of the major factors of ecological training intensification is the implementation of innovative information and communication education technologies. Practicing teachers state that in the ecological education, information and communication technologies as a system of teaching methods ensuring optimal and effective perception, learning and use of information interactively are most advisable for solving educational tasks. ICT application in the professional training raises students' motivation, stimulates cognitive interest of the prospective experts and creates opportunities for enhancing students' independent learning. Computers and information technologies open new horizons for students' learning and creative work.

Scientists have developed a sufficient potential for solving theoretical and applied problems appertaining to ecological education and use of information and communication technologies in education. Philosophical concepts of innovative development of education in modern society were studied by V.Andrushchenko, H.Vasianovych, I.Ziaziun, V.Kremen, V.Lutay, N. Nychkalo, M. Romanenko, and P. Saukh. Theoretical and methodological aspects of developing ecological competence in prospective experts were discussed by V. Boholiubov, O. Zablotska, L. Lukyanova, O. Mateiuk and I.Soloshych. Such scholars as H.Biliavskiy, V. Boholiubov, L.Raksha, O.Nahorniuk and A.Khudin developed the didactic aspects of ecological education. Individual issues of the university training of ecologists were explored by L.Budnik, Yu.Komissarov and N. Taranova.

The main aspects of educational process computerization were analysed in the works of V.Bykov, M.Zhaldak and V.Zabolotnyi. The core of information and communication technologies for education and aspects of their application in learning particular academic disciplines were studied by such scientists as M.Anisimova, I. Bulakh, V. Hlushkov, R. Hurevych, M. Kademiia, Ye. Klementieva, V. Klochko, V. Lavrynets, Yu. Mashbyts, V. Monakhov, N. Morze, O. Piekhota, I. Pidlasyi, Ye. Polat, S. Rakov, S. Semerikov, I. Synelnyk, S. Smyrnov, O. Spivakovskiy, V. Sumskyi and O. Shestopaliuk.

Objectives of the paper. As of today, the issue of using ICT for teaching professional disciplines to prospective ecologists has not been sufficiently treated in the scientific and practical literature. Therefore, this paper aims at discussing some specific aspects of this issue.

Presentation of the main materials of the study. Practice shows that the conventional system of training ecology experts does not promote either creativity in students or their self-fulfilment or knowledge acquisition intensification. Extensive character of the educational process targeting middling students fails to further the development of a professional interest in gaining knowledge and does not form the habits of a creative approach to problem solution and optimal information search in the course of professional training.

Accordingly, the studies of practicing teachers show that these are information technologies as a system of teaching methods ensuring optimal and effective perception, learning and use of information interactively that are most advisable for solving educational tasks [2]. Integration of the areas of natural sciences and humanities in the modern ecological education on the basis of educational ICT makes it possible to kindle the students' interest in academic disciplines, fosters their creative abilities and stimulates their further development [3].

ICT combine information technologies with communication ones in order to solve various tasks confronting contemporary educational information society and include all the technologies used for communication and information handling [4]. In the learning process, information and communication technologies can be regarded as the methodology and technology of the educational process with the use of cutting-edge e-learning tools. Here belong both information technologies and pedagogical ones, i.e. not only the methods and technical means of collecting, organization, storage, processing, transfer and presentation of information with the help of computers and computer communication, but also the study, development and systemic use of the principles of educational process organization for developing learning-enhancing tools [1].

We believe that the implementation of ICT in the prospective ecologists' training should be done in the following areas:

- computer-oriented learning, first of all, for economic and legal sciences;
- application of cutting-edge information technologies in students' scientific research;
- development of new computer software.

Use of ICT in the above-listed areas allows the implementation of the following functions of innovative learning in the course of ecological training:

- information (expansion of the information space of the educational process owing to the access to various ecological information resources);
- tools (implementation of the computer-aided powerful state-of-the-art cognitive and search tools for students' learning, research and creative activities);
- modelling (use of interactive multimedia models of various ecological objects, phenomena and processes for the organization of learning and research activities);

- visualization (visual presentation of various ecological objects, dynamic demonstration of correlations and interdependencies, using computer and multimedia facilities);
- automation (automation of specific phases of the learning – monitoring of students' performance, practicing reproductive skills, learning the algorithms of solving typical ecological problems, getting acquainted with new information, etc.);
- communicative (implementation of group learning, in particular group projects, round tables, business games, group mini-research, surveys, discussions, conferences, seminars);
- analytical (accumulation, statistical and comparative analysis, and forecasting of the main tendencies and regularities of the social and economic development on the global and local scale) [5].

Of all the variety of information and communication technologies for education, the most efficacious and promising for training prospective ecologists, in our opinion, are the following:

- projective technologies, i.e., development of all kinds of ecological projects such as creative, research, game, information ones; this fosters students' creative potential, promotes their independence due to the possibilities of free choice in decision making, understanding of the need for a comprehensive approach to different spheres of social life, practical use of the gained knowledge, skills and experience, adopting of ecobiocentric attitude [4];
- technologies involving the modelling of certain objects and their properties or phenomena both at the stage of learning new information and for research purposes; this increases students' curiosity, promotes formation of ideas of the properties of a certain object, phenomenon or process on the basis of students' own experiments and observations;

- technologies involving the use of multimedia presentations, which allows an intrinsic combination of ICT elements with the conventional learning; this exerts a comprehensive influence on the students' sensory system and emotional sphere and increases the interest in the learning process and motivation of prospective experts for professional training;

- technologies based on e-resources; students' involvement in solving learning tasks using games or role playing based on the facts of the real world with the use of various information resources helps to prove the importance of ecological knowledge and skills and stimulates their conscious acquisition [5].

With a focus on the information and communication technologies most promising for training prospective ecologists, let us single out the resources with which to implement these technologies. First of all, it should be noted that such resources can be both universal, i.e. suitable for training experts in different fields, and specialized, i.e. meant for training prospective ecologists.

The category of universal resources includes:

- Internet resources. The Internet is a source of data beneficial for the objectives of learning, information analysis and evaluation, which can be used both for the search of the necessary tutorials and for a distant (remote) discussion of the problems arising while gaining new knowledge and solving the set tasks. Such variative (both independent and group) creative work enhances the motivation for learning, develops communicative and creative skills and abilities, fosters students' independence;

- multimedia software packages, which allow the development and reproduction of text, graphic, animation, video and audio information. An integral use of several information perception channels improves the quality of knowledge acquisition;

– office software packages (text and graphic editors, software applications for making presentations, spreadsheets, database management systems, etc.) are used for preparation of learning and teaching materials (templates, diagrams, tables, presentations, papers) and for students' presentation of the results of the tasks in the electronic form;

– educational software packages used for organizing the learning activity (for instance, Moodle), which help students both at the new information learning stage (due to teaching guides, illustrative examples and additional references contained therein) and at the stage of academic performance assessment (distant monitoring, various types of assessment).

The specialized software for ecological training includes:

– geographic information systems (GIS) for a variety of purposes (land management, general ecological situation, contamination of water objects, soil and air by toxicants, etc.). Most GIS have a graphic representation of spatial information in the form of separate freely-combinable layers and some reference information (textual or numeral) on the objects, which can be used for selection. In the scope of the university educational process, these, first of all, include ready-to-use GIS, for example, 2Gis (double-GIS) enabling one to analyze the location of environmentally-unfriendly factories and traffic flows, and compare this data with the experimental information [6];

– statistical software packages, including Statistika, Statgraphics and SPSS;

– software tools for analysing and forecasting of ecological processes, for example, simulation modelling packages FreeWare and Creative Common;

– expert systems (ES), which are formalized knowledge bases obtained from ecology experts. When working with them, one should take into account that most existing ES do not generate a single solution, but

rather a set of possible solutions specifying their strong and weak points and the probability of solving the problem. Out of this set, ecology experts can independently select the optimal solution based on the additional information;

– field-specific information and reference systems, for instance, LigaZakon and NaU-online.

At the same time, it should be remembered that excessive use of ICT in the educational process can have negative consequences stemming from the active invasion of artificial and illusory impressions from the on-screen virtual plots into the human natural inner world and from the interaction with them. The danger may also lurk in a deliberate manipulation of a young person's consciousness and disregard for computer health and safety regulations. Therefore, the implementation of information and communication technologies into the learning process should be well-considered, carefully planned and prepared [7].

Conclusions. The necessity of introducing ICT in ecological education is obvious and unquestionable. The application of universal and specialized software, combination of a great number of images, sound, graphic, video and animated materials by using educational e-resources is gaining a particular importance, especially in professional training of prospective ecologists, which allows changing the whole learning process. Due to using ICT, organization of the educational process is focused not only on the discussion of theoretical issues and implementation of practical tasks, but also enhances ecology students' learning and research, which ensures the efficient use of class hours paying attention to the key and difficult issues of a course.

The further research will be aimed at studying the optimal ICT forms and tools for studying the legal disciplines by prospective ecologists.

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