Middle-East Journal of Scientific Research 16 (7): 904-906, 2013
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2013.16.07.11957

Use of Information and Electronic Means for Teaching Natural Sciences in Kazakhstan

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Abstract: In the process of teaching natural sciences within masters and doctoral programs in the Republic of Kazakhstan the modern modular curricula are used. Application of these educational programs requires knowledge of information, electronic and interactive technologies. The authors used the following technologies in the pedagogical process: online tutorials, lectures-presentations, videos, animations, etc.). The training process became easier for both teachers and students due to modern computer technologies used for a rapid access to information on the posed problem in the Internet network. Besides, it is possible to select individual pace of learning and to intensify the students. The main aspects of effective training were rapid and effective control of knowledge and the possibility of additional training to correct knowledge. The paper describes the structure of the electronic textbook used by the authors in teaching the subject "Environment and Biodiversity" within the masters course in "Biology". The textbook can be simply and effectively managed, has different navigations and the instructor can change the material at his discretion and according to the need and monitor the extent of mastering the training material, etc.

Key words: Information technology · Electronic textbook · Natural sciences · Biological diversity

INTRODUCTION

Informatization of education is seen in the educational system of the Republic of Kazakhstan as a priority, because since signing of the Bologna Charter of Universities (2005) by our country a new system of education has been established. The effectiveness of modern educational process required to change the strategy of natural science education: to create new approaches to the form and content of teaching materials for students and new ways of presenting educational materials. In recent years, Kazakhstan has been widely using information, electronic and interactive technologies in teaching natural sciences. Modern education and teaching of biological and environmental disciplines also demanded greater interaction of technical and natural components. This goal is achieved through the use of modern information technologies, particularly computer at various stages of the learning process. The arguments were the effectiveness of their introduction in the practice of teaching natural-science disciplines from the 80-90s of the twentieth century and, as a consequence, increase in the efficiency of the learning process [1-4].

Since 2012, training within masters and doctoral programs in the Republic of Kazakhstan has been based on the developed modular educational programs, which necessary element is knowledge of modern information technology. Information technologies are used as a means to control cognitive activities of masters studying natural sciences, providing the instructor and students with textual, visual and other information [5]. In our view, there are problems with preparation of teaching materials, teaching aids and textbooks that in fact only contain the information but do not ensure an active cognitive activity.

Electronic forms of training material can increase the motivation and stimulation of teaching and learning process. Besides, e-learning allows students to obtain information from Internet network (from different databases) on any problem and question, to select individual pace of work with scientific and educational

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information, to reduce training time, to ensure the fast control of knowledge and training and to get the training elements for correction and high efficiency of training [6, 7]. The media and Internet technologies provide students knowing foreign languages with greater opportunities for improvement of knowledge and skills. In general, the use of computer technology in education has significantly changed the methods of the students' work with the material and brought significant learning outcomes, since the learning process is switched to active learning rather than on teaching activities [8].

Examples of such computer technology are: *a computer lecture –presentation, video, animation, etc*. All these forms of e-learning tools are effective for teaching. Thus, computer technology used in the learning process, allows presenting training material at several levels simultaneously: verbal, graphic, testing, terminology, etc. The effectiveness of training is enforced due to the possibility of the training level correction: at correct answers the computer technologies provide students with further information and at wrong ones return them to the previous material or give them essential hints [6].

The most significant product of computer technology for the learning process, in our opinion, is the electronic textbook, which formation provides not only the mentioned benefits, but allows rejecting from such teaching aids such as video and audio tape, television, slide projectors, as well as from using and storing wet preparations, plaster casts, stuffed animals, pictures and tables that are inconvenient for training. Modern electronic textbook allows the trainee to use all of these visual aids in a digital format, to store the data in appropriate media and computer memory and to provide the necessary clarity on the computer screen [9]. For example, some studies have shown the possibility of using virtual biological laboratory and computer models in biology [10, 11].

There are examples of other electronic aids in biology for secondary schools that have different goals and objectives, such as "Biology, a Series for Tutor," "Popular Encyclopedia" ("1C" software), "Tutor in Biology ", " Lessons in Biology for the Ninth Grade" ("Cyril and Methodius"), as well as software "Digital Atlas for Schools", "Open Biology", etc.

It is well known that the electronic textbook is an automated training system, which includes didactic, methodical and information and reference materials on the subject, as well as software that allows their comprehensive use for self-learning and knowledge control. Electronic textbook has recently become more popular due to its functionality. The advantage of the electronic textbook is the presence of multimedia, i.e. the rich arsenal of ways to illustrate the studied problem or phenomenon. Multimedia means are interactive in nature; they also improve the quality of training. A system of self-examination of knowledge, the system of intermediate control, compatibility with electronic examination system and the ability to assess the acquired knowledge [12] is also very important for the students. Thus, the main advantage of using e-books is high efficiency of learning, as they include texts of the lessons, a glossary, tests, practical and laboratory classes, visual material: photos, videos and animations.

We have created an electronic textbook for masters studying "Environment and Biodiversity" (author - B.N. Mynbayeva and developer L.B. Rakhimzhanova). It is made as the original electronic textbook which text contains a significant amount of illustrations and hyperlinks. Illustrations are presented by photographs and video fragments that allow clearly demonstrating the biodiversity of various natural zones of the planet. In addition, the tutorial contains the control tests and problems and a glossary for all sections of the textbook. This program has a convenient search engine and provides the ability to print the text with the printer.

This electronic textbook was developed on the basis of didactic principles and was tested in the practice of bachelor programs in the form of a book on "Biogeography of the Basics of Ecology" [13, 14] for almost 5 years. Since 2009, this training material was used in the masters program in "Biology" in teaching the subject named "The Environment and Biological Diversity" [15] in the Russian and Kazakh languages. In the structure of the electronic textbook there are lectures, practice exercises, assignments for homework, tests and a glossary, as well as checklists for self-control and intermediate control.

The lecture material is dedicated to increasing the knowledge in biogeography, the current state of the biodiversity of the planet and Kazakhstan and the development of guidelines for biodiversity conservation.

By creating the electronic textbook we used the proper educational and methodological developments and provided it with the appropriate navigation and rich illustrative material (about 1500 photos and other multimedia). Due to the efforts of the author and developer the electronic textbook has not become a text with images or colorful catalog, as the set goals and objectives were the maximum ease of understanding and memorizing the learning material (and, in the active form).

Another advantage of the electronic textbook should be noted: in the same academic material there is not only a description of animals and plants, but also data on the conditions of their habitat, which allows students to analyze the reasons of reducing the biological diversity of different regions of the world. During training, it was found out that learners actively used this electronic book and found out that its arrangement is the maximum simple: one can easily display the pictures of animals and plants that live in a particular natural area and analyze the conditions of their habitat; the teacher has an opportunity to change the material at his/her discretion and according to the necessity and to monitor the degree of assimilation of the educational material by the learners, as well as the students themselves can actively participate in the process of assessing their knowledge.

Thus, our experience of teaching with the help of computer technologies testified that the formation of students' perceptions of the necessary objects and phenomena under study is subject to a complex application of computer visualization. The use of e-books is of great value in learning or self-education of students.

In the future, we assume to use other computer technologies for teaching other various disciplines of natural sciences (biology, ecology, chemistry and geography): for example, the electronic encyclopedias and software simulators to prepare for the exams, which in addition to the result give explanation and the correct answer, the systems of virtual experiments and the learning games. For the next academic year in cooperation with the Department of Informatics it is planned to develop the electronic textbook on the subject "Cell Biology" in the Kazakh language with video fragments, videos and animations, as using these tools, you can show students the processes and phenomena that are often not available to monitor such as meiosis, mitosis, the synthesis of nucleic acids, the transfer of electrons during respiration, etc. This will help the studetns of magistracy to study the complex biological processes in the cell at the molecular level and their mutual understanding during the discussion of the studied topics.

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