16. *Яковлева О. В.* Исследование возможностей информационных и коммуникационных технологий в формировании коммуникативной компетентности студентов педагогического вуза : дис. ... канд. пед. наук : 13.00.08 / Яковлева Ольга Валерьевна. – СПб., 2007. – 166 с.

Яшанов С. Н. Реализация идей модульного обучения в системе информатической подготовки учителя технологий.

В статье рассмотрены общие подходы относительно реализации идей модульного обучения в системе информатической подготовки учителей технологий в условиях компетентносного подхода. Показаны пути формирования содержательных линий информатической подготовки с учетом межпредметных связей.

Ключевые слова: *информатическая компетентность, модульное обучение, модульное представление учебного материала, модульное построение системы информатической подготовки.*

Yashanov S. N. Realization of ideas of module training in the informational education of technologies teachers in the means of competence approach.

The article examines general approaches to the realization of ideas of module training in the informational education of technologies teachers in the means of competence approach. The ways of forming substantiallines of information study with interdisciplinary connections.

Keywords: *informational competence, module study, presentation of educational material.*

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VIRTUAL OBSERVATORIES AND INTERACTIVE WEBSITES – MODERN TECHNOLOGIES IN EDUCATION

Authors of the article present modern, computer-supported techniques in education. Information technologies help to process large amounts of data efficiently. The importance of modern technologies is in fact to raise students' interest in natural sciences. There are several important projects whose products are complex, virtual observatories, programs or interactive websites. This article focuses specifically on modern technologies in the teaching of astronomy and astrophysics. There are some interesting projects such as European Virtual Observatory project EURO-VO, Aladin and Stellarium programs, or interactive websites of many universities.

INTRODUCTION

Astronomy as a science currently experiences the biggest boom in the field of astrophysics, extragalactic astronomy, and cosmology in particular. It is associated primarily with current progress in the development of observational techniques. The quantity of astronomical data and also methods of their processing have requested a new method of archiving. Therefore, there were created online catalogues and virtual observatories which allow for global access to available astronomical data for researchers, schools as well as the general public. To use these virtual observatories it is necessary to offer a standardized data format as well as a methodological guide for candidates. We know several European projects whose aim is to encourage and make more effective the teaching of natural sciences by means of modern educational technologies – the specially designed programs. Such products can include Aladin and Stellarium programs. The use of the mentioned programs opens new dimensions of knowledge around the world in the teaching of physics. Own journey of knowledge of objective reality becomes a dominant feature. Engaging students in active knowledge with these new programs is implemented by a new attractive form. Learning process organized in this way

motivates students, contributes to the durability of knowledge, and increases clarity of exposition. Furthermore, it demonstrates the application of scientific approach to discover the world around them. It is an opportunity for teachers to familiarize students with real astronomical data and methods for working with them.

VIRTUAL OBSERVATORIES

In recent decades, astronomical observations accumulated large amounts of data from various observations, grouped into catalogues according to the spectral regions, for example Hipparcos, Tycho, Simbad, VizieR. Databases of these data use virtual observatories, which make data available to the scientific community and the public on the Internet. To allow global electronic access to available astronomical data archives and other databases standardized data format and also the techniques of data analysis are required. Such standards are provided by an international alliance IVOA1.

Another aim, on which this alliance focuses, is the coordination in the development of virtual observatories and cooperation between them. The most important virtual observatories in Europe are hosted by EURO-VO2 project. It provides software tools for search, virtualization and data analysis for scientific and educational purposes. The virtual observatory is a great opportunity for teachers in secondary schools and universities to teach astronomy. They can introduce students to real astronomical data and methods for working with them. To extend teaching through virtual observatories it is important to familiarize teachers with the techniques focused on the use of information mediated by virtual observatories that represents a further phase of the European project EURO-VO. Within this phase simple computer products that facilitate the teaching have been developed.

One of the tools for access to the virtual laboratory is Aladin program (developed by the Astronomy centre in Strasbourg, CDS). Another possible approach to the virtual laboratory is a Stellarium browser developed by a committee of the European Southern Observatory (ESO). ESO3 collects data from the most technologically advanced and the largest telescopes of the world and provides data to the general public through professional virtual observatory ESO VO4. Another European project of the virtual observatory is AVO5 (Astrophysical Virtual Observatory). This project is specialized in data processing and demonstration of the results by the technology GRID.

In the USA there is an overarching project NVO[6] (US National Virtual Observatory), which is aimed at processing of data acquired from NASA[7] missions. The product of NVO project is an online virtual telescope NASA SkyView[8].

Summarizing this part of the article we can conclude that there are many different projects of virtual laboratories in the world that are specific especially by an object of investigation of the observatory.

ALADIN

Aladin9 interactive computer program working as a cosmic atlas allows the user to visualize digitized astronomical images, search for data from astronomical catalogues and databases (e.g., Simbad, VizieR) and connect all servers of virtual observatories. In teaching it allows the students to reproduce the astronomical discoveries on the basis of all needed data. It also includes built-in spreadsheet for calculations which other programs lack. In regards to the

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1 http://www.ivoa.net/
2 http://www.euro-vo.org/pub/
3 http://www.eso.org/
4 http://www.eso.org/sci/archive/ESOVO.html
5 http://www.euro-vo.org/avo/
6 http://www.us-vo.org/
7 http://www.nasa.gov/
8 http://skyview.gsfc.nasa.gov/
9 http://aladin.u-strasbg.fr/aladin.gml

complexity of the whole program it is more suitable for astronomy students and academia. The expertise level can be customized in the program settings; one option is to create a specific student profile that depends on the knowledge of the student. Aladin is the basic environment that can run specialized tools of virtual observatories available on the Internet as separate modules, for example, for data visualization and spectral analysis. The first experience with the program's capabilities regarding basic astronomical calculations can be obtained from methodically prepared examples available on the web EURO-VO1

STELLARIUM

Stellarium2 is a computer planetarium that displays a realistic 3D sky as you can see it with the naked eye or binoculars. It contains a number of applications; we will focus on those that are used in teaching. It is based in the Hipparcos catalogue and the basic Stellarium catalogue that contains 600 000 stars. The brightest stars also contain information about parallax, spectral type, as well as about the absolute magnitude. This information makes it particularly suitable for the use in teaching area. In this way it is possible to construct an HR diagram, and also the distribution of the bright stars near the Sun. However, Stellarium offers only data and it does not include a spreadsheet editor for data processing. It is therefore necessary to use a different spreadsheet editor for calculations related to individual tasks. A part of Stellarium is the Messier catalogue in which the graphic representations of objects of the sky are processed. Stellarium allows finding these objects directly in the constellations, which makes it very suitable for amateur sky observation. Every year in spring there takes place a marathon of searching for all 108 objects of the Messier catalogue in their real environment of the northern sky in a single night. Stellarium program allows the future observer to familiarize with these objects in a virtual environment. If he has a telescope guiding the telescope is available directly through the program Stellarium. Applications of equatorial and azimuthal coordinates allow practising the celestial astronomy. There are also realistic orbits of planets together with their moons. This computer program is suitable for the preparation of realistic observations of the night sky. Individual objects (star clusters, galaxies ....) are displayed as 2D images accurately placed in the night sky background. For an explanation of real phenomena in the sky, Stellarium provides additional programs (scripts) that one can download from the Internet or program them himself. Current scripts include illustrations of the Moon and solar eclipses, image of the Earth from other planets, as well as a map of the surface of individual planets. Stellarium is a program with an open source code, which means that everyone can contribute to new version of the program, or new additional scripts.

CELESTIA

Another example of a computer program specialized in simulating the position of objects in real time is a free space simulator Celestia3. Cosmic objects (galaxies, stars, solar system objects) are displayed in 3D space, which is interactively controllable by the mouse. Since it is a simulator, the view is not limited to the views of actual astronomical observations, but is calculated and simulated according to the given position in space and time. The surfaces of cosmic objects (planets, moons, and asteroids) are displayed as sharp images, that can be smoothly zoomed in and rotated. This program has the advantage of the illustrated 3D views of objects, for example, asteroids, which we can rotate in different directions.

INTERACTIVE WEBSITES

Each university has its own portal, where operates the curriculum in interactive form often accompanied by tests and tasks. An interactive website is a simple and effective solution of program availability. Websites may have various degrees of interactivity, from search through

[1] http://wwwas.oats.inaf.it/aidawp5/eng_download.html
[2] http://www.stellarium.org/
[3] http://www.shatters.net/celestia

zoom, rotation, to the simulation, input of parameters and calculation according to entered data. The example for the simulation of the star life may be the Star Life Cycle1 on the website of ASPIRE Lab (University of Utah, USA). This teaching site offers interactive test to check students' knowledge. An interactive atlas of the night sky Sky Atlas2 according to the entered coordinates and time displays the cut of the sky and the given object. The above mentioned Aladin3 program is available on the Internet as an interactive applet. Google Sky4 offers catalogues of objects in the visual, infrared, UV area. Sky image procesor5 allows interactive processing and analyzing of the astronomical images.

CONCLUSION

Virtual observatories create a modern platform for teaching of astronomy through information technologies. Their inclusion in the educational process has an enormous range of options, whether a 2D or 3D graphic display, or accessibility of data sources and their processing. The big advantage of virtual observatories is to allow for the general public to access online the real observational data, which creates a new space for the attractiveness of teaching and new directions to explore the universe. Virtual observatories present a new phase in the archiving and processing data obtained by observing the universe.

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