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USE OF ANIMATIONS IN NATURAL SCIENCE TEACHING

1. Introduction

Introduction and intense development of new digital information and communication tools represented by computer technology and computer networks qualitatively change the ways of our lives and behaviour in many areas. Impact of these technological innovations is seen also in the area of traditional teaching methods which are becoming more effective due to a broader use of the computer systems, their networks and educational multimedia materials. The broad use of new digital information and communication technology is naturally connected with creation and development of new forms of education which are based on a conscious meaningful utilization of various potential possibilities offered by these facilities. And so we are dealing currently with new phenomena in education represented either by notions like *e-learning, blended-learning* or *e-LTR*, one of the newest ones which has been named by its authors as *e-Voluntions* and consists in combination of *e-Learning, e-Teaching* and *e-Research.*

2. Computers in natural science teaching

A common aim of teaching all natural science subjects is to make pupils and students acquainted with relevant ways of exploration and to give them an appropriate amount of knowledge regarding the natural science area. Currently carried out enquiries show, that both scope and quality of the natural science education among the young population are on a significant decline. It is very paradoxical that we are witnesses of this phenomenon just in a period of an information and communication technology rapid development which enables teachers to apply in teaching its vari-

ous potential possibilities: from a possibility to prepare and use various teaching and study materials in an electronic form, through creation of simulations and animations of various processes and phenomena, interactive applets, possibilities of information access through internet and information transfer through data-projectors, to a possibility of a real experiments demonstration by the means of internet.

For Slovak primary and secondary schools a segregated way of natural science teaching is typical. This means that the particular subject matters (physics, chemistry, biology, geography, ecology) are taught separately with a dominant use of explanation methods while in some of the west European countries there is a tradition of integrated teaching natural sciences preferring interactive forms and methods. Using interactive form and method, applications of information and communication technologies in teaching become of a great importance. Zelenický (in: Vadaš 2002) ranks to the main advantages of the use of information and communication technologies in natural science teaching these following ones:

- *visualisation*
  (because it makes easier to imagine the studied process or phenomenon and to cut down time needful to learn the subject matter),
- *simulation*
  (because on the bases of various input data it can create a model of a real process behaviour),
- *interaction student – computer*
  (as one of the most important multimedia features).

Out of question one of the school subjects the students are most afraid about is physics. To develop students' computer literacy does not belong to the aims of physics teaching, it is a content of teaching the subject informatics. In physics computers are not used as the content of education, they are used as a means of education. They are a means with the assistance of which the goals of physics teaching are reached. Nevertheless physical phenomena exploration, measurement of various physical values, recording of physical parameters, processing of the measured experimental data, theoretical calculations and modelling by the means of computers and their peripheral facilities (including various sensors) belong also to the physics teaching aims. Computer simulated models of physical phenomena enable to observe and explore also processes which cannot be carried out in classrooms or school laboratories because of different reasons (safety reasons, high financial cost, inaccessible experimental facilities, very short or very long duration of the experiments or studied phenomena, etc). This group of experiments is known as Java applets or Flash animations.

Applets are interactive java programmes. Animation is usually created through a possibility to move some points, lines or greater graphical shapes. To work with applets in teaching lessons is very easy. In many of them it is enough only to change a cursor position, in others to move various objects - "figures" to their right position using the mouse pointer, or to fill in a correct number. The use of applets and animations directly in teaching and learning processes contributes to students' higher motivation, enhancement of the subject matter attractiveness and to visual accessing of the studied phenomena.

3. Examples of the use of animations in e-courses

A lot of projects carried out in the Institute of Technology of Education at the Faculty of Education, Constantine the Philosopher University in Nitra, are oriented on innovations of the offered forms of education. They are focused mainly on implementation and utilization of interactive applications in teaching and learning processes at various levels of the educational system. Herein we would like to present three of these our results: multimedia course *Geometrical Optics Fundaments*, electronic learning material *Elementary Functions* and electronic study materials *Tree Plot of Analytical Methods*.

Geometrical Optics Fundaments

The multimedial teaching and learning material *Geometrical Optics Fundaments* of the authors A. Hašková– J. Záhorec–D. Klocoková is designed as an electronic course supporting teaching *Selected Chapters from Physics* what is an optional study subject included into a study programme of Technology of Education at Constantine the Philosopher University in Nitra. This course has been created with the intention to enhance visual aspects of geometrical optics teaching, which is a dominant part of the study subject *Selected Chapters from Physics.* It consists of six chapters:

1. Light Theories Development
2. Dualism Wave – Particle
3. Geometrical Optics
4. Optical Tools
5. Optical Curiosities
6. Final Test

from which each has a structure shown on the figure 1.

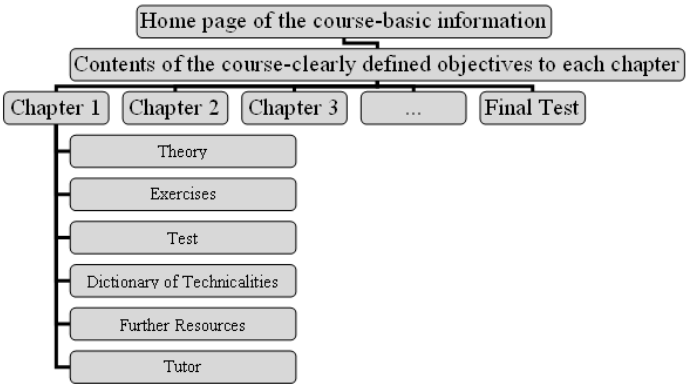

Figure 1: Content structure of the multimedia course Geometrical Optics Fundaments

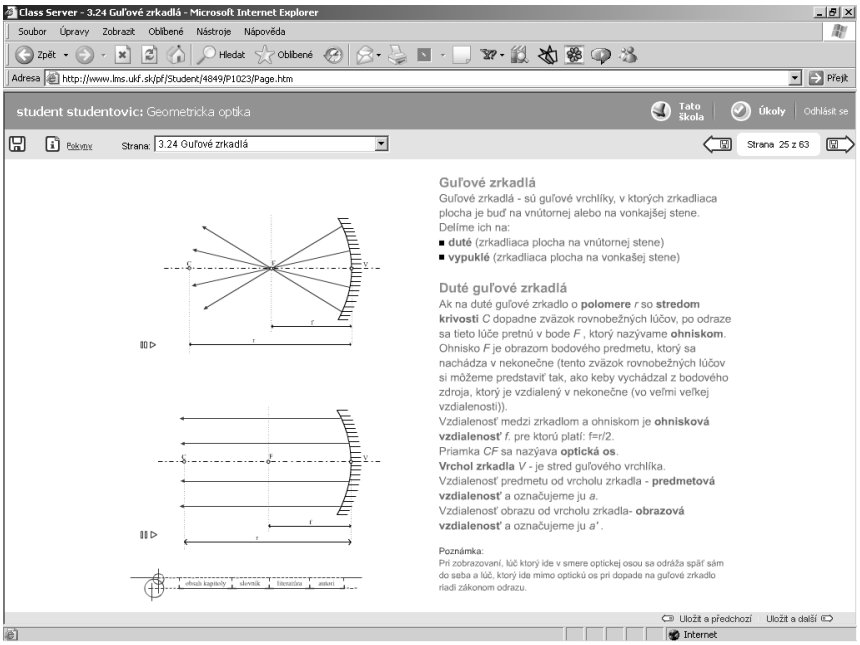

Figure 2: Example of the design of the e-learning course Geometrical Optics Fundaments

The electronic study material is created with the use of blended learning features. Through animations and simulations of various phenomena from geometrical optics (figure 2) the students are given a possibility to obtain a clearer and deeper understanding of the studied processes. Particular parts of the electronic course can be used directly in the teaching process as a supporting teaching material (e.g. within computer assisted instruction) or it can be used by students within their self-study - continuous preparation or exam preparation (e.g. within computer assisted learning). Currently the course is designed in an on-line form, but for the future as well its off-line version is planned. The on-line form of the course is operated in a Microsoft learning management system Class Server 4.0 which enables a comfortable administration of the course also in a distance study form. The study material itself has been developed in the Macromedia Flash MX application environment and consequently it has been implemented into the managing LMS system.

Elementary Functions

The teaching software *Elementary Functions* (D. Klocoková) consists of electronic study materials designed to a study subject *Selected Chapters from Mathematics* of the study programme *Technologies in Education.* This electronic course is designed in two parts. The right side creates a html code (because of the mathematical formulae). In this part one can find partial goals of the course, key words, basic

study texts, reference addresses on additional study text and materials and examples of solved tasks as well as tasks given for solving (in relation to a concrete given function) can be found. The left side is a Flash composition set on discovery and visualisation features.

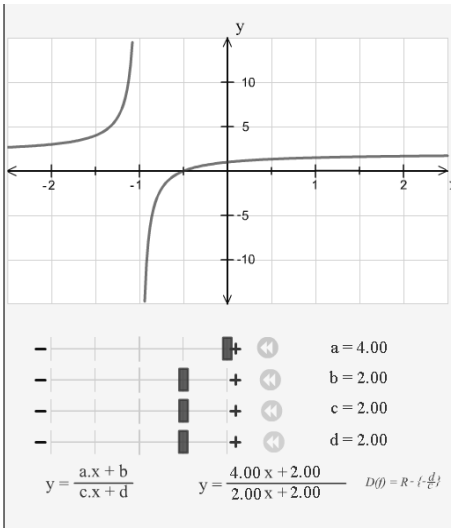

Figure 3: Example of the interactive animation

The animation consists of two parts (figure 3). In the upper part there is located a co-ordinate system where the given function is automatically drawn. In the lower part there is located a numeric axis of the interval from - 4 up to + 4 with an active red rectangle. The red rectangle movement in a positive or negative direction automatically makes a drawing of a new curve. Each numeric axis represents one changing parameter and shows its actual value. At the interactive numeric axes there is visible the given elementary function and next to it there is visible a function with the predetermined parameters.

Tree Plot of Analytical Methods

The learning software *Tree Plot of Analytical Methods* of the author M. Munk is an electronic aid to help a user to specify a suitable analytic method to process e.g. experimental data. It shows all commonly used statistical methods, classified into groups according their character (figure 4). In the basic plot, individual levels have the same frame. Concrete methods (analysis, tests, measures and plots) are shown in one colour. The roots, which classify the methods and help the right method selection, are not colourful highlighted concerning their help function. To simplify the orientation in the plot, it is completed with a tool for finding the desired searched method (*search page, pan and zoom*).

In the plot it is possible to browse in two ways. One way is from the general to the particular (up to down), e.g.: Statistical Methods – Basic Statistics – Tests of Differences between Variables – Tests about Expected Value and their Nonparametric Alternatives – Independent Samples – Two and More Independent Samples – Nonparametric – Kruskal-Wallis's ANOVA. The second way is from the particular to the general (bottom up), e.g. we give into the *search pages* – Sign Test and we find out when and for what kind of conditions we can use it (parametric vs. nonparametric methods, dependent vs. independent samples).

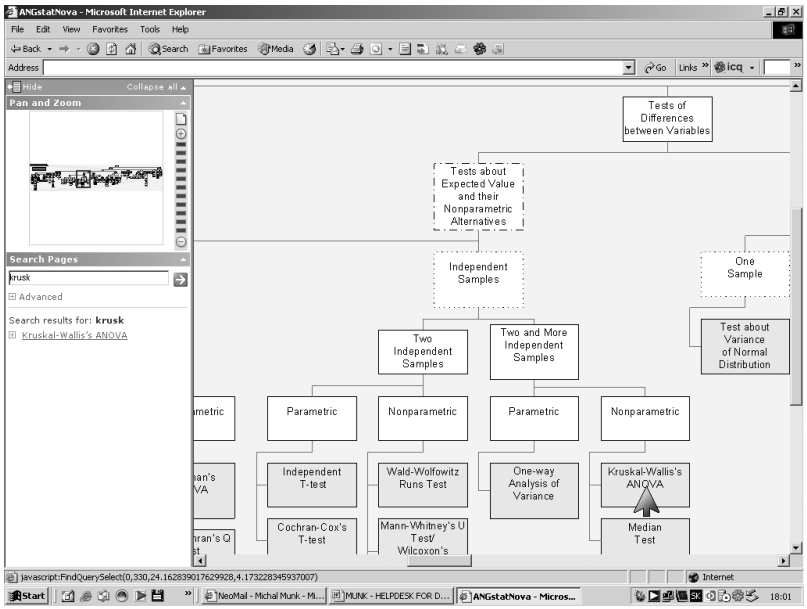

Figure 4 Tree Plot of Analytical Methods

After the selection of the particular method from the plot is done, a description material from the given field is offered to the user. Of course, it was not possible to include all analytical methods in the designed plot content and so only the most often used ones were processed.

Literature

HAŠKOVÁ, A. – ZÁHOREC, J. – KLOCOKOVÁ, D.: Základy geometrickej optiky – Multimediálny učebný materiál k študijnému programu technológia vzdelávania. In: eLearning 2005. Hradec Králové (CZ) : UHK, 2005. ISBN 80-7041-595-9

MUNK, M.: Navigátor spracovania dát. In: eLearning 2004: Zborník. Hradec Králové (CZ) : UHK, 2004

VADAŠ, R.: Informačné a komunikačné technológie a ich miesto na 1. stupni základnej školy. In: Technológia vzdelávania, roč. X, 05/2002, p. 16–17, ISSN 1335-003-X