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## Theory of Creating Projects for Teaching Technical Subjects and Computer Visualization

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## **Theory of Creating Projects for Teaching Technical Subjects and Computer Visualization**

### **Introduction. Basic notions and terms**

**The arrival of computer technology** has offered unprecedented opportunities for the application of computer simulation and animation in the teaching process. It has raised our awareness of the necessity of a new quality platform creation for visualization of objects, processes and phenomena in teaching technical subjects. Our expectation as well as the goal of our research was to prove that the new visualization platform would help increase the effectiveness in the natural and technical subject teaching process.

It is necessary to remind that in all fast-developing scientific branches (such as information technologies) a great deal of dynamics is observed also in their terminology and translation. New and new terms are continuously being coined and introduced or the content of some already existing terms is being changed, stabilized or made more precise. Due to the dynamics of computer terminology the following definition of an applet taken from Wikipedia is only one of several possible definitions [[http://en.wikipedia.org/wiki/Main\\_Page](http://en.wikipedia.org/wiki/Main_Page)].

An applet is a software component that runs in the context of another program, for example a web browser. An applet usually performs a very narrow function that has no independent use. Hence, it is an *application -let*. The term was introduced in AppleScript in 1993. An applet is distinguished from „subroutine” by several features. First, it executes only on the „client” platform environment of a system, as contrasted from „servlet”. As such, an applet provides functionality or performance beyond the default capabilities of its container (the browser). Also, in contrast with a subroutine, certain capabilities are restricted by the container. An applet is written in a language that is different from the scripting or HTML language which invokes it. The applet is written in a compiled language, while the scripting language of the container is an interpreted language, hence the greater performance or functionality of the applet. Unlike a „subroutine”, a complete web component can be implemented as an applet.

This long definition requires to be appended by another short description which characterizes a Java applet from the didactics point of view. In our view an applet is a „small” special monofunctional application programme used for example for interactive animations or calculations made by a client himself without the need of cooperation with a server. Being applied in the pedagogical

process a Java applet enables a teacher to create texts with simulations. Thus, it becomes a tool for creating interactive teaching materials.

## Researcho

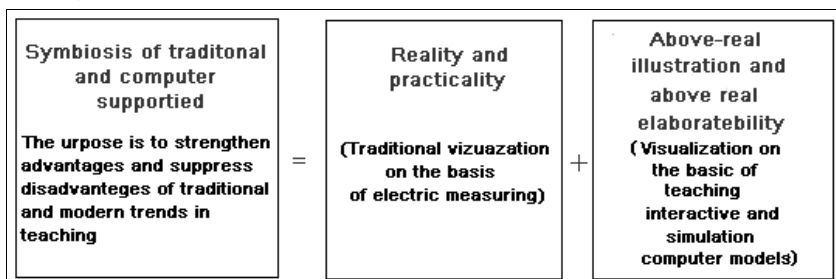
**The main goal** of our research was to create Java applets for improving natural and technical subject teaching. Our objective was not only to **create** an innovative system of teaching natural and technical subject but also to verify it in the conditions of real school.

For this purpose we created over two hundred Java applets in the Java environment. The applets were created, i.e. **the individual static pictures and figures from the traditional printed text books or schemes** included in the instructions for use in **pupils' model construction kits (meccanoes) were animated (or simulated)**. Our final objective was to create a virtual visualization 'appendix' which enlarged the radius of action of traditional printed text book visualization (as well as visualization of instructions how to use pupils' model construction kits and plastics models) and moved it behind its natural borders.

Moreover, on one of the applets we demonstrated the technique of the applet creation and its didactic application. The creation principles, strategies and tactics of the other applets are analogical. In general, the key point of the application of visualization may be articulated as follows: those phenomena, processes and objects that can be visualized in a traditional, it means static way (a picture or a figure in a textbook, a plastic model or other three-dimensional models such as a model construction kit, etc.) are to be visualized traditionally. Those phenomena, processes and objects which go beyond the possibilities of the traditional and conventional ways of visualization are to be visualized by means of Java applets ('enlargement of a hand of knowledge').

On the contrary, the visualization by means of an applet may be improved by a practical and real attribute that is contained in a textbook or a model construction kit but not in an applet.

## Principles, strategy, and tactics of creating visualization platform as applied in teaching natural and technical subjects



**Fig. 1. Scheme of strategy and tactics of creating experimental way of visualization**

„The principled essence” of the difference between experimental and traditional way of visualization of natural processes in our research is that the traditional way of visualization was using „static” techniques of visualization of natural and technical system and the experimental way of visualization was furthermore using „dynamic” techniques of visualization (computer modeling and simulation and their results presented by computer graphics – Fig. 1).

**I. The first pillar of creation:** The basis of the strategy and tactics of the approach to the innovation proposal of the current systems of teaching natural and technical system – and also the main aim of our research – is not to suppress in practice approved and didactically well-elaborated traditional teaching systems and replace them by new ones, quite the contrary, to preserve them and enrich them with new innovative elements. Thus, the objective is to extend the horizons and the operating range of traditional teaching systems beyond their current limits by employing new possibilities, which the traditional system lacks. It is basically a symbiosis of the traditional and innovative teaching systems which eliminates the drawbacks and reinforce the advantages of both types. The new dimensions of the innovative system should be understood as natural contribution of applying the research results to natural, pedagogical, as well as technical sciences; as an innovative necessity applied to reasonable extend and intensity, and not for the sake of innovation (see Fig. 1) or as a radical mass innovation of the traditional teaching system.

**II. The second pillar of creation:** Generally, the aim of creating the NIESVA in teaching natural and technical system to show more than the traditional visualization forms have enabled us (e.g. through construction kit).

**III. The third pillar of creation:** The basic difference between the experimental and the traditional ways of visualization of natural processes (used in our research and specified in the introduction) is that the traditional way of visualization have been using „static” techniques of natural and technical system visualization and the experimental way of visualization have been additionally using „dynamic” visualization techniques (computer modeling and simulation through educational interactive animation and simulation computer models and their results presented by computer graphics).

**IV. The fourth pillar of creation:** As it has already been stated, the purpose of our research is to elaborate a system of teaching natural and technical system (methods, teaching aid, etc.) and a „know how” of its using, which would enable to visualize more illustratively some of the processes running beyond visualization framework which cannot be achieved through the traditional visualization. An interactive graphical computer animation and simulation models of some of the natural and technical system created in the Java environment have been used as a visualization medium for the experimental way of visualization (a model need not be necessarily created in the above-mentioned environment, but any graphically visually object-oriented simulation environment can be used). The models have been didactically transformed by elements of project conception teaching, which should give teaching „its application meaning”.

The visualization base of our innovative experimental teaching system lies in a comparative, cooperative, compensatory, and complementary symbiosis of measuring and computer simulation (alongside with animation) of natural processes running in natural systems, which is subject of teaching. The particular drawbacks of the symbiotic components can not only be eliminated by using the symbiosis, but the visualization possibilities of didactic visualization platforms (measuring on a real model, video-animation, overhead transparency, connection scheme and its description) can be extended.

The innovative experimental system NIESVA was designed to eliminate the above-mentioned drawbacks of the existing (traditional) ways visualization of natural processes for didactic purposes. The experimental way of visualization applied in the NIESVA, enables among other things, to accelerate, decelerate, run the action; this was the drawback of the physical measuring; further, it enables us to interactively enter into the course of visualization process and change the model parameters, which has been the drawback of the video-animation; and finally, the experimental way of visualization is practical and pragmatical and the visualization through computer simulation lacks these features. These NIESVA attributes (including multimediality and the synergic effect of mutual intersection) also extends both quality and quantity dimensions of the degree of didactic visualization demonstrativeness beyond the possibilities of all the above-mentioned traditional forms of visualization. We have been also concerned with the issues of effectiveness of teaching in the NIESVA in comparison with the traditional teaching system (see the section – the experimental research).

## Literature

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## Abstract

The paper reports the aspects related to Java applets creation and their application in teaching natural and technical subjects. The author of the paper also presents the Java applets he himself created and applied in the natural and technical teaching process. At the same time he emphasizes the irreplaceability of didactic and professional mastership of a teacher in the teaching process using Java applet programmes.

**Keywords:** creating projects, computer model, teaching technical subjects.