# ON INCREASING EFFICIENCY IN TEACHING TECHNICAL AND NATURAL SCIENCES BY MEANS OF JAVA APPLETS I (THE PRINCIPLES OF THE RESEARCH)

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***Abstracts:*** *The paper reports the aspects related to Java applets creation and their application in teaching technical and natural subjects. The authors of the paper also present the Java applets he himself created and applied in the natural and technical teaching process. At the same time he emphasises the irreplaceability of didactic and professional mastership of a teacher in the teaching process using Java applet programs.*

***Key words:*** *computer, teaching technical and natural subjects.*

## K ZVYŠOVANIU EFEKTÍVNOSTI VYUČOVANIA TECHNICKÝCH A PRÍRODOVEDNÝCH PREDMETOV POMOCOU APLIKÁCIE JAVA APPLETOV I (PRINCIPÁLNÁ PODSTATA VÝSKUMU)

***Resumé:*** *Príspevok prezentuje výskum základných aspektov tvorby Java appletov a ich možnej aplikácie vo výučbe technických a prírodovedných predmetov. Autori pri tom zároveň prezentujú vlastnú tvorbu appletov, pri ktorej najviac vynikne didaktické i odborné majstrovstvo vyučujúceho.*

***Kľúčové slová:*** *počítač, výučba technických a prírodovedných predmetov.*

### 1. 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].

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 *app*lication -*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 program 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.

## 2 Research Objectives

**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 (mechanoes) 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 realized 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.

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

„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 modelling and simulation and their results presented by computer graphics - Fig. 1).

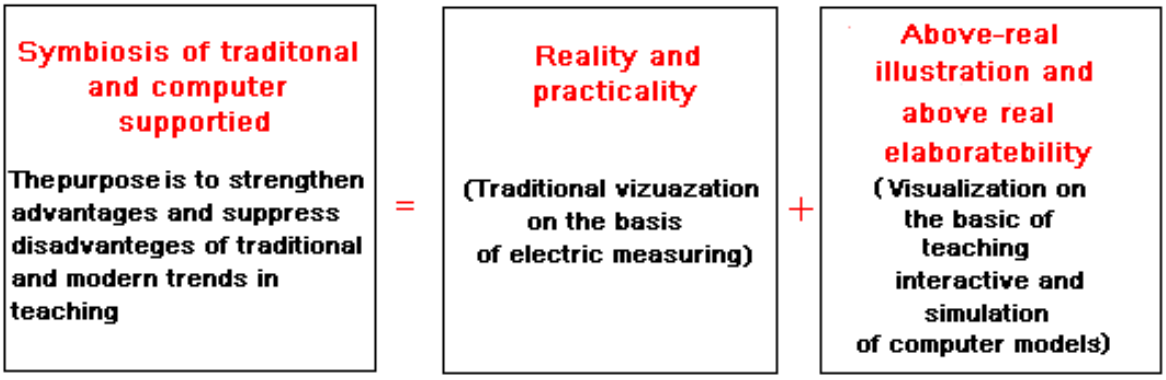



***Fig. 1*** *Scheme of strategy and tactics of creating experimental way of visualization*

## 4 Set of Selected Applets Designed for Thematic Teaching in Technical Subjects

On the contrary, the visualization by means of a computer model may be improved by a practical and real attribute that is contained in a textbook or a model construction kit but not in an computer model. The created collection of computer models was called **Electrical Engineering and Informatics around us in computer models.** In order to strengthen the didactic application of the computer model the names of the individual computer models begin with the words "How does…… operate/function? To be more concrete:

Visualization on other pragmatic **application models** (Selection of core programmes which form the basis of educational package) **using project conception of teaching -** the applets for teaching basic

circuits of residential electrical installation; the applets for teaching automation technology (lift operation control); the applets for teaching transistor technique (automatic garage door openers); the applets for teaching electronic digital systems (electronic digital stop watches, a bicycle electronic tachometer, an electronic advertising eye-catcher, an electronic code lock, an automatic bus ticket machine, automatic control of conveyer operation); the applets for teaching electrical energy generation and distribution from an electric power plant to the consumer, etc.

## 5 Set of Selected Applets Designed for Thematic Teaching in Natural Subjects

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

The created collection of computer models was called : The world of natural and technical sciences (of younger pupils) in computer models (educational models designed for teaching natural sciences, technical work and essentials of ecological education at the first level of primary schools).. In order to strengthen the didactic application of the computer model the names of the individual computer models begin with the words. The individual applets of the packet start with the following words: How does it work/function? or Do you know why/Do you know how…? How does the human body work? Do you know your digestive system? Do you know how it works? Do you know how your heart works? Do you know how the respiratory and circulatory systems work? Do you know how the musculoskeletal system works? Do you know how the nervous system works? Do you know how the endocrine system works? What do you know about human reproduction? How does the reflex arch work? How does the sense of sight work? How does the sense of smell work? How does the sense of touch work? How do we affect the environment? How does the hydrological cycle work? How does the nitrogen cycle in the nature work? How does the nitrogen cycle in the nature work? How does the feeding network in the nature work?

### 5.1 The applets for teaching basic circuits of residential electrical installation

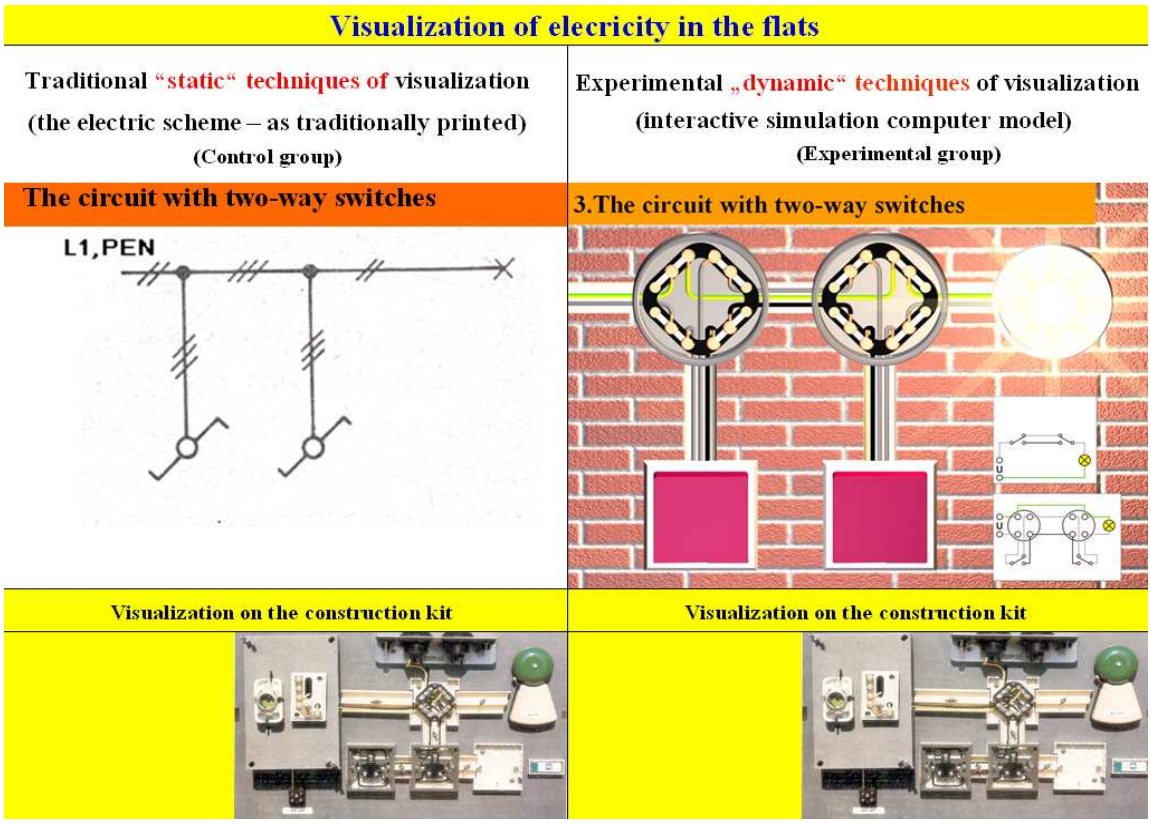



***Fig. 5.1.1:*** *The applet-How does a circuits of electrical installation function? (the outline of the applet creation principles and its application in didactics)*

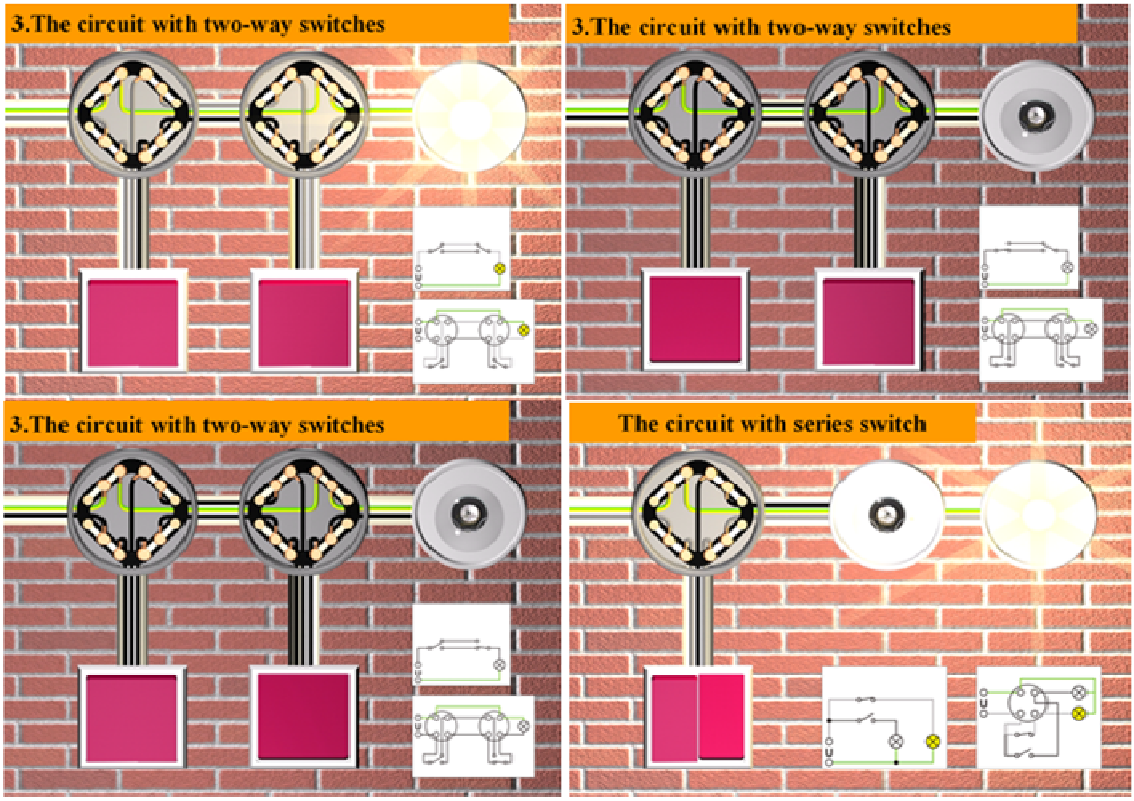



***Fig. 5.1.2:*** *The applet - How does a circuits of electrical installation function?*
*(the selection of the key sequences of the decelerated animation process)*

## 5.2 The applets for teaching automation technology

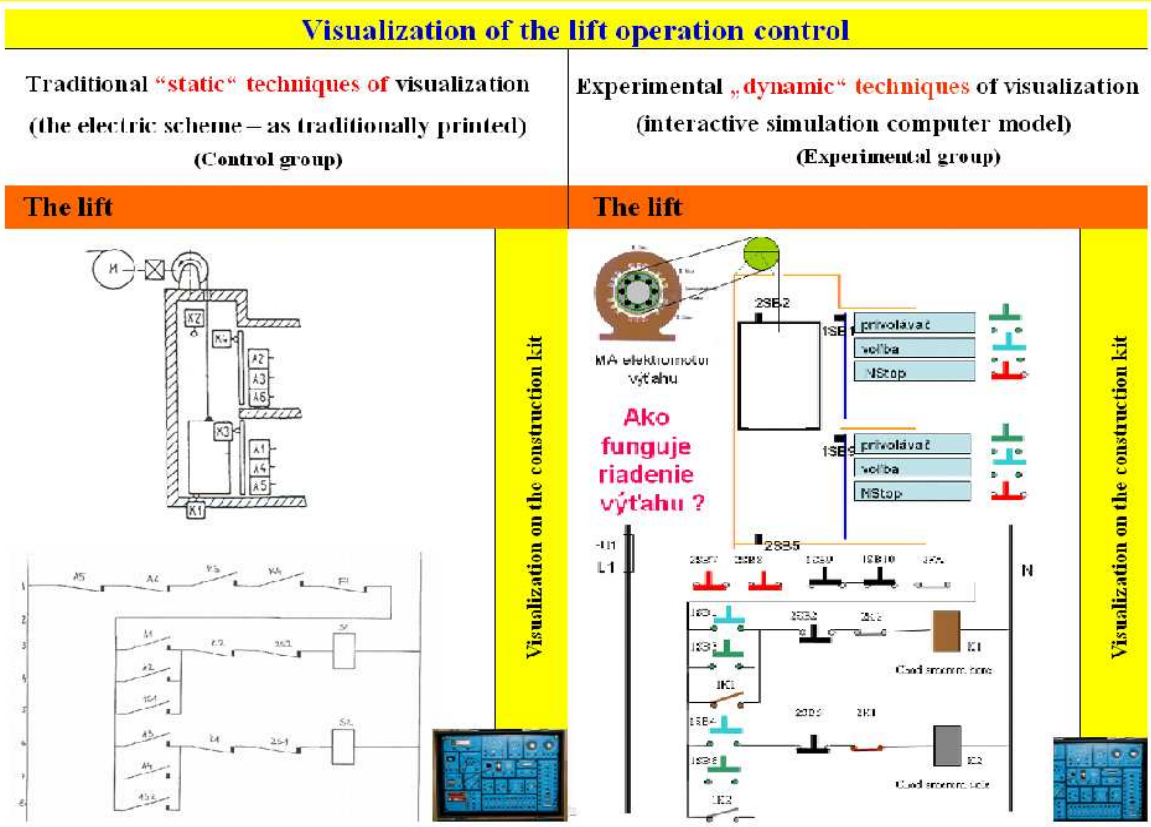



***Fig 5.2.1:*** *The applet - How does a lift operation control function?*
*(the outline of the applet and its application in didactics)*

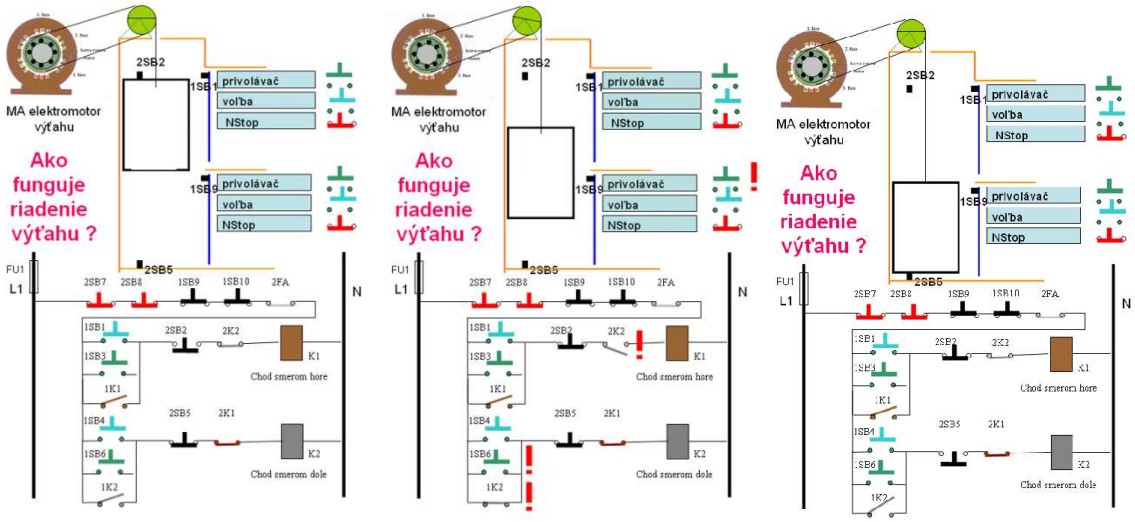
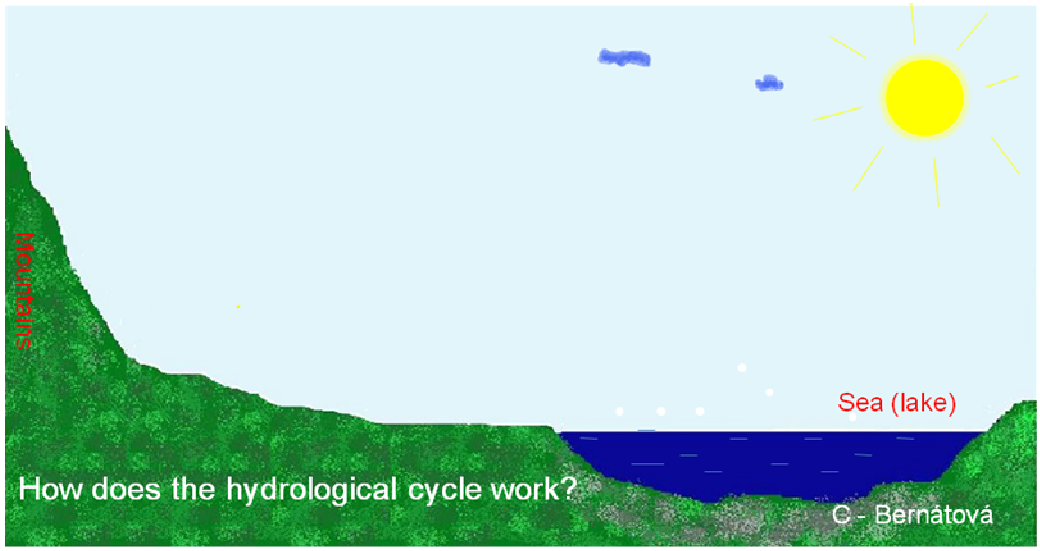
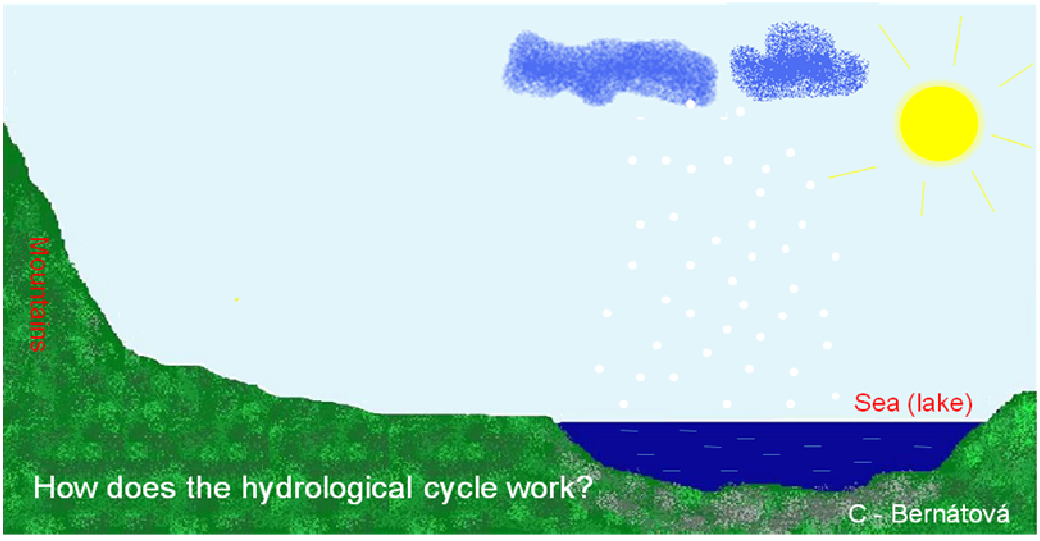



***Fig. 5.2.2:*** *The applet - How does a lift operation control function?*
*(the selection of the key sequences of the decelerated animation process)*

## *5.3 The applets for teaching the hydrological cycle*



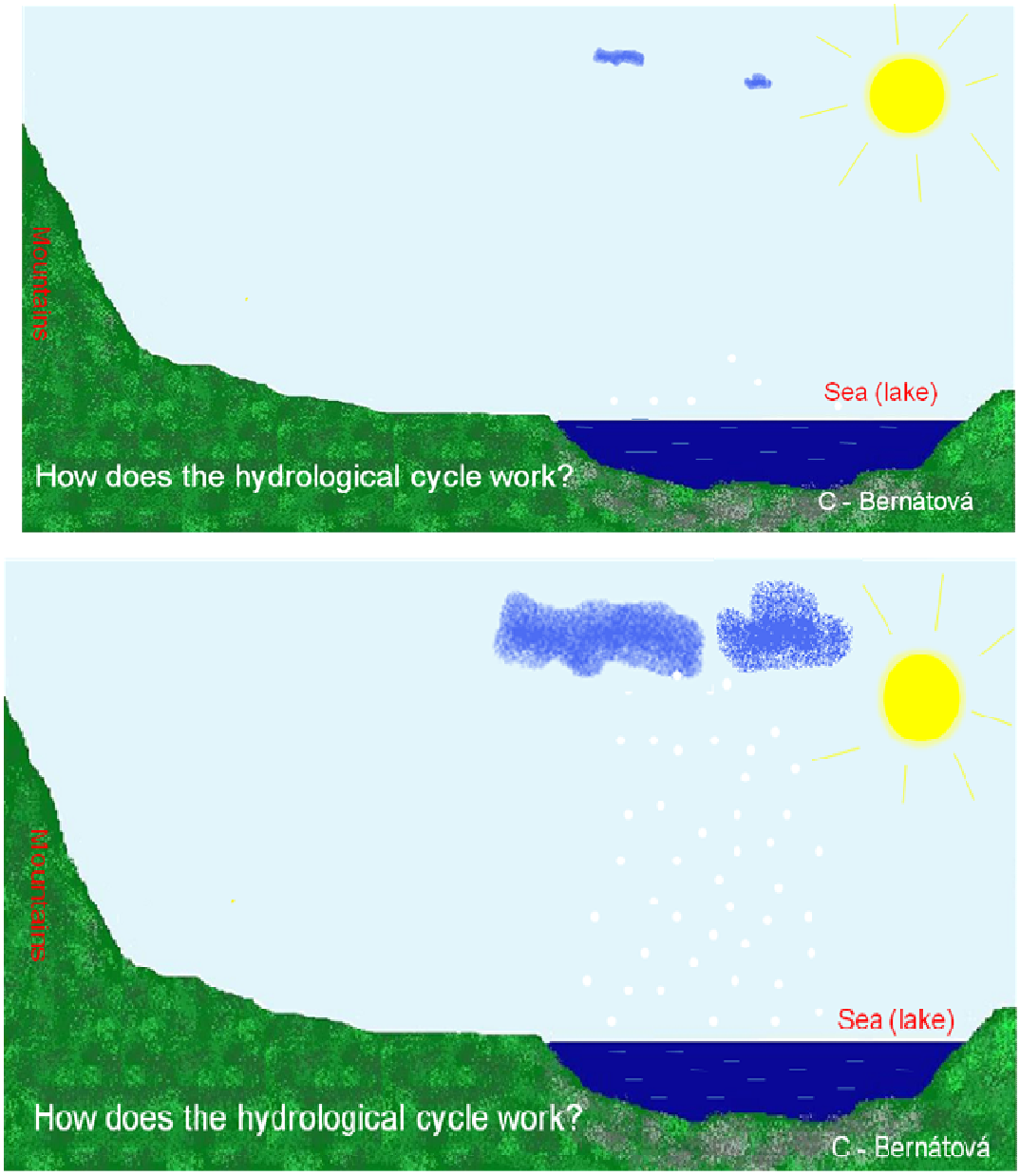



***Fig. 5.3.1*** *The applet - How does the hydrological cycle work?*
*(the selection of the key sequences of the decelerated animation process)*

## Conclusion

The research findings confirmed that the Java applet application in teaching in natural and technical subjects is of great didactic importance. It broadens the horizon of visualization, application, didactic and educational possibilities which cannot be made available by traditional techniques of visualization of objects, processes and phenomena in the teaching process. Using Java applets which would enable us to visualize more illustratively some processes that cannot be visualized through the traditional means of visualization.

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