Electro-technical Kits in Science Didactics and Technology Lessons

K. Radocha, J. Sedivy and S. Hubalovsky

***Abstract*—**The article deals with the place of electronic kits of didactic system of science and technical subjects. Briefly summarizes measurements with the support of computer kit at laboratory measurement or demonstration wiring electrical circuits. Within general and didactics electro-technical kits among didactic material resources. The term "didactic tool" is a very range-wide and rich in content. The default term for this issue. Educational resources are an important didactic categories.

***Keywords*—**Technology, electrical kits, measuring circuits.

I. Introduction

IN particular, pedagogy and didactics in general term funds in the broad sense includes everything leads to meet educational goals. Among the educational resources can sort teaching methods, organizational forms of teaching, didactic principles, intermediate objectives as well as visual and auditory techniques, teaching facilities, teaching aids and others. Teaching resources represent a diverse group. It can be divided into two main groups, namely to [1]:

1. intangible (e.g. teaching methods, organizational forms of teaching, intermediate objectives)

2. material (e.g. teaching aids, teaching techniques, classroom) resources.

Material didactic aids are now an integral part of the curriculum. It is difficult to imagine a teacher, which relies only on his verbal and nonverbal communication. They are also an important aspect of improving teaching effectiveness. Classification of material didactic tools in his work deals with a number of authors such. [2]. Often they are elected by various criteria and approaches. Issues of material didactic resources systematically deals with didactic material resources, which is an important interdisciplinary field that has a relationship with technology, ergonomics, information theory, cybernetics and other related disciplines [3]. The important didactic material resources include teaching aids. Teaching aids are in the Pedagogical dictionary [4] defined as intermediary objects or imitating reality conducive to greater clarity and facilitate learning. They are natural objects or objects imitating a certain degree of abstraction fact that teaching contributes to the creation, deepening and enriching ideas and allow you to create skills in practical activities of students, serve to generalize and learning the laws of natural and social phenomena. Applying the principle of clarity is one of the essential, but not always of well-tried teaching principles. Its importance results from the fact that one obtains 80% of the information visually, 12% of hearing information, tactile information, 5% and 3% other senses. However, in a traditional school, these facts are not respected and the involvement of the senses is as follows: approximately 12% of the information is obtained visually, 80% by hearing, touch 5% and 3% other senses [2].

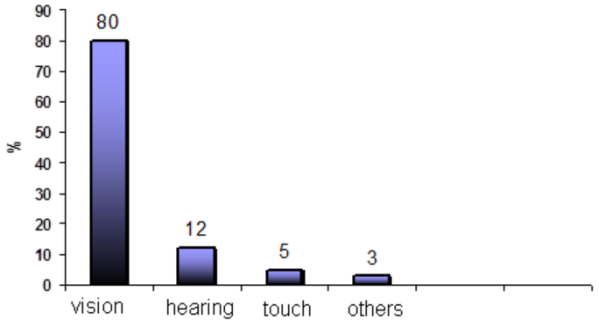

Fig. 1 Share sensory receptors to receive information in a natural situation

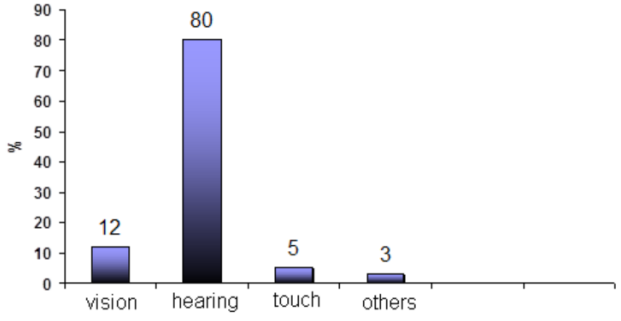

Fig. 2 Share sensory receptors receiving information in a classical school

This article was created under the project called Specific research done at UHK Hradec Králové in 2015.

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There are a plethora of teaching materials for various fields of varying quality, from domestic and foreign manufacturers, makes at different prices and so on. At the same time, schools are already equipped with certain educational tools, but in different quality and quantity. When preparing to teach the teacher has a repertoire of teaching aids to choose consciously and reasonably. What is important is the approach to their use in the classroom. When selecting appropriate teaching aids are recommended to take into account [5]:

First to the goal of teaching,

2. The age and psychological development of students, their previous experience and knowledge,

3. The conditions of implementation (classroom equipment and school) and the experience and skills of teachers.

II. 1 Electrical Kits and Computer

Electrical engineering as a discipline continues to develop unstoppable speed, more can be observed trends, in particular the management, control and regulate electrical systems used computers (e.g. a system-ALLAN BRADLEY designed to automate the management of entire plants). This trend must necessarily respond educational environment at all levels of education, which includes the electrical didactically transformed form is. Through didactic transformation is effectively ensured that the content of education is appropriate to their age and graduate profile [6]. Schools will inevitably come didactically transformed electrical systems, primarily in the form of electrical kits whose leading representatives are electrical kit. Even they recently clear trend in their interconnection with the computer, or the full replacement in simulated form. It is thus possible in parallel to observe electrical kits several different concepts, which can be divided into the following categories (the designation used only as a category 1, 2, etc.):

1. An electric circuit is realized physically, to diagnose the state of the electrical circuit is used analog or digital measuring instruments for which the measured values are displayed as deviations hands or display characters on the alphanumeric display,

2. The electrical circuit is realized physically, to diagnose the state of the electrical circuits used by digital measuring instruments for which the measured values are displayed as display characters on the alphanumeric display and the signal is then transmitted to the evaluation computer

3. The electrical circuit is implemented physically kit is primarily intended for connection to a computer, to diagnose the state of the electrical circuit is used built-in transmitter, the signal is further transmitted to the evaluation computer and to detect the state of the electrical circuits are used simulated measuring instruments, kits can equal which make it possible to control and regulate using a computer,

4. Electrical circuit is implemented on a computer simulated to diagnose the electrical circuits are used simulated measuring instruments,

5. Combined kit already mentioned categories.

With all reported categories can be widely different types of schools to meet, depending on the scope and level of expertise. Especially in the curriculum of electrical engineering is a number of reasons for the application of electronic kits in the educational process, through which it is possible to facilitate the interpretation difficult electrical engineering concepts, phenomena, processes and laws. Concretize abstract theoretical knowledge of electrical objects and easier to describe their main features.

1. Categories

One of the oldest educational media of this type, there are many variants of design. The electrical circuit, which is realized through, physically prepares the immediate handling of the functional elements and units, they may be also encapsulated into different blocks and placed on the support plates, which protect them against damage and facilitate handling. This design measures are appropriately adapted for easier wiring.

The components are placed either fixed (stationary) to the support members, and these are then interconnected via wires or component leads are loosely inserted into releasable contact fields. It is also possible to solder the components fixed to the printed circuit board. Frequently used variant of the aforementioned location of components in different blocks or locations of the supporting plate which are provided with contacts for simple wiring. These kits danger in involving the destruction of both the mechanical nature (release contact cracking plastics etc.), But also electric (destructive effects of short circuit, overvoltage, etc.).

They are produced in both versions of pupils and demonstration. Measuring electrical parameters is performed by analog measuring devices (usually measuring system permanent magnet, electromagnetic or electrodynamic) or digital measuring instruments, which are more attractive for students, working with them is easier, faster, and eliminates a number of errors generated during measurement. Measuring instruments can also be developed specifically for educational applications, or you can use commonly available measuring instruments for electrical engineering practice.

2. Categories

Page design and implementation of these electronic kits is the same as for Category 1. The difference is only in the use of digital measuring instruments, which is a digital signal via an interface (e.g. The RS 232 interface for measuring devices METEX) transferred for further processing to a computer. Data can then be further analyzed numerically and graphically processed and evaluated (see. e.g. time course on the bulb and compact fluorescent lamp). Often the mere addition of older electronic kits such measuring techniques are completely different dimension and their usefulness is greatly increased. Not applicable so manually typing tables, readings and complex engineering the charts. The downside is the disproportionately high cost of such measuring instruments, thus becoming the normal school a few applications available. The advantage of linking electrical kit with the computer's

ability to connect a beamer to project the results of measurements of the entire class.

3. Categories

Electrical kit of this type are characterized in that when working with them include actual physical realization of electronic circuits. Compared to the previous major difference is that the interfaces are some exceptions developed specifically for educational applications. This eliminates the purchase of measuring instruments, as measured values are read only on a computer monitor. Again, the measurement results is possible to process in various ways. The disadvantage is that the student is not able to ascertain the actually used measurement techniques. Appropriately, however, allow a full understanding of electrical concepts, phenomena, processes and laws. In this category it can be included successful kit of RC Didactic Systems μLab [10], which is particularly suitable for vocational high schools and universities. It is also appropriate to connect the computer to a projector.

4. Categories

Nowadays, computers and software products at a level that allows the state to restrict the use of a completely classic "of part" electronic kits in the classroom. Already it offers a range of computer electrical engineering laboratories that allow the simulated form implement various electrical circuits and to study them all phenomena and laws, e.g. in terms of programs Electronics Workbench, Tina Pro and others. There must be no real measuring instruments, as the programs include a variety of multi-meters and oscilloscopes. Component base is wide enough allows the realization difficult electrical circuits. Measurement results can be transferred to other software applications. Indisputable advantage is the price at which you can buy an entire laboratory, in the case of purchases of physical devices would have climbed into the hundreds of thousands of amounts. The question is how much is advantageous education completely eliminate the real components. These electrical lab can also be found at various levels of didactic transformation. See, Edison program for elementary schools and Tina Pro for middle and high school. Through data projector can project the entire course of the implementation of an electrical circuit, including the measurement of electrical quantities. This eliminates the distinction demonstration and student of Electrical kit.

5. Categories

These electrical kits are suitable combinations of the preceding categories. And combine all the advantages of a single integrated unit. Their application in the classroom seems to be for its versatility as advantageous, allowing differentiated forms of implementation of the various electrical circuits, their further analysis and measurement of electrical quantities. New on the market in this category is a multimedia kit Electrical COM3LAB with remarkable design architecture. The kit is comprised of a base, into which are inserted special cards fed and suitably interconnected functional elements and units. The assembly thus formed is connected to a computer with installed software, without which the tool kits is not possible.

Included in the kit is a simulated laboratory for electrical machine, which has similar properties as the above-mentioned programs, for example. Tina Pro. The library contains 20 000 components.

III. School Experimental Tasks with Computer Assisted Teaching Electrical Engineering Subjects

When teaching electrical engineering subjects in connection with a computer in the teaching process to enhance the effects of didactic use different types of teaching aids. They help students to effectively understand and remember the explained phenomena or function of technical equipment. In terms of student mobilization is important manipulation tool which deepens and strengthens the sensory perception. It is necessary to use in the classroom and allow students to work actively with utilities. Now it is very suitable kit RC Didactic Systems μLab.

When lab equipment running RC Didactic Systems μLab will increase the efficiency of laboratory work, students can perfectly acquire a greater amount of knowledge. The system allows for a large proportion of individual active work of students and teachers. Clearness modules leads to virtually one hundred percent successful students in problem solving, which contributes to a peaceful atmosphere in the lab, the teacher or the student is not under stress from an unsuccessful job. This creates the conditions for its own unlimited creativity of students and for the growth of healthy self-esteem. The teacher can fully focus on their core teaching.

Among the advantages of the system include the possibility of differentiated teaching for weaker students on the one hand and talented on the other. The measurement results are so convincing that even weaker students understand the basic principles. System protection and protection of modules allows students to examine larger number of alternative solutions without the risk of collision situations. On the contrary, the variability of talented students to develop their creative skills. [9]

One example of the use of both in laboratory exercises and lectures is an example of the behavior of the circuit for measuring OZ connected as a low-pass 2nd order.

IV. Examples of Use in Laboratory Tests

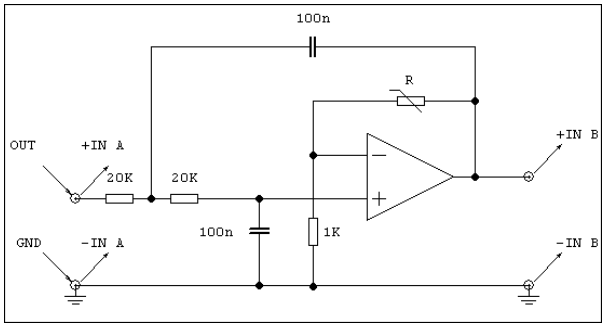

Fig. 3 Circuit diagram for measuring OZ as active lowpass 2nd

order - frequency analysis

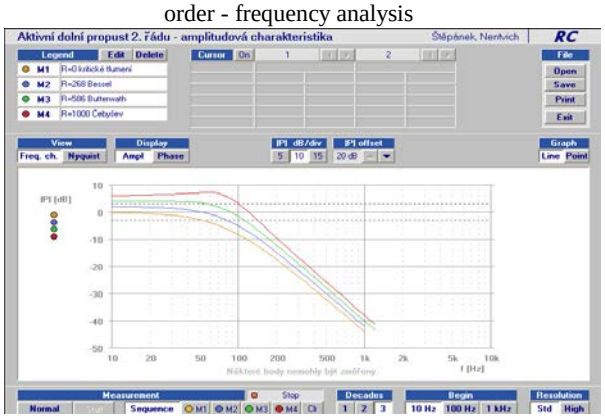

Fig. 4 Measured characteristics lowpass 2nd order - frequency analysis

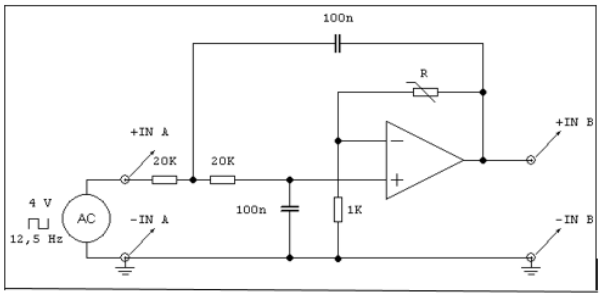

Fig. 5 Circuit diagram for measuring OZ as active lowpass 2nd order - time analysis.

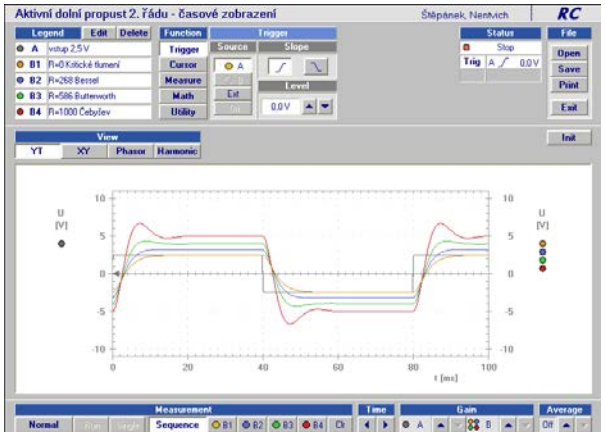

Fig. 6 Measured characteristics lowpass 2nd order - time analysis.

V. Conclusion

The use of computers for electrical applications offers a broad, but still underused options. Interconnection "component sub" electrical kit with the computer can be described as very beneficial for increasing the efficiency of the teaching process, students can acquire new knowledge and skills. From an educational perspective it remains debatable whether fully replace physical electrical kit simulated by computer. Lacks much-needed contact with individual pupil electro-technical components are placed greater demands on abstract thinking and imagination pupil. Very suitable seems to be deploying electronic kits combined into teaching, which integrates the advantages of their categories. Wide range of uses computers are also in the creation of technical documentation.

Acknowledgment

This article was created under the project called Didactic research team led prof. Martin Bilek, Ph.D. by Specific research done at UHK, Faculty of Science, Hradec Králové in 2015.

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