



Received: 21.07.2021

DOI: 10.15584/jetacomps.2021.2.14

Accepted for printing: 18.11.2021

Published: 28.12.2021

License: CC BY-SA 4.0

PETER KOVÁČIK 

Design and Creation of Electronic Teaching Aid for Effectiveness and Attractiveness of Education Increasing

ORCID: 0000-0002-0697-6499, doc. Ing., PhD., DTI University in Dubnica nad Váhom, Department of didactics and special subjects, Slovakia

Abstract

The article analyses requirements of new methods of student education at the level of secondary school with professional electrical and electronic focus. It describes the creation of a new teaching aid that incites fantasy, concentration and motivation to create interesting things by self competence of students oriented to the electrical field of study. At the same time it orientates students towards unconventional ways of thinking and non orthodox solutions. Teaching aid exploits digital form that is attractive for young people with the aspiration to focus the attention of students to study professional knowledge.

Keywords: teaching aid, electronics, digitizing, quality of education

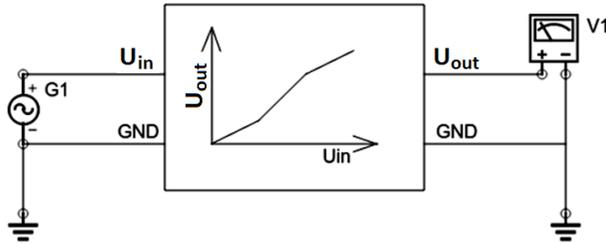
Introduction

At present, digitizing is applied at school accordingly. Standard blackboard and chalk (standard teaching aids) were replaced by interactive boards and data projectors. Thanks to present software of computers, it is possible to join into one presentation: text, pictures, different animations, video and sound that creates more interesting and attractive material for students. Electronic aids replace some standard aids in successive steps.

Students can't physically see many actions in electrical engineering and electronics. This is the reason why it is very important as students create correct ideas about behaviour of studied electronic components. Designed electronic teaching aids are able to simulate characteristics of electronic components and to display characteristics visually by display. Taught topic is then more understandable at the lesson, thanks to this educational aid. On the basis of object teaching, it is possible to visualise characteristics of electronic components to students, to allow better understanding and to help for knowledge using in practice.

The requirement of unconventional, attractive solution

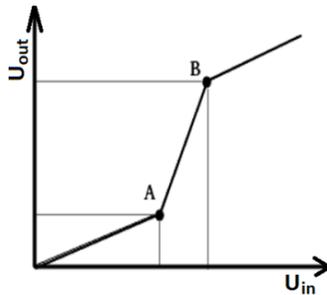
Basic aim of designed teaching aid is to create such an electronic instrument that is able, at arbitrary part of its transfer characteristics, to change its amplification – that means profile of volt – ampere characteristics. The purpose is to create such an instrument that transforms input voltage to output voltage by transfer characteristics created by author (Picture 1).



Picture 1. Principle of designed electronic teaching aid

The instrument changes input signal to output signal by transfer characteristics. Output signal is conveyed into measuring instrument V1 – imaging display. The instrument is possible to create by two principles: analogue and digital. Each of these principles has its advantages and disadvantages.

Analogue principle is usually realized by computing amplifiers. Signal is transferred from input to output nearly without time delay and without massive distortion – what is the advantage. The disadvantage is the relatively complex and extensive scheme, limited number of points on transfer characteristics where profile of characteristics is changed (Picture 2).

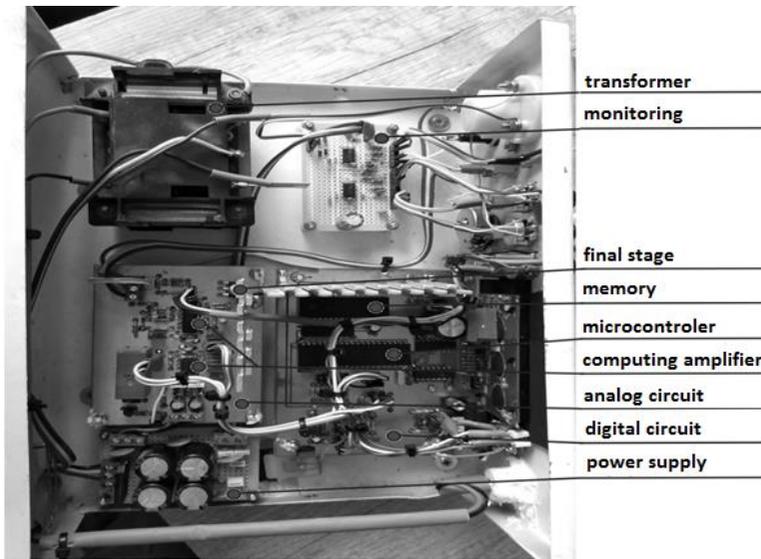


Picture 2. The principle of transfer characteristics profile design for teaching aid

Digital teaching aid changes analogue input signal to digital. Digital signal is changed by characteristics saved in memory of teaching aid to adequate value. Obtained digital output value is consequently changed to analogue form by digital analogue converter.

A digitizing has its disadvantages: Analogue signal has to be sampled. Each sample has to have determined its corresponding numerical value (quantization) by its analogue amplitude. Non linear distortion and time delay is originated by these processes and is corresponding to the terms of separate activities (transfer of data between converter and microprocessor, time of conversion at analogue-digital and digital-analogue converter, time of microcontroller activity). The digital teaching aid has a big advantage on the other hand – transfer characteristic is possible to create by requirement, without any restrictions. A restriction by number of points on transfer characteristics does not exist, as it is at analogue principle.

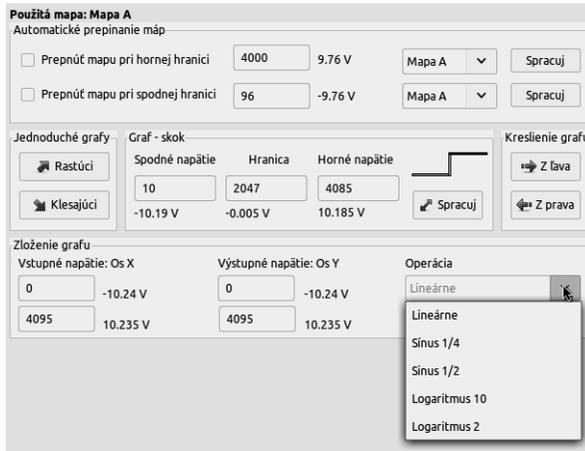
The decision of device creation resulted into the digital principle, from the point of view of actual but mainly future trends. Dominant occasion was – non limited possibilities of transfer characteristics profile creation by principle shown in Picture 2. The teaching aid was designed in the form of modules to take lucidity for students (main transformer, power source, analogue-digital and digital-analogue converter, microcontroller, display) shown in Picture 3.



Picture 3. Designed electronic instrument as teaching aid

The transfer characteristic is created by software to take general purpose, as it was mentioned. Advantage is also the possibility to use software and program language used at lessons at school – students are allowed to create transform characteristics by job or by their requirements. Thereafter, students can verify the product of their knowledge and accuracy of their work by teaching aid. It faces an increase in students’ creativity including an emphasis on the preciseness

The environment, that makes it possible to create characteristics more quickly and comfortably, was created for simplification of student activity and for approaching to equipment of higher programming languages (Picture 7).



Picture 7. Environment for comfortable design of characteristics

Designed teaching aid makes it possible to motivate students towards activity at taught subjects at which teaching aid is used. Its potentialities are much larger and depend on creativity of educated students as well as mastery of an educator. An educator should continuously incite fantasy and creativity of students during education of electronic and informatics subjects.

Conclusion

The article describes the design of teaching aids that uses digital concepts of characteristics creation, for example of electronic components. Teaching aid forms possibilities to apply the innovative potential of students during the educational process and to obtain professional knowledge at school or after-school activity. Teaching aid provides the possibility to study deeply and to evolve knowledge in the studied sphere of electronics and informatics.

References

- <http://ww1.microchip.com/downloads/en/devicedoc/doc2512.pdf> (9.07.2021).
<http://ww1.microchip.com/downloads/en/devicedoc/21897b.pdf> (8.07.2021).
<http://pdf.masters.com.pl/RAYSTAR/RG12864B-BIW-V.pdf> (5. 07.2021).
<http://www.ti.com/lit/ds/symlink/cd54hc164.pdf> (14.07.2021).
 Novák, D., Valent, T. (2014). Simulačné programy ako náhrada elektrotechnických stavebníc vo výučbe techniky na základných školách. *Acta universitatis Matthiae Belli*, 14.
 Turek, I. (2008). *Didaktika*. Bratislava: Iura Edition.
 Višňovský, V. (2020). *Design of teaching tool for electronics* [Bachelor's Thesis]. DTI University.