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Instruction Videos for Psychomotor Skills Development

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Abstract

The paper responds to the unsatisfactory situation in teaching technical subjects. The paper provides methodology for making instructional videos as one of e-components of the developing multimedia educational aid (MEA). The MEA was intended to develop students' psychomotor skills. In assessment and evaluation of the results achieved by natural pedagogical experiment, we followed Simpson's taxonomy. The author presents the opinion that with an assistance of didactically processed multimedia elements, taking into account the specific features of the content, the information and motivational functions, exposure capacity, formative-systematized, repetitive-fixing, control-examinable and diagnostic-didactic functions can be provided. Empirically, based on investigation, she proves that in the case of appropriate processing of such a tool, its implementation in the educational process will facilitate the transition from theory to practice, and support the self-study process.

Keywords:
Multimedia educational aid (MEA)
Instruction video
Lighting circuits
Psychomotor skills

1 Introduction

Unsatisfactory situation in the teaching of technical subjects in Slovakia and the lack of interest of students in studying technical and scientific fields has been widely published (Švorcová, 2011; Ondrejkovič, 2010; Kozík, Škodová, 2008). This situation gave rise to a search and application of innovative forms and methods of education, modernizing and increasing the efficiency of the educational process, using multimedia and e-learning elements.

Method of teaching and presentation of the subject matter has a significant impact not only on the motivation and interest of students in technical and scientific disciplines, but also on knowledge and skills. Unfortunately, at schools we are still faced the one-way transmission of information from teacher to pupil, mostly in a form of oral presentation without illustrative examples, without creative and practice-oriented approach. It is well known that the quality of education is influenced by educational aids used in educational process. It is important that these are provided in sufficient quantities and required quality, and that teachers and students have access to such aids. Disunity of equipping schools is a significant problem because of which it is not possible to provide education in an equal quality.

Despite the fact that in Slovakia and abroad several studies aimed at determining the impact of multimedia on pupils' knowledge were carried out, no research was aimed at detecting the changes in knowledge and psychomotor skills influenced by such a tool as the Multimedia Educational Aid (MEA), that has been designed and developed at our workplace, is. The research aimed at tracking psychomotor skills we met only occasionally. The most elaborate results are provided by Bajtoš (2005, 2003), who studied the changes in psychomotor skills of pupils under the influence of using a variety of practical tasks and real (material) aids. We have not met any research that would survey an impact on psychomotor skills of students through a combination of multimedia and practical work.

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We have facilitated the tackling of this problem comprehensively, and draw our attention at design and verification of methodology of MEA with elements of e-learning. After designing and developing of MEA, the main objective was its inclusion in the educational process and verifying its impact on students' cognitive knowledge and psychomotor skills with an emphasis on achieving greater clarity of abstract concepts, increasing the interest and active approach of students in the subject.

2 Materials and methods

2.1 Multimedia educational aid (MEA)

MEA covers the subject area of residential wiring, reflects the pedagogical-didactic patterns, meets the requirements for a teaching tool and includes the multimedia and e-learning elements that were combined and formed so that the pupils would achieve the expected results as efficiently as possible. The requirements for the learners' competences were specified according to the State Education Programme (ISCED 3A and 3C) for a group of study fields 26 – Electricity in relation to the content focus of MEA.
The aid can be characterized as a complex, interactive and graphically friendly learning hypermedium with suggestions, ideas and tasks that the teachers can use, combine and partially modify according to their needs. Its content and form are designed to support a positive attitude of learners to the issue and to the subject itself, and the teacher could act in the role of facilitator. The MEA content can be briefly defined as follows:

- content of teaching material in the form of text and static imaging system – about 135 pages,
- fourteen interactive photo galleries (14 galleries = about 600 images),
- didactic PC Pexeso Memory Match Game of pairs with electricity content,
- four animations illustrating the operation of the breaker in the circuit,
- eight instructional videos of the socket and lighting circuits installation,
- seven interactive descriptive animations of sockets and switches,
- interactive 3D home visualization of lighting circuits,
- proposals for practical activities (designed with respect to the low cost and simple organization),
- thirteen interactive tests (13 tests = about 270 questions) (Jurinová, 2013).

Fig. 1: Scheme of multimedia educational aid

2.2 Methodology for the development of instructional videos and related parts

One of the issue within the processed unit, residential wiring, is the lighting circuits. Technical terminology that students need in this area is difficult for imagination and requires from them a great deal of abstraction. For this reason, there was created an interactive application (Jurinová, Ölvecký, 2012) that in an interactive way explains principles and regularities of lighting circuits in the home. The application offers a subject matter processing, so that the acquiring technical terminology and regularities, that in a concise form are the part of the application itself, are conveniently visualized by means of visual material and interactive animations. At the same time, it allows students to experiment with them. Theoretical bases are wider developed in hypermedium itself, part of which is the application. Theory classifies the various ways of connection of lighting. We pay attention to those most commonly used in practice:

- Wiring scheme No. 1 = switching of one lighting circuit using a single-pole switch
- Wiring scheme No. 5 = switching of two lighting circuits from one place using a serial switch
- Wiring scheme No. 6 = switching of one lighting circuit from two different locations using 2-way switch

- Wiring scheme No. 7 = switching of one lighting circuit independently from three different places using two 2-way switches and one crossbar switch
- Wiring scheme No. 6-5b-6 = switching of two lighting circuits from three different places by using two, 2-way switches and one double-intermediate switch.
- Wiring scheme No. 5b-5b = switching of two lighting circuits from two different places using two double intermediate switches

For each individual connection, the necessary theoretical apparatus is elaborated. It illustrates the way of particular connection, giving practical examples of application in practice. Schematic symbols and a real visual display of the switches are part of the interactive tool, so that pupils would be able to identify the correct switch described in the relevant wiring diagram. For all types of application, descriptive interactive applications are processed. Their aim is to describe the individual parts as a preparation for practical and seamless activities of students (see Fig. 2). At the same time, for each connection type, the functional circuit connection scheme, loop wiring diagram and installation plan of connection are processed. They provide students sufficient theoretical basis be able to carry out the connection tasks in practice (see Fig. 3).

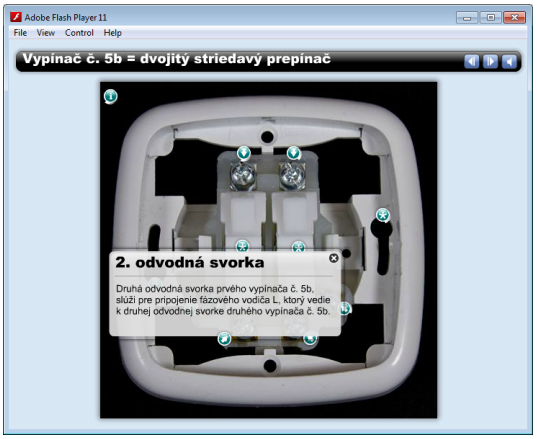

Fig. 2: An illustration of descriptive interactive application for the switch No. 5b = double intermediate switch

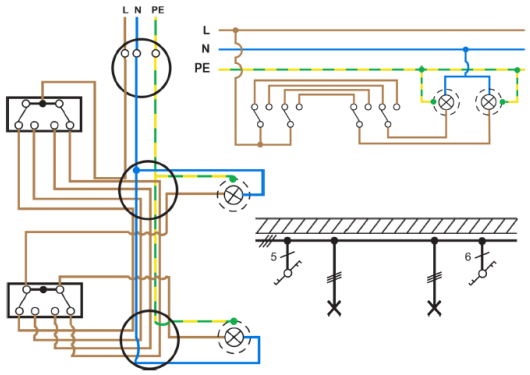

Fig. 3: Installation plan and a functional circuit diagram for wiring type No. 5b-5b

The implementation of practical connection either under the scheme, or based on own knowledge on a given connection, however, presupposes acquiring additional knowledge and skills. For this reason, we designed and processed instructional videos that illustrate in a vivid descriptive manner the individual activities necessary for the implementation of circuitry connections. Since we did not have available panel, which could illustrate the type of connection, we created a simple inexpensive device that simulates individual zones for conductor lines. This can serve as an inspiration for those schools that do not have sufficient technology equipment. The teaching aid may be a result of students' activity within their vocational training. An instructional video is also accompanied by an audio recording, which apart from commenting on individual activities, also interconnects theoretical facts with practical training. Each video begins with an introduction of necessary working tools, and connecting and wiring material. The aim is to build up skills for preparing the working environment and the necessary tool accessories as well as acquiring the appropriate technical terminology. Subsequently, a part of the video is also circuit diagram according to which the connection is carried out - this is illustrated throughout the length of the circuitry connection to allow a student to follow the interdependence of the process with plotted scheme. Subsequently, the process of circuitry connection is recorded in detail, along with the test the functionality of the connection. In case that the more detailed image is needed, the tool provides this possibility to ensure that every student, regardless of the training room arrangement, may track the entire process without any limits. This eliminates also frustration of failure, which is often actually caused by the fact that student could not see object examples demonstrated by the teacher, or the teacher must repeat this several times for smaller groups and whenever a student cannot proceed. We consider it an evidence of major inefficiency - leading to unnecessary time losses and inefficient use of the teachers' potential. Through this type of videos, we can easily minimize the lacks.

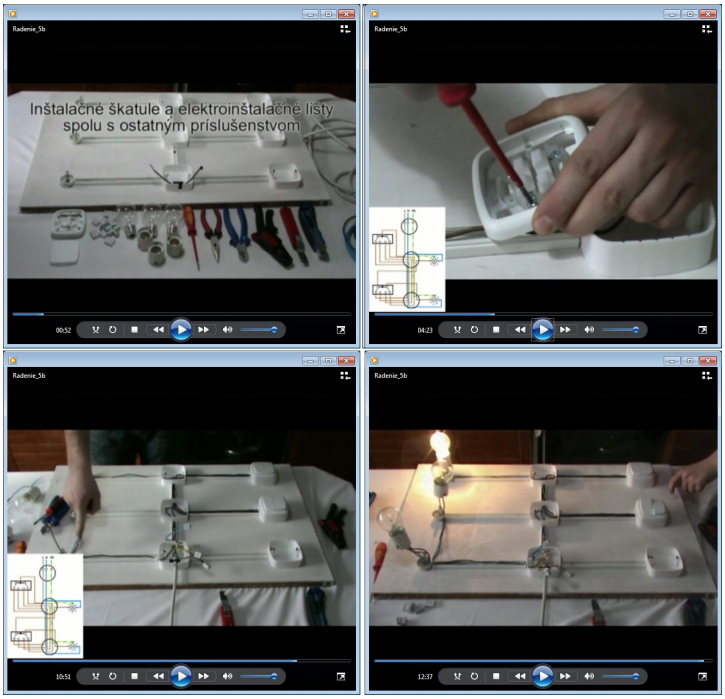

Fig. 4: Sequence of selected images from the instructional video

3 Result and discussion

We did not assume that introducing multimedia and elements of e-learning in the educational process will cause significant changes in the quality of education. However, we assumed that designing of MEA and its application in the educational process will open the time frame for implementation practical activities, what besides the current, mostly theory-oriented training, will strengthen the quality of vocational training. Combination of the advantages of multimedia and e-elements with practical activities and the direct interaction of teacher and classmates, who are the source of many other stimuli facilitating learning and acquisition of the required skills, with the use of methodologically and professionally designed MEA appeared to be a suitable way of success.

Because of the results of many domestic and foreign researches verifying that positive influence of multimedia on students' motivation, we did not investigate this idea and we focused on determining the impact of multimedia on the knowledge and psychomotor skills of pupils. In this paper, we pay attention only to psychomotor skills. To verify the psychomotor skills of students we used Simpson's taxonomy of educational objectives, which comprises seven levels. We statistically verified results only for the first and fifth level of significance. The second level of significance was excluded due to the substantial subjectivity of its assessment. In the case of verification of the third level of significance, we would have to examine this level throughout the experiment - during lessons, in which an acquisition of these skills occurred as described above. This is time consuming and very difficult to organize for one person, but we plan to deal with it in the future. In case of positive evaluation in verifying the fifth level of significance, which represents a comprehensive automatic operation, the fourth level of significance can be considered fulfilled.

Assuming that the psychomotor skills of pupils are related to the used teaching methods, organizational forms and teaching resources, we formulated the main hypothesis as follows:

H1: We assume that pupils of experimental groups, in which teaching takes place using the MEA, at the end of the experimental teaching in solving practical tasks will achieve better results in psychomotor area of selected themes than students in the control groups taught in a traditional way (without application of MEA).

To verify this hypothesis, on basis of the Simpson taxonomy of educational objectives, we formulated two hypotheses:

H1.1: At solving practical output tasks focused on the sensory perception, students in the experimental group will achieve better results than the students of in the control group.

H1.2: At solving practical output tasks focused on the complex overt responses, students in the experimental group will achieve better results than the students of in the control group.

To verify the validity of the research hypotheses, we used the following research methods:

- natural pedagogical experiment,
- an output non-standardized norm-referenced (distinctive) didactic test,
- analysis of the products of practical activities with the use of assessment sheets for analysis of the outputs produced by students during testing. The use of this research tool expected:
    - definition of the observed categories,
    - elaboration of practical tasks that are part of the output non-standardized norm-referenced didactic test,
    - compiling evaluation sheet of outputs produced by pupils based on the performance of practical tasks according to the assignment,
    - students outputs evaluation directly after testing,
- statistical methods of the research results processing.

By the statistical verification of the hypothesis H1.1 H1.2 we verified statistical significance in both monitored areas in favour of the students in experimental group. We expected the validity of hypothesis H1 in the case, that at least one of the working hypotheses is confirmed. Both hypotheses were confirmed, and therefore we consider the hypothesis H1 valid. We can therefore conclude that the use of MEA positively influenced the psychomotor skills of students. More detailed results of the research, as well as the course and organization of the research will be published in another paper.

4 Conclusion

In general, the development of MEA and e-learning courses is time consuming and professionally very difficult. When creating this type of material, the author must possess a range of knowledge and competences in the didactic, educational, professional, legal field , be a developer, programmer, master ICT and multimedia processing, etc. We believe that similar devices should be created and made available to all schools in a centralized, specialized institutions or specialized departments. It is difficult to expect that teachers will create it in their spare time. We assume that the positive results of our research will contribute to the resolution of the current situation, and thus will open the way to effective teaching of certain thematic sections of the course of "technology".

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References

Bajtoš, J. (2003). Teória a prax didaktiky. 1. vyd. Žilina : Žilinská univerzita. 384 str. ISBN 80-8070-130-X.
Bajtoš, J. (2005). Návrh taxonómie cieľov vyučovania pre rozvoj psychomotorickej zložky osobnosti žiaka v technickej výchove. In: *InEduTech 2005 : Inovácie v edukácii technických odborných predmetov*. [online]. Prešov: Prešovská univerzita v Prešove. [cit. 2014-10-9]. Available on: <http://www.fhpv.unipo.sk/ktechv/inedutech2005/prispevky/02.pdf>.
Jurinová, J. (2013). *Bytová elektroinštalácia v kocke*. [elektronický zdroj]. Bratislava : Qintec s.r.o. ISBN 978-80-89574-01-8.
Jurinová, J., Ölvecký, M. (2012). Visualization of lighting circuits in the home. In: *Advances in Computer Science* : Proceedings of the 6th WSEAS European Computing Conference (ECC ´12) : Prague : WSEAS Press. s. 67-70. ISBN 978-1-61804-126-5. ISSN 1790-5109.
Kozík, T., Škodová, M. (2008). Školská reforma z pohľadu technického vzdelávania. In: *Technické vzdelávanie ako súčasť všeobecného vzdelávania*. Banská Bystrica : Katedra techniky a technológií, FPV, Univerzita Mateja Bela. 382 str. ISBN 978-80-8083-721-1.
Ondejkovič, A. (2010). Príčiny nezáujmu absolventov základných škôl o učebné a študijné odbory technického zamerania v súvislosti s vyučovaním predmetu technika. In: *Technológia vzdelávania*. ISSN 1338-1202. Nitra : Vol 18 No 2, 2010. s. 16-18.
Turek, I. (1997). *Zvyšovanie efektívnosti vyučovania*. 1. vydanie. Bratislava : Metodické centrum. 316 s. ISBN 80-88796-79-0.
Švorcová, P. (2011). Digitálne vzdelávanie – zatiaľ s otáznikmi. [online]. [cit. 2014-09-06]. Available on: <http://profit.etrend.sk/kariera/digitalne-vzdelavanie-s-otaznikmi.html>.