Electric Current – Knowledge and Skills – Conclusions from Research

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Abstract

The electric current is a part of physics very difficult to understand by pupils in secondary school. We prepared investigation in this field and we tried to found some results to improve knowledge and skills of pupils. Knowledge and skills of lower classes of secondary school pupils are given in the results of investigations. The further investigations were carried out on the pupils of the two types of teaching/learning processes. The first type of learning process was realised without computers and the second one with computers. The same questions were given to the pupils of these different types. Paper concludes the comparison of results of both testing groups.

Introduction

In recent years pupils of the Faculty of Science at the University of Ostrava have carried out investigations as a part of the final assessments, through applying didactic tests. The goal of my research was to determine the long term knowledge and skills of primary schools pupils in the field of electricity in their physics education and to compare their standard with the standard of pupils from the lower classes in secondary schools.

1 Results of investigation in lower classes of secondary school

From the specific conclusions of the research it is possible to say that pupils, whose received higher grades in physics in their previous school year, have a stronger personal comprehension of the subject matter, than those who had received lower grades. The level of comprehension of basic physical concepts doesn't change significantly with pupil's age. Nevertheless, the pupils of the lower classes at secondary schools have a higher degree of the comprehension, knowledge and skills in physics education than primary school pupils. The last conclusion is that there is no significant difference in the level of the comprehension of physics between male and female pupils.

The concept of "electric current" was tested from the point of view how is understood by pupils. The sample of pupils consisted of 272 respondents at three different schools (to be more specific, they were two primary schools and one eight-years secondary school – age from about 15). The statistic evaluations of the outcome of all variations of the didactic tests were done. The average of successful answers was 50,80 %. This result is very good if we consider that the level of **long term** standard of knowledge was determined.

In spite of the results mentioned above, that point to some considerable deficiencies in the long term knowledge and skills of the pupils in the learning of electricity that were or should be explained in physics education in previous school year. We are going to try to explain the main reasons of the appearance of these deficiencies together with the suggestions how to prevent these in the future.

Firstly, it can be caused by the choosing of the textbook that can be unsuitable pupils. The main functions of good textbook are: the information source for learning of pupils and for controlling of pupils' learning.

Than we have to bare in mind that it is impossible to explain all the topics according to our syllabus in the current curriculum. We think that the situation can be solved by the accepting of increasing number of physics lessons in the school year.

Another possible reason for miss understanding of concept of electric current in pupils' minds can be wrong or imperfect structure of the topics explained. The result is not the structured knowledge of electric current with creation of the necessary relations and structure units. The pupils than understand concept of electric current as the file of isolated facts, laws and definitions without the logic system of the interrelated laws cannot understand this concept. We think that the good model of the teaching/learning structure can be, for example, our Concept Mapping.

We can think that the pupils have the lack of activities in lessons on theme electric current. It is necessary to make interest by the interesting experiments of pupils or teacher, by mentioning the example from life – the activities that are closed to the pupils.

Other reasons can be the lack of building the interest in pupils in particular topic. But the fact is that nowadays the pupils are still in contact with electric and electromagnetic phenomena, they are surrounded by them and it is obvious that it would be useful for them to understand them deeply. One of the main needs is a good motivation provided by teachers to pupils.

At the end we would like to set one fundamental question which was already mentioned in our work: "Wouldn't the physics education be more effective if we, the teachers, would be able to present this science for pupils in the way that they themselves would be interested in, they

would mastered the basic relations and laws, see them in practice around them and would see the world around with understanding of it?"

2 Results of investigation in higher classes of secondary school with computer aided education

Our investigation have two main aims:

- Is efficiency of education with computer higher then traditional education?
- Do pupils prefer the computer aided experiments or traditional experiments?

Time of research was half of school year. Target group of investigation was pupils of 16+ ages, in one class which was divided to two groups of 15 pupils. They worked in small groups of 3-5 members with one computer and measuring equipment. All of pupils have identical theory background and identical teacher.

3 Tasks for pupils

These experiments were measured by pupils with computers and second group without computers

- Ohm's Law
- Kirchhoff's Law
- Internal resistance of the cells
- *VI* curves of resistor, lamp, diode, LED, Zener's diode
- *VI* curves of electrolytes
    - With identical electrodes
    - With different electrodes

The pupils were tested. Understanding of concept electric current was statistically better in group that measured by computer to compare with group of pupils that measured by classical equipments. The questionnaires were given to both groups. The first group of pupils gave answers that measurements with computer were interesting and useful and that connecting of circuit was easy and transparent. The second group of pupils with classical equipment gave answers: measurement was helpful for understanding but not useful and connection was lowly transparent.

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