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## Additional course of physics

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Problemy Profesjologii nr 1, 205-210

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2011

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## ADDITIONAL COURSE OF PHYSICS

### Summary

In this article we deal about the actual reform of regional education in Slovakia and its impact on students of technical universities. We talk about position of the subject Physics on Technical University in Zvolen and about teaching of physics on all faculties. Main part of this paper is devoted, to additional course of physics for students in first year of study. At the end of the paper we compare results attained by students, who passed the course and results of students who did not get through the course.

### DODATKOWE ZAJĘCIA Z FIZYKI

#### Streszczenie

W artykule zaprezentowano tematykę związaną z aktualną reformą edukacji regionalnej na Słowacji i jej wpływu na studentów wyższych uczelni technicznych. Autorzy piszą o umiejscowieniu fizyki w przygotowaniu zawodowym na Uniwersytecie Technicznym w Zvoleniu i na temat nauczania fizyki na wszystkich wydziałach. Główna część prezentowanej pracy poświęcona jest dodatkowym zajęciom z fizyki dla studentów pierwszego roku studiów. Na końcu artykułu porównano osiągnięte wyniki przez studentów, którzy uczęszczali na kursy dodatkowe z fizyki z wynikami studentów, którzy na te kursy nie uczęszczali.

### Reform of the regional educational system

Slovakia in last few years gets through the reform of educational system. It deals about two reforms: first is reform of regional educational system and the second one is reform of the university educational system.

Main idea of the regional reform, which appears from the project Millenium, is passing to the creatively – humanely educational system with the orientation on schoolchildren. At the sight on the results of this reform it looks like, that the authors of this reform not quite understood why is reform needed, because the whole reform prefers humanities in teaching at the expense of natural science – technical subjects. Reduction of subjects afflicts mostly physics and mathematics. We think that the right direction is the differentiation of teaching of these subjects by further focus and profile of students within the frame of high schools and grammar schools. There will be option of choice of the subjects in compliance with further profile, even if is very questionable, if are students able to right choose the subjects, because

many of them don't have conception, what they want to study on the university. This situation is a result of insufficient communication between high schools and universities.

Much worse is the reduction of classes of mathematics and physics on basic schools. The situations, when the students have problems with basic mathematic operations are very common. We can not imagine how it will look like after another reduction of classes. Next problem of physics on universities is the competition of many financially and socially more lucrative fields of study (medicine, law, economy). For the majority of students physics is very difficult and not attractive.

### **Reform of the university education**

The reform of the university education was realized recently. One of the results is a change to the three-step system of the university education. For this reason it is required to change study programs and its content. The reduction affected a number of physics and mathematics classes. Every student, who passed through the education on technical university, should understand, how important this subjects are (mathematics and physics) and how it is connected with other technical disciplines. Mathematics and physics are base for other technical subjects and important for its better understanding. Reduction of hours out of mathematics and physics on the technical universities continues even though.

The purpose of the reform in university education system is to increase the number of people, who have university education. The result is that more students are coming to study to the universities and the level of their knowledge is from year to year worse. This situation is especially on the universities, where is not so big interest, such as technical universities. To technical universities are comings students from grammar schools, high schools, training colleges etc. Their preparedness on study is miscellaneous. Many of them were on high school without mathematics and physics, some of them had these subjects only for two years and some of them all four years. Their knowledge is in many cases on ultra low level on the beginning of the university study. It is very difficult to select adequate tempo and form of academic teaching [4].

### **Educations on Technical University in Zvolen**

Physical teaching on Technical University in Zvolen has quite a number of specifications, which are affected with heterogeneity of study programs in separate faculties. Our department

also deals with the physical and musical acoustics and research of physical acoustic characteristics of wood for musical instruments [1, 2]. However, one is common for all faculties and it is a shining reduction of number of hours for physics after passing to three stage educational system. In bachelor's level of the study of all faculties is for physics reserved only one semester with weekly dotation of two hours for lectures and two hours for seminars. Within the basic bachelor's course is needed to go through basis of physics in theoretically also practically with respect to field of study. For students, who did not have physics on high schools is majority of knowledge from base completely new and is hard to keep pace with the others. During lectures students will acquire quantum of new knowledge from many parts of physics. This knowledge they should know to apply by solving theoretical and practical problems. It is content of the seminars. Students go through six laboratory measuring and 14 hours they have for theoretical problems. During this time is impossible to learn them to think physical and technical, what should be primary function of this subject. Many of students have problems with handling of basic methods out of solving theoretical physic's problems. Either their experimental skillfulness are not on the sufficient level [6].

### **The additional course**

As we already reflected, on our university we have different prepared student in first year of study. Some of them have enormous problems with handling of such quantity of tutored during one semester. After reflected reform, which one of the results is cut-down temporal donation of hours out of mathematics and physic, we are awaiting by students bigger problems like to this time. Therefore we decided three years ago to offer for student the additional course of physics, which last three years was oriented primary to solving of physical tasks. This course goes parallel with lectures and seminars during all the semester. With content it is copying lectures and seminars, bud there is more time to explain some theoretical and practical problems [3, 6].

Every year this course is divided between three teachers in different days of the week, to every student can visiting course in time, which prefers. Second reason is, that in one group is not so many students, and teacher can choose individual access, which helps to increase the effectiveness of the course. After six semesters, when we made the course, we can state, that majority of students, who visited the course, have better knowledge. Also after talks with these students we see, that this course is useful for students.

### Researches

We have carried out educational experiment, through which we wanted to show the extent which affects two hours long (weekly) additional course of physics. For the survey of student's knowledge we used didactic tests, by which we tested — the level of understanding of the concepts to learn, remember, the ability to solve tasks of varying degrees of difficulty. Didactical tests were used at the beginning of the semester prior to the passing of object Physics and additional course of physics and at the end of the semester after they passed physics, in the winter semester of school year 2009/2010. We have expressed the hypothesis, in which we have assumed that the results achieved by the students, who have passed through the additional course of physics, will have significantly better results, than students who haven't completed this course. Students had received an entry test at the beginning of the semester. This was a didactic test, which included 20 questions with complex scoring. The test was attended by 146 students, 64 of whom subsequently during the semester has passed through a normal teaching plus additional course of Physics (experimental group) and the remaining 82 students has passed only through the normal teaching (control group).

Table 1. Statistical characteristics of the pretest

		Experimental group	Control group
Number of students solving the test		64	82
Valuable score	Relative score ( $p^y_{priemer}$ )	22,04	23,72
	Median ( $p$ )	15,22	16,42
	Standard deviation ( $s$ )	15,44	16,56
	Variation interval ( $R$ )	48,17	62,18
	Variation coefficient ( $V$ )	70,05	69,81

On the basis of the results from the table it can be assumed that the knowledge level of the classes – the control and the experimental is approximately at the same level. All students were tested again with didactical test after the educational experiment at the end of the semester. Based on the hypothesis it had been assumed that the level of knowledge obtained would be higher in experimental groups. To verify the assumptions we used test of arithmetic means. Our point of t-distribution, the value of the test variables were compared with the critical value [5, 9].

Table 2. Statistical characteristics of the post test

	Experimental	Control
The number of students solving the test	64	82
Relative score ( $p^v$ average)	77,55 %	50,35 %
Median ( $p$ )	75,35 %	47 %
Standard deviation ( $s$ )	11,32 %	12,16 %
Variation interval	48 %	50 %
Variation coefficient	14,59 %	24,15 %
Scale average of distortion tolerance ( $s_v$ )	11,79	
Test quantity ( $t$ )	13,83	
Critical value ( $t_{\alpha,t}$ )	1,97	

Based on the criteria  $|t| > t_{0,05,113}$  we can accept the hypothesis H: The average scores of students of experimental group are appreciably higher than the average scores of students of the control group.

It turned out that additional physics course with his time grant two hours per week has significantly contributed to improved results for students. This argument is based on the outcome of teaching experiment that was conducted on a sample of 146 students during one semester in school year 2009/2010. The results of this test show that the average results of students in the experimental group were significantly better than results of students in control groups [7, 8].

## Conclusions

Students incoming to our University are various. Some of them have a huge problem to cope with such a quantity of the curriculum for one semester. After the reform of regional educational system, resulting in a reduced amount of time devoted hours of mathematics and physics, we expect students to even greater problems with the physics. Just for these students is mentioned supplementary course designed.

Based on the above-mentioned results, although on a small set of statistics, as well as five years' experience with the additional course of physics, it is noted that graduates have significantly better success rate in solving tasks and thus the percentage for the test. Already

two hours of physics per week in addition helped to significantly improve the results achieved by students.

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