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Abstract

The report deals with the teaching of thematic unit related to energy at elementary schools, especially with insufficient contents of a given problems in Physics schoolbooks for elementary schools. It contains the research results, whose aim was to point to the importance of classification the additional multimedia education script on energy for the ninth year at elementary schools and to a positive difference in comparison with traditional way of teaching these problems at elementary schools.

Keywords: multimedia, elementary schools, physics, energy

Introduction

The term energy has a primary meaning for the natural science education and belongs to the most important terms of didactic system at elementary school. The right conception and development of the term energy, problems with gathering the energy resources, transfer and transformation of energy are not just the subjects of Physics teaching, but also of Chemistry, Biology and Geography.

Energy at elementary schools

Energy is an everyday part of our lives, one of the most important things on this planet and basic condition for the life of each organism. The activity, movement, development are accompanied with the transformation of energy from one form to the other. The important form of energy for our civilization is undoubtedly the electric energy. The main reason is its easy distribution and usage. It can be transformed to the other forms of energy without any problems. Energy has a key meaning for the maintainable development as it is the moving force of each economy. To ensure the effective function of economy subject to maintainable development, it is necessary to provide the supplies of cost effective energy to continually increasing population of the world together with the maximal environmental protection. These are only a few reasons for paying attention to this question.

The term energy is the integrating term of didactic structures of teaching all natural science subjects. Pupils encounter this term systematically and gradually in each natural science subject. One of the possibilities to achieve higher level of natural science literacy in educational process is a more consistent application of interdisciplinary relations in the teaching of natural science subjects, as well as the usage of interdisciplinary links. This approach improves and systemizes the knowledge. The interdisciplinary relations as a didactic mean enable more qualified systematization of knowledge; they develop synthesis ability and knowledge transfer from one subject to the other (Stebila, J., 2008). Their systematic use enables the elimination of artificial boundaries between the natural science and the interpretation of natural phenomenon around us in narrow relative connections. Together with pupils' everyday experience this approach enables the explanation of basic natural science topics in available and attractive way (Stebila, J., 2009).

In the curriculum of Physics for elementary schools, pupils encounter the energy in the eighth year in the thematic unit *kinetic energy, energy of position, mutual transformation of energy of position and kinetic energy of a body, inner energy of a body and change of inner energy of a body in action and in a thermal exchange*. The curriculum in the ninth year (apart from the revision) follows in *atomic power and other energy resources. Renewable resources of energy* are marked as *unconventional energy resources* in the schoolbook and just a short space is left for them at the end of it. As the meaning of these resources is still increasing nowadays, it is advisable to add the knowledge with the supplementary resources. One of the possibilities to extend pupils' knowledge in the given area is the elaboration and completion the energy and energy resources knowledge and creation of additional multimedia educational script, which should contribute to the better conception of the curriculum as well as to the completion of energy generation from various resources knowledge (Hockicko, P., 2009).

We have created additional multimedia educational script on energy, whose main attention was on the basic questions in the energy area. Pupils will find here enough explanation on how needful is the energy, what are the possibilities for energy usage, they will realize the supplies level of energy resources together with the possibilities for gathering the energy from various resources. Apart from the fossil fuel, we have focused on the questions, related to the atomic power and thermonuclear fusion from the unrenewables resources of energy. The thermonuclear fusion is nowadays especially current theme, and as its knowledge absent in the actual schoolbooks, pupils will find many basic terms and explanations to this area in the script. The multimedia educational script should help to improve the quality and results of educational process in the energy and its resources area (Hockicko, P., 2009).

Pedagogical experiment

We have realized the pedagogical experiment, whose aim was the usage verification of additional multimedia educational script on energy in the teaching process. The verification consisted in the comparison of the educational results, reached in the teaching process where these scripts were used with the results of traditional teaching method. The knowledge level of actual topic was compared, that means that pupils were taken in for a didactic examination after the study of „Energy in nature, technical and society" thematic unit (Němec, M., 2008).

The pedagogical experiment was realized at two elementary schools. In the checking class, the thematic unit was taught by a traditional method, without the use of additional educational script on energy. In the experimental class, these scripts were used apart from Physics schoolbook for the ninth year. The same teacher taught in both classes. The classes were chosen on the basis of Physics knowledge level, which was defined by a mark at the school report in the end of the eighth year and by a mark at the half-term school report in the ninth year. Four classes were chosen whose knowledge was approximately at the same level (Chart 1). There were 29 pupils in the first experimental class (EC), 25 pupils in the second experimental class, 29 pupils in the first checking class (CC) and 27 pupils in the second checking class. After the linking the both experimental and both checking classes together, the number of pupils in the experimental group is 54 and in the checking group 56 (Krišťák, Ľ., 2007).

Chart 1. The comparison of arithmetic average of pupils´ marks at the school report in experimental and checking class.

	Experimental class	Checking class
8th year	2.31	2.29
9th year	2.40	2.36

For the discovery of pupils´ knowledge in the experimental and checking class from the given thematic unit, a non-standard didactic test was used. The memory level, conception of the curriculum and the ability to solve the tasks of different difficulty level were tested. In the beginning, the version with the pack of tasks, representing the content of a given thematic unit in the classic schoolbook was created. The final version of a test developed from the discussions between the teachers. The didactic test was created for the groups A and B. It was used in the CC and EC after the given thematic unit was taught in the same time (the same week) to avoid the distortion of results in consequence of obtaining the information and task questions in the CC or EC. Before starting the test, pupils were familiarized with the basic information, related to its elaboration. The time for individual tests was 40 minutes (Němec, M., 2008).

The evaluation of didactic tests

The test contained 20 tasks. Total number of marks was 36. We have supposed that the knowledge level will be higher in the experimental class than in the checking class and that the conception of a text in the schoolbook improves in the experimental class as they expanded their knowledge of a given theme from the additional texts on energy. As far as the content, the test was created on the basis of the schoolbook.

We present the test's characteristics for the experimental and checking class in the chart (Chart 2): the averages number of marks (maximum mark number was 36) the pupils achieved, standard deviation, the average success rate (arithmetic average of success rate), median, variation range (the difference between the highest and lowest value in the attained mark number) and variation ratio.

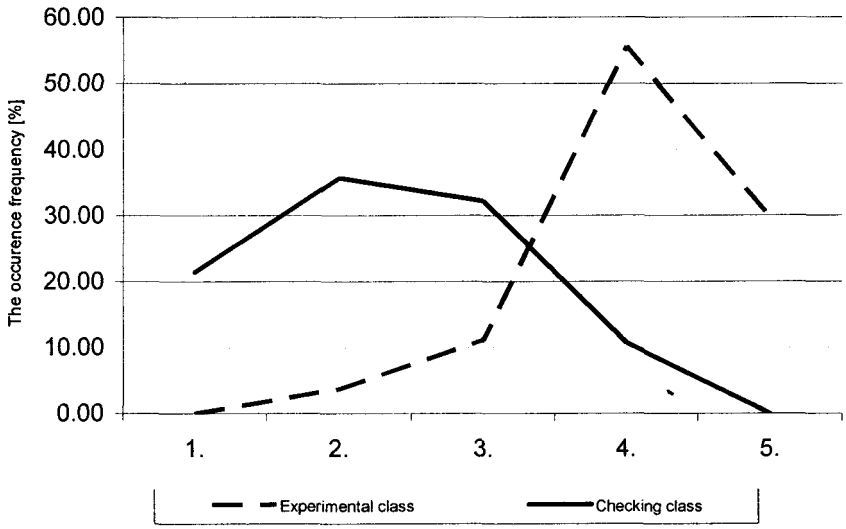
Chart 2. The characteristics of a didactic test

		EC	CC
The number of pupils, solving the test		51	52
Valuable score	**Relative score** ($p^{v}_{average}$)	76.61 %	51.24 %
	Median	76 %	49 %
	Standard deviation	12.24 %	13.33 %
	Variation interval	47.94 %	51.06 %
	Variation coefficient	15.12 %	23.85 %

As the chart shows, the pupils' average score from the experimental class was higher than the average score from the checking class pupils. This hypothesis will be confirmed by a graph, created from the frequency chart.

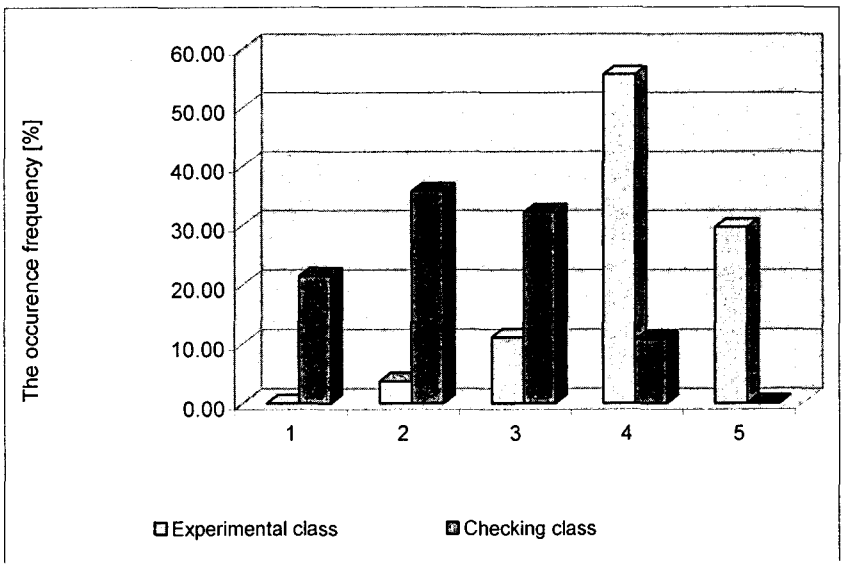
Chart 3. Frequency chart for the used didactic test

	Interval	Experimental class	Checking class
	[%]	[%]	[%]
1.	26.0 – 39.2	0.00	21.43
2.	39.3 – 52.4	3.70	35.71
3.	52.5 – 65.6	11.11	32.14
4.	65.7 – 78.8	55.56	10.71
5.	78.9 – 92.0	29.63	0.00



Graph 1. Characteristic of pupils' effort layout in the experimental and checking class

We can see a visible shift of a curve, representing the average pupils' effort in the experimental class to the higher values of attained average score (Spodniaková, P.M., 2009).



Graph 2. Percentual success rates of pupils in both classes with the first group's tasks

Conclusion

The results of the didactic test, gained during the pedagogical experiment can be summarized into these points:

1. The usage of additional multimedia educational script on energy with the teaching these problems in the ninth year at elementary school contributed to a higher knowledge level.
2. The usage of additional multimedia educational script is interesting and attractive for pupils with the teaching of the thematic unit „energy", because they relate to the current area of our time, which results in a higher interest in this topic.

References

[1] Stebila J. (2009), Results of the research of using the multimedia teaching aid under real conditions at primary schools in SVK. Journal of Technology and Information Education. Olomouc (2009) Palacký University of Olomouc

[2] Stebila J. (2008), Research in the application of innovative teaching methods in transport problems in elementary education. ACTA Universitatis Matthiae Belii. Séria Technická výchova č.8 (2008). Banská Bystrica.

[3] Hockicko P. (2009), Useful computer software for physical analysis of processes. Proceedings of the 2009 Information and Communication Technology in Education (ICTE) Annual Conference (2009). Rožnov pod Radhoštěm.

[4] Hockicko P. (2009), Role of the Children's Universities in Innovative Learning Activities. Moderní trendy v přípravě učitelů fyziky 4. Moderní prostředky a metody výuky fyziky. 2009. Západočeská univerzita v Plzni.

[5] Němec M. (2008), Influence of the qualitative tasks on the students' knowledge of acoustics. Záujmová činnosť žiakov – stav, problémy, trendy (2008). Prešov.

[6] Krišťák Ľ. (2007), Improvement of teaching nuclear physics at grammar schools. Zborník z medzinárodnej vedeckej konferencie ICTE 2007. Ostrava.

[7] Němec M. (2008), Innovative methods in teaching of physics and acoustics. Proceedings of the 4-th International Symposium Material-Akustika-Priestor (2008). Zvolen.

[8] Spodniaková, Pfefferová Miriam (2006), Impact of using of computers-aided experiments in educational attainment of pupils at grammar schools. Physics education in the light of new scientific knowledge: zborník referátov zo XVI. medzinárodnej konferencie DIDFYZ 2008. Nitra.

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