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Research Examination of the Options to Increase the Education Effectiveness in the Technical Subjects at the 7th Grade of Elementary School Using Hypertext Educational Material

L'ubomír ŽÁČOK
Department of Technics and Technology, Faculty of Natural Science on Matej Bel University
Tajovského 40, 974 01 Banská Bystrica, Slovak Republic
e-mail: zacok@fpv.umb.sk

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Abstract. The utilization of hypertext educational material is going to be solved in this paper as a source using which the effectiveness of education the technical subjects at the 7th grade of elementary school can be increased. As a comparison between reached results in the control and experimental groups of pupils we used final didactical examination, which was evaluated using statistical methods. As a necessity for the pedagogical experiment we verified our hypotheses.

Keywords: hypertext, research, pedagogical experiment.

1. Introduction

Teacher as an activator of the process of education, can control and teach the pupils using technical data, though he must be able to have own reflexion and evaluation for himself. He supports individual, but cooperative work of pupils as well, he keeps pedagogical, psychological and social aspects at the education. He uses appropriate educational stuff and the didactical technics. The new medias and various innovative excercises are motivating elements from the subject of the technics and the new technologies.

Our aim was to propose the system of controlled study for pupils at the 7th grade of elementary school using didactical environment created by hypertext portal. Important parts of this project were to find out the method how to create mentioned environment and also its following application by the teachers at the education of technical subjects. The effectiveness of this new method was examined by the pedagogical experiment.

2. Present State of Subject

The problematics of modernization the general education from the point of incorporation the educational stuff of technological character into its content, is one of the basic programmes, solved by UNESCO (Askerud, 1998). Starting with the technical subjects, it

enables to know certain forms of work, and moreover it develops the technical meaning and technical creativity at the pupils during the school presence. The technical subjects (Technics and Technical education) in the system of educational subjects at the higher grades of elementary school have ensured basic defined conditions of individual educational subject – they have certain subject, educational methods, terminological and didactical system. The technics and technical education can be considered as a key element which can prepare pupils to live in the technosphere. UNESCO Pilot Project targeted the aim to make the technical knowledge to be a part of general education. Introduction the pupils with the technical knowledge and learning basic abilities and habits the various countries solved in two ways (Montagnes, 2000):

- finding the special subject of technical character (technology),
- several technical topics are incorporated into the educational stuff of another subjects in the field of life sciences.

The project emphasized and still emphasize the necessity of keeping the speed with the changes in the production and it makes important the preparation of young generation as a flexible and adaptabile for fastly changing conditions in the field of technics at present and in the future.

Also in Slovakia the elementary school is important level of study to reach a certain degree of technical education, and which has the subject "The technics" as one of the educational subjects (according to the new State educational programme) as well as the subject "Technical education". Those subjects have their strong place at the lower secondary education too. There are rooted the principles of the connection between the school and the life. Technical education must be organic compartment of the general education on all levels of education. Then a man with creative way of thinking has bigger chance to apply himself in the present technical modern society (Žáčok, 2009).

Under the creative way of thinking we can understand the solution of the problems actively and finding even more options of the solutions. Creative technical way of thinking is a divergent process, which starts from the learning the knowledge through their changed organization can lead to the production of new information. Modern society is a society, where people work with informational and communicational technologies actively, and where the hypertext educational material can occur. The knowledge from this field of science can be taught at the elementary school degree at the subjects "The technics" and "Technical education". So the man can easily understand the priciples how various technical devices work. It must be a basis of present modern education. To be technically skilled we can understand the technical educated minimum that shoult be taught as a part of general education by each pupil.

Present school must give to a young man to get the basics of the technical skills. It is necessary to keep in mind that in this era where we live, the technics has a strong place for practical application, but also in the present school. It is necessary to understand that the every man is not a producer of technical objects, but he should be an active user. However at present school the technical subjects are taught via traditional way more and more. Also the research results from 2004 showed that the teachers use traditional presentation of the content of lessons (Ďuriš, 2008). There is a demand for the methodical material between the teachers, educational stuff and information-communicational technologies as

well. This long-lasting tendency can be improved by a proposal, creation and application of the hypertext educational material for the education of the technical subjects at the elementary schools. We understand that the hyperttext educational material will not be a real electronical shape of the classical excercise book, but will support the pupils to the more active way of work with the information, individual educational environment, the options for actualization and comments shaped as hypertext educational material (Ďuriš, 2008).

3. Particular Contribution Expected

However content of lessons is enriched with the information in connection between the man and his work, with the necessity to have basic work skills in various work fields. Education in this field is directed to the creation and development the key competencies of the pupils, so that they are directed to know the surrounding world objectively, they need enhance their self – thrust, to have new attitudes and values in the life in connection with the work, the technics and life environment. The aims of the technical education involve the cognitive, sensitive and psychomotoric fields at the primary school and must be developing proportionally. These aims follow these key competencies (Žáčok, 2010):

- to give proof to get the knowledge and abilities in various work and extra-work life situations,
- to propose the new tasks, the new solutions, to look for the solutions of the tasks in the new projects, to be able to plan and to control the work.

The teacher controls and teach the technical data for the pupils at the process of education. He uses appropriate educational tools – traditional or modern ones, to reach the aim. We consider as the most modern educational tools the multimedia tools, which are able to unit various forms of information. We think the hypertext is one of the most characteristic marks of the multimedia. Information in form of the text we could imagine only shaped classical way such as in the magazines, in the newspapers, or in the books recently. The structure of the classical text is simple and linear. The new options of computer utilization enable to create the new form of the text, where the linear text is only starting unit of wide rooted structure named as hypertext. From informational point of view we define the hypertext as many of the text information. The elements of this group are information items (Hašková, 2004).

Information items are connected to each other into the linear, tree, network, net, or another structure using hyperlines. From these information items the total information can be prepared following certain rules. The bonds between the parts of information enable to enter to the information effectively. Technical and programme tools, which enable to save these information in form of hypertext (to create hypertext) and can make possible and comfortable to enter to the information (to make hypertext), we can call it as the hypertext system. The main characteristics is to unite the text. While working with the hypertext we can use some more its characteristics. The comeback to the previous pages is possible if we have already worked with it, or there is some offer for previously visited pages. These characteristics and the structure of the hypertext some educational

softwares are using, as well as the multimedial encyclopedias and also the service World Wide Web.

Healthy competitiveness between the pupils is natural, but there must be friendly spirit, responsibility and team work. As mentioned using hypertext educational material we can enhance the pupil´s interest to be educated. There is also the space to use dramatic performances to increase the activity of pupils so that they could directly influence the process of education. Widening the pedagogical activities of the teachers through hypertext educational material we can see the effective transfer of knowledge in frame of fastly developing technical disciplines as the basis of the "technical revolution".

4. The Goals and Contents of the Thematic Units in the Course "Technical Education" for the 7th Grade

The contents of the course Technical Education at the 7th grade of elementary school consists of the following thematic units (Žáčok, 2010):

- Procedures and tools for processing technical materials;
- Means of mechanization;
- Components of residential installation;
- Wiring works. Electronic components of automation and regulation;
- Individual work of the pupils.

The curriculum contents mean the curriculum which the pupil is supposed to learn at school. It is a sum of knowledge, skills and habits mastering of which provide development of mental and physical capabilities of the pupils necessary for their future life.

Furthermore, we attempted to analyze individual thematic units and pointed out the shortcomings of a new textbook which contains the respective curriculum.

The first topic at the 7th grade of elementary school is **"More Complex Procedures and Tools for Processing Technical Materials"**. In this thematic unit, the teacher develops technical ideas and imagination of the pupils. Pupils will be introduced in detail to technical materials and they will learn to make the tools manually through basic technical procedures and with the use of available and proper equipment. The pupils should understand, know and be introduced to the characteristics and proper selection of technical materials. The requirements for knowledge and skills in this thematic unit should contain: planing, chiseling, drilling, coupling of technical materials (both dismountable and non-dismountable) through mortising, gluing; with nails and screws; riveting, soldering, welding; the principle of casting; external and internal threads – manual cutting. They should name the characteristics and use of board products made out of wood, profiled metal semi-products and plastics. They should know how to cut, rasp and abrade these materials. As the situation of a respective school is taken into account, it is possible to produce only objects made out of materials which are accessible to a teacher at that school (e.g., only wood, plastic or only metal; alternatively other accessible natural materials such as leather).

Content of the thematic unit **"Work Principle and Mechanical Components of the Household Means of Mechanization"** is focused on means of mechanization and means

of minor manual mechanization which is the main. Its content is focused on their main division, use as well as their importance for the human and safety during their operation. The pupils will learn to use the household means of mechanization economically and sensibly. The requirements for knowledge and skills of the pupils in this thematic unit are as follows: to be introduced to the principle and to know the functions of the most common manual and electric household mechanisms (kitchen and garden; manual and motor). They should be able to explain the function of minor manual mechanization which the pupils have a chance of encountering in the technical education (drill; electric grinder; band-, oscillatory- and circulatory saw; spray gun). They should know the safety rules for operation of manual and electric means of mechanization in household and the technical education. They should be capable of doing regular maintenance of some kinds of household mechanisms (vacuum cleaner, refrigerator, juicer etc.) in practice. They should be introduced to operation and to work with the means of minor manual mechanization and to the safety rules for their operation (hand drill, metal grinder, circulatory and oscillatory saw, etc.). The teacher may accomplish a significant didactic effect using a practical demonstration in class (also a dysfunctional appliance is suitable for a practical demonstration). The study *Spotrebiče v domácnosti* (Ďuriš and Pavlovkin, 2003), published at the Faculty of Natural Sciences on Matej Bel University in Banská Bystrica in the first half of 2003, may be of effective assistance to the teacher. In their study, the authors provide a selection of the most common household appliances which are, on the basis of their function, divided to electric and mechanical ones. The identical structure is preserved with all appliances. The point of departure is represented by the construction of an appliance while the emphasis is put on the principle of its operation, basic maintenance and its eventual repair. The text is supplemented with schemes and figures so that the user gets as broad information as possible in a simple form. Questions and tasks intended for confirmation and repetition of the curriculum are stylistically included in the text. A part of the publication is also a CD ROM where the user finds all figures which are included in the text in a separate form (Ďuriš and Pavlovkin, 2003).

Content of the thematic unit **"Basic Components of Residential Installation"** introduce the pupils to basic information from the field of residential installation. In this recently introduced thematic unit, the content of the curriculum is focused on basic information on the field of residential installation – heating, distribution of cold and hot water; in sum, on the household and energy saving, ecological aspects and minor maintenance in the household. The pupils will be introduced to the system, and basics of construction and maintenance of individual components of residential installation. They will learn to evaluate individual systems economically and ecologically. The pupils will get to know the system of central heating in residences and its function. They should know how to calculate energy consumption for heating. They should master the repair of a seal in the water faucet (battery) via its replacement, milling of valve seats or replacement valve seals in practice. The teacher draws the knowledge from a textbook for the technical education. The above mentioned study *Spotrebiče v domácnosti* (Ďuriš and Pavlovkin, 2003) is also suitable. On the basis of science and technology development, the teacher should continuously supplement the curriculum with new information.

Content of the thematic unit **"Wiring works. Electronic components of automation and regulation"** virtually broadens and deepens knowledge and skills of the pupils at wiring works. A significant part consists of practical exercise of soldering when plugging in electric circuits. The pupils will be introduced to components of automation and they will solidify their habits of safety operation with the electric current. They will get to know the basic components of automation and their application in household electric appliances (electric door bell, electromagnetic relay, bimetal temperature regulator, regulation valve, various types of sensors, etc.). They will be able to explain some automatic systems – in an iron, automatic door opening, lighting, PC printer, principle of elevator functioning, etc. They should know the principle of disc (HDD, FDD) function in a computer. They are introduced to PC hardware and software.

The last thematic unit which is prescribed by the curriculum for the Technical Education at the 7th grade is **"Individual work of the pupils"**. In this thematic unit, the pupils are supposed to apply their theoretical knowledge and practical skills as good as possible. The task in this unit is that the pupils independently and correctly draw a construction of a chosen topic, select correct material, follow correct technological procedure and, if applicable, choose an adequate surfacing. After having been familiarized with the working procedure in detail and having obtained material, the pupils are working individually or in groups. The teacher manages their activity by the way of an individual or frontal discussion. The goal of this thematic unit is development of self-reliance and creativity of the pupils by the way of proposing or, possibly, selecting and manufacturing chosen products, applying a solution of appropriate technical problems. *Manufacturing via chosen work topics with tasks such as:*

- Choice of construction (elaboration), finalization of an ideological topic;
- Possibly a change of construction;
- Selection of a material;
- Selection of a technological procedure;
- Selection of a surfacing, etc.

Products may be made of metal, wood, plastic or combined or, alternatively, in combination with electric installation. Co-operation at reparations and maintenance of installation material at school.

5. Methodology and Research Management

We used the pedagogic experiment as a research method. The research strategy was conditioned by the character of the problem which we have been dealing with at work, being a proposal, formation and verification of a hypertext didactic text in educational process. In order to research performances of pupils in the cognitive sphere, we used a non-standard cognitive final didactic test. The didactic test was differentiating and the performances of the pupils were compared to the performances of the pupils in the experimental and the control groups. We processed the acquired data using basic statistical methods. We calculated basic statistical characteristics (arithmetic mean, decisive deviation and error,

median, modus, etc.). Subsequently, we tested given hypotheses at the significance level of $\alpha = 0.05$.

6. Pedagogic Experiment

We dealt with the problem concerning to which extent the existing hypertext didactic text may help pupils at the 7th grade, or, possibly, could affect a level of acquired mastered knowledge. In the control group (A), the education process was carried in a traditional way (the pupils did not work with the hypertext didactic text); in the experimental group (B), the pupils worked with the hypertext didactic text. After the education process in both control and experimental groups was finished, we used the didactic test for both groups at the end of the natural pedagogic experiment. The didactic test (DT) was intended for the pupils at the 7th grade of elementary school.

7. Determination of Hypotheses

$\boldsymbol{H_0}$: The results obtained via the non-standard didactic test could be identical in both control and experimental group.

$\boldsymbol{H_1}$: We assumed that the hypertext didactic text could increase efficiency of teaching of the technical education at the 7th grade of elementary school.

$\boldsymbol{H_2}$: The respondents in the experimental group at the educational process with the hypertext didactic text could achieve a higher performance in the cognitive sphere in comparison with the control group in which the education process was realized in the way of traditional methods without the use of the hypertext didactic text.

$\boldsymbol{H_{2.1}}$: We assumed that the pupils in the experimental group at the education process with the hypertext didactic text could achieve a higher performance at the education level "memorization" in comparison with the pupils from the control group in which the education process was realized without the use of the hypertext didactic text.

$\boldsymbol{H_{2.2}}$: We assumed that the pupils in the experimental group at the education process with workbooks would achieve a higher performance at the education level "understanding" in comparison with the pupils from the control group in which the education process would be realized without the use of the hypertext didactic text.

$\boldsymbol{H_{2.3}}$: We assumed that the pupils in the experimental group at the education process with the hypertext didactic text would achieve a higher performance at the education level "specific transfer" in comparison with the pupils from the control group in which the education process would be realized without the use of the hypertext didactic text.

$\boldsymbol{H_{2.4}}$: We assumed that the pupils in the experimental group at the education process with the hypertext didactic text would achieve a higher performance at the education level "non-specific transfer" in comparison with the pupils from the control group in which the education process would be realized without the use of the hypertext didactic text.

8. Selection Sample in the Research

The research sample consisted of the pupils from the 7th grade of elementary schools. In the research, there were included 12 control groups with total of 300 pupils and 12 experimental groups with total of 300 pupils. The control and experimental groups represented a sample with total of 600 pupils. On the basic list, there were 15 schools from the whole Slovak Republic. By the way of an accidental selection (drawing of lots), we chose 12 schools. At each school, we chose 50 pupils by the way of an accidental selection; further on they were divided (drawing of lots) into two groups – the experimental and the control. The control and experimental groups were equal concerning the indicators of a number and sex of the pupils. The pedagogic experiment was realized at the 7th grade of elementary school and no pupil repeated the level. The age of reviewees was almost identical.

9. Statistically Verification of Hypotheses Research

We were interested to find out what performances will the pupils achieve on the didactic test. Answering the questions on the test for the 7th grade correctly, the pupil could have gained maximum of 15 points of a gross score (gs) in the 7th grade. It is obvious already from the descriptive statistics (Tables 1, 2 and 3) that the 7th graders from the experimental group mastered the curriculum with a greater success than the pupils from the control group. The calculated arithmetic mean and decisive deviation were calculated on the reliability interval: the lower interval: -95%, the upper interval: +95%.

It is also possible to see from the Fig. 1 that the acquired results in the experimental group were better than in the control group. The calculated arithmetic mean for the experimental group lies between 11.26 and 12.02 on the reliability interval; for the control group it lies between 9.17 and 9.96 on the reliability interval.

The variation span is determined by a minimal value of 3.5 and a maximal value of 15. We discovered that the acquired results among the pupils are divergent. It is possible to see from the Fig. 2 that a medium value of the unit is equal to 11 with the control group and to 12.5 with the experimental group. The quartile span represents an area of medium 50% of the values of variables; i.e., from 6 to 12.5 with the control group and from 10.5 to 14 with the experimental group.

Table 1
Descriptive statistics

			Score	Score	Score	Score	Score
	Level of factor	N	Mean	Std.Dev.	Std.Err.	-95%	95%
Total		600	10.60167	3.558431	0.145272	10.31636	10.88697
group	kontrolná	300	9.56333	3.500022	0.202074	9.16567	9.96100
group	experimentálna	300	11.64000	3.309619	0.191081	11.26397	12.01603

Table 2

Descriptive statistics

Variables	A	Control group
Valid data	300	
Missing data	0	
Sum	2869	
Mean	9.563333	
Variance	12.25016	
Standard deviation	3.500022	
Variance coefficient	0.365984	
Standard error of mean	0.202074	
Upper 95% CL of mean	9.961001	
Lower 95% CL of mean	9.165666	
Geometric mean	8.805213	
Skewness	−0.2624	
Kurtosis	1.743843	
Maximum	15	
Upper quartile	12.5	
Median	11	
Lower quartile	6	
Minimum	3.5	
Range	11.5	
Centile 95	14.5	
Centile 5	3.5	

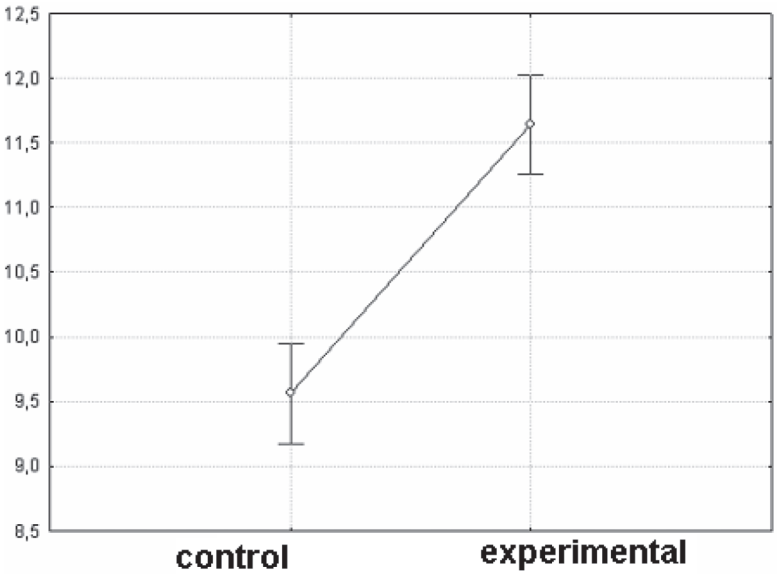

Fig. 1. Comparison of results in the control and experimental groups.

Table 3
Descriptive statistics

Variables	A	Experimental group
Valid data	300	
Missing data	0	
Sum	3492	
Mean	11.64	
Variance	10.95358	
Standard deviation	3.309619	
Variance coefficient	0.284332	
Standard error of mean	0.191081	
Upper 95% CL of mean	12.01603	
Lower 95% CL of mean	11.26397	
Geometric mean	11.01388	
Skewness	−0.92298	
Kurtosis	2.721242	
Maximum	15	
Upper quartile	14	
Median	12.5	
Lower quartile	10.5	
Minimum	4.5	
Range	10.5	
Centile 95	15	
Centile 5	4.5	

By the way of a value analysis, we found out if these results are statistically significant. To be able to choose the right value analysis, we first of all needed to examine the presupposition on a normal division of probability of accidental errors. We examined the presupposition on a normal division of probability of accidental errors with the help of a histogram and also through comparison of variances of basic files. Both figures (Figs. 3 and 4) are not unequivocally symmetrical and also the calculated variances are not identical (Table 5). The variances of both files are not equal because 0.05 > 0.001737 ($\alpha >$ p value). On the basis of the established facts we decided to use a non-parametrical test, the **Kruskal–Wallis** test (Table 4). We reject the zero hypothesis if H $\geqslant \chi^2_{1-\alpha(k-1)}$. For the significance level of $\alpha = 0.05$, a sphere of rejection is determined by the quantile of $\chi^2_{1-\alpha(k-1)=}\chi^2_{0.95(1)} = 3.841$ (Chajdiak *et al.*, 1994). It means that value of the test statistics lies in the sphere of rejection of the zero hypothesis. A conclusion follows from this observation that the performances achieved by the pupils in the control and experimental groups are statistically different. Also, the calculated p value is too small, thus we reject the zero hypothesis. Last of all, we may conclude that both H_1 and H_2 hypotheses were confirmed.

We have determined a phenomenal analysis of the tasks of the didactic test. On the basis of the phenomenal analysis of the tasks of the didactic test we have found out solu-

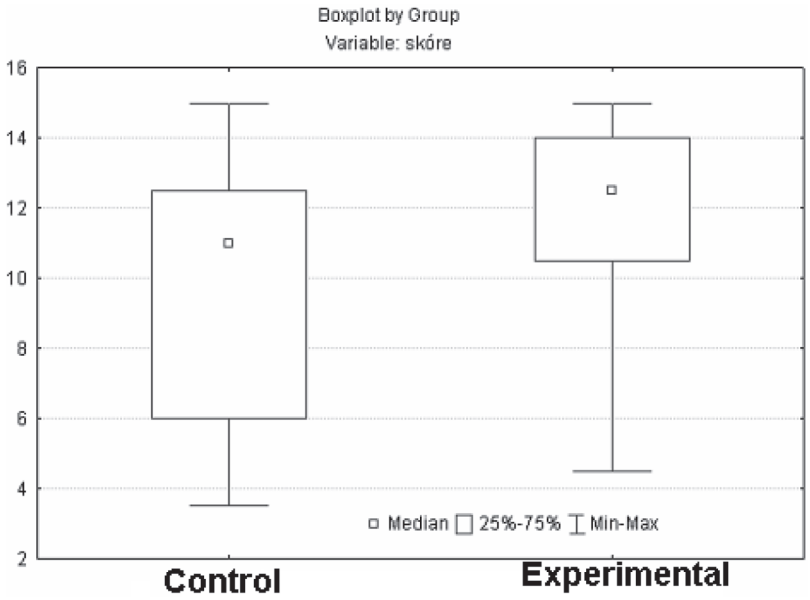

Fig. 2. Boxplot by Group, Variable score.

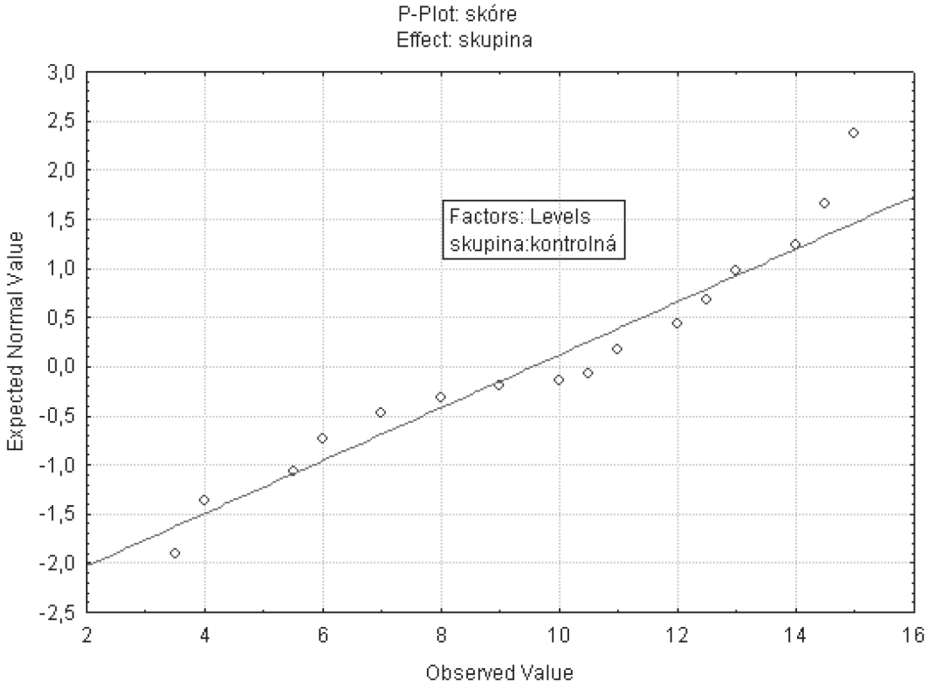

Fig. 3. Normal division of probability of accidental errors in the control group.

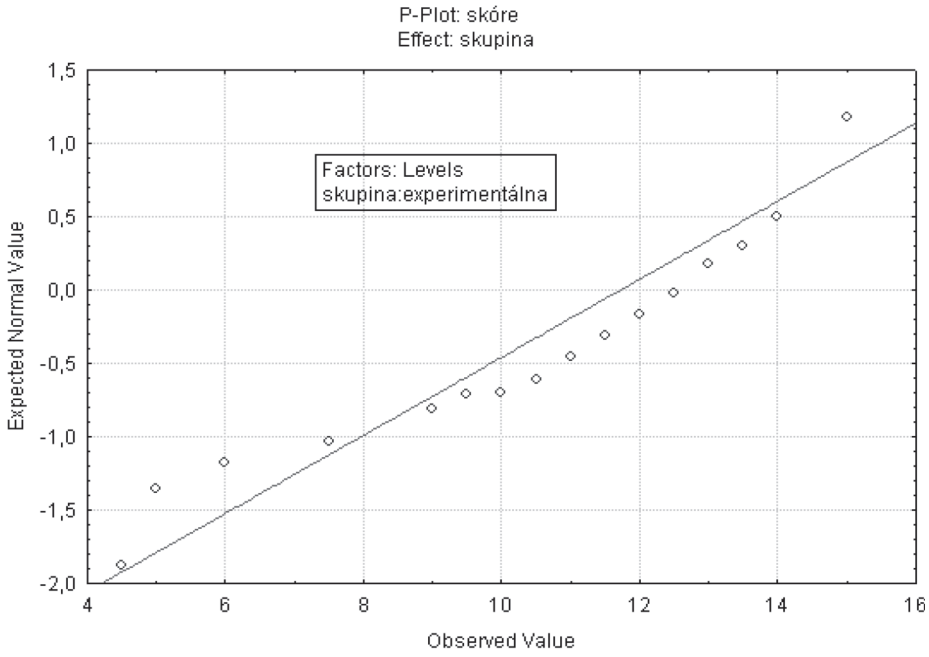

Fig. 4. Normal division of probability of accidental errors in the experimental group.

Table 4

Kruskal–Wallis test

	Control	Experimental	Total	
<= Median: observed	191.0000	122.0000	313.0000	
Expected	156.5000	156.5000		
Obs.-exp.	34.5000	−34.5000		
> Median: observed	109.0000	178.0000	287.0000	
Expected	143.5000	143.5000		
Obs.-exp.	−34.5000	34.5000		
Total: observed	300.0000	300.0000	600.0000	
	Overall Median	df	Chi-Square	p
Median test	11.5	1	31.79971	0.0000
	Valid	Sum of Ranks		
Control	300	73980.0		
Experimental	300	106320.0		
	N	df	H	p
Kruskal–Wallis test	600	1	58.34968	0.0000

Table 5
Leven's F-test

Levene's test	MS effect	MS error	F	p
Score	30.62752	3.094280	9.898111	0.001737

Table 6
Phenomenal analysis of the tasks in the didactic test

Number of task	1	2 summary	3 P	4	5	6	7	8	9	10	DT	Score
Max. score	1	1	2	1	1	2	1	2	3	1	**15**	
Σ	551	402	822	526	501	612	542	812	1021	572	6361	
p i,j	91.8	67.0	68.5	87.6	83.5	51.0	90.3	67.6	56.7	95.3		**75.9 %**

$\mathbf{P}_{i,j-}$ – percentage fruitfulness of solution tasks.

Table 7
Phenomenal analysis of the tasks in the didactic test (control group)

Number of task	Memorization **1,4,7,10**	Undersstanding **2,3,5,8**	Specific transfer **6**	Non-specific transfer **9**	DT summary	Score P
Max. score	4	6	2	3	**15**	
Σ	882	1112	298	577	2869	
p i,j	73.5	61.7	49.6	64.1		**62.2 %**

$\mathbf{P}_{i,j-}$ – percentage fruitfulness of solution tasks.

Table 8
Phenomenal analysis of tasks in the didactic test (experimental group)

Number of task	Memorization **1,4,7,10**	Undersstanding **2,3,5,8**	Specific transfer **6**	Non-specific transfer **9**	DT summary	Score P
Max. score	4	6	2	3	**15**	
Σ	994	1328	481	689	3492	
p i,j	82.8	73.7	80.1	76.5		**78.2 %**

$\mathbf{P}_{i,j-}$ – percentage fruitfulness of solution tasks.

tion successfulness of individual components of the curriculum included in the didactic test. The tasks in the didactic test were weighted; we have calculated a total weighted score which is a weighted average of solution successfulness of the tasks in the didactic test. In the case of our final didactic test, the pupils have inadequately mastered the curriculum included in the tasks 6 and 9 (Table 6) which the pupils solved with the average successfulness lesser than 60%. These are the tasks which solution demands a correct ap-

Table 9

Comparison between results of the pupils in connection with learning – memorization in the control and experimental groups

Kruskal–Wallis test

Variables: A, B. Groups A – control group, Groups B – experimental group (*memorization*)

Groups = 2
df = 1
Total observations = 600

H = 27.208996
P < 0.0001

Kruskal–Wallis: all pairwise comparisons (Dwass–Steel–Chritchlow–Fligner)

Critical q (range) = 2.771808

A vs. B	*significant*
(|7.864131| > 2.771808)	*P < 0.0001*

Kruskal–Wallis: all pairwise comparisons (Conover–Inman)

Critical t (598 df) = 1.963939

A and B	*significant*
(73.83 > 27.181452)	*P < 0.0001*

plication of theoretical information and knowledge in typical school and problem tasks. When comparing successfulness of solution of the tasks among the 7th grade pupils in the control and experimental groups, it follows that the pupils from the experimental groups were more successful in task solving in comparison with the pupils from the control groups at all four education levels according to the Niemierk taxonomy (Tables 7 and 8). We have used the Kruskal–Wallis test to find out if the differences at the individual education levels were also statistically significant among the pupils of the control and experimental groups in the 7th grade. We give the results in the Tables 9 to 12. We have found out that the calculated p value is too small, i.e., the hypotheses $\boldsymbol{H_{2.1} - H_{2.4}}$ were confirmed for the significance level of $\alpha = 0.05$.

10. Conclusion

Realised pedagogical experiment showed that the hypothesis – $\boldsymbol{H_0}$ was rejected. So we can consider that the pupils of the experimental group reached higher results in the levels of education in compare to the pupils in control group which were less powerfull in the didactic test. Then we wanted to analyse if the difference in the power between pupils in both groups was statistically significant. Hypothesis $\boldsymbol{H_2}$ was accepted and we can say the hypertext educational material had better impact on the effectiveness of education the technical subjects for the pupils at the 7th grade of elementary school. Partial hypotheses

Table 10

Comparison between results of the pupils in connection with learning – understanding in the control and experimental groups

Kruskal–Wallis test

Variables: A, B. Groups A – control group, Groups B – experimental group (understanding)

Groups = 2
df = 1
Total observations = 600

H = 31.137306
P < 0.0001

Kruskal–Wallis: all pairwise comparisons (Dwass–Steel–Chritchlow–Fligner)

Critical q (range) = 2.771808

A vs. B	*significant*
(|8.032412| > 2.771808)	*P < 0.0001*

Kruskal–Wallis: all pairwise comparisons (Conover–Inman)

Critical t (598 df) = 1.963939

A and B	*significant*
(78.98 > 27.08792)	*P < 0.0001*

Table 11

Comparison between results of the pupils in connection with learning – specific transfer in the control and experimental groups

Kruskal–Wallis test

Variables: A, B. Groups A – control group, Groups B – experimental group (specific transfer)

Groups = 2
df = 1
Total observations = 600

H = 108.384384
P < 0.0001

Kruskal–Wallis: all pairwise comparisons (Dwass–Steel–Chritchlow–Fligner)

Critical q (range) = 2.771808

A vs. B	*significant*
(|15.469943| > 2.771808)	*P < 0.0001*

Kruskal–Wallis: all pairwise comparisons (Conover–Inman)

Critical t (598 df) = 1.963939

A and B	*significant*
(147.353333 > 25.1782)	*P < 0.0001*

Table 12

Comparison between results of the pupils in connection with learning – non-specific transfer in the control and experimental groups

Kruskal–Wallis test

Variables: A, B. Groups A – control group, Groups B – experimental group (non-specific transfer)

Groups = 2
df = 1
Total observations = 600

H = 29.062556
P < 0.0001

Kruskal–Wallis: all pairwise comparisons (Dwass–Steel–Chritchlow–Fligner)
Critical q (range) = 2.771808

A vs. B	*significant*
(|8.070786| > 2.771808)	*P < 0.0001*

Kruskal–Wallis: all pairwise comparisons (Conover–Inman)

Critical t (598 df) = 1.963939

A and B	*significant*
(76.303333 > 27.137359)	*P < 0.0001*

$\mathbf{H_{2.1-}}$ $\mathbf{H_{2.4}}$ were oriented to verify the results of pupils in all four levels of education of taxonomy by Niemerk educational aims in the cognitive field. Mentioned results led to the acceptation of verified hypotheses and the significance was high on the level of importance $\alpha = 0.05(95\%)$. However we reached the results that showed we succeeded in showing that the application of the hypertext didactic text to the process of education is legitimate and brings a better efficiency of the teaching.

The analysis of the issue related to the teaching of the technical education at the 7th level of primary school cannot be considered complete and resolved, because only this level was reviewed. The issue and its proposed solution should be also extended to the other levels after careful analysis. If we want to educate a young generation for more demanding conditions well, we need to educate them with the technical culture from their childhood on; it needs to be done in adequate conditions. Our proposed, created and verified hypertext didactic text precisely helped to achieve that goal.

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L. Žáčok, PhD, Dr. works as an assistant professor at the Depatment of Technics and Technology FPV UMB in Banská Bystrica. He is focused to the field named as implementation of informational and communicational technologies into the process of education in the technical subjects. He is an author of two scientific monographies and one of them was published in Ukraine. Professional and scientific publications were published in the slovak, but also in the international journals. Used language in the publications is english and russian.

Septintokų techninių dalykų mokymosi panaudojant hipertekstinę medžiagą veiksmingumo gerinimo tyrimas

L'ubomír ŽÁČOK

Šiame straipsnyje analizuojamas hipertekstinės mokomosios medžiagos panaudojimas siekiant padidinti septintokų techninių dalykų mokymosi veiksmingumą. Kontrolinės ir tiriamųjų mokinių grupių palyginimui buvo naudojamas galutinis didaktinis tyrimas taikant statistinius metodus. Iškeltos hipotezės buvo testuojamos ir vertinamos, kaip to reikalauja pedagoginis tyrimas.