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Research Article

INFLUENCE OF AN EDUCATIONAL FILM ON THE EFFECTIVENESS OF TECHNICAL EDUCATION

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ABSTRACT
Given its capacity to stimulate several senses simultaneously, the educational film triggers many paths of information flow during the learning process. Not only does it offer a diversified form of transmitting information, but it also makes the learning process more effective and attractive. This feature is particularly important in technical education, where the problems and issues discussed are often complex and difficult for students. The following paper contains an analysis of the impact of an educational film on the efficiency of technical education based on a pedagogical experiment performed on middle school students.

Keywords: educational film, technical education, pedagogical experiment.

INTRODUCTION

Among the variety of teaching aids available, modern teacher should primarily focus on tools which, in addition to being an effective way of transmitting knowledge, enjoy popularity among students. Video films certainly belong to those – they have been used in schools for many years already, and now see an educational renaissance thanks to the popularity of YouTube and other similar online video hosting sites [4, 5].

An educational film is one of the most attractive forms of presenting learning content, easily attracting students' attention and keeping them interested for a long time [1, 6]. The use of video elements allows the achievement of such goals in technical education as:

- an introduction to the discussion of the issues raised in the film;
- a change in the current form of presenting learning content, namely through showing examples of practical application of the issues previously discussed;
- a summary of the subject at the end of the lesson.

The use of educational film in learning process, which constitutes an excellent audio-visual tool, enriches a lesson by allowing unlimited transmission and reception of information [7]. This type of film implements specific learning objectives and reflects the curriculum at all levels of education. Its structure, the means of expression used, the rate of transmission of information, the vocabulary used, etc. are all adapted to the features of both the subject and the recipient's capacities, in this case – the student's [2, 5].

Educational film is structured on the basis of pedagogical principles and indications. Depending on its function, it can be used at different stages of the didactic process.

Several features of video aids determine their high suitability for the educational process [2]:

- the film constitutes a visualisation of movement that can be watched at any place and time convenient for the user;
- it allows viewers to observe uncommon situations and processes;
- it allows transformations in time, reducing long-term processes or stretching out shorter phenomena;
- all the viewers see the same content, while

phenomena observed in nature may be perceived differently depending on the location of the viewer;
- the analysis of the processes seen in the film stimulates the audience, allows drawing conclusions and solving problems;
- visual information provided with a commentary is better received and memorised.

Educational video is usually addressed to a defined recipient, therefore, its preparation and creation should be carried out in accordance with established principles, including the identification of its objectives and the correlation of the content with the curriculum. Well considered and planned educational activities involving video aids should lead to:
- increasing the students' technical knowledge;
- teaching skills in working with different types of sources;
- stimulating reflection on the subject;
- undertaking independent research by the students.

Educational video currently occupies one of the leading places among many ways of illustrating lesson subjects. Therefore, it may be beneficial to explore the ways educational film influences the effectiveness of the learning process. By allowing visualising phenomena unobtainable or unachievable in direct observation, it helps to understand different processes and discover the existing correlations in both macroscale and microscale, and should therefore play a particularly important role in technical education.

METHODOLOGY OF RESEARCH

The aim of the study was to determine the influence of educational film on students' knowledge in one of the technical fields taught in middle school. A total of 52 students participated in the study. In order to achieve the aim of the study, the following research methods and techniques were implemented:
- a pedagogical experiment,
- an achievement test,
- a chi-squared statistical test.

In the experimental group, an educational video "Soldering – construction and types" was shown during the lesson, while the control group only used textbooks. The students' knowledge was then verified in both groups by means of a multiple-choice test comprising eight questions. The number of correct and incorrect answers was counted. Due to the fact that students from both groups attended the same school, pursued the same curriculum and were taught by the same teacher, their level of knowledge prior to the experiment was assumed a priori to be similar.

In order to evaluate the variability of the number of correct answers in the test after multimedia lessons, in comparison to the lesson conducted with traditional methods, a coefficient K was introduced, described by (1):

$$K = \frac{y_n}{y_0} * 100\% \quad (1)$$

where: y_n – number of correct answers of students in the experimental group,
y_0 – number of correct answers of students in the control group.

A chi-squared test was also used to determine whether the number of correct and incorrect answers depends on the didactic method used (i.e. the use of educational film). The variables tested were dichotomous by nature, so a bipartite table was used (Table 1) [3].

Table 1. Schema of the bipartite table used in the study [3]

Variable Y	Variable X		Sum of rows
	X_1	X_2	
Y_1	a	b	a + b
Y_2	c	d	c + d
Sum of columns	a + c	b + d	N = a + b + c + d

Using the bipartite table you can use the following formulas to test of the independence of the variables (2):

$$\chi^2 = \frac{(ad-bc)^2}{(a+b)(c+d)(a+c)(b+d)} * N \quad (2)$$

where: a, b, c, d – number of variants of the two variables,
N – number of sample.

The number of degrees of freedom for the $\chi 2$ test is calculated according to the formula (3):

$$df = (k-1)\cdot(w-1) \quad (3)$$

where: k – the number of columns in the bipartite table,
w – the number of rows.

A null and an alternative hypothesis were then formulated:

H_0 – there is no relationship between the variables (there is no link between the number of correct answers in the test and the use of educational video);

H_1 – a relationship between the variables exists (there is a link between the number of correct answers in the test and the use of educational video).

In order to determine the strength of the relationship between the variables, a coefficient r_c was also introduced (4):

$$r_c = \sqrt{\frac{\chi^2}{N}} \tag{4}$$

where: χ^2 – empirical value of the test,
N – number of sample.

ANALYSIS OF TEST RESULTS

The results were presented in eight tables (Tables 2–9) and in graphical form as a radar chart (Figure 1).

On the basis of the formula (1), the coefficient K was calculated as 142.9%, meaning that throughout the test the number of correct answers of students in the experimental group was 42.9% higher compared to the number of correct answers in the control group.

In order to verify the independence of the features in accordance with the assumptions outlined in the methodology of research based on the data in Table 10, the empirical value χ^2_{emp}= 31.36 was calculated using formula (2). For the significance level α = 0.05 and the calculated number of degrees of freedom (formula 3) df = 1, the critical value was χ^2_{tab}=3,84.

Because $\chi^2_{emp} > \chi^2_{tab}$, it is assumed with 0.95 probability that there is no reason to accept the hypothesis H_0. It is therefore assumed that a correlation exists between the variables.

In order to determine the strength of the relation between dichotomous variables, the coefficient r_c was calculated on the basis of the formula (4) as 0.27.

Table 2. Students' responses to question 1: What is soldering?

	Number of answers in the experimental group [N]	N %	Number of answers in the experimental group [N]	N %
Correct answer	21	81	17	65
Incorrect answer	5	19	9	35
Total	26	100	26	100

Table 3. Students' responses to question 2: Soldering can be divided into soft and hard due to: the temperature melting solder, soldering type, construction elements combined

	Number of answers in the experimental group [N]	N %	Number of answers in the control group [N]	N %
Correct answer	16	62	9	35
Incorrect answer	10	38	17	65
Total	26	100	26	100

Table 4. Students' responses to question 3: Where are soft solder connections used?

	Number of answers in the experimental group [N]	N %	Number of answers in the control group [N]	N %
Correct answer	18	69	9	35
Incorrect answer	8	31	17	65
Total	26	100	26	100

Table 5. Students' responses to question 4: Gas soldering irons are used for soldering: the larger the surface, small electronic components

	Number of answers in the experimental group [N]	N %	Number of answers in the control group [N]	N %
Correct answer	20	77	15	58
Incorrect answer	6	23	11	42
Total	26	100	26	100

Table 6. Students' responses to question 5: The most popular and simple soldering are:: transistor, transformer, gas

	Number of answers in the experimental group [N]	N %	Number of answers in the control group [N]	N %
Correct answer	24	92	19	73
Incorrect answer	2	8	7	27
Total	26	100	26	100

Table 7. Students' responses to question 6: The operational part of soldering selected in the drawing are: core transformer, heater, blade

	Number of answers in the experimental group [N]	N %	Number of answers in the control group [N]	N %
Correct answer	25	96	16	62
Incorrect answer	1	4	10	38
Total	26	100	26	100

Table 8. Students' responses to question 7: What temperature are used for brazed connections?

	Number of answers in the experimental group [N]	N %	Number of answers in the control group [N]	N %
Correct answer	24	92	16	62
Incorrect answer	2	8	10	38
Total	26	100	26	100

Table 9. Students' responses to question 8: What do you call a soldering iron which does not have a tip?

	Number of answers in the experimental group [N]	N %	Number of answers in the control group [N]	N %
Correct answer	25	96	20	77
Incorrect answer	1	4	6	23
Total	26	100	26	100

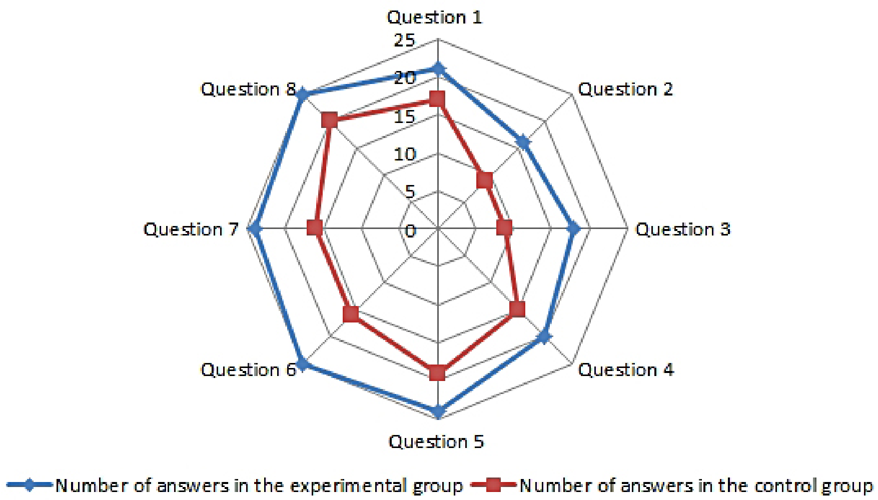

Fig. 1. The number of correct answers in the experimental and the control group

Table 10. The total number of answers in the test

Kind of group	Number of answers: correct	Number of answers: incorrect	Sum of rows
Experimental	173	35	208
Control	121	87	208
Sum of columns	294	122	N = 416

CONCLUSIONS

The results obtained in the study made it possible, in conjunction with literature data, to formulate the following conclusions:

1. The use of educational video during technical lessons contributed to an increase of knowledge level. On the basis of the calculated coefficient *K* (142.9%), it can be concluded that the experimental group obtained much better results in the achievement test.
2. The estimation of the χ^2 test confirmed that there is a correlation between the number of correct answers in the test and the use of educational video during the lesson.
3. The correlation between the number of correct answers in the test and the use of educational video during the lesson is quite high (r_c= 0.27).

In summary of the results and in response to the issue formulated in the subject of the article, it can be concluded that the use of educational films during lessons results in an increase of efficiency in technical education.

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