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PEDAGOGICAL ADVANTAGES OF USING SIMULATORS IN STRENGTHENING THE THEORETICAL KNOWLEDGE OF THE SUBJECT "ELECTRICAL ENGINEERING"

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ABSTRACT- This article examines the results of students who use information and communication technologies in higher education through the use of simulators in the educational process, effectively mastering the lessons, working independently and creatively, not limited to new information provided by the teacher.

KEYWORDS. **Simulator, virtual, capacitor, information and communication technologies.**

I. INTRODUCTION

As a result of the analysis of foreign and domestic scientific literature sources, it is necessary to improve the skills of teachers to use virtual simulators in the professional system. Thus, the use of simulators in the educational process allows to generalize the experience of natural processes, to determine their location, conditions of use, to identify and prevent the main problems [1-4].

The data obtained during the pedagogical research show that the teacher is not able to provide the audience with theoretical knowledge during the lesson, to form the course of the process, and as a result it is advisable to use simulators to prevent problems with the organization of some students. Interest in the development and use of simulators (virtual simulators) in the system of professional training of a specialist is one of the peculiarities of professional activity in modern society. The effectiveness of the use of simulators in the professional training of specialists dealing with human-machine interfaces has been proven and validated. Currently, there is a growing interest in the production of simulators for employees and workers of the Ministry of Emergency Situations, military personnel, medical personnel [3-6].

The use of simulators in the learning process has a number of advantages [1]:

- sufficient repetition;
-unlimited in terms of temporary source;
- independence from the environment and conditions of the organization of professional training;
-objectivity in assessing the level of professionalism in terms of certification or examination.

In assessing the conditions for the activities of the teacher in modern society, it should be noted their uncertainty, complexity, the presence of a sufficient number of contradictions and stressful situations in the process of organizing the lesson. It is necessary to develop and introduce simulators and virtual simulators in the system of professional training of teachers, aimed at the management of the educational process and the formation of competencies in the field of pedagogical activity. The main goal is to study the possibilities of using the simulator in the system of teacher training, to identify the main tasks that they can be solved.

According to the results of the analysis of foreign scientific literature, 10 years of experience in the use of simulators in the system of professional training of students was identified. The use of simulators abroad is aimed at creating conditions for the integration of pedagogical university students into the educational environment and the formation of practical teaching skills. For example, simulators are considered as a universal solution to various problems in the education of American teachers. Simulator training products such as SimSchool Teacher Training Platform, TeachLivE ™, Teacher Prep SIMS are the most in demand [2-4]. The modern generation of simulators is characterized by a real penetration into the educational environment. For example, the TeachLivE ™ virtual simulator, developed at the University of Central Florida, allows you to form practical skills related to lesson organization, management decision-making in different pedagogical situations, almost as a teaching reality.

It should be noted that the use of simulators in the system of teacher training, first of all, the formation of the student's initial professional experience takes place in a safe and calm learning environment that allows you to learn from your mistakes.

Another such simulator is the phet.colorado.edu simulator. This simulator is the most convenient simulator for strengthening theoretical knowledge in the field of "Electrical Engineering", practical classes and laboratory classes.

II. ANALYSIS AND RESULTS

Students 'knowledge of capacitors will be shaped in school, but they will not have realistic ideas about its operating principle, shape, properties, and connection procedure. To do this, we can search for answers to the above questions using the simulator phet.colorado.edu. Figure 1 shows the application that applies to the capacitor. From this application we can select a capacitor for different situations [2].

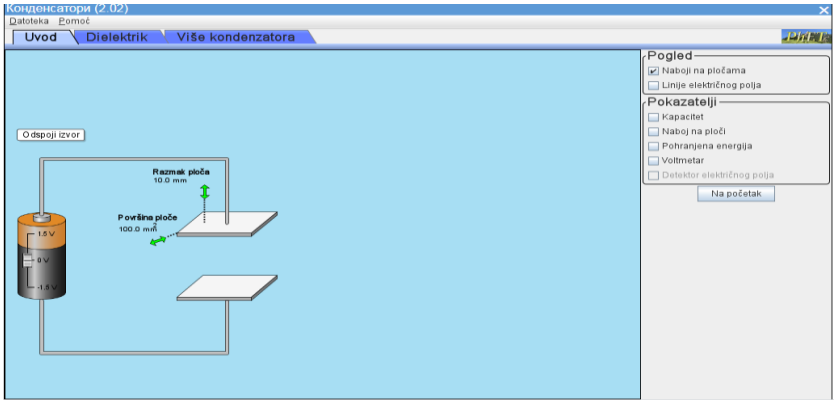

Figure 1. Wiring diagram of the capacitor to the power supply.

A flat capacitor with an empty space between the plates (equal to e = 1) is obtained, in which case the capacitance of the capacitor, the charge in it, and the electric field energy between the plates can be determined simultaneously (Fig. 2). It can be checked that the value of these physical quantities corresponds to the theoretical calculations.

Table 1. Technical and electrical parameters of the capacitor, which consists of a gap between the plates.

№	U, V	S, mm²	d, mm	c, F	q, kl	W, j
1	1,5	100	10	$0{,}89\cdot10^{-13}$	$1{,}33\cdot10^{-13}$	$1\cdot10^{-13}$
2		100	5	$1{,}77\cdot10^{-13}$	$2{,}66\cdot10^{-13}$	$1{,}99\cdot10^{-13}$
3		165.1	5	$2{,}92\cdot10^{-13}$	$4{,}38\cdot10^{-13}$	$3{,}29\cdot10^{-13}$
4	0,987	322	10	$2{,}85\cdot10^{-13}$	$2{,}81\cdot10^{-13}$	$1{,}39\cdot10^{-13}$
5		322	8	$3{,}57\cdot10^{-13}$	$3{,}52\cdot10^{-13}$	$1{,}74\cdot10^{-13}$
6		170,5	7,3	$2{,}07\cdot10^{-13}$	$2{,}04\cdot10^{-13}$	$1{,}01\cdot10^{-13}$

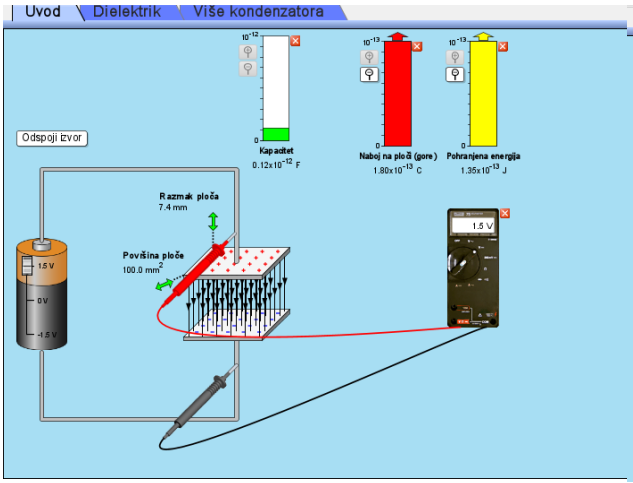

Figure 2. Wiring diagram of a capacitor consisting of a gap between the plates

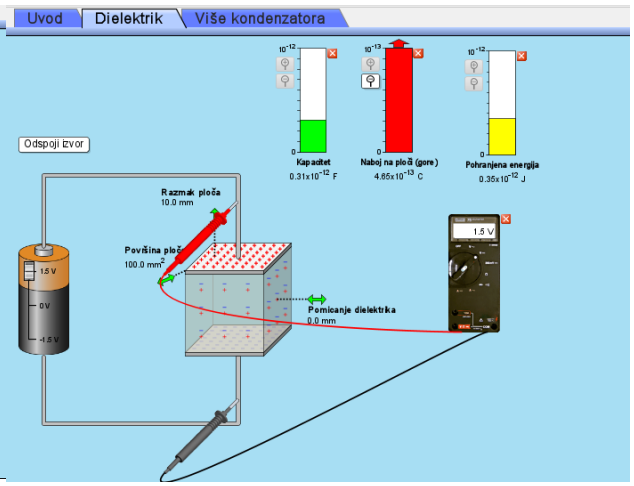

Figure 3. Wiring diagram of a capacitor filled with a dielectric medium between the plates

II. A flat capacitor is placed between the plates with a dielectric medium (equal to e = 3.4), and in this case it is possible to simultaneously determine the capacitance of the capacitor, its charge and the electric field energy between the plates (Figure 3).

Table 2. Technical and electrical parameters of a capacitor whose plates are filled with a dielectric medium

№	U, V	S, mm²	d, mm	c, F	q, Kl	W, J
1	1,5	100	10	$0{,}3\cdot10^{-12}$	$0{,}45\cdot10^{-12}$	$0{,}34\cdot10^{-12}$
2		149	5	$0{,}90\cdot10^{-12}$	$1{,}35\cdot10^{-12}$	$1{,}01\cdot10^{-12}$
3	0,829	207,8	7,1	$0{,}89\cdot10^{-12}$	$0{,}73\cdot10^{-12}$	$0{,}30\cdot10^{-12}$
5		287,8	9,6	$0{,}90\cdot10^{-12}$	$0{,}75\cdot10^{-12}$	$0{,}31\cdot10^{-12}$

III. Figures 4 and 5 show the series and parallel connected condition of the flat capacitors. In the lectures, information was given on the voltage applied to each capacitor when the capacitors were connected in series and in parallel. With the help of this simulator we are able to measure the voltage across each capacitor and allow the analysis of theoretical knowledge.

Table 3. Technical and electrical parameters when capacitors are connected in series.

№	U, V	c_1, F	c_2, F	c_3, F	c, F	q, kl	W, j
1	1,5	$1\cdot10^{-13}$	$1\cdot10^{-13}$	$1\cdot10^{-13}$	$0{,}33\cdot10^{-13}$	$0{,}5\cdot10^{-13}$	$0{,}38\cdot10^{-13}$
2		$1{,}7\cdot10^{-13}$	$1{,}6\cdot10^{-13}$	$1\cdot10^{-13}$	$0{,}45\cdot10^{-13}$	$0{,}68\cdot10^{-13}$	$0{,}51\cdot10^{-13}$
3	0,552	$2{,}20\cdot10^{-13}$	$2{,}6\cdot10^{-13}$	$1{,}9\cdot10^{-13}$	$0{,}69\cdot10^{-13}$	$0{,}38\cdot10^{-13}$	$0{,}10\cdot10^{-13}$
4		$2{,}70\cdot10^{-13}$	$2{,}7\cdot10^{-13}$	$2{,}5\cdot10^{-13}$	$0{,}88\cdot10^{-13}$	$0{,}48\cdot10^{-13}$	$0{,}13\cdot10^{-13}$

Table 4. Technical and electrical parameters of capacitors in parallel.

№	U, V	c_1, F	c_2, F	c_3, F	c, F	q, Kl	W, J
1	1,5	$1\cdot10^{-13}$	$1\cdot10^{-13}$	$1\cdot10^{-13}$	$3{,}00\cdot10^{-13}$	$4{,}50\cdot10^{-13}$	$3{,}38\cdot10^{-13}$
2		$2{,}0\cdot10^{-13}$	$1{,}7\cdot10^{-13}$	$2{,}6\cdot10^{-13}$	$6{,}30\cdot10^{-13}$	$9{,}45\cdot10^{-13}$	$7{,}09\cdot10^{-13}$
3	0.868	$1{,}80\cdot10^{-13}$	$2{,}20\cdot10^{-13}$	$2{,}20\cdot10^{-13}$	$6{,}20\cdot10^{-13}$	$5{,}38\cdot10^{-13}$	$2{,}34\cdot10^{-13}$
4		$2{,}50\cdot10^{-13}$	$2{,}80\cdot10^{-13}$	$2{,}70\cdot10^{-13}$	$8{,}00\cdot10^{-13}$	$6{,}94\cdot10^{-13}$	$3{,}01\cdot10^{-13}$

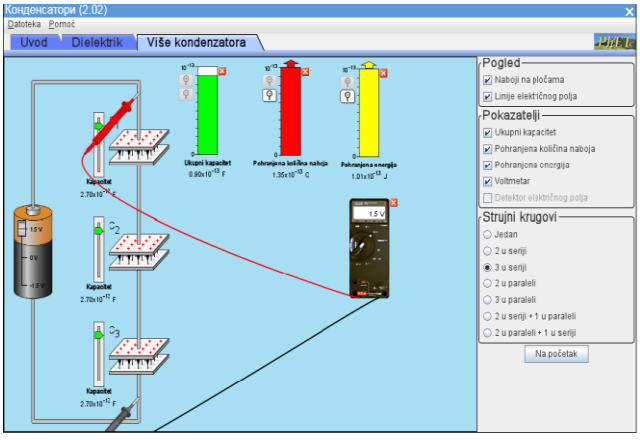

Figure 4. Schematic connection of capacitors in series.

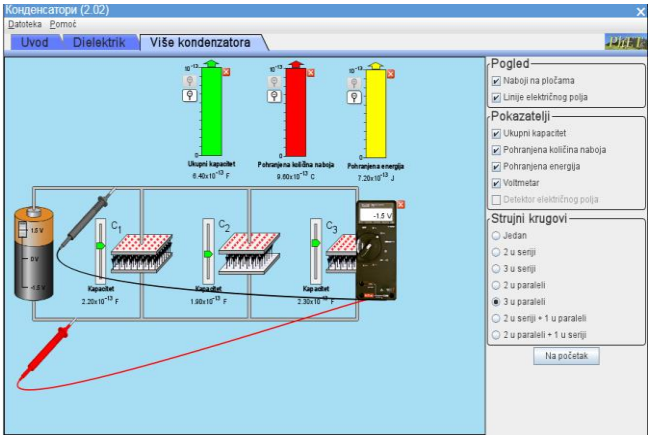

Figure 5. Schematic of parallel connection of capacitors.

The results of solving the problems generated during the students 'learning practice during the study are shown in detail in Figure 5.

The data show that in the first academic practice, students (84%) face problems related to the management of the learning process and professional activity. To focus on some of them: 10% of students

have difficulty solving problems related to discipline and behavior in the audience; 9% of students face the problem of efficient use of time in the classroom; 8% of students have difficulty resolving conflict situations with individual students; 6% of students are not ready to organize a lesson in a school where there is not enough software or hardware..

III. CONCLUSION

Effectiveness in education is reflected in the quality of education. The quality of education is an integral description of the process and outcome of education, its degree of conformity to the prevailing perception in society about what education is, what goals it serves.

In higher education, students of information and communication technologies effectively master the lessons and move to the stage of independent work and creative activity, not limited to new information provided by the teacher, but in their spare time independently increase their knowledge using simulators. This can be seen in the fact that they complete the tasks given by the teacher quickly and without mistakes during the lesson.

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