

# Research on the Impact of Innovative Interactive Technologies in the Education of Health Care Students

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**Abstract**—The article examines the impact of innovative technologies in the educational process of health care students. The results of a study on the impact of modern interactive technologies in the training of future health professionals are presented. Within one academic year, an experimental study was conducted with student volunteers, divided into two groups: students by traditional methods and students to whom the learning content is presented through a comprehensive interactive training system. The research is analyzed using mathematical methods and the results are presented in tabular form. The summarized results show the advantage of the presented innovative interactive learning system over the traditional way of conducting training and practical classes. A detailed analysis of the results shown was performed using analysis of variance. The conducted experimental research clearly shows that modern innovative educational technologies contribute to the construction of lasting, effective knowledge, skills, competencies and the acquisition of professional qualities.

**Keywords**—interactive training, health care, health professionals, educational problems

## 1 Introduction

The continuous increase in the level of health needs of the population, health challenges over the past two years worldwide cause a change in people's attitudes towards health as a value and can be cited as reasons for training and forming a new type of medical professionals with new thinking and professional competencies.

In the last two years, higher education institutions training nurses and midwives have been subject to the need for change and flexibility in teaching methods. Healthcare teachers continue to rely on traditional teaching methods, but understand the need to introduce innovative methods to respond to changes in lifestyles, education and human health. Many universities around the world are forced to introduce innovative teaching strategies and technologies to meet current challenges.

In Bulgaria during these two years there is a process of improving the quality of the educational process of students in the professional field of Health Care through the inclusion of innovative interactive methods: web-based teaching, simulation learning environment, videos, serious games, online digital resources and others.

In their teaching, teachers face a number of challenges [1] that they must be able to address in order to develop the abilities of their students. In the same ways of teaching, learners learn the presented material in different ways, depending on their unique human characteristics. However, it is also established that the use of innovative teaching methods leads to an increase in the assimilation of the taught material by all learners [2]. Research shows [3, 4] that the average storage rate of taught information is 5% for 24 hours, which is a very small percentage. When using alternative methods, much more information is permanently absorbed, such as: Hearing and visual aids (20%); Demonstration activities (30%); Discussion groups (50%); Practical classes (75%); Affiliate training (90%).

The purpose of this article is to study and reveal the organizational and pedagogical conditions under which interactive technologies in education have an optimal impact on the formation of future medical professionals.

## **2 Related works**

The authors in their research emphasize the need for new methods of teaching modern students who were born and raised in the era of technological innovation [5]. Interactive approaches, serious learning games are good to be part of modern learning [6].

In their study, the authors of [7] show the need for online learning to include an interactive digital environment, to promote alternative tasks, interactive presentation of taught material, use of online resources and others.

The authors of [8] show in their study the need to create a model of learning based on pedagogical research and evaluations of experts in education. The authors emphasize the impact of problem-based learning, interactive digital storytelling and gamification of the world around them to improve the quality of learning and promote learners' problem-solving skills.

Transformation in teaching [9, 10, 11, 12] should take place through an institutional teaching strategy and individual teaching skills. Innovative concepts for modern student learning are highly recommended when teachers want to support the successful completion of their students' learning. New approaches require increasing the professional training of teachers, and require the development of new teaching aids. The implementation of problem-based learning contributes to the effectiveness and flexibility of learning.

## **3 Methodology of conducting the experimental study for one school year**

An experimental pedagogical study was conducted for a period of one school year, during which time 2 groups of students were studied: control group (CG), which was trained in the traditional way of conducting practical training sessions and experimental group (EG) in the training of which includes a comprehensive interactive training system. The participating students are from the following specialties: Midwife, Nurse and Kinesitherapist.

The study was conducted at the following universities in Bulgaria: University of Ruse “Angel Kanchev” – specialties Midwife and Kinesitherapist; Thracian University (base of Stara Zagora and Branch of Haskovo) – specialties Midwife and Nurse. Total number of participants 225 (115 – EG, 110 – CG). Students are included in the didactic research after receiving their informed consent.

Initial tests (entrance levels) were conducted for both training groups and final tests (exit levels) at the end of the studied training time.

A system of criteria has been created (assimilation of basic concepts of health care, essential features and level of assimilation of the concept) and indicators for evaluation of the results of the pedagogical experiment. The criterion is a “feature” on the basis of which an assessment is made, ie the “qualitative side of a result” is considered a criterion, and the “quantitative characteristic” is considered an “indicator”. The criteria make it possible [13] to assess completeness, depth, efficiency, flexibility, specificity and generality, systematicity and systematicity, awareness of knowledge. A knowledge in didactics is considered mastered if the coefficient “K” (criterion) is greater than or equal to 0.7.

The complex interactive system for training of specialists in Health Care has been created taking into account research by pedagogical authors on criteria and indicators for evaluation of educational results [14, 15]. The created innovative system includes videos (according to the educational content) and a system of situational problem tasks.

The developed system of criteria and indicators for evaluation of the results of the didactic experiment (N – number of students examined by the test) includes:

1. *Coefficient of completeness of mastering the content of the concept:*

$$K_{ind} = \frac{\sum_{i=1}^N l_i}{l \cdot N}, \quad (1)$$

where:  $l_i$  – number of essential features mastered by the  $i$ -th student;  
 $l$  – number of features provided for mastering the curriculum.

In the present study, the first of the criteria is a concept, the second criterion is its level of assimilation.

The following levels are defined:

- First – identification, involves recognizing the object in the task;
- Second – reproductive, requires the student to analyze, explain, reproduce, solve an algorithmic problem to explain the behavioral model;
- Third – applicative, the student must apply the learned knowledge in a familiar or similar to the familiar situation, to apply a behavioral model in various simulated or real clinical situations close to the studied;
- Fourth – creatively, the student applies his knowledge in an unknown, unexplored, unusual situation.

2. *The coefficient of completeness of the assimilated connections between the essential features is given by the formula:*

$$K_{conn} = \frac{\sum_{i=1}^N q_i}{q \cdot N}, \quad (2)$$

where:  $q_i$  are the number of assimilated connections between the essential features of the  $i$ -th student;

$q$  – number of connections provided for learning in the curriculum.

The coefficients were determined after solving a test by the students who participated in the study. The didactic test developed for this purpose is constructed on the studied curriculum in high school from the subject Biology and Health Education.

The first three tasks of the test focus on the three essential features of the concept of “infections”: causes of infections, ways of spreading infections and measures to prevent infections. It is planned to check the acquired signs at the reproductive level.

The fourth, fifth and sixth tasks of the test are focused on the content of the concept of “pulse” as a physiological, vital indicator. This concept has the following essential features: arteries, such as blood vessels, on which the pulse is measured; oscillation of the arterial wall after each heartbeat and normal heart rate in an adult.

Seventh, eighth and ninth tasks of the test check the mastery of the concept of “blood pressure”. Features: the force that the blood exerts on the arterial walls under the influence of ventricular contractions; age as a factor in high blood pressure; logical values in hypotension and hypertension.

Tasks number ten, eleven and twelve are aimed at testing the concept of “breathing”. Features of this concept are: the process of exchange of oxygen and carbon dioxide between the atmosphere and the body; there are two phases of the unified process of “breathing”; number of breaths per minute in newborns and adults.

Tasks number thirteen, fourteen, fifteen are aimed at the content of the concept of “body temperature”. Features: the mechanism of thermoregulation to maintain a constant body temperature; places for measuring the temperature of the human body; normal values of the temperature range.

## 4 Results

A reference sample has been created, with the help of which the degree of knowledge acquired by the CG and EG has been established. The values for the coefficients were obtained after an input test was performed with the two groups – CG and EG (Figure 1). The figure shows that the coefficients of mastering the basic concepts related to vital signs are below 0.3. Only for the assimilation of the concepts related to infections, this coefficient is 0.33, but its value is significantly lower than desired.

The final ascertaining test is carried out with the help of the same tasks in order to be able to correctly establish the difference before and after the transformation experiment (the obtained results are presented in Figure 2). The experimental group has a coefficient of absorption significantly higher (0.84) than that of the control group of students (0.6).

Figure 3 shows the coefficients of absorption of the individual concepts from the output test for CG and EG. Studies have been conducted on the coefficients of assimilation of the individual concepts from the output test by the two studied groups participating in the experiment.

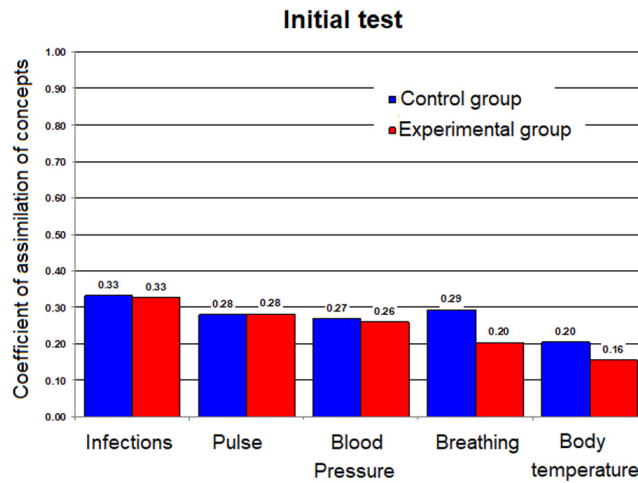


Fig. 1. Coefficient of mastering the individual concepts from the entrance test by the control and the experimental group

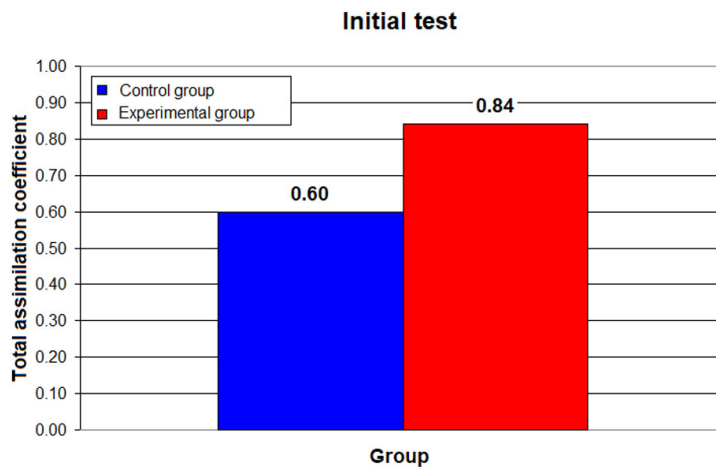


Fig. 2. Coefficient of absorption from the output test made by the control and the experimental group

From Figure 3 it can be seen that the coefficients of mastering the basic concepts are significantly higher in the outgoing test, as they vary on different topics. The ratios of the output test / input test results in the experimental (1.68) and control groups (1.25) were calculated. The average value of the increase of the coefficients of absorption of the basic concepts of EG compared to CG is 1.41. This means that the concepts are learned 1.41 times better at the identification and reproductive level than EG. In graphical form (Figure 4) a comparison is made between the results obtained before and after the conversion experiment.

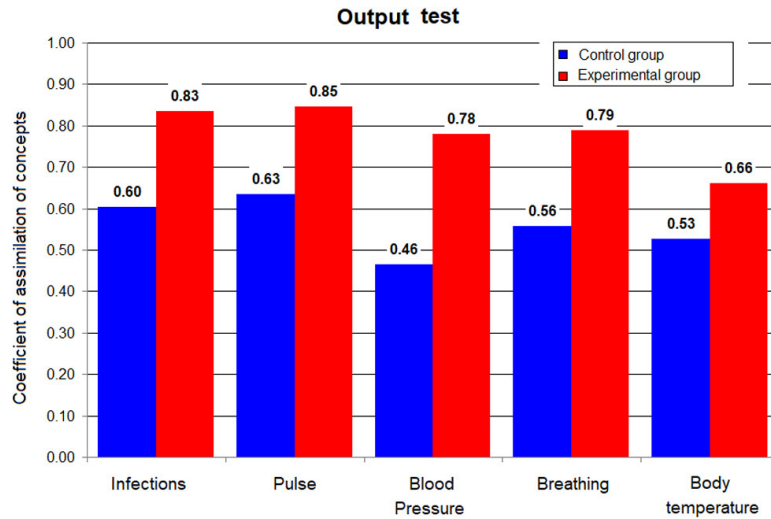


Fig. 3. Coefficient of assimilation of the individual concepts from the output test by the control and experimental group

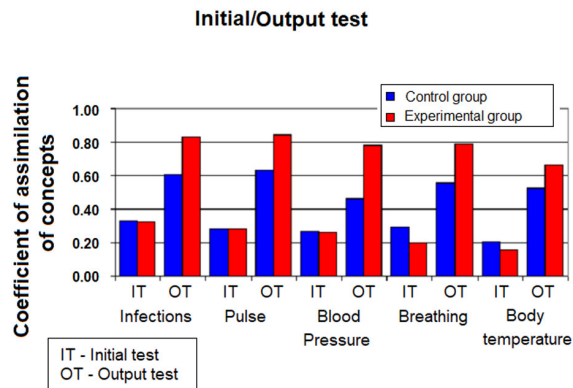


Fig. 4. Comparison between the coefficients of assimilation of the individual concepts before and after the transformation experiment by CG and EG

Similar studies have been done for the coefficient of completeness of the assimilated connections  $K_{comm}$ , where it was found that the connections between the essential features are absorbed 1.57 times better in EG.

## 5 Analysis of the obtained results

From the statistical processing performed with the help of three-factor analysis of variance, it was found that in the entrance test the degree of mastery of individual concepts is approximately the same for all participants, which is a prerequisite for a correct didactic experiment. In the output test, it was found that the assimilation coefficient  $K_{ind}$  and the coefficient of assimilated connections  $K_{conn}$  are influenced by all three factors – specialty, teaching methodology, which is different for the control and experimental groups and the concepts. The greatest degree of influence is exerted by the teaching methodology factor – for the control group it is traditional, and for the experimental group it is a complex interactive training system.

## 6 Conclusion

The article presents the use of an innovative interactive training system in medical education in Bulgaria, the professional field of “Health Care“. The conducted one-year pedagogical experiment shows a significant increase in the quality of the mastered learning material in the tested experimental group of students, the training of which includes innovative interactive technologies. The research was conducted in comparison with a control group of students trained in traditional pedagogical methods. The conducted training experiment covers students in health care in the following specialties: Midwife, Nurse and Kinesiotherapist. The obtained results show on average 1.41 times better mastering of the studied main categories and concepts and 1.57 times better establishment of connections between the signs in the studied areas by the students using innovative technologies in teaching. These results can be improved by including additional problem-solving tasks in the training.

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