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Integration Methods as a Means of Improving the Level of Teachers' Professional Training

Abstract

This article suggests one of the possible ways of integrating teaching methods from the integration methods developed by the authors, namely: the integration based on the dominant teaching method. The article aims to substantiate the author's methods of integrative teaching based on the dominant method and present the results of the approbation of these methods in higher schools. The project was implemented within the course "Medical Biophysics". An integration algorithm as a dominant teaching method is proposed. The project contained several specific techniques. In the first specific method, the situational method is chosen as the dominant one. For the second one, the method of trials and coincidences is dominant. For diagnostics as a complex topic in medicine, physics, chemistry and other sciences, the problem method as dominant is dominant. In all methods, several other methods are gradually integrated into the dominant method, depending on the content and nature of the educational material. The practical significance of the project is to create algorithms for integrating teaching methods and the possibility of their transformation into other educational topics. The approbation shows an increase in the indicators of saving time and flexibility of knowledge.

Keywords: *integration of teaching method, flexibility of knowledge, dominant teaching method, Medical Biophysics*

Introduction

In the scientific literature, the following questions were considered for the modelling of the integrative scientific method (Rusbult, 1997), integration of information and communication technologies in education (Bhasin, 2012, pp. 130–140), integrative curricula (Beane, 1998, pp. 30–33), paradigmatic aspects of integrative technologies in higher education of the new millennium (Rogers, 2000, pp. 19–33), development of the idea of integrative education from position to philosophy (Fan, 2004), learning models in the context of integrative sciences (Wintrop, 1973, p. 73), the effectiveness of integration for students and teachers innovative, integrative processes (Christensen, 2002, pp. 411–443), integrative educational principles (Earle, 2002, pp. 5–13), integration in university education (Yildirim et al., 2010, pp. 831–845), scientific substantiation of integrative curricula (Turpin, 2004, pp. 1–17), etc.

The experiment was conducted according to the protocols of Vinnytsia Pedagogical University, the Center for the Coordination of Research in Pedagogy and Psychology, with the participation of voluntary students of Lviv National Medical University. The essence of the experiment is purely pedagogical and educational, and the experiment was conducted purely with the voluntary consent of the participants.

Methodology and Theory of the Problem of Integration. The Role of Teaching Methods

The choice of teaching methods depends on the goals of education, upbringing and development and the leading attitudes of modern education. No single method can provide the required results in full. A positive result can be achieved only when using many methods. Each teaching method focuses on solving a certain range of didactic tasks.

With this in mind, it is necessary to analyse the possibilities of each teaching method, determine its strengths and weaknesses, choosing the optimal combination of applied methods for each topic of the educational subject for each specific lesson. With an integrative approach to education, all existing teaching methods

can be used, but their capabilities increase significantly due to the expansion of the conceptual and operational apparatus and the increase in the number of elements of various subject knowledge. Acting as an integrating factor, teaching methods should, first of all, be aimed at helping the student transfer knowledge and skills from one field to another.

Results

Methodology of Integration of Teaching Methods and Stages of Its Implementation

The choice of methods for a particular lesson depends on the tasks and learning conditions and the peculiarities of its content.

We offer an integration algorithm, which is the basis of our methodology.

1. Identification of the basis for their integration of teaching methods.
2. Selection and formulation of a specific educational problem for a lesson.
3. Formation of integrated blocks of methods and their implementation at different lesson stages.

The method of teaching methods integration was implemented in the process of teaching professional disciplines in the higher school. One of the main training courses to which teaching methods were integrated was the course "Medical Biophysics".

This course is chosen because it is important for medical students to study the physics of a living organism.

In the first specific method, the situational method was chosen as the dominant one based on introducing students to a certain professional situation. Specific examples from practice are of interest to others and attract attention, which for a short time, allows for considering a large number of specific situations of a practical nature. The situation description should not include any comments from the teacher or his emotional attitude to it but should cover only the information essential for decision-making.

An interesting example is the use of the situational method in the study of such a disease as cataract: this is where the influence of the development of physics on the technology and treatment is manifested. Today, laser technology and the development of new materials allow the implantation of an artificial lens that restores normal vision.

The integration of teaching methods in the study of this topic by students is a step-by-step use of interrelated teaching methods, the dominant of which is the situational method. Diagnosis options are analysed using heuristic teaching methods. Finally, the system includes a problem-solving method – students must choose the final diagnosis and outline treatment options.

The second specific method is used as the dominant method of randomness tests, which involves a small group of students to consider a description of an extreme case and aims to explain this case

A striking example of educational material is the problem of controlling the coronavirus and finding a vaccine against an unknown disease.

The testing method is integrated with the historical method, which allows for acquainting students with the problems of creating vaccines in the past. In this context, the teacher explains to students that modern technology can significantly accelerate vaccine research, production, and testing. The integration with heuristic methods completes the study of the topic and shows the role of physics in solving some problems.

Integrating dominant and auxiliary methods with heuristic methods is the final stage of methodology development. It is the highest level of integration. It includes integrated blocks of methods. An example of such a block is the method of solving the problem of creating a product previously unknown to students due to their certain mental actions. For example, this is a method of changing the situation. Students are asked to describe or draw a diagram of a particular change in the human body or environment. For example, certain viruses or bacteria will disappear, the appearance of a hitherto unknown virus, the possibility of developing medical devices based on new ideas of modern physics, and so on. Performing such tasks by students not only develops their ability to imagine but also significantly improves their readiness to work as doctors in the future.

Ways to Implement Methods of Integrating Student Teaching Methods

Organisation of Implementation of Specific Methods in the Learning Process

The study was conducted for eight weeks. First, teachers filled out a questionnaire. It made it possible to identify the state of integration of methods and determine the educational potential of their integration.

During the second week, teachers were introduced to the method of integrating teaching methods and the algorithm of integration based on the dominant teaching method.

Most teachers readily agreed to use the proposed methods and algorithms.

The experts acted as independent ones. The examination aimed to determine the feasibility and effectiveness of an integrative approach to student teaching methods.

In the framework of this experimental study, we identified control and experimental groups, the most homogeneous in terms of participants, namely: control groups in which the learning process took place in the usual mode; experimental groups in which the educational process took place under the influence of an active pedagogical factor, namely according to the author's methods of integration of teaching methods.

In total, 12 teachers and 80 students were involved in the experiment.

The Results of the Analysis of the Integration of Teaching Methods Before the Experiment

Higher school teachers are eager to improve their performance. It is evidenced by the high rate of their desire, which can not be said about the real possibility of applying the integration of methods. The positive fact is that both indicators are the highest for teachers working for less than ten years. It is due to their desire to reach the top of professional excellence faster. We received interesting observations not only in the process of interviewing teachers but also observing their work. At the same time, there was conducted a survey of students and graduates who have been working in the profession for several years.

The answers of the graduates closely coincided with the estimates of experts. Students' answers were less accurate but also similar in content. In general, we could summarise the results of surveys and interviews and draw many conclusions.

Thus, it is found that teachers are interested in integrating teaching methods but do not have enough time and appropriate training to implement these processes.

The teacher's readiness to use the proposed integration methods is a key aspect in obtaining a positive result.

The teacher's task is to make personally significant for the needs of students those objects that are of real importance for future professional activities. Such purposeful learning involves systematically setting students' learning objectives, which plays an important, sometimes crucial role in solving the integration of teaching methods

The Effectiveness of the Use of Integration of Teaching Methods

Choosing the maximum time allotted by the curriculum (100%), we determined the time required to master a particular topic in a particular subject and compared changes in this time using traditional and integrative approaches to teaching methods (Figure 1).

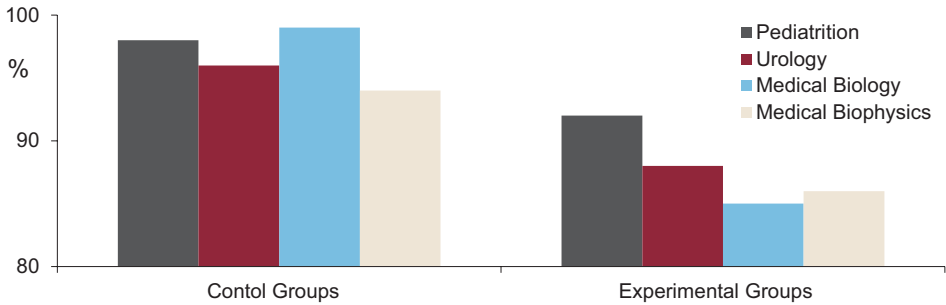


Figure 1. Indicators of saving study time under the traditional (control groups) and integrative approach (experimental groups) to teaching methods

Thus, integrating teaching methods in experimental groups makes it possible to master the selected amount of knowledge of the same quality in less study time. It was also noted that the experimental group students were more able to connect the acquired knowledge from different disciplines.

A standard scheme was used to study the quality of students' professional knowledge and skills: the ratio of the actual result to the result theoretically predicted.

Thus, the completeness and efficiency of knowledge, levels of operation, systematicity, generalisation, etc., are determined. Using the traditional approach, there is almost no difference in knowledge between the control and experimental groups.

The experiment showed that the integration of teaching methods positively affects the level of knowledge flexibility (Figure 2).

The low level is characterised by situational interest, which motivates the student to solve a certain practical problem, which usually fades with difficulty. He

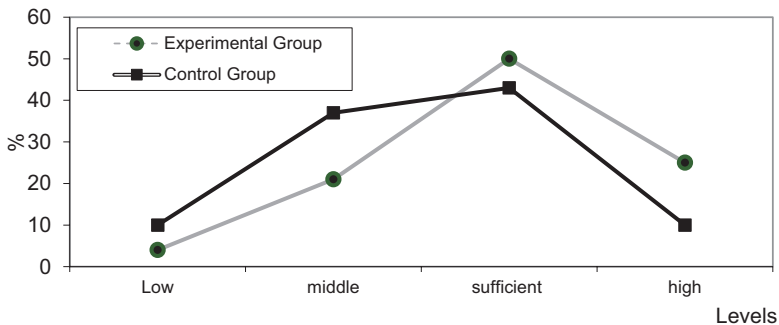


Figure 2. Levels of the flexibility of students' knowledge under the condition of traditional (control groups) and integrative approach (experimental groups) to teaching methods

has a general idea of the basics of medical biophysics, but the knowledge is not systematised. The skills and abilities to solve professional problems are almost non-existent. It may be sporadic and not always correct. Applying knowledge of medical biophysics for professional purposes independently.

The middle level is characterised by the students' interest in medical biophysics. However, awareness of its importance as a means of professional activity does not go beyond the educational material. The application of knowledge of medical biophysics in order to solve professional problems is limited to known examples.

The sufficient level is characterised by a steady interest in medical biophysics. The student connects professional success with using this knowledge and can apply it in solving their own educational professional tasks. However, the knowledge about the peculiarities of using the basics of medical biophysics and the ability to use them in professional activities is partially limited.

The high level is characterised by the need for self-realisation as a doctor. The student connects his professional success with knowledge of medical biophysics. He can use this knowledge not only to solve their own educational needs but also to use it creatively in professional activities.

Flexibility of knowledge is an extremely important characteristic of a doctor's professional competence. The flexibility of knowledge allows for using it in new, unfamiliar, or unusual situations. And such situations in medical practice are quite common.

As we can see from Figure 2, the levels of flexibility of knowledge are higher in the experimental group due to the use of an integrative approach to the choice of teaching methods. We can confidently say the latter because integrating teaching methods was the only thing that distinguished teaching in both control and experimental groups. On all other grounds, we have equalised all groups as much as possible.

An important aspect was the comparison of success levels in the integration of teaching methods. Figure 3 presents the results of success, represented at three levels.

The reproductive level implies that students' interests are mostly vague, situational and unstable. One-sided, practical interests in knowledge are characteristic. Students have only superficial knowledge and a low level of systematisation and generalisation of knowledge. For the most part, the success is satisfactory.

The productive level is determined by the ability to quickly determine knowledge's essential and characteristic features to understand its relationship with professional activities. Students with this level can apply the acquired knowledge to analyse specific situations. The quality of knowledge of these students is good.

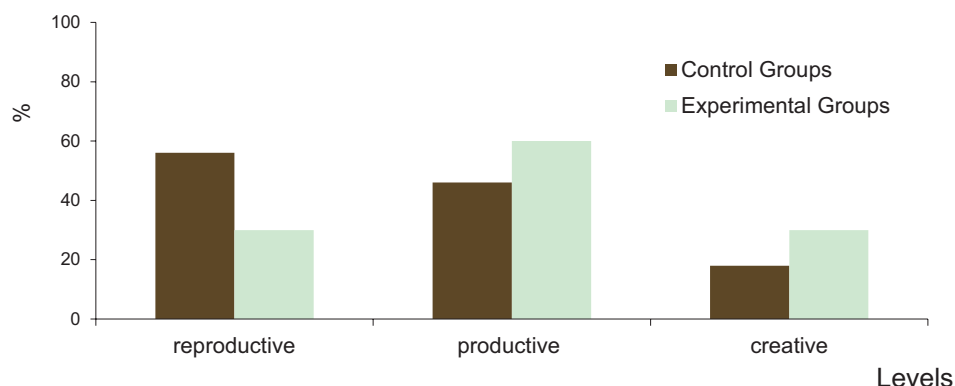


Figure 3. Levels of medical biophysics students' success in terms of traditional (control groups) and integrative approach (experimental groups) to teaching methods

They have mostly good grades and are characterised by a positive emotional attitude to professional activities.

The creative level is characterised by the formation of students' understanding of the structure of knowledge and the dominant role played by focusing on the success of future professional activities. Thinking techniques that ensure the quality of knowledge are creative. Students understand the importance of acquired ways of learning. There is an internal need to understand the place and importance of perceived knowledge and find new knowledge necessary to solve a problematic professional situation. These students have a high quality of knowledge acquisition with a correspondingly high level of independence and success.

A series of experiments were also conducted, in which the coefficient of knowledge acquisition K (the ratio of knowledge actually acquired by students to those that had to be mastered) in the control and experimental groups is compared. In the experimental groups, there was an integration of storytelling methods, conversation and discussion. The introduction of the integration of teaching methods has reduced the number of students with low scores and increased the number of students who have scored more than 80 points. These results are average, but the general trend indicates that scientifically based integration of teaching methods increases students' knowledge, primarily by increasing interest in learning, increasing learning motivation and eliminating monotony in the classroom.

The dissemination of our proposed method to a wider range of students and its implementation in the educational process of the higher medical school confirmed our hypothesis, the reality of experimental training data and the reliability of the study results, which indicates the study's main objectives.

Conclusions and Discussion

The review of teaching methods allows us to understand the method as a dynamic process of development of educational content based on the choice of content alongside the methods of a teacher and a student. The implementation of teaching methods integration in student training is provided by the development of methodological bases of integration, which includes such components as the purpose of the integration of teaching methods, their content, integration process, as well as teacher training for the use of integrated teaching methods and guidelines for their integration.

The method of teaching methods integration, which is implemented in the process of teaching the course "Medical Biophysics" and professional medical topics, is presented. Specific examples of methods were given as part of the study.

The question of research, diagnosis and treatment of new diseases, such as COVID-19, is debatable. In this case, there is still no clear answer to finding a vaccine against an unfamiliar disease. We consider it expedient to integrate the testing method with the historical method of teaching the development of vaccines in the past. It allows us to compare the conditions and technologies in which doctors have worked and emphasise the role of natural sciences in creating drugs.

The problem method involves integrating knowledge in medicine and biophysics with the subsequent integration of teaching methods, in particular, using the algorithm for studying a physical phenomenon for diagnosis to build integrated blocks.

The results of approbation show a positive dynamic in the course of medical biophysics with an integrative approach to teaching.

Experience shows that students increase their level of competence in the profession by saving study time and more effective acquisition of knowledge by integrating teaching methods.

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