

*Chepok Oleg<sup>1</sup> & Sinyukova Helena<sup>2</sup>*

## **ON THE CONCEPT OF PRACTICAL-ORIENTATED TEACHING-LEARNING PROCESS FOR FUTURE TEACHERS OF MATHEMATICS AT INSTITUTIONS OF HIGHER EDUCATION**

*<sup>1, 2</sup>South Ukrainian National Pedagogical University named after K. D. Ushynsky, Odesa, Ukraine*

**Abstract.** *The author's concept of the essence of practical-orientated teaching-learning process for future teachers of mathematics at institutions of higher education is represented in the paper. The concept has been created on the base of analyzing the possible directions of organization practical-orientated teaching-learning process in mathematics for students of institutions of secondary education. The idea of representation the practical-oriented teaching-learning process at institutions of higher education as a process of training, directed onto applications of the received knowledge and skills to the subsequent professional activities forms the ground of the concept. For the suggested concept the possible ways of its implementation to the real teaching-learning process are introduced.*

**Keywords:** *teacher of Mathematics, teaching-learning process, practical-orientated training, institution of higher education, institution of general secondary education*

In Ukraine for all levels of education practical-orientated form of organization the teaching-learning process is one of the modern educational trends. It is obvious, by this, that such teaching-learning process must have different content and different forms of implementation on various levels and directions of education. The fact is bound up as with the general purpose of education on the every separate direction, as with age and psychological peculiarities of those who are going through the educational process.

For example, on the level of pre-school education practical-orientated form can't but be a prevail form for any direction. A child can receive sound knowledge only by the help of its own practical experience.

The level of primary education intends on the previous form of practical-orientated teaching-learning process as a unique form only for the education of inclusive type. For the level of general primary education together to the thesis "I make conclusions by my own on the ground of my own practical experience" the thesis "I want to know, what it is necessary for" begins to work. Thanks to the existence of the modern information-communicative technologies the concept of the "own practical experience" gains a new, more broad sense. It means not only the direct hands-on activities but also, for example, some work on the base of the system of Internet in the corresponding virtual educational laboratories according to the recommendations of the international project MoPED (Modernization of

Pedagogical Higher Education by Innovative Teaching Instruments) [2]. Step by step there also appears such thesis as “It is interesting for me to know, how and why such statement have appeared”.

Simultaneously, it is clear that application only the different forms of practical-orientated training can't guarantee the achievement of desirable for the community educational outcomes even for the primary level of education. To a considerable extent it is explained by the fact that realization of all forms of practical-orientated training needs essentially more time for classroom activities than realization of the traditional process of dogmatic training or, even, theoretical aspects of inquiry-based training, and not only by this.

The level of general basis secondary education (middle school) and the level of profile secondary education (senior school) assume the creation of an integral system of secondary education. Practical-orientated teaching-learning process must be put into the ground of the system. It must change its forms not only in connection with the corresponding level of education but also in connection with the corresponding educational subject.

Establishment and inclusion to the real educational process the most expedient for the present stage of development of Ukrainian society correlation between different levels and directions of education form an important practical task for building in Ukraine the modern system of education. The concept of a New Ukrainian School is directed onto its solution [1].

Higher education is vocational, not general. In accordance with the corresponding Educational Vocational Program for the very limited time student must acquire a lot of competences. The integral competence, general competence and vocational competences are among them. Just this fact explains the specificity of realization of the concept of practical-orientated training in the institutions of higher education.

***The purpose of the article*** is to represent the investigation devoted to the different aspects of introduction the practical-orientated training into the teaching-learning process for future teachers of mathematics at institutions of higher education.

In Ukraine, according to the contemporary educational programs for institutions of general secondary education, mathematics, as always, is the one of the basic educational subjects as for the basis secondary school, as for the senior secondary school [3,4]. The special place of mathematics among sciences being created by humanity is generally known. Mathematics' relationship to the activity of men onto mastering the properties of the environment has a specific character. Hence, the existence of some specificity in realization of the concept of practical-orientated training during the process of mastering mathematics by students of institutions of general secondary education and by that students of institutions of higher education that are going to become teachers of mathematics at institutions of general secondary education is a quite natural phenomenon, the formulated purpose of the article merit to be recognized as actual.

First of all we must state, that practical-orientated training at institutions of higher education the future teachers of mathematics of institutions of secondary education has a dual character.

On one hand, the corresponding program of their training contains subjects of fundamental training that are directed onto the formation an integrity notion about the present stage of development mathematics as a science, onto the detailed mastering the grounds of such parts of higher mathematics that form theoretical basis for the other, supposed by the program, mathematical subjects and for the traditional courses of mathematics in institutions of secondary education. It is necessary to find an answer onto the question how we can and how we ought to use practical-orientated training during mastering exactly such educational subjects. On the other hand, the program contains subjects of vocational training, the most part of which is directed to the methods of teaching mathematics at institutions of general secondary education and means finding the answers to the next questions. How can we use methods of practical-orientated training in the corresponding teaching-learning process and what the methods namely? Are some of the methods (maybe, all of them) analogous to the methods, used in the teaching-learning treatment of the student himself?

By author's opinion, first of all we must achieve a precision of the thesis of what at the present time must be understood by practical-orientated teaching-learning treating in mathematics at institutions of secondary education.

In Ukraine, according to the contemporary educational programs for institutions of general secondary education, for the students of the 5-6 forms there exist an integral course of mathematics, devoted to the questions of arithmetic, algebra and some geometrical questions of introductory character.

Starting from the seventh form, the course is divided onto two separate courses: the course of algebra and the course of geometry (the course of algebra and the beginnings of calculus and the course of geometry for students of the 10-11 forms).

For the courses of algebra practical-orientated training consists, at first, in increasing the amount of tasks of the same type, the treatment in fulfillment of which makes it possible to reduce the fulfillment to automatism, and in working off mathematically strict and laconic forms of writing down the processes and the results of fulfillment the tasks. A list of themes of such tasks must be a part of the list of compulsory results of training and be different for students of the so-called "ordinary" forms and forms with the intensified level of mathematical training. We must strive for working out skills of fulfillment such tasks as by hands-on activities, as with the help of a marker (a chalk) on the blackboard, as by a calculator, as with the help of special programs on the screen of monitor. Secondly, with the help of textbooks and additional sources of information teachers can and must acquaint students with the application of the corresponding knowledge to the reality. They must give to students the next information: specialists of what professions, for what circumstances and how use algebra in their professional activities, how people use algebra in their everyday life. They must acquaint students with the historical grounds and any other information about the origin of algebraic concepts. Solution

of so-called tasks of practical content must supplement and deepen this second direction of practical-orientated teaching-learning process.

Content of geometrical courses (by fact, we have there two geometrical courses: a course of planimetry – for students of 7-9 forms, a course of stereometry – for students of 10-11 forms) traditionally has a duality character [3,4]. The so-called elementary “physical” geometry – a science of the properties of spatial shapes of the direct environment – and elements of axiomatic theory of Euclidean geometry are tied together in it by mutually penetrating way. Such situation simultaneously simplify and complicate the expedient organization of the corresponding practical-orientated process of training.

Almost all concepts of Euclidean geometry are the mathematical abstractions of the concrete objects of the direct environment or of some relations between such objects. By this, it is clear that some geometrical concepts may be considered as mathematical abstractions of some objects from the direct environment not always, only under some circumstances. So, for example, under different circumstances a usual lid of the desk may be considered as a point, a segment, a rectangular, a parallelepiped, a line or a plane. On mastering geometry at propaedeutic level, when we really speak only about “physical” geometry, such facts, undoubtedly, must be indicated and explained, tasks of modeling different geometrical concepts are very useful for students. It is natural to solve the “inverse” tasks during mastering the other educational subjects, to demonstrate by such a way interconnections between different subjects. At the beginning of mastering the systematic course of Euclidean planimetry, as at the beginning of mastering the systematic course of Euclidean stereometry we, undoubtedly, must pay attention to the natural models of all the basic undefinable concepts (the basic sets and the basic relations) of the axiomatic that is put to the ground of the corresponding systematic courses in explicit or in implicit form. Simultaneously, it is necessary to demonstrate the fact that axioms of the corresponding theories are the mathematical abstractions of such characteristics of the basic undefinable concepts that, for the first look, seem to be natural and obvious. During the subsequent development of the corresponding courses, it seems to be expedient to use such methods of realization of practical-orientated training that have been stated for the second aspect of realization of the training during mastering the systematic course of algebra.

Besides geometry, there exist another spheres of people practical activities and connected with them educational subjects, including subjects of institutions of general secondary education, that also model and investigate the properties of the spatial shapes of the direct environment but solve in such a way another tasks. First of all drawing and technical drawing are among them. Both subjects suppose concrete practical activities on the sheet of paper, on the blackboard or on the screen of a monitor. Application of models of spatial shapes, created by the help of simple or technical drawing, essentially simplify the process of understanding the essence of geometrical objects and relations between them. Application of such a model during the process of geometrical reasoning essentially simplifies the ways of finding the expedient directions of such reasoning. Exactly by this, and just so it has been turned out historically, creation and application of simple or technical drawings of

the corresponding geometrical figures traditionally are considered to be part and parcel of the teaching-learning process according to Euclidean geometry. Competent construction of such drawings (technical drawings) is, undoubtedly, a component of a practical-orientated training. The so-called tasks on construction plane geometrical figures with the help of a compass and a ruler takes in the process a special place. By the proper organization of courses of geometry at institutions of general secondary education training in fulfillment “task of the same type” first of all means training in realization of typical logical deductions. And this is quit necessary for formation student’s skills of the everyday logic, mastering of which is recognized as one of the main targets of secondary education. Training in realization of such deductions also represents a form of practical-orientated training: skills of the everyday logic are working out by practice.

It is clear that realization at institutions of higher education for the future teachers of mathematics at institutions of secondary education the principle of practical-orientated training by its content first of all means the direction of the whole teaching-learning process onto the student’s future professional activities. At the same time, among some teachers of mathematical subjects of fundamental cycle of training the future mathematics’ teachers there exist a conviction that, for mastering the competences, that are specified by the corresponding Educational Vocational Program, it is quite enough to set the educational subjects with the sufficient level of proficiency, the concept of practical-orientated teaching-learning process must be understood only as the condition that the number of educational hours, intended for the self-guided work of students, must top the number of educational hours, intended for classroom experiences, the number of educational hours, intended for practical classroom experiences, must top the number of educational hours, intended for lectures, at the process of measurement the student’s results of the study, the preference must be given to the results of students learning outcomes of practical character.

In fact, such point of view is highly narrow and, in a whole, is wrong. It is clear, that qualitative mastering educational subjects of the fundamental cycle of training is the necessary addend of the general qualitative training of the future teachers. But what must we understand just by qualitative mastering and can or not the suggested scheme of mastering the corresponding qualitative mastering guarantee? Experience of practical work and the corresponding theoretical reasonings undoubtedly indicate the fact that in general case a student of institution of higher education will not master the new knowledge if he will not understand for what the knowledge is needed for him. This statement simultaneously, concerns as theoretical knowledge as practical skills. Many students are convinced that for the successful work as a teacher it is enough to have a textbook to be acquainted with its theoretical material and to buy a book of solutions to it. From the other hand the number of credits that are allotted by the corresponding Educational Vocational Program for subjects of vocational training, mastering of which suppose the acquaintance with the content of different textbooks, in not sufficient at all.

Analysis of the present content of the mathematical courses of institutions of general secondary education convincingly shows that, together to the themes of the

so-called elementary mathematics, only theoretical grounds of the most of which traditionally is considered in the courses of higher mathematics, it contains an essential number of such elements of higher mathematics, thorough mastering of which is envisaged, for example, by such courses of the cycle of fundamental training of the future teachers of mathematics as the courses of mathematical analyses and analytical geometry.

At the present situation the authors suggest to redistribute credits and the training material among subjects of higher mathematics and subjects of elementary mathematics and methods of teaching mathematics at institutions of general secondary education by a way that eliminates the inevitable to-day dubbing-in the training material (that usually manifests itself unless in the different interpretations of the content of the same concepts then in the different level of accuracy of their consideration). Except of the traditional course of mathematical analyses it is expedient to introduce the integrated course under the title “Mathematical analysis and its elements in mathematical courses of institutions of general secondary education”, except of the course of analytical geometry – the integrated course under the title “Analytical Geometry and its elements in mathematical courses of institutions of general secondary education” and so on. By the author’s opinion, such redistribution will create the necessary pre-conditions for the organizing the integrity system of practical-orientated training, essentially improve the quality of the process of training as a whole. From the point of view of the task of improvement the outcomes of process of training of future teachers of mathematics at institutions of general secondary education according to their possibility of organizing the practical-orientated teaching-learning process of training, it will be better to include to the corresponding Educational Vocational Program a course of applied mathematics, directed onto examples of applications of mathematical methods and concepts in different spheres of human being, the everyday life including.

The work has been carried out within the international project MoPED [2]. The author’s suggestions have been discussed by the scientific-methodical committee of department of Physics and Mathematics of South Ukrainian National Pedagogical University named after K. D. Ushynsky and have been recognized as very interesting. It has been suggested to the authors to work out, for example, an educational program for at least one of the supposed integrated courses.

**Conclusions.** It is advisable to begin the process of working out the corresponding experimental Educational Vocational Program of training the future teachers of mathematics at institutions of general secondary education with the purpose of its subsequent approbation to the educational process.

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