

## PROFESSIONAL TASKS IN THE EDUCATIONAL SYSTEM OF TRAINING MATHEMATICIANS-TEACHERS

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### ANNOTATION

In modern mathematics education, there is a dilemma whether a graduate of the Faculty of Mathematics of a pedagogical university should know and master the methods of teaching or still firmly know the basics of a real discipline. Obviously, this question would have been an artificial question 20-30 years ago, but now a significant reduction in teaching hours in geometry programs, bringing them to a volume of three semesters leads us to disappointing conclusions. Some part of the aspect of the attitude to professional tasks this article is devoted to future specialists in the field of mathematics who are able to develop abstract thinking in students - future ones: biologists, engineers, physicists, etc.

**Keywords:** Special complexes of geometric problems, design features of geometry, development of verbal and logical skills of communication and justification, regulated difficulties of perception and comprehension of tasks.

### INTRODUCTION

Unfortunately, we have to begin the article with a statement of casusbelli to mathematics by people who are passionate about educational methodology, which is answered by mathematics professionals by denying the importance of studying the methodology of teaching mathematics, especially those associated with age-related changes in students.

Here's an example. In the Moscow State Regional University (former Pedagogical Regional Institute named after N.K. Krupskaya) in the recent past, even in this century there were separately existing departments of mathematical analysis and geometry in them worked outstanding mathematicians, Vice-Rector for Science Lukankin G.L., Head of the Faculty of Mathematics. Geometry was Manturov O.V.

Recall, "the essence of geometry is in the organic connection of spatial representations with strict logic, in which they mutually penetrate and organize each other. And since everything that is not in space, geometry, as a theory of spatial forms and relations, has universal significance. We are surrounded by its real embodiments, it is the basis of all technology, it appears wherever the slightest accuracy in determining shapes and sizes is required." [1, p. 3] Hours in geometry in terms of training future mathematicians were decreasing. The same trend is observed in Uzbekistan [2, 3, 4, 5].

In the curriculum approved by the Ministry of Higher and Secondary Special Education of the Republic of Uzbekistan on 25.08.2016. by order of

No 355 in the direction BD- 510100-3.06 Methods of teaching mathematics

T / P / W	Ўқув bloklari, fanlar va hofoliyat turlarining nomalari (Study block, name of subject and activities)	Talabaniing ўқuv yuklamasi (co-parliament) (Student workload (hours))									Soatlarning course, semester of va ھاftalar b'yiicha taksimoti (Allocation of course hours, semester and weekly)							
		Umumiy yuklamaning ھاazhmi (Total workload)		Auditorium (soatlar-da) (Classroom (in hours))						Mustaqil talim (independent education)	1-year	2-year course	3-year course	4-year course				
				soat (watches)	%	Jami (Total)	Maruza (Lectures)	Amaliy (Practical)	Laboratory (Laboratory)						Seminar (Seminary)	Loy'ashi Course (Course project (work))		
		Kurslardagi ھاftalar soni (Number of course weeks)																
		Semester								1	2	3	4	5	6	7	8	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
3.06	Geometry	852		500	236	264				352	5	4	5	5	3	4		

In the curriculum approved by the Ministry of Higher and Secondary Special Education of the Republic of Uzbekistan on 25.08.2018. in the direction of B- 510100-18 methods of teaching mathematics

T / P / W	Ўқuv bloklari, fanlar va hofoliyat turlarining nomalari (Study block, name of subject and activities)	Talabaniing ўқuv yuklamasi (co-parliament) (Student workload (hours))									Soatlarning course, semester of va ھاftalar b'yiicha taksimoti (Allocation of course hours, semester and weekly)							
		Umumiy yuklamaning ھاazhmi (Total workload)		Auditorium (soatlar-da) (Classroom (in hours))						Mustaqil talim (independent education)	1-year	2-year course	3-year course	4-year course				
				soat (watches)	%	Jami (Total)	Maruza (Lectures)	Amaliy (Practical)	Laboratory (Laboratory)						Seminar (Seminary)	Loy'ashi Course (Course project (work))		
		Kurslardagi ھاftalar soni (Number of course weeks)																
		Semester								1	2	3	4	5	6	7	8	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2.06	Geometry	768		428	208	220				340	6	4	4	4	4	2		

In connection with the transition to a modular credit system of education starting from the 2020-2021 academic year, the curriculum had a reduction in hours and in the subject geometry in the direction of 510100-mathematics and computer science

T / r p / n	Fanni ngmal akavi ykodi (Subject code)	O'quv fan lar, blok lar va fao liyatt urlari (Study block, name of the subject and activities)	Talabani ng'o'quv yuklamasi soatlarda (Student workload (hours))										Soatlarning kurs, semestr va haftalar bo'yicha taqsimoti (Allocation of course hours, semester and weekly)								Kreditlarning kurs, semestr va haftalar bo'yicha taqsimoti (Distribution of course credits, semester and weekly)								Jami kreditlar
			Umumiy yuklam a hajmi (Total workload)		Classroom sessions (hours) (Classroom (in hours))								1 course				2 course				3 course				4 course				
			So at (w atch es)	%	Jami (Total)	Maruza (lectures)	Amaliy (practical)	Laboratoriya (laboratory)	Seminar (Семинарские)	Kursishi (term paper)	Mustaqil talim (self-education)	Weekends in courses (Number of course weeks)				Weekends in courses (Number of course weeks)				Semestrlar (семестры)				Semestrlar (семестры)					
												1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4		
			Number of weeks of ayditoria classes per semester (Number of weeks of classroom classes per semester)										Kredittaqsimoti (Credit distribution)																
1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
1		2	45		2	1	1			1	1	1	1	1	1	1	1	1	1	2	2	2	2	24	2	2	2	2	28
	GeoM 20013	Geometriya	45		2	1	1			2	2	2	2	2	2	2	2	2	2	6	5	4						15	

In the 2021-2022 academic year, the curriculum had a reduction in hours in the subject of geometry in the direction of 60110600-mathematics and computer science

T / r p / n	Fanni ngmal akavi ykodi (Subject code)	O'quv fan lar, blok lar va fao liyatt urlari (Study block, name of the subject and activities)	Talabani ng'o'quv yuklamasi soatlarda (Student workload (hours))										Soatlarning kurs, semestr va haftalar bo'yicha taqsimoti (Allocation of course hours, semester and weekly)								Kreditlarning kurs, semestr va haftalar bo'yicha taqsimoti (Distribution of course credits, semester and weekly)								Jami kreditlar
			Umumiy yuklam a hajmi (Total workload)		Classroom sessions (hours) (Classroom (in hours))								1 course				2 course				3 course				4 course				
			So at (w atch es)	%	Jami (Total)	Maruza (lectures)	Amaliy (practical)	Laboratoriya (laboratory)	Seminar (Семинарские)	Kursishi (term paper)	Mustaqil talim (self-education)	Weekends in courses (Number of course weeks)				Weekends in courses (Number of course weeks)				Semestrlar (семестры)				Semestrlar (семестры)					
												1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4		
			Number of weeks of ayditoria classes per semester (Number of weeks of classroom classes per semester)										Kredittaqsimoti (Credit distribution)																
1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
1		2	45		1	1				1	1	1	1	1	1	1	1	1	2	2	2	2	24	2	2	2	2	28	
	GM115	Geometriya	45		1	1				2	2	2	2	2	2	2	2	2	4	5	6						15		

A natural question is when decisions were made to reduce the volume of hours, whether the possibilities of students' perception of educational material throughout the course of Geometry were taken into account, for example, a change in mental operations when studying the



Elements of Projective Geometry or acquaintance with the elements of drawing construction using the Theory of Visualization and Images, etc. Recall that in ancient times mathematicians were called geometers, perhaps this was not for nothing. In the pedagogical literature of recent times, very often refer to the capabilities of computers with application packages that allow you to make various sections of geometric bodies, combinations of geometric bodies, "see" any of their projections. It is necessary to recognize the great achievements of information systems and their applied capabilities. But is it possible for a future mathematician-teacher to simplify critical thinking, and if so, will such a "specialist" then be a mathematician-teacher, solve problems and think independently, or is it enough for secondary education algorithmics, i.e. a teacher of the executor of instructions, whose main task will be to correctly report on the hours spent (these lessons)? It is certainly necessary to use the "miracles" of programming in Geometry lessons, but not by reducing the number of hours per subject itself, but on the contrary by adding them to the curriculum.

### Historical Observations

The methodological landscape of pedagogy has now changed in comparison with the end of the twentieth century. To the traditional problems of the twentieth century, the problems of the beginning of our millennium have been added. Recall that the founding fathers of the pedagogy of the French, Czech, German pedagogical and psychological schools did not have significant problems with the creation and transmission of educational messages. Currently, educational messages have turned into information flows, which in the educational process experience indignation - "noise" sent from the external environment. The function of the teacher has changed - he has become a defender of true knowledge.

As is known, the main goals of teaching methods are the development of the most effective techniques and methods of transmitting, fixing (consolidating) knowledge, educating thinking. In the modern methodological school, another task has arisen, namely, the need to create, preserve the educational environment, which is the source of true, scientific knowledge, in which the emergence (awakens) of interest in knowledge in children's groups, which persists until the end of the individual's life, is ensured.

If we turn to the history of the Soviet pedagogical school, we can recall that in the late fifties of the twentieth century, specialized schools were created in various areas, but the first were physics and mathematics schools (L.V. Kantorovich, A.N. Kolmogorov). They aroused great interest among innovative teachers in the study of work with gifted children and the improvement of physical and mathematical education in the USSR. Following them, methodological schools began to develop. In addition, it should certainly be noted, first of all, the originality of methodological national schools, with their priorities in upbringing and education, in particular, one of the most ancient and formalized educational traditions in the USSR was the school of Central Asia, and in it the mathematical school of the Republic of Uzbekistan (Uzbek SSR).

It should also be noted that in modern pedagogical knowledge there was a stage in which problems with cultural and psychological topics were added to general pedagogical problems.

### **To the content of mathematical education.**

About one hundred and fifty years ago, the problem of filling the content of courses in gymnasium mathematics, mathematical training in trade schools was formulated, briefly - the problem between modern knowledge and educational knowledge "How, and, is it necessary to teach advanced ideas of science in a general education school?"

In the recent history of education, the desires of mathematicians-teachers, mathematicians of the sixties in France and the seventies in the USSR to introduce students of schools (specialized schools) into the circle of the "most" advanced ideas of mathematics, to acquaint them with its magnificent abstractions are known. And is it necessary to teach modern ideas at all in school, maybe it is better to teach students to think? The usual answer among mathematicians is "if not given, then why teach?". However, the pathos of such an answer is offset by the remark, "we are dealing with a person." A person reveals his abilities at various intervals of growing up, some like G.V. Leibniz at the age of three, and who set himself the task of finding a universal method of solving the problem, and Srinivas Ramanujan Ayengor - after eighteen years, in the history of mathematics you can find many facts confirming the above thesis.

Therefore, the task of educating teachers of mathematics in the modern pedagogical Higher School has become its most acute facets. In fact, the further development of the child depends on the Teacher, if the mathematics teacher does not notice or is not able to create an educational environment for the manifestation of the abilities of his students, he will cripple the future of this child. Therefore, the "founding fathers" of the theory of pedagogy formulated the principles of teaching, among them the most "young" are the continuity and nature-orientation of learning. The principle of continuity is currently the most significant in a modern secondary school. First of all, because the information flows in the educational environment both support and destroy it. From its functioning depends: the severity of the transfer of initial and developing knowledge, adaptability relative to national codes, the embodiment of scientific knowledge in the educational environment, their transfer and preservation (accumulation). It should also be noted with the help of this principle the principle of sufficient difficulty of tasks **"Training at a high level of difficulty with compliance with the measure of difficulty" (Zankova L.V.), in addition - "the leading role of theoretical knowledge; awareness of the learning process; fast pace of passage of training material; purposeful and systematic work on the overall development of all students, including weak students."** Therefore, the most important component in pedagogical knowledge was the principle of continuity.

Because of this, in our study, we turned to the arsenal of methods for solving problems and planimetry and stereometry. We give for example the following fact. So in the textbook Mathematics 10 Parts 1-2 [6], the author of the section "Geometry" B.K. Khaidarov in the part "System repetition of planimetry" gave the paragraphs "Logical construction of planimetry" and "Geometric problems and methods for solving them", the following methods for solving problems are listed:

- synthetic method;
- analytical method;
- Method of proof of the contrary;
- algebraic method;
- area method;

It should be noted here that in the parts of the textbook related to the geometry course, the printing possibilities of the text are excellent, but the selection of tasks could be organized differently, i.e. follow not only the principle of "from simple to complex", but it is also possible to redirect tasks on a constructive principle directly to the student working on this textbook. So, using the principles of continuity, sufficient complexity (difficulty), accessibility, as well as the design features of Geometry, in the geometry courses of future teachers, as our experience and experiments with reading special courses show, the use of all known methods of solving problems combined in one or more problems leads to effective education. Thus, the methodological principles and methods of educating independent thinking in the educational process are implemented simultaneously.

### Special set of tasks

The above describes the reasons for the emergence of special complexes of geometric problems (by geometry). Let's give an example of one of the complexes.

As you know, in school (school) geometry the thematic method of teaching is from simple to complex.

In the higher pedagogical school, in addition to the principle of the school (accessible) level of educational material, the so-called method of setting professional tasks is developing. Let's clarify the professional ones for both the teacher and the professional mathematician.

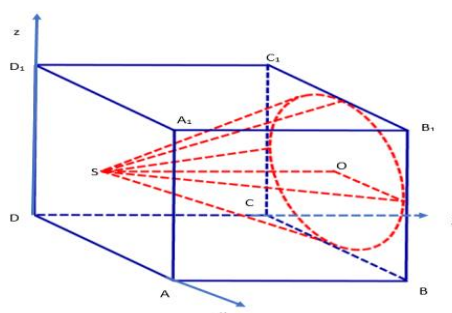
We call special complexes of geometric problems so-selected problems so that their solution is based on the maximum mathematical apparatus and the number of techniques studied.

This goal combines a number of specific tasks, the most important of which are:

- development of spatial representations and graphic culture of students;
- generalization and systematization of knowledge about the properties of geometric shapes and methods of their representation, obtained in the main course of geometry of the school and pedagogical university;
- development of the ability to apply the studied methods to depict figures found in the practice of the teacher's work;
- development of the ability to compile and solve the problems of the school geometry course;
- consideration of methodological problems arising in the presentation of questions about combinations of figures. [8]

**Task:** It is necessary to calculate the volume of the body obtained by extracting a straight circular cone inscribed in it from the cube (see the drawing), if the length of the edge of cube  $a$  is known.

Note that this problem is given at the end of the entire Geometry course in a special course on problem solving.





Cube, straight circular cone;  $\ell = a H_k = \frac{a}{2}$

Find  $=?V_T$

Next, subtasks are formed:

1. Choosing a method for solving the specified problem:
  - (a) Analytical geometry
  - b) Euclidean geometry
2. Compilation of a conceptual dictionary of this task: definitions, properties and justifications of the interrelations of concepts.
3. Construction of a drawing of the resulting body in all axonometric projections.
4. Problem solving.
5. Discussion of the rationality of the chosen method.<sup>1</sup>

### FINDINGS

1. The design features of geometry in modern courses of pedagogical universities are more focused on the adaptation of the future teacher-mathematician to the working conditions in a secondary school. In fact, they should be focused on the development and education of the thinking of the future mathematician-teacher.
2. The development of verbal and logical skills of communication and justification for solving geometric problems, as well as regulated difficulties in perceiving and comprehending problems in the learning process, is perhaps one of the most difficult professional tasks of the future teacher, mathematician-teacher.

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<sup>1</sup>A more detailed presentation of this method of the Special Complex of Geometric Problems methodical collection [7].

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