MINISTRY OF EDUCATION, CULTURE AND RESEARCH OF THE REPUBLIC OF MOLDOVA
TIRASPOL STATE UNIVERSITY

Manuscript
C.Z.U: 377.016 : 51(043.2)

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IMPACT OF MATHEMATICS IN THE DEVELOPMENT OF PROFESSIONAL DISCIPLINES IN SECONDARY VOCATIONAL EDUCATION

532.02 -SCHOOL DIDACTICS

(BY STAGES AND EDUCATIONAL DISCIPLINES)

Summary of Ph.D. Thesis in Pedagogical Sciences

Thesis was drafted and submitted at Educational Sciences Doctoral School

CHISINAU, 2019

The thesis was elaborated within "Educational Sciences" Doctoral School of Partnership of Higher Educational institutions, Tiraspol State University, "Bogdan Petriceicu Hashdeu" Cahul State University and the Institute of Education Sciences.

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The thises defense will take place on November 18, 2019, at 2:00 pm, room 304, in the meeting of the Commission for the public defense of the doctoral thesis within Tiraspol State University of the Republic of Moldova (5, G. Yablochkin Str., Chisinau, MD-2069)

The doctoral thesis and summary can be consulted at the library of Tiraspol State University and on the ANACEC/NAQAER website (www.anacip.md).

The summary was sent on October 17, 2019

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CONCEPTUAL BENCHMARKS OF THE RESEARCH

The relevance of research. The modern stage in the development of the education system in Moldova is characterized by serious reforms, the need for which is dictated by the requirements of the time and the country's development tasks. Since May 2005, Moldova joined the Bologna process, which implies the inclusion of a national education system in the European educational space.

Educational institutions of secondary vocational education (hereinafter - SVE), along with vocational training of students, implement the educational program of secondary (complete) general education. The list of specialties in which vocational training is carried out is approved by the Government at the proposal of various ministries and departments. Among the many specialties, the most popular in the modern world are technical specialties.

In the Republic of Moldova, as in all developed countries, the training of mid-level specialists takes place under the conditions implementation of a competency-based approach,, in which "the strategic goal of education proclaims the formation of the real competence of the student as a person capable of self-determination, self-regulation, self-actualization, competitiveness in the labor market" [1].

Today in Moldova, about a third of enrollees go to secondary vocational education institutions, and in the near future their importance will increase, due to the acute shortage of qualified mid-level specialists, especially technical profile. The quality of technical education is inextricably linked with the level of mathematical training of a specialist.

Thus, the definition of the role of mathematics through the development of professionally-oriented teaching technology in the system of secondary vocational education is an urgent task.

Description of the situation and identification of the research problem. Problems of the content and structure of mathematical education in SVE have arisen with the advent of secondary vocational schools and are currently particularly relevant. This is due to the fact that qualified labor resources play an important role in ensuring stable economic development of the country. Particular attention should be paid to technical specialists for whom a high level of mathematical culture is a professional necessity. Based on this, the content and structure of mathematical education in STR should have a targeted focus on a specific specialty.

Modern trends and development strategies of mathematical education are considered in their works by Le Boterf G.[2], Lupu I.[3, 4, 5, 6], Brănzei D., Brănzei R.[7], Cabac G.[8], Cioban M., Cioban-Pileţcaia A.[9], Newell W.[10,11], Мухаметзянова Г.В.[1, 12], Махмутов М.И.[13], Афанасьев В.В.[14], Борисенко Н.А. [15], Смирнов Е.И.[16], Гаранина И.Ю.[17], Лемешко Н.Н.[18], Беспалько В.П.[19]and others, in which much attention is paid to the

development of innovative educational technologies that replace traditional ones and are being introduced into the system of modern education.

At the moment, none of the normative documents that determine the implementation of the requirements for general education of students in institutions of secondary vocational education(SVE), does not define the objectives of the subject study of mathematics, taking into account the tasks of training.

To become a highly qualified technical specialist, a student of secondary vocational education needs to receive fundamental mathematical training, without which it is impossible to solve the problems of future professional activity. The experience of research educators shows how important motivation of students to study professional disciplines is, especially in primary school, when they consider everything related to their future profession to be motivationally significant.

A great contribution to the study of professional motivation was made by their research Маслоу. А.[20], Ames C.[21], Ильин Е.П.[22, 23], Белых И.Л.[24], И. Лупу, Чобан-Пилецкая А. [25], Birch A.[26], Deci E.L., Vallerand R.J., Pelletier L.G., Ryan R.M.[27], Чобан-Пилецкая А.[28], Нисман О.Ю.[29], Родионов М.А.[30].

The highest efficiency in the formation of professional motivation of future specialists is facilitated by such mathematical skills as: modeling of production situations, analysis and generalization; logical thinking; solving professionally oriented problems; solving mathematical problems.

In the scientific and methodological literature relating to the teaching of mathematics in institutions of secondary vocational education, there are a number of works devoted to various aspects of teaching, but the influence of the level of mathematical knowledge and professional motivation has not been sufficiently studied on the quality of mastering the professional disciplines of the specialty: Amabile T. [31], Baciu S.[32], Cerghit I.[33], Hariton A.[34], Давыдов Л.Д.[35], Белозерцев Е.П.[36], Низамов Р.А.[37], Кузьмина Л.П.[38], Худякова Г.И.[39], Мордкович А.Г.[40], Беляева А.П.[41], Лемешко Н.Н.[42].

The above allows to highlight the following **contradictions:**

– between the requirements of the labor market for technical specialists and the existing training of students in the secondary vocational education system;

– between the formal content of mathematical education in SVE and the necessary level of mathematical knowledge for the qualitative development of the profession;

– between the need for a professionally oriented technology of teaching mathematics, which allows one to form a mathematical apparatus, as a tool for the qualitative development of a profession in the specific conditions of SVE technical profile and the undeveloped nature of such a teaching technology.

The problem of research. To determine the theoretical and methodological foundations of the effectiveness of teaching mathematics aimed at improving the

quality of vocational training of technical graduates in the implementation of the state standard of secondary vocational education. Explore the sphere of professional motivation during the testing of pedagogical technology of professionally oriented teaching of mathematics.

Purpose of research. Theoretically substantiate and develop a pedagogical model and methodology for integrating mathematics in the system of secondary vocational education.

The objectives of research.

1. Analyze the specifics and experience of teaching mathematics in educational institutions of secondary vocational education.
2. To study normative documents, scientific, methodological, psychological and pedagogical literature on this issue to identify approaches to the development of professionally oriented technology for teaching mathematics.
3. To determine the principles on which the pedagogical technology of teaching mathematics will be built in the system of secondary vocational education of a technical profile, aimed at increasing the level of professionalism of a graduate of secondary vocational education of a technical profile.
4. To develop a pedagogical model and methodology for integrating mathematics in the system of secondary vocational education of a technical profile, aimed at increasing the level of professionalism of a graduate and testing it.
5. Create a methodology for applying a complex of professionally oriented tasks.

To solve the assigned tasks, the following **research methods** are applicable: pedagogical observation of the process of teaching mathematics; conversation, questioning, questioning of students and teachers; pedagogical experiment.

The novelty and originality of the study lies in the fact that due to the systematic and multi-stage fulfillment of professionally oriented tasks, it becomes possible, while maintaining a high level of motivation of students, to simultaneously achieve the development of mathematical knowledge and skills and expand the students' understanding of the applied and professional value of mathematics. Using the Pedagogical model as a theoretical constructor, the teacher will fill it with concrete practical content, taking into account the chosen specialty and the type of future professional activity of a mid-level specialist.

The scientific problem solved in the study lies in the methodological substantiation of the pedagogical model of teaching mathematics, focused on achieving a high level of professional training for a graduate of a technical profile, taking into account the features of the modern stage of development of education and the revealed specifics of training in institutions of this type.

The theoretical significance of the study is:

– in substantiating the methodological approaches used in the development of pedagogical technology of professionally oriented teaching of mathematics;

– in the development of a methodology for the use of a complex of professionally-oriented tasks that has certain mechanisms of influencing educational motivation and the assimilation of mathematical knowledge and skills;

– in determining the system-forming role of the interdisciplinary relations of mathematics with professional disciplines;

– in defining the role of mathematics in the introduction of professionally oriented technology in the educational process at the faculty of secondary vocational education of the engineering and technical institute in Tiraspol.

Practical significance is determined by the successful testing and implementation of the engineering institute in the educational processin Tiraspol, a developed pedagogical model for integrating mathematics in the system of secondary vocational education, including a methodology for establishing and accounting for interdisciplinary relationships. The concept of a matrix of interdisciplinary communications of the first and second levels is introduced. The possibilities are disclosed and the methodology for using the matrix to describe mathematical objects and intersubject connections of mathematics with special disciplines, professional modules is justified.

In addition, in the research process developed:

– a complex of professionally-oriented tasks, consisting of professionally-oriented tasks, tasks for performing laboratory work using application software packages, professionally-oriented projects. The technique of using the complex when teaching mathematics is described;

– textbook on the discipline "Elements of higher mathematics."

Provisions for protection:

1. The essence and features of the Pedagogical model of integrating mathematics through the introduction of professionally-oriented teaching technology in the context of the implementation of the educational standard of SVE.
2. Methodology for the use of a set of professionally oriented tasks based on the establishment and accounting of interdisciplinary relations.
3. The influence of pedagogical technology of professionally-oriented teaching of mathematics on professional motivation.

The introduction of the research results was carried out in the educational process at the faculty of secondary vocational education of the Engineering and Technical Institute of Tiraspol.

Testing of scientific results. The results of the study were presented at a meeting of the Department of Didactics of Sciences of Tiraspol State University, as well as at the following conferences:

– Conferința științifico-practică națională cu participare internațională «Reconceptualizarea formarii inițiale și continue a cadrelor didactice din

perspectiva interconexiunii invăţământului modern general şi universitar» 27-28 octombrie 2017.

– VII Republican Scientific and Practical Conference "Ways to Improve Physical Education" March 28, 2017.

– Materialele Conferinţei Republicane a Cadrelor Didactice, 10-11 martie 2018.

– Internaţional Conferinţa Changing roles and impact teachers in the modern society. September 20, 2018.

– Materialele Conferinţei ştiinţifice naţionale cu participare internaţională ÎNVĂŢĂMÂNT SUPERIOR: TRADIŢII, VALORI, PERSPECTIVE. 28-29 Septembrie 2018.

Main ideas, research results are reflected in 13 publications of the author.

Scope and structure of doctoral work. The work consists of introduction, three chapters, conclusions, bibliography of 168 titles, 8 appendices, 127 pages of the main text, 22 figures, 19 tables.

Keywords: mathematical education, secondary vocational education, professional motivation, pedagogical model, interdisciplinary communication.

List of abbreviations:

SVE - Secondary Vocational Education; GC- General Competencies; **PK**-Professional Competencies; **PM**-Professional Module; **SPSS** – Statistical Package for the Social Sciences.

CONTENT OF THE THESIS

In the **Introduction**, the choice of research topic is argued; the relevance and significance of the topic are indicated; the purpose of the study is formulated, based on which, the tasks of its implementation are determined. The research methods are listed; described in accordance with the field of study, novelty and originality, theoretical and practical significance; substantiated practical implementation of the results.

The first chapter "Psychological and pedagogical foundations of professionally oriented technology for teaching mathematics in the system of secondary vocational education of a technical profile" is devoted to the analysis of the main components and problems of mathematical education in the system of secondary vocational education.

The main components of mathematical education include:

- *content* - mathematical information, subject to study;
- s*tructure* - a construction system and a sequence for studying information;
- *methods and means* of supplying and assimilating educational information;
- *activities of the teacher* during the lesson;

– *students' interest* in the study of mathematics and understanding of its connection with the future profession.

In accordance with these components in the didactics of mathematics of secondary vocational education, the following main problems can be distinguished:

– modernization of the content of a mathematics course with a focus on the future profession;

– improving the structure of the mathematics course in various specialties;

– improvement of methods and means of teaching mathematics in SVE;

– оптимизацию деятельности преподавателя по сочетанию его функций преподавания, организации и управления процессом учения;

– optimization of the teacher's activities by combining his teaching functions, organization and management of the learning process;

– the formation of a stable active interest among students in the study of mathematics and an understanding of the role of mathematics in his professional activity.

These problems are key and designed to solve a new social problem - to increase the effectiveness of training and the level of training of qualified mid-level specialists.

Special importance in conditions of secondary vocational education, professional motivation acquires. In order to become a professional, the learner's personality must enter the space of activity and vital meanings, and the knowledge and methods of activity must be combined into an organic whole, the system-forming factor of which are certain key values and motives.

И. Лупу believes that the general problem of the formation of motivation for the teaching of mathematics, essentially its nature, is inextricably linked with a variety of teaching methods [25, p. 52]. In particular:

– with the method of developing cognitive interest in mathematics;

– with the method of stimulating and enhancing the educational and cognitive activities of students;

– with the method of compiling and solving problems, conducting creative work;

– with the problematic method;

– with research method;

– with partial search method

– with the method of cooperation in teaching mathematics;

– with the method of structuring and integrating knowledge.

Motivation of professional activity is determined by the corresponding orientation, the presence of its meaning, professional attitudes of a person. Stable relationship systems in professional activities form his professional mentality and determine his professional position [36].

To implement the principle of professional orientation in teaching mathematics in the system of secondary vocational education of a technical profile, certain *pedagogical conditions* must be created, namely:

- motivation of all participants in the pedagogical process for the development of mathematical and professional competencies;
- systematic fulfillment by students of professionally oriented tasks;
- the systematic use of calculative technology (CT) in solving mathematical and technical problems;
- providing the learning process with special means: task books of professionally oriented tasks, computer programs, VT tools, methodological recommendations for completing tasks.

The combination of theoretical and practical training cycles requires close interdisciplinary ties, the ability of the teacher to link knowledge in general and special subjects with the contents of laboratory and practical classes in workshops and in production.

The most complete psychological and pedagogical substantiation of the didactic significance of intersubject communications was given by KD Ushinsky [43]. He proved that knowledge and ideas are drawn from various academic subjects and generalized by students. Interdisciplinary connections play a worldview role; they contribute to the creation of interconnected ideas about the real world in students.

The second chapter, "The pedagogical model and methodology of integrating mathematics in the secondary vocational education system of a technical profile," presents the pedagogical model of integrating mathematics in the SVE system and the methodology for its application through the establishment and consideration of interdisciplinary connections (Fig. 1).

The target block outlines such goals of teaching mathematics as meaningful, applied, worldview and general cultural. These goals are realized in methodological approaches, the central of which is a professionally oriented approach.

Achieving the above goals depends on the requirements of didactic principles, they help determine the content of training, methods, forms of training, they also dictate the behavior of the teacher at the lesson.

When selecting content, interdisciplinary communication must be taken into account and all principles for selecting content should be followed. The next component of the model of professionally oriented teaching of mathematics is technological, it shows the features of the selection of methods, forms and teaching aids.

The main means by which the principle of professional orientation of training is implemented is the implementation of professionally oriented tasks.

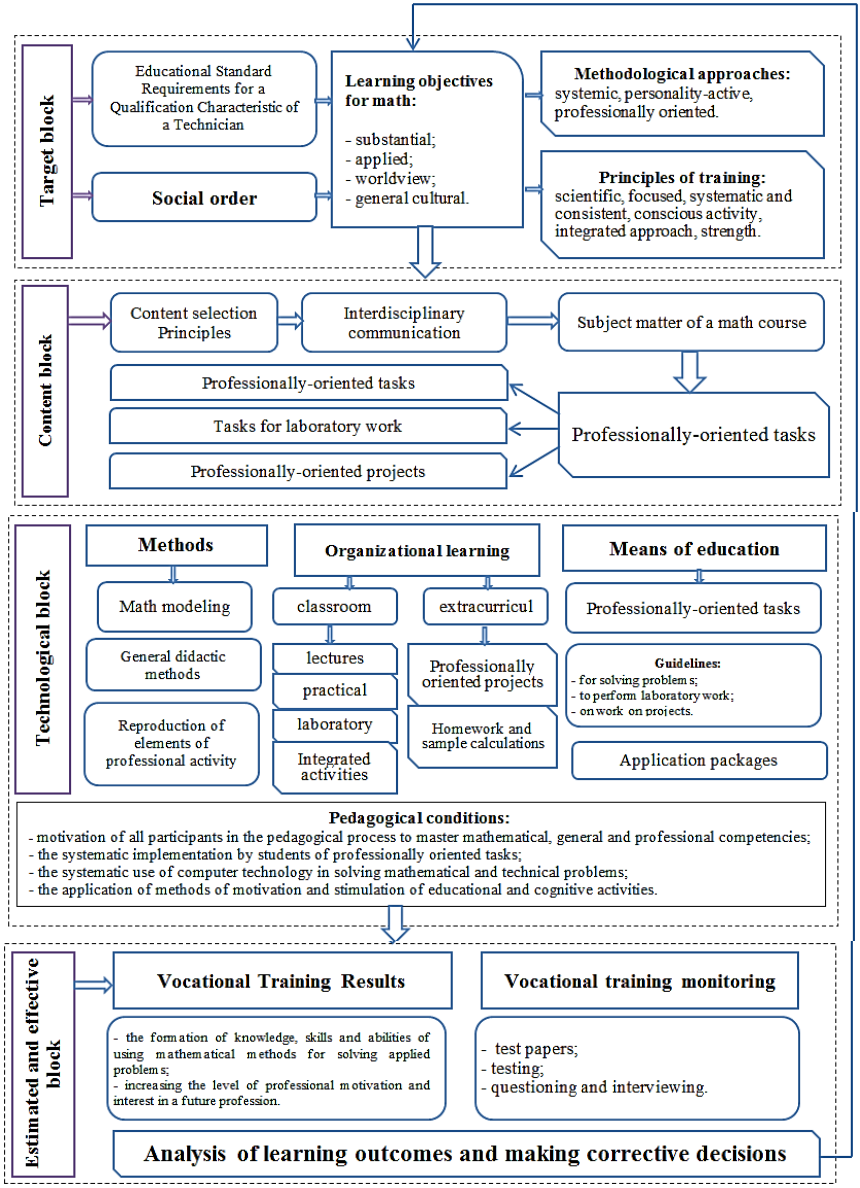

Fig. 1 Pedagogical model of integrating mathematics in the system of secondary vocational education

The final component of the model is evaluative and effective. As a result of the implementation of the principle of professional orientation, we expect, firstly, the formation of students' knowledge, abilities and skills in using mathematical methods to solve applied problems, secondly, the development of professionally important personality traits, the request for which was received from social partners, and, finally, increasing motivation to learn and master your future profession.

In order to diagnose the level of achievement of the expected results, phased monitoring of students is carried out: tests, testing, observation, questioning, interviews.

According to the results of monitoring, corrective activities of the teacher are carried out, aimed at adjusting the goals, content, methods, forms and means of training.

After analyzing the general and professional competencies, the field and objects of professional activity of graduates in the specialty "Computer systems and complexes" to determine the role of mathematics in the process of mastering professional disciplines, we consider the correspondence table of professional competencies of the discipline "Elements of higher mathematics" and the disciplines of the professional cycle (Table 1.). The table is based on the educational standard.

Table 1. The relationship of professional competencies

Elements of higher mathematics	PC 1.1	PC 1.2		PC 1.4				PC 2.3				PC 3.3
Professional competencies / Name disciplines	PC 1.1	PC 1.2	PC 1.3	PC 1.4	PC 1.5	PC 2.1	PC 2.2	PC 2.3	PC 2.4	PC 3.1	PC 3.2	PC 3.3
Engineering graphics	+				+							
Electrical Engineering Basics	+					+						
Applied Electronics						+		+				
Electrical measurements	+				+	+		+				
Information Technology	+				+	+		+				
Metrology, standardization and certification	+				+	+		+				+
Operating Systems and Environments						+		+				+
Discrete Math	+		+			+						
Fundamentals of Algorithmization and Programming						+		+				+
Fundamentals of Economics		+			+							+
PM.01 Designing Digital Devices	+	+	+	+	+							
PM.02 The use of microprocessor systems, installation and configuration of peripheral equipment						+	+	+	+			
PM.03 Maintenance and repair of computer systems and complexes										+	+	+

As a result of the study, a matrix of ***interdisciplinary ties of the first level*** was compiled (Table 2). The matrix reflects the field of mathematics and special disciplines, which must be mastered by the whole group as a whole in order to increase the level of motivation and expand the students' understanding of the applied and professional significance of mathematics.

The proposed matrix of interdisciplinary relations as elements contains a relationship, where *i* - professional discipline, *j* - section of mathematics. The distinguished connections are interpreted in the form of mathematical methods, professionally oriented tasks, laboratory work using application software packages.

Table 2. Interdisciplinary matrix of the first level

Name professional disciplines \ Name of sections disciplines		Linear and Vector Algebra	Analytical geometry in the plane	Limit theory	Differential calculus of a function of one variable	Integral calculus of function of one variable	Complex number theory
		1	2	3	4	5	6
Engineering graphics	1	C_1^1	C_1^2				
Electrical Engineering Basics	2	C_2^1			C_2^4		
Applied Electronics	3				C_3^4		C_3^6
Electrical measurements	4				C_4^4	C_4^5	
Information Technology	5	C_5^1					
Metrology, standardization and certification	6	C_6^1					
Operating Systems and Environments	7	C_7^1					
Discrete Math	8	C_8^1					
Fundamentals of Algorithmization and Programming	9	C_9^1	C_9^2	C_9^3	C_9^4	C_9^5	
Fundamentals of Economics	10	C_{10}^1	C_{10}^2	C_{10}^3	C_{10}^4		

In the course of the study, it was found that for a greater depth of detail of interdisciplinary connections, it is advisable to compose a matrix of ***interdisciplinary connections of the second level*** between the topics studied in a certain professional discipline and the sections of the mathematics course studied in the SVE system.

As an example, consider such a matrix for the discipline "Fundamentals of Electrical Engineering" (Table 3).

The dissertation interprets the relationships that exist between the relevant objects.

Table 3. The matrix of interdisciplinary relations of the second level

Name of sections math course / Name topics of discipline «Basics electrical engineering»		Vector algebra	Linear algebra	Complex numbers	Differential calculus of a function of one variable	Integral calculus of function of one variable	Convert function graphs	Error theory	Algebra of logic
		1	2	3	4	5	6	7	8
Calculation of electric circuits of direct current. Laws of Ohm and Kirchhoff	1		C_1^2						
Electromagnetic induction	2				C_2^4				
Calculation of AC electric circuits	3	C_3^1			C_3^3	C_3^5	C_3^6		
Electrical appliances and measurements	4							C_4^7	
Transformers	5	C_5^1		C_5^3	C_5^4				
Electric cars	6	C_6^1		C_6^3					
Semiconductors	7						C_7^6		C_7^8

The professional module (PM) involves the study of theoretical approaches coupled with their immediate consolidation in practice. The study found that each professional module is based on certain professional disciplines, i.e. there is a correlation between professional modules and special disciplines of varying degrees of severity. Based on the matrix of interdisciplinary connections of the first level (Table 2), we will draw up a table that defines the system-forming role of mathematics in the development of professional modules, as well as determine the basic disciplines of each PM.

Table 4. reflects the interdisciplinary courses of the corresponding PM and the professional disciplines on which they are based, as well as the relationships described above in the form of mathematical methods, professionally oriented tasks, laboratory work using application software packages.

Table 4. Connection of professional modules with mathematics

Professional Modules (PM)	Interdisciplinary courses (IDC)	Basic professional disciplines	Communication C_i^j
PM.01 Designing Digital Devices	IDC 01.01. Digital circuitry IDC 01.02. Designing Digital Devices	«Electrical Engineering Basics», «Discrete Math», «Applied Electronics», «Electrical measurements».	C_2^1; C_2^4; C_3^4; C_3^6; C_4^4; C_4^5; C_8^1.
PM.02 The use of microprocessor systems, installation and configuration of peripheral equipment	IDC 02.01. Microprocessor systems IDC 02.02. Installation and configuration of peripheral equipment IDC 02.03. Computer networks and telecommunications	«Applied Electronics», «Metrology, standardization and certification», «Discrete Math », «Fundamentals of Algorithmization and Programming».	C_3^4; C_3^6; C_6^1; C_8^1; $C_9^1 - C_9^5$.
PM.03 Maintenance and repair of computer systems and complexes	IDC 03.01. Maintenance and repair of computer systems and complexes IDC 03.02. Computer graphics IDC 03.03. Installation and maintenance of software for personal computers and servers	«Electrical Engineering Basics», « Engineering graphics», «Electrical measurements», «Information Technology», «Operating Systems and Environments», « Discrete Math».	C_1^1; C_1^2; C_2^1; C_2^4; C_4^4; C_4^5; C_5^1; C_7^1 C_8^1.

The complex of professionally-oriented tasks consists of three types of tasks: professionally-oriented tasks (POT), tasks for performing laboratory work using application software packages, professionally-oriented projects (POP). The dissertation describes the methodology for using a complex of professionally oriented tasks in teaching mathematics to students of a technical profile:

1. *Methodology for applying professionally oriented tasks.*
2. *Methodology for laboratory work using application software packages.*
3. *Methods of applying professionally-oriented projects.*

The third chapter, "Experimental substantiation of the effectiveness of the pedagogical model and the methodology of its application," describes the organization, conduct and results of the pedagogical experiment, as well as a mathematical and statistical analysis of the research results.

The proposed professionally-oriented technology of teaching mathematics is determined by research objectives, which are designed to reveal that the introduction of pedagogical technology provides:

−formation of knowledge, skills and abilities of using mathematical methods in solving applied problems from related disciplines of a professional cycle of a technical profile;

−increasing the level of professional motivation of students and interest in a future profession, maintaining motivation at a stable high level.

The pedagogical experiment was conducted with second-year students of the direction “Computer Systems and Complexes” (information profile). Experimental and control groups were organized. Classes with the control group were conducted according to the traditional method, and in the experimental group the pedagogical technology of professionally-oriented teaching of mathematics using professionally-oriented tasks was introduced.

The experimental and control groups included:

– 21 and 18 students of specialties of the specified information profile (respectively).

The selection in the control and experimental groups was carried out at the beginning of the second year immediately before studying the discipline "Elements of higher mathematics" in such a way that both groups had approximately the same level of motivation and the level of mathematical preparation of students.

The success of a pedagogical experiment is ensured by the use of research methods that guarantee a reliable pedagogical result at each stage of the experiment. For this purpose, the following methods of the pedagogical experiment were selected:

– questioning, testing, interviewing students and teachers;
– pedagogical observations at all stages of the experiment;
– control work;
– analysis of laboratory work;
– analysis of the results of tests and exams in the experimental and control groups.

In order to determine the level of various types of motivation among students of the 2nd year of technical profile, the diagnosis of motivation was used according to the method of Е. М. Лепешевой [44]. Motivation can be differentiated into many different types, and the essence of this technique is to identify the predominant type of student motivation - that is, the motivational mechanism that is dominant for him in his educational activities [45, 28, 23]. These types are represented by questionnaire scales.

At the first stage, statistically significant differences were not revealed, that is, the distribution of average scores for different types of motivation according to the results of the test methodology in the groups are not statistically different - the accepted hypothesis is H_0.

Table 5. Processing of the results - Pearson criterion

Motives	Stage 1			Accepted hypothesis
	CG n=18	EG n=21	$\chi^2_{эмп}$	
Prestige studies in the group	0,39	0,27		
Prestige studies in the family	0,75	0,56		
Cognitive interest	0,63	0,68		
Achievement motivation	0,52	0,45		
The motive of social approval by classmates	0,24	0,37		
The motive of social approval by teachers	0,46	0,57		
The motive of social approval by parents	0,46	0,47		
Fear of punishment from an educational institution	0,41	0,51	18,924	*H0*
Fear of punishment from an family	0,33	0,25		
Professional motivation	0,65	0,60		
Motive of communication	0,60	0,53		
Extracurricular motivation	0,17	0,33		
The motive of self-realization	0,39	0,55		
The influence of classmates	0,53	0,45		
Family influence	0,40	0,36		
Impact of educational institution	0,44	0,54		

$\chi^2_{кр}(df = 15;\ \alpha = 0{,}05) = 25{,}0$ * - differences are veracious p<0,05;

$\chi^2_{кр}(df = 15;\ \alpha = 0{,}01) = 30{,}6$ ** - differences are veracious p<0,01.

Table 6. Results processing - t-student criterion

Motives	Stage 1			Accepted hypothesis
	CG n=18	EG n=21	*t*	
Prestige studies in the group	0,39	0,27	1,794	
Prestige studies in the family	0,75	0,56	1,333	
Cognitive interest	0,63	0,68	-0,615	
Achievement motivation	0,52	0,45	-0,110	
The motive of social approval by classmates	0,24	0,37	-1,494	
The motive of social approval by teachers	0,46	0,57	-1,015	
The motive of social approval by parents	0,46	0,47	-0,334	
Fear of punishment from an educational institution	0,41	0,51	-0,055	*H0*
Fear of punishment from an family	0,33	0,25	0,107	
Professional motivation	0,65	0,60	1,404	
Motive of communication	0,60	0,53	-0,274	
Extracurricular motivation	0,17	0,33	0,123	
The motive of self-realization	0,39	0,55	-1,560	
The influence of classmates	0,53	0,45	-0,120	
Family influence	0,40	0,36	0,134	
Impact of educational institution	0,44	0,54	-1,045	

$t_{кр}(df = 15;\ p = 0{,}05) = 2{,}131$; * - differences are authentic p<0,05;

$t_{кр}(df = 15;\ p = 0{,}001) = 4{,}073$; ** - differences are authentic p<0,001.

At the second stage of the study, the diagnosis of educational motivation in the experimental group was carried out after the introduction of the pedagogical technology of professionally oriented teaching of mathematics, and in the control one with the traditional form of training.

The results of the statistical processing of the source data are presented in table 7 and table 8.

At the second stage of the study, differences in all motives between the experimental and control groups are statistically significant at a significance level of p <0.05 - the accepted hypothesis H_1.

Table 7. Processing of the results - Pearson criterion

Motives	Stage 2			Accepted hypothesis
	CG n=18	EG n=21	$\chi^2_{эмп}$	
Prestige studies in the group	0,28	0,62	28,647*	H_1
Prestige studies in the family	0,59	0,92		
Cognitive interest	0,72	0,88		
Achievement motivation	0,47	0,83		
The motive of social approval by classmates	0,39	0,22		
The motive of social approval by teachers	0,57	0,74		
The motive of social approval by parents	0,49	0,74		
Fear of punishment from an educational institution	0,52	0,66		
Fear of punishment from an family	0,26	0,53		
Professional motivation	0,81	0,96		
Motive of communication	0,56	0,76		
Extracurricular motivation	0,45	0,27		
The motive of self-realization	0,48	0,62		
The influence of classmates	0,47	0,65		
Family influence	0,38	0,64		
Impact of educational institution	0,54	0,70		

$\chi^2_{кр}(df = 15; \alpha = 0{,}05) = 25{,}0$; * - differences are authentic p<0,05;

$\chi^2_{кр}(df = 15; \alpha = 0{,}01) = 30{,}6$; ** - differences are authentic p<0,01.

Table 8. Processing of results - t-student criterion

Motives	Stage 2			Accepted hypothesis
	CG n=18	EG n=21	*t*	
Prestige studies in the group	0,28	0,62	**2,894***	*H1*
Prestige studies in the family	0,59	0,92	**4,025***	
Cognitive interest	0,72	0,88	**2,189***	
Achievement motivation	0,47	0,83	**3,196***	
The motive of social approval by classmates	0,39	0,22	**-2,148***	
The motive of social approval by teachers	0,57	0,74	**2,134***	
The motive of social approval by parents	0,49	0,74	**3,248***	
Fear of punishment from an educational institution	0,52	0,66	**2,054***	
Fear of punishment from an family	0,26	0,53	**2,267***	
Professional motivation	0,81	0,96	**2,242***	
Motive of communication	0,56	0,76	**3,678***	
Extracurricular motivation	0,45	0,27	**-2,128***	
The motive of self-realization	0,48	0,62	**2,684***	
The influence of classmates	0,47	0,65	**3,862***	
Family influence	0,38	0,64	**2,437***	
Impact of educational institution	0,54	0,70	**2,064***	

$t_{кр}(df = 15;\ p = 0{,}05) = 2{,}131$; * - differences are authentic p<0,05;

$t_{кр}(df = 15;\ p = 0{,}001) = 4{,}073$; ** - differences are authentic p<0,001.

To test the effectiveness of the introduction of pedagogical technology of professionally oriented teaching of mathematics, two tests were conducted with second-year students studying in the technical field [47]. The first test was carried out in the second year after completing the study of the discipline "Mathematics" as a starting test. Its main goal is to assess the readiness of students in the control and experimental groups to learn mathematics. Examination contains tasks of basic (14 tasks) and advanced level (5 tasks) in mathematics for a secondary school course, including 8 tasks of applied content (40% of the total number of tasks).

The second test was carried out at the end of the course of disciplines "Mathematics" and "Elements of higher mathematics" to study the results and analyze the learning outcomes after the introduction of pedagogical teaching technology in the experimental group [48, 49]. Examination contains 12 basic tasks and 7 tasks of a higher (professional) level in the disciplines "Mathematics" and "Elements of higher mathematics", professionally-oriented tasks account for 37% of the total number of tasks.

Table 9. Processing the results of the control work No. 1 - Pearson criterion (the number of coped, people)

Types of tasks	Stage 1			Accepted hypothesis
	CG n=18	EG n=21	χ^2	
The simplest text task	15	18	20,486	H_0
Reading chart	16	15		
Calculation of the area of the figure	15	18		
Choosing the best option	17	20		
Irrational equation	14	17		
Planimetry, the task of calculating the angles in a triangle	15	17		
Calculation of the value of a trigonometric expression	15	15		
The geometric meaning of the derivative	12	14		
Stereometry, rectangular box	14	17		
Probability theory	16	13		
Stereometry, rotation bodies	12	14		
The task of the applied nature of physical content	15	18		
The text problem of compiling an equation	9	12		
Smallest function value	12	15		
Trigonometric equation, root selection	3	4		
Stereometry, the angle between the planes	2	3		
System of inequalities	4	5		

$\chi^2_{кр}(df = 15; \alpha = 0{,}05) = 25{,}0$; * - differences are authentic p<0,05;

$\chi^2_{кр}(df = 15; \alpha = 0{,}01) = 30{,}6$; ** - differences are authentic p<0,01.

At the first stage of the study, we take the initial data as the results obtained when checking control work No. 1 by the number of correctly solved tasks of each type. We will process the results using the statistical package SPSS.20. As a statistical criterion, we use the Pearson criterion (tab. 9).

Comparison of the levels of knowledge, abilities and skills of students in mathematics before the introduction of professionally-oriented teaching technology revealed the similarity of the level of mathematical training in the control and experimental groups.

At the second stage of the study, we take the initial data as the results obtained when checking the control work No. 2 by the number of correctly solved tasks of each type (table 10).

According to the results of the experiment, it can be seen that special problems cause applied problems in the control group of students. Therefore, we can conclude that the professionally-oriented technology of teaching mathematics contributes to the formation of knowledge, skills and abilities to use mathematical methods in solving applied problems from related disciplines of a professional technical cycle.

Table 10. Processing the results of the control work No. 2 - Pearson's criterion (number of coped, people)

Types of tasks	Stage 2			Accepted hypothesis
	CG n=18	EG n=21	χ^2	
Matrix actions	11	19		
Matrix determinant calculation	10	19		
Solving linear systems of equations	10	19		
Linear vector operations	12	20		
Analytic geometry	10	19		
Second order lines	10	18		
Analytical presentation of second-order curves	10	19		
Finding a function limit	10	18		
Differential calculation	11	19		
Calculation of the indefinite integral	10	18	46,857**	H_1
Calculation of a definite integral	10	18		
Complex number actions	11	19		
Applied problem-elements of linear algebra	7	16		
Applied problem-elements of analytic geometry	9	19		
Applied problem-curves of the second order	3	16		
Applied problem-differential calculus (1)	2	15		
Applied problem-differential calculus (2)	4	15		
Applied problem-integral calculus	11	19		
Applied problem - complex numbers	8	18		

$\chi^2_{кр}(df = 18; \alpha = 0{,}05) = 28{,}9$; * - differences are authentic p<0,05;

$\chi^2_{кр}(df = 18; \alpha = 0{,}01) = 34{,}8$; ** - differences are authentic p<0,01.

The relationship between the two causes, expressed in quantitative form, is called the ***correlation***, which shows how one factor changes relative to another, as well as how they are related. We will build a two-way correlation matrix that includes all the disciplines of the professional cycle and professional modules, showing the close connection between the degree of mastering of mathematical disciplines and the success of mastering professional skills.

At the first stage, we will form a correlation matrix based on the final assessments of the control group (graduates of 2017) studying mathematics using the traditional method (tab. 11).

Table 11. Processing of final estimates of the control group — Pearson correlation coefficient

Stage 1 (control group-release 2017)	
	Elements of higher mathematics
Engineering graphics	0,412
Electrical Engineering Basics	0,408
Applied Electronics	0,355
Electrical measurements	0,321
Information Technology	0,436
Metrology, standardization and certification	0,365
Operating Systems and Environments	0,433
Discrete Math	0,265
Fundamentals of Algorithmization and Programming	0,369
Fundamentals of Economics	0,331
PM.01 Designing Digital Devices	0,339
PM.02 The use of microprocessor systems, installation and configuration of peripheral equipment	0,214
PM.03 Maintenance and repair of computer systems and complexes	0,376

* - correlation is significant at the level 0,05;
** - correlation is significant at the level 0,01.

As can be seen from table 11, **the calculated correlation coefficient has a positive sign**, therefore, both factors change in the same direction. In other words, the level of mathematical knowledge affects the development of professional disciplines and professional modules. The value of the correlation coefficient calculated at the first stage for each of the factors is insignificant.

At the second stage of the study, we construct the correlation matrix of final grades for the experimental group (graduates of 2018), after the introduction of professionally oriented technology for teaching mathematics (tab. 12).

Table 12. Processing of the final estimates of the experimental group - Pearson correlation coefficient

Stage 2 (experimental group-release 2018)	
	Elements of higher mathematics
Engineering graphics	0,619**
Electrical Engineering Basics	0,695**
Applied Electronics	0,736**
Electrical measurements	0,794**
Information Technology	0,646**
Metrology, standardization and certification	0,443*
Operating Systems and Environments	0,487*
Discrete Math	0,687**
Fundamentals of Algorithmization and Programming	0,678**
Fundamentals of Economics	0,768**
PM.01 Designing Digital Devices	0,785**
PM.02 The use of microprocessor systems, installation and configuration of peripheral equipment	0,803**
PM.03 Maintenance and repair of computer systems and complexes	0,586**

* - correlation is significant at the level 0,05;
** - correlation is significant at the level 0,01.

The constructed two-sided correlation matrix of final grades in the experimental group demonstrates close relationships between the degree of mastering of mathematical disciplines and the success of mastering professional skills. In professional modules, correlation is significant at the level of 0.01, therefore, the professional competencies of future specialists in the specialty "Computer Systems and Complexes" directly correspond to the quality requirements and the completeness of mathematical knowledge.

The results of the statistical analysis presented above indicate a significant increase in the level of formation in students of professionally directed subjective experience in the experimental group, where training was based on the developed technology and taking into account the identified conditions.

GENERAL CONCLUSIONS AND RECOMMENDATIONS

1. Based on a comprehensive analysis of the methodological, methodological, psychological and pedagogical literature on the problem of studying the process of teaching mathematics in secondary vocational education institutions in different countries, the possibilities of integrating mathematics through the introduction of a professionally-oriented teaching technology in the conditions of fulfilling the educational standard of SVE have been identified and substantiated. In the dissertation research it is proved that the main mechanisms that implement the principle of professional orientation are interdisciplinary communications and a set of professionally oriented tasks [50].
2. The author has developed a pedagogical model for integrating mathematics in the system of secondary vocational education of a technical profile, aimed at implementing the principle of professional orientation. Professionally-oriented tasks are the core of the practical component of pedagogical technology, and the specificity of the model is manifested in a special way of including professionally-oriented tasks in the learning process [51, 52].
3. A bank of professionally-oriented tasks has been developed, the systematic implementation of which at all stages of teaching mathematics, the use of various forms of organization of the educational process, allowing you to include professionally-oriented tasks in the learning process, make it possible, while maintaining a high level of educational motivation of students to achieve the formation of professional competencies and expand students' ideas about the applied and professional significance of mathematics [53].
4. Theoretically substantiated that in order to increase professional motivation and the quality of professional mastery of students in the vocational school system SVE of technical profile, it is necessary:

– implement the content of training in organizational forms that contribute to the manifestation of cognitive activity and professional orientation;

– apply methods of motivation and stimulation of educational and cognitive activities;

– use laboratory work to study the technical means of conducting complex mathematical calculations when modeling professional tasks;

– apply a professionally-oriented technology of teaching mathematics in the SVE system [54].

5. As a result of the pedagogical experiment: (a) the effectiveness of the implementation of the developed pedagogical model using mathematical and statistical methods has been proved: -Pearson criterion and t- Student's criterion; (b) based on the Pearson correlation coefficient, a direct relationship is established between the degree of mastering of mathematical disciplines and the success of mastering professional skills; (c) it was established that the use of professionally

oriented tasks helps to increase the professional motivation of students and the quality of development of mathematical knowledge and skills [55].

6. It can be argued that the implementation of professionally-oriented pedagogical technology for teaching mathematics in the secondary vocational education system of a technical profile, based on the principle of integrating mathematics with related disciplines, revealing the content of interdisciplinary connections and implemented through the use of a complex of professionally oriented tasks, makes it possible to increase the level of mathematical preparation future mid-level professionals, implement the principles of practical and professional the vocational focus of training and improve the professional training of a future specialist.

7. A manual "Elements of Higher Mathematics" was developed containing a bank of professionally oriented tasks [53].

Based on the foregoing, we offer the following **practical recommendations:**

1. For teachers:

– Use professionally-oriented technology of teaching mathematics in the SVE system to increase professional motivation and the quality of mathematical training of future specialists.

– Use the methodology of applying a complex of professionally oriented tasks to implement the principle of professional orientation of training.

2. For authors of textbooks and study guides:

– Apply the proposed pedagogical model in the development of new textbooks and teaching aids.

– Use developed materials for conducting input, current and final controls.

3. For students and masters:

– Study the developed pedagogical model.

– To study mathematics using an approach based on the principle of professional orientation of training and, when developing practical skills, take into account the interdisciplinary connections of mathematics with other disciplines.

BIBLIOGRAPHY

1. МУХАМЕТЗЯНОВА, Г.В. Основные тенденции развития системы профессионального образования. В: *Специалист*. 2009, №11, с. 2–9. ISSN 1726-846X.
2. LE BOTERF, G. *Construire les conpetence si ndividuales et collectives: agir et reussir avec competens.* Paris: Les Edition d′Organisation, 2006, 300p.
3. LUPU, I. *Metodica predării matematicii*. Chişinău: LICEUM, 1996. 308 p.
4. LUPU, I. *Practicum de rezolvare a problemelor de matematică*. Chişinău: Editura USM, 2002. 520 p.
5. LUPU, I. *Metodologia rezolvării problemelor de demonstraţie la matematică*. Chişinău: Prut Internaţional, 2007. 143p.
6. LUPU, I. *Metodologia rezolvării problemelor de matematica cu un grad sporit de dificultate.* Editura Prut International, Chişinău, 2011.
7. BRĂNZEI, D., BRĂNZE, I.R. *Metodica predării matematicii*. Piteşti: Editura Paralela 45, 2005. 217 p.
8. CABAC, G. Individuaizarie formării în medii digitate prin construiria trazeelori ndividuale de instruire. *În Formaria universitară în medii digitale: cercetări teoretico-experimentale.*Băeţi, 2015, p.197-236.
9. CIOBAN, M., CIOBAN-PILEŢCAIA, A. Despre relaţii metrice între elementele unui triunghi. In: *Delta revistă de matematică şi informatică*, 1(4), Chişinău, 2007, p.3-14.
10. NEWELL, W. *Interdisciplinarity in undergraduate general education.* In R. Frodeman, J.T. Klein&C. Mitcham (Eds.), The Oxford handbook on interdisciplinarity. Oxford: Oxford University Press, 2009.ISBN 978-0-19-923691-6.
11. NEWELL, W. *Decision making in interdisciplinary studies.* In G. Morcol, Handbook of decision making. New York:CRC, 2007.
12. МУХАМЕТЗЯНОВА, Г.В. Приоритетные задачи профессионального образования в современной теории и практике. В: *Среднее профессиональное образование*. 2010, №10, с. 2–6.
13. МАХМУТОВ, М.И. Принцип профессиональной направленности обучения. Принципы обучения в современной педагогической теории и практике. – Челябинск: ЧПУ, 1985. С. 88–100.
14. АФАНАСЬЕВ, В.В. *Профессионализация предметной подготовки учителя математики в педагогическом вузе.* Ярославль, 2002. 389 с. ISBN: 5829700875.
15. БОРИСЕНКО, Н.А. Барометр влияния или какие факторы оказывают наибольшее воздействие на обучение. В: *Вопросы образования*. Москва, Ежкварт. научно-образ. Журнал. 2018, №1, 286 с.
16. СМИРНОВ, Е.И. *Фундирование опыта в профессиональной подготовке и инновационной деятельности педагога*: монография. Ярославль, 2012. 646 с.ISBN 978-5-91730-061-0.
17. ГАРАНИНА, И.Ю. *Профессиональная направленность обучения математике студентов системы СПО в процессе осуществления*

профессионально–личностного подхода. Сборник научных работ лауреатов областных премий и стипендий. Выпуск 2. Ч. 1.Калуга: КГПУ им. К.Э. Циолковского, 2006. с. 115– 121.
18. ЛЕМЕШКО, Н.Н. *Особенности профессиональной направленности математической подготовки в средних специальных учебных заведениях*: дис. канд. пед. наук. М., 1994. 124 с.
19. БЕСПАЛЬКО, В.П. *Слагаемые педагогической технологии*. Москва: Педагогика, 1989. 192 с.ISBN 5-7155-0099-0.
20. МАСЛОУ, А. *Мотивация и личность*. 3-е изд.- СПб.: Питер, 2003, 352 с.
21. AMES, C. Classrooms, goal structures and student motivation. *Journal of Educational Psychology*. №84(3), 1992, p.261-271.
22. ИЛЬИН, Е.П. *Мотивация и мотивы*. СПб.: Питер, 2002. 512 с. ISBN 5-272-00028-5.
23. ИЛЬИН, Е.П. *Мотивация и мотивы*. Питер, 2011. 508 с. ISBN 978-5-459-00574-5.
24. БЕЛЫХ, И.Л. К вопросу о мотивации учения студентов вузов. В: *Профессиональное образование*. №1/98, с. 199-205.
25. ЛУПУ, И., ЧОБАН-ПИЛЕЦКАЯ, А. *Мотивация обучения математике.* Ch.: Tipogr. A.S.M., 2008. 164 p. ISBN 978-9975-62-211-0.
26. BIRCH, A. *Psihologia dezvoltării*. Bucureşti: Editura Tehnică, 1999. 239 p. ISSN 1857-0224.
27. DECI, E.L., VALLERAND, R.J., PELLETIER, L.G., RYAN, R.M. *Motivation and Education: the Self-Determination Perspective*. Education Psychology, 26, 1991. ISBN 1462528767.
28. ЧОБАН-ПИЛЕЦКАЯ, А. Роль мотивационных принципов в организации обучения математике: мотивационные стратегии. In: *Studias Universitati s ştiinţe ale Educaţiei*, nr. 10, 2007.
29. НИСМАН, О.Ю. *Формирование социальной активности студентов в учреждениях среднего профессионального образования*: автореф. дис. канд. пед. наук. Самара, 2006. 22с.
30. РОДИОНОВ, М.А. *Мотивация учения математике и пути ее формирования*. Саранск: Изд-во МГПИ им. М.Е. Евсевьева, 2001. ISBN 5-8156-0088-1.
31. AMABILE, T. *Cunoaşterea şi stimularea capacităţii creative a şcolarului mic*: rezumatul tezei de doctorat. Cluj-Napoca, 2011. 17 p.
32. BACIU, S. Elaborarea standarelor formării profesionale şi reforma sistemului de pregătire profesională. In: *Didactica profesională*, iunie 2003, №3(19), Chişinău, p.31-36.
33. CERGHIT, I. *Metode de Învăţământ*. Iaşi: POLIROM, 2006. 315 p.ISBN 973-46-0175-X 2.
34. HARITON, A. *Teoremă, condiţie neceseră şi suficientă*. Chişinău, Universitatea de Stat din Tiraspol, 2007. 145 p.

35. ДАВЫДОВ, Л.Д. *Модернизация содержания среднего профессионального образования на основе компетентностной модели специалиста*: дис. канд. пед. Наук. – М., 2006. 189 с.
36. БЕЛОЗЕРЦЕВ, Е.П., ГОНЕЕВ, А.Д., ПАШКОВ, А.Г. Педагогика профессионального образования. Учеб.пособие для студ. высш.пед.учеб.заведений. М.: Издательский центр «Академия», 2004, 368с.
37. НИЗАМОВ, Р. А. *Дидактические основы активизации учебной деятельности студентов.* Казань: КГУ, 1975. 302 с.
38. КУЗЬМИНА, Л.П. *Проектирование содержания специализированной математической подготовки маркетолога в колледже*: дис. канд. пед. наук. Казань, 1999. 266 с.
39. ХУДЯКОВА, Г.И. *Методические основы реализации экономической направленности обучения математике в военно-экономическом вузе*: дис. канд. пед. наук. Ярославль, 2001.192 с.
40. МОРДКОВИЧ, А.Г. *Профессионально-педагогическая направленность специальной подготовки учителя математики в педагогическом институте*: автореф. дис. д-ра пед. наук. М., 1986. 36 с.
41. БЕЛЯЕВА, А.П. *Дидактические принципы профессиональной подготовки в профтехучилищах.* М.: Высш. шк.. 1991. 205 с. ISBN 5-06-001947-0.
42. ЛЕМЕШКО, Н.Н. *Особенности профессиональной направленности математической подготовки в средних специальных учебных заведениях*: дис. канд. пед. наук. М., 1994. 124 с.
43. ЛОРДКИПАНИДЗЕ, Д.О. *Педагогическое учение К.Д. Ушинского.* Акад. пед. наук РСФСР. 3-е изд. Москва: Учпедгиз. 1954. 368 с.
44. ЛЕПЕШОВА, Е.М. Методика диагностики типа школьной мотивации у старшеклассников. В: *Школьный психолог*. 2007, №9, с. 20–24.
45. ГИППЕНРЕЙТЕР, Ю.Б. ФАЛИКМАН, М.В. *Психология мотиваций и эмоций*. Москва: ЧеРо, МПСИ, Омега-Л, 2006. 752 с.ISBN 5-88711-228-X.
46. НОВИКОВ, Д.А. *Статистические методы в педагогических исследованиях (типовые случаи)*. М.: МЗ-Пресс, 2004. 67 с. ISBN 5-94073-073-6.
47. ЧОБАН, М., ЛУПУ, И., ЧОБАН-ПИЛЕЦКАЯ, А. Роль математических задач в развитии интеллектуальных способностей учащихся. В: *Совершенствование математического образования, 2016: Состояние и перспективы развития, Материалы IX Международной научно-методической конференции, 29-30 сентября 2016 года.* Тирасполь, с. 122-127.
48. АФАНАСЬЕВА, О.Н, БРОДСКИЙ, Я.С., ГУТКИН, И.И., ПАВЛОВ, А.Л. *Сборник задач по математике для техникумов.* М.: Наука, 1992. 205 с.ISBN 5-02-014648-X.
49. СОЛОВЕЙЧИК, И.Л., ЛИСИЧКИН, В.Т. *Сборник задач по математике с решениями для техникумов*. М.: ООО «Издательский дом «ОНИКС 21 век», 2003. 464. ISBN 5-329-00902-2.

LIST OF THE AUTHOR′S PUBLICATIONS ON THE THESIS THEME

50. **ДЕТКОВА, А.** Интегрирование математики в системе среднего профессионального образования посредством матрицы междисциплинарных связей. In: *Materialele Conferinţei ştiinţifice naţionala cu participare internaţională 28-29 Septembrie 2018: Învăţământ superior: tradiţii, valori, perspective.* Chişinău, 2018, c.142-148. ISBN 978-9975-76-248-9.

51. **ДЕТКОВА, А.** Дидактическая модель профессионально-ориентированного обучения математике в системе среднего профессионального образования технического профиля. In: *Acta et commentationes Ştiinţe ale Educaţiei.* Revistă ştiinţifică, 2018, №2(13), c. 176-180. ISSN 1857-0623.

52. **ДЕТКОВА, А.** Методология применения комплекса профессионально-ориентированных заданий при обучении математике в системе среднего профессионального образования**.** In: *Acta et commentationes Ştiinţe ale Educaţiei.* Revistă ştiinţifică, 2019, №2(16), p. 91-96. ISSN 1857-0623, E-ISSN 2587-3636.

53. **ДЕТКОВА, А.** Элементы высшей математики: Учебное пособие/ Деткова Анна; Тираспол. гос.ун-т.-Кишинэу: Б. и, 2019 (Tipogr.UST) – 175 p. ISBN 978-9975-76-275-5.

54. **ДЕТКОВА, А**. Компетентностно-направленный фонд оценочных средств по математическим дисциплинам. *В: Вестник Приднестровского университета – Тирасполь: Изд-во Приднестр. ун-та, 2019 Сер.: Гуманитарные науки:* № 1 (61), 2019. – с. 111-119. E-ISSN 1857-1395.

55. **ДЕТКОВА, А.** Анализ качественных показателей обученности математике в системе среднего профессионального образования. In: *Revistă ştiinţifică Studia Universitatis Moldoviae, Seria Ştiinţe ale Educaţiei (Pedagogie, Psihologie)*. Revistă ştiinţifică, 2019, №5 (125)

56. **ДЕТКОВА, А.В.** Развитие мотивации у студентов среднего профессионального образования в процессе изучения математики».In: *Acta et commentationes Ştiinţe ale Educaţiei.* Revistă ştiinţifică, 2016, №1(8), c.156-159.ISSN 1857-0623.

57. **ДЕТКОВА, А.В.** Роль и место математики в системе среднего профессионального образования. In: *Acta et commentationes Ştiinţe ale Educaţiei.* Revistă ştiinţifică, 2017, №2(11), c.149-155. ISSN 1857-0623.

58. **ДЕТКОВА, А.** Профессионально-направленное обучение математике студентов технического профиля в системе среднего профессионального образования. In: *Conferinţa ştiintifico-practicănaţională cu participare internaţională 27-28 octombrie 2017: Reconceptualizarea formării initiale şi continue a cadlelor didactice din perspective interconexiunii Învăţământului*

modern general şi universitar. Chişinău, 2017, c.340-346. ISBN 978-9975-76-213-7.
59. **ДЕТКОВА, А.** Роль математики при изучении физики в системе среднего профессионального образования. В: *VII Республиканской научно-практической конференции 28 марта 2017: Пути совершенствования физического образования.* Тирасполь, 2017, с.107-110.ISBN 978-9975-9813-6-1.
60. **ДЕТКОВА, А.** Формирование профессиональной мотивации при обучении математике студентов технического профиля в системе среднего профессионального образования. В: *Materialele Conferinţei Republicane a Cadrelor Didactice, 10-11 martie 2018.* Chişinău, 2018 c.113-117. ISBN 978-9975-76-228-1.
61. **ДЕТКОВА, А.** Методология применения комплекса профессионально-ориентированных заданий при обучении математике в системе профобразования. В: Univers Pedagogic. Revistă ştiinţifică de Pedagogie şi psihologiea Institutului de ştiinţe ale educaţiei, 2019, №2(62), с.89-93. ISSN 1811-54-70.

ADNOTARE

Detcova Anna

Impactul matematicii în însuşirea disciplinelor profesionale în sistemul învăţământului secundar profesional

Teza de doctor în ştiinţe pedagogice. Chişinău, 2019

Structura tezei: introducere, trei capitole, concluzii şi recomandări, bibliografie din 168 titluri, 8 anexe, 127 pagini text de bază, 22 figuri, 19 tabele. Rezultatele cercetării sunt publicate în 13 lucrări ştiinţifice.

Cuvinte cheie: educaţia matematică, învăţământ secundar profesional, motivaţia profesională, model pedagogic, legături interdisciplinare.

Domeniu de studiu: Ştiinţe pedagogice. Didactică şcolară (pe trepte şi discipline de învăţământ).

Scopul cercetării: fundamentarea teoretică şi elaborarea modelului pedagogic şi metodologiei de integrare a matematicii în sistemul învăţământului secundar profesional**.**

Obiectivele cercetării: (1) Analiza specificului şi experienţei predării matematicii în instituţiile de învăţământ secundar profesional. (2) Determinarea principiilor de bază ale tehnologiei pedagogice pentru predarea matematicii în sistemul de învățământ profesional secundar. (3 Elaborarea modelului pedagogic şi a metodologiei de integrare a matematicii în sistemul de ÎSP de profil tehnic şi testarea acesteia. (4) Crearea metodologiei de aplicare a complexului de sarcini orientate profesional.

Noutatea şi originalitatea ştiinţifică a lucrării: constă în faptul că, datorită îndeplinirii sistematice şi în mai multe etape a sarcinilor orientate profesional, devine posibil, menţinând în acelaşi timp un nivel înalt de motivaţie a studenţilor, să realizeze simultan dezvoltarea competenţelor matematice şi să extindă înţelegerea studenţilor asupra semnificaţiei profesionale a matematicii.

Problemă ştiinţifică soluţionată: constă în determinarea fundamentelor teoretice şi metodologice pentru dezvoltarea modelului pedagogic de integrare a matematicii în sistemul de învăţământ secundar profesional.

Semnificaţia teoretică a lucrării: constă în determinarea rolului formator de sistem al conexiunilor interdisciplinare ale matematicii cu disciplinele profesionale.

Valoarea aplicativă a lucrării: constă în posibilitatea introducerii metodologiei dezvoltate în procesul de predare a matematicii în instituţiile secundare profesionale de diferit profil. Folosind modelul pedagogic ca constructor teoretic, profesorul îl va completa cu conţinut practic concret, ţinând cont de specialitatea aleasă şi de tipul activităţii profesionale viitoare a unui specialist de nivel mediu.

Implementarea rezultatelor ştiinţifice: tehnologia pedagogică este folosită în procesul educaţional la facultatea de ÎSP al institutului de inginerie şi tehnică din Tiraspol.

АННОТАЦИЯ

Деткова Анна

Роль математики при освоении профессиональных дисциплин в системе среднего профессионального образования

Диссертация доктора педагогических наук. Кишинев, 2019

Структура диссертации: введение, три главы, выводы и рекомендации, библиография из 168 наименований, 8 приложений, 127 страниц основного текста, 22 рисунка, 19 таблиц. Результаты исследований опубликованы в 13 научных работах.

Ключевые слова: математическое образование, среднее профессиональное образование, профессиональная мотивация, педагогическая модель, междисциплинарные связи.

Область исследования: Педагогика. Дидактика математики.

Цель исследования: теоретически обосновать и разработать Педагогическую модель и методологию интегрирования математики в системе среднего профессионального образования.

Задачи исследования.(1) Проанализировать специфику обучения математике в учебных заведениях среднего профессионального образования. (2) Определить принципы, на которых будет строиться педагогическая технология обучения математике. (3) Разработать Педагогическую модель и методологию интегрирования математики в системе СПО технического профиля и апробировать ее. (4) Создать методологию применения комплекса профессионально-ориентированных заданий.

Научная новизна работы: заключается в том, что за счет систематического и многоэтапного выполнения профессионально-ориентированных заданий становится возможным, поддерживая высокий уровень мотивации обучающихся, добиваться одновременно освоения математических компетенций и расширения представления обучающихся о профессиональном значении математики.

Главная решенная проблема: заключается в определении теоретических и методологических основ для разработки Педагогической модели интегрирования математики в системе среднего профессионального образования.

Теоретическая значимость исследования: заключается в определении системообразующей роли междисциплинарных связей математики с профессиональными дисциплинами.

Практическая значимость: состоит в возможности внедрения разработанной методологии в процесс обучения математике в средние профессиональные учебные заведения различного профиля. Используя Педагогическую модель как теоретический конструктор, преподаватель наполнит ее конкретным практическим содержанием с учетом выбранной специальности и вида будущей профессиональной деятельности специалиста среднего звена.

Внедрение результатов исследования: педагогическая технология применяется в образовательном процессе на факультете СПО инженерно-технического института г. Тирасполь.

ANNOTATION

Detcova Anna

Impact of mathematics in the development of professional disciplines in secondary vocational education

Doctoral thesis in pedagogical sciences. Chisinau, 2019

Thesis structure: introduction, three chapters, conclusions and recommendations, bibliography of 168 titles, 8 annexes, 127 pages of basic main text, 22 figures, 19 tables. The results obtaind are published in 13 scientific papers.

Keywords: mathematical education, secondary vocational education, professional motivation, pedagogical model, interdisciplinary communication.

Field of study: Pedagogy. Didactics of mathematics.

Aim of the research: theoretical foundation and development of pedagogical model and methodology for integrating mathematics in the system of secondary vocational education.

Objectives of the research:(1) To analyze the specifics of teaching mathematics in educational institutions of secondary vocational education. (2) To determine the principles on which the pedagogical technology of teaching mathematics will be built. (3) To develop a pedagogical model and methodology for integrating mathematics in the vocational education system of a technical profile and test it. (4) Create a methodology for applying a set of professionally oriented tasks.

The scientific novelty of the work: lies in the fact that due to the systematic and multi-stage fulfillment of professionally oriented tasks, it becomes possible, while maintaining a high level of motivation of students, to simultaneously achieve the development of mathematical competencies and expand the students' understanding of the professional significance of mathematics.

The solved scientific problem: is to determine the theoretical and methodological foundations for the development of the Pedagogical model of integrating mathematics in the system of secondary vocational education.

The theoretical significance of the research: is to determine the system-forming role of the interdisciplinary connections of mathematics with professional disciplines.

Practical significance: it consists in the possibility of introducing the developed methodology into the process of teaching mathematics in secondary vocational schools of various fields. Using the Pedagogical model as a theoretical constructor, the teacher will fill it with concrete practical content, taking into account the chosen specialty and the type of future professional activity of a mid-level specialist.

Implementation of the research results: pedagogical technology is used in the educational process at the faculty of secondary vocational education of the Engineering Institute of Tiraspol.

DETCOVA ANNA

IMPACT OF MATHEMATICS IN THE DEVELOPMENT OF PROFESSIONAL DISCIPLINES IN SECONDARY VOCATIONAL EDUCATION

532.02 -SCHOOL DIDACTICS

(BY STAGES AND EDUCATIONAL DISCIPLINES)

Summary of Ph.D. Thesis in Pedagogical Sciences

Approved for publishing:15.10.19	Paper format 60×84 1/16
Ofset Paper: Tipar ofset.	Tiraj: 10 ex.
Print sheets: 2,07	Command nr.34

Tipografia Universităţii de Stat din Tiraspol
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