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PREPARATION OF FUTURE TEACHERS OF MATHEMATICS FOR IMPLEMENTATION ACADEMIC LINE «ENTREPRENEURSHIP AND FINANCIAL LITERACY» AT SCHOOLS

Lilia Nichugovska,
Valentyna Bevz

У статті розглянуто актуальну для системи освіти й усього суспільства проблему підготовки майбутніх учителів до роботи в сучасній школі, до використання компетентнісного підходу у процесі навчання математики. Висвітлюються особливості впровадження в систему освіти Концепції нової української школи, зокрема, реалізації в загальноосвітніх навчальних закладах змістової лінії «підприємливість і фінансова грамотність». Розглянуто шляхи підготовки майбутніх учителів математики до формування в учнів основ фінансової компетентності в процесі навчання окремих дисциплін. Наведено окремі приклади задач, що спрямовані на реалізацію в процесі навчання математики змістової лінії «підприємливість і фінансова грамотність», які доцільно розв'язувати у вищій та середній школі.

Ключові слова: компетентнісний підхід, аксіологічний і діяльнісний складники, наскрізні лінії ключових компетентностей, підприємливість і фінансова грамотність, задачі, майбутні вчителі математики, учні.

Future teachers' professional training relies on higher education institutions and is determined by national normative documents, as well as goals, objectives, requirements, criteria and standards that underlie global and regional integration processes. Changing the role of a person in the modern world and new requirements for the qualification of pedagogical workers need to improve the content of higher education and the organization of educational process in pedagogical universities. Graduates of pedagogical universities should be ready to work in modern conditions of functioning of general educational institutions, which are defined by the Concept of a new Ukrainian school.

The modern world is complex, and therefore, it is desirable not only for students to get a certain amount of knowledge, but also to learn to use them, that is, to create the vital competencies necessary for successful self-realization in life, further education and professional activity. That is why the modern school introduces a competent approach and identifies 10 key competencies: information-digital, social and civic, lifelong learning, awareness and expression in the field of culture, environmental literacy and healthy life, and others. One of these competencies is «Initiative and Entrepreneurship», which includes: the ability to generate new ideas and initiatives and implement them in order to improve both their own social status and welfare, and the development of society and the state. Moreover, it is important to pay attention ability to behave rationally as a consumer, effectively use individual savings, make appropriate decisions in the field of employment, finance, etc. [5]. All above mentioned indicates the need to prepare the future teacher for the introduction of a competent approach to teaching mathematics at school in general and make actual the formation of students financial literacy in particular.

Analysis of research and publications. Ways to increase the level of financial literacy of different strata of the population were considered by R. Bond, O. Blaskavka, S. Bulavenko, L. Zakharkina, M. Katerinina, T. Kizima, A. Klymchuk, G. Kucherova, I. Lomachinskaya, B. Prikhodko, D. Radzishvskaya T. Smovzhenko and others. The development of separate

training courses (of a choice) for schools of different levels and profiles was undertaken by S. Bidenko, Y. Bitsyur, G. Gorlenko, D. Zimovsky, I. Kravchenko, L. Mezhenikov, T. Smovzhenko, G. Fesenko and others. The work of N. Bajun, D. Vasiliev, N. Vasilyuk, T. Zadorozhnaya, G. Dutka, L. Ignatenko, S. Lukyanova, L. Mezhejnikikova, G. Melnyk, I. Rudenko, O. Strelchenko, I. Strelchenko, O. Sushko, Y. Tkach are devoted to forming of financial literacy in the process of learning Maths at school. In the works of these authors, the focus is on applied problems and the peculiarities of their solving in school. The advantage is given to tasks of economic content. Issues related to the formation of financial literacy of students and the preparation of future mathematics teachers for the forming of pupils' financial competence were covered by M. Golovan, G. Dutka, O. Ovchar, O. Sushko, G. Fesenko [10]. and other scholars. In the context of the topic under consideration, the article by G. Fesenko «Preparation of future mathematics teachers for the financial education of the students of the profile school deserves attention», in it the author examines four stages of financial education of the individual: familiarization with the general norms and social rules of conduct with money; formation of attitudes towards money; formation of views and beliefs related to financial activity; forming a personality orientation for financial success. The author proposes content lines for the training of future teachers of mathematics for the financial education of schoolchildren, which include: 1) the theoretical basis of the economical / financial education of students; 2) models for increasing the financial literacy of students by means of a school course of mathematics; 3) the content of financial education of high school students during the study of School Computer Mathematics;

4) technologies of competence-oriented teaching of mathematics students and basic forms, methods and means of financial education; 5) the design of financial education and training of students of the profile school in the process of studying mathematics at the level of class, section, topic, lesson, pedagogical situation.

It is emphasized that the quality of financial education of students significantly depends on the level of readiness for such activities of the teachers. It is anticipated that future teachers will acquire the relevant competencies when studying normative disciplines (such as Pedagogy and Methods of Teaching Mathematics) and the special course «Fundamentals of Financial Mathematics», which is a prerequisite for the implementation of the proposed content lines [10, p. 152].

Another, more realistic approach in our opinion is proposed in works [3], [4]. The authors propose to implement a competent approach to learning, in particular, to develop students' ability to use mathematical knowledge for financial calculations based on the axiological component of the competence approach (taking into account students' interest in financial transactions and their needs) and its activity component (solving specially created tasks with financial content, its workshops are available for students and teachers). The view is expressed that motivating pupils' activities in the classroom is an unusual formulation of the topic of the lesson. For example: «Banking Transactions» (instead of «The problems for percentage») or «Save Family Budget» (instead of «Data Sharing»). This technique is of interest to students and holds their interest for a long time. At the same time, it is possible to naturally draw students' attention to the family values associated with economizing and savings [3, p. 46]. Under these conditions, it is not necessary to include additional training courses for the future teacher training program.

The purpose of the article is to elucidate the peculiarities of introducing the concept of a new Ukrainian school into the education system, in particular the implementation of the «entrepreneurship and financial literacy» content syllabus in general education institutions, and to highlight the ways of preparing future mathematics teachers to form students in the basics of financial competence.

A specialist in the field of education must deeply understand the place and role of changes taking place in the world of scientific and cultural space, combine deep theoretical knowledge with practical training, freely orientate themselves in social, natural and educational processes, understand the peculiarities of cultural development, and acquire scientific wisdom. The Concept for the Development of Continuous Pedagogical Education emphasizes the need to bring the content of training of pedagogical and scientific workers to the requirements of the information society and the changes taking place in the socio-economic, spiritual and humanitarian spheres, at different levels of educational institutions.

Significant changes are now taking place in secondary education. The updated math program [8] identifies four cross-cutting lines of key competencies: «Environmental Security and Sustainable Development», «Civic Responsibility», «Health and Safety», «Entrepreneurship and Financial literacy», which are aimed at forming pupils ability to apply knowledge and skills in real life situations. Cross-cutting lines are socially significant interdisciplinary themes that help form students' perceptions of society as a whole, develop the ability to apply the knowledge gained in different situations. These lines are means of integrating key and general-purpose competencies, study subjects and subject cycles, and therefore they need to be taken into account in the formation of the school environment. The cross-cutting line «Entrepreneurship and Financial literacy» is aimed at developing leadership initiatives, the ability to successfully operate in a rapidly changing technology environment, and providing students with a better understanding of the practical aspects of financial issues (savings, investing, borrowing, insurance, lending, etc.). This cross-cutting line is connected with the solving of practical tasks related to planning of economic activity and real estimation of own opportunities, drawing up of a family budget, formation of economical attitude to natural resources. It is implemented in the study of interest calculations, equations and functions [8].

Teacher training for the implementation of this cross-cutting line at future school should begin during the training of students in pedagogical universities. It is necessary to do this during studying of: – «Elementary Mathematics». – «Theory of Probability and Mathematics statistic». – «Higher Mathematics». – «Informatics». – «Methods of teaching mathematics». – «History of mathematics».

For example, in the course «History of Mathematics» students get acquainted with the entrepreneurship of the famous Greek mathematician Thales of Miletus, the history of the emergence and use of the concept of «percentage», with historical tasks of financial content, with the work of the famous Italian mathematician L. Pacioli «Treatise on computing and writing», in which he deals with the wording of the basic principles of accounting: double entry, debit, credit, balance, etc. More details about this you can find in our work [2].

While studying the course of «Elementary mathematics», there is a real opportunity to show the connection between mathematics and human activity, and to consider more complex tasks that students will encounter in future pedagogical activities. In the context of the formation of financial literacy – these are tasks on interest. Among them there are many difficult to understand and solve. At university it is necessary to form in students not only the ability to solve such problems, but also to reveal the essence of such tasks and methods of their solution, to teach future mathematics teachers to prevent and correct mistakes that students often admit. For this purpose, in the course of «Elementary mathematics» it is expedient:

- to devote one practical lesson to solving more complex tasks with interest, the curricula of which are related to the separated lines in the program;

- to invite students to analyze school textbooks, to find interesting tasks on interest (in particular those relating to entrepreneurship and financial literacy) and to submit them with methodological instructions;

– for individual or project work, to offer students a task for themselves on percentages of relevant subjects and to exchange them with their associates as control and self-control.

Many financial processes are represented using tables and charts, and calculations are carried out using software. Establishing interdisciplinary ties in the process of teaching future teachers of elementary mathematics contributes to the formation of interdisciplinary competence on the basis of mastering content, procedural and motivational components from various branches of knowledge. For example, the skillfully used connections of elementary mathematics and computer science contribute to the implementation of methodological, educational, developing, educational functions [9].

In the context of research subject such course as «Theory of Probability and Mathematic statistic» has a considerable potential for the formation «entrepreneurial and financial literacy». The last is due to fact that researching economic phenomena is impossible without mathematical modeling, Regression correlation analyses, variance models, and other methods which are based on Theory of Probability. Realisation of professional direction of teaching mathematical courses and application of mathematical models and methods in production, financial, managerial and many other spheres is impossible without intensive application of problems with practical content in studying process.

Solving of problems of practical content requires from students not only deep theoretical Knowledge of each topic but also skills of adaptation of them to analyses of certain situations and making the corresponding decision.

For example, in the process of considering numerical characteristics of discrete random variables you can suggest students the problems of the type: Find the variance of the random variable X , given as follows.

x_i	1	3	4	5
p_i	0,1	0,3	0,2	0,4

But more effective would problems with the following statement which are taken from our handbook [6, 77].

• Chapter Bus Company offers intercity transportation to Surrounding location. One particular run carries passengers as shown by the probability distribution.

Number of Passengers	Relative Frequency
20	0,2
25	0,3
30	0,15
35	0,10
40	0,25

a) Costs are fixed at 1000(грн) per trip regardless of the number of passengers. If CBC wants to average a profit of 400(грн) for each run, how much should it charge per passenger?

b) What variation in revenue will result if it charges the amount specified in part (a)?

• A popular financial theory holds that there is a direct relationship between the risk of an investment and the return it promises. A stock's risk is measured by its β -value. Shown here are the returns and β -values for 12 fictitious stocks suggested by the investment firm. Do these data seem to support this financial theory of a direct relationship?

Stock	Return (%)	β -value
1	5.4	1.5
2	8.9	1.9
3	2.3	1.0
4	1.5	0.5
5	3.7	1.5
6	8.2	1.8
7	5.3	1.3
8	0.5	-0.5
9	1.3	0.5
10	5.9	1.8
11	6.8	1.9
12	7.2	1.9

- Investors typically view return as a function of risk. Use an interpretation of both the regression coefficient and the coefficient of correlation in your response;
- Calculate and interpret the standard error of the estimate.
- Test the hypothesis regarding the correlation coefficient at the 5 percent level.
- Test the hypothesis regarding the estimation an adequate obtaining regression model.
- Make conclusion.

It is important to focus on some positive facts connected with implementation of problems with practical content to the process of studying.

First, rejection from standard statement of mathematical problem makes student interested because it focuses their attention to the analyses of the content of the problem and to the searding of necessary mathematical formulas and then to making corresponding colculations second, the majority of problems with practical content has problematic character that in it its turn helps not only to application of the known mathematical information for analyzing given problem, but also stimulates students to find and master new knowledge, increases their individud bank of mathematical methods that would be applied for solving difficult economic problems [7].

In the course of «Methods of teaching mathematics», students (future mathematics teachers) consider the purpose, content, forms, methods and means of teaching mathematics at school. Since the content and purpose are specified in the normative documents, the question of the need for the implementation of the cross-cutting line «Entrepreneurship and financial literacy» is considered during the 3rd year (general methodology), during the 4th year (the methodology of teaching mathematics in the basic school) and during the 5th year (the methodology of teaching mathematics in senior specialist school).

Among other things, students get acquainted with the current textbooks and the system of tasks contained in them. Here is an example of such a task from our textbook [1].

- The object of taxation of transport tax is passenger cars, which have been running since the year of issue no more than five years (inclusive) and whose average market value is UAH 1.03 million. The transport tax for 2016 for cars is paid by owners at a rate of 25 000 UAH per year for each car. Determine what percentage of the cost of a new car will be paid by its owner in the form of a transport tax for 5 years, if the car costs:

- 1 055 835 USD;
- UAH 2 051 281;
- UAH 1,187,844;
- 2 450 448 UAH.

Well, if for the analysis of alternative textbooks, the teacher will determine for students, among others, the following tasks:

– Determine the types and number of tasks of the textbook, aimed at developing financial literacy of students.

– Make your own financial tasks, which can be used when studying the equations (functions, derivative, etc.).

– What types of tasks can be offered to students to create entrepreneurship and financial literacy in them.

Interesting to reveal certain aspects of entrepreneurship can be historical tasks, such as:

- Ancient task. Once, a wise poor man asked a poor, sheltered refuge for two weeks on the following conditions: «For this I will pay you for the first day 1 coin, the second – 2, the third – 3, etc., increasing the daily fee for 1 coin. You will give alms: on the first day, 1 coin, the second – 2, the third – 4, etc., increasing twice daily alms. The rich gladly agreed on this, considering the conditions favorable. How much money did the rich get?

- Euler's task. A man selling a horse offered the buyer to pay only for nails, which were hooked to the hoof of that horseshoe. For the first nail – 1 pfennig, for the second – 2, for the third – 4, etc. – for each one is twice more than the previous one. How much did he sell a horse if the nails were 32?

To enable students to formulate readiness to implement the cross-cutting line «Entrepreneurship and Financial literacy» during their pedagogical practice, it is advisable for them to use the additional Problem Collection [4], which contains an appropriate system of tasks, structured according to the program themes for each class of the primary school, and methodological recommendations for integration and implementation of cross-cutting lines of key competencies in the process of teaching mathematics. The collection also describes the types of tasks (according to the phonograms) that are advisable to offer students for solving: the cost of goods and services, family budget, insurance, banking, securities, charity, taxes, etc.

It is envisaged that studying through cross-cutting lines is implemented, among other things, through work in projects, extra-curricular training and the work of circles. That is why students should be trained to organize thematic evenings, conversations, quizzes, etc. The current work of students and students is currently relevant. It is possible to formulate projects related to financial issues, namely «Currency Exchange», «Energy Conservation and Savings», «Charity in Ukraine», «My Family Taxes», etc.

The implementation of the main provisions of the Concept of a new Ukrainian school and updated curricula relies on a teacher. The quality and efficiency of the professional activity of a modern teacher is determined not only by special and methodical preparation, and also by the level of its general and methodological culture, professional competence. At first plan are the tasks of personal development based on its internal potential, in accordance with the best achievements of mankind and its values. The financial literacy of the teacher and his readiness to form the cross-cutting line «entrepreneurship and financial literacy» in the younger generation will have a positive impact on the development of the personality of students and teachers, as well as on the state's economy and the welfare of its citizens.

BIBLIOGRAPHY

1. Algebra: under the arm. for 9 cl. general education tutor shut up / G. Bevz, V. Bevz – K. : Publishing House «Education», 2017. – 272 p.

2. Bevz V.G. History of Mathematics in the Professional Training of Future Teachers: Monograph. – K. : NM Drahomarov NPU, 2005. – 360 p.

3. Vasiliev D.V. Methodological principles of the implementation of the axiological approach to the study of mathematics at school // Ukrainian Pedagogical Journal. – K.: Pedagogical thought, 2016. – № 2. – С. 42-49.

4. Vasiliev D.V., Vasilyuk N.I. Collection of problems in mathematics. 5 to 9 classes. (Cross-cutting lines of competencies and their implementation). – K. : Publishing House «Education», 2017. – 112 p.

5. New Ukrainian School. Conceptual Principles of Reforming High School. – [Electronic resource]. – Mode of access: <http://mon.gov.ua/konczepczyia.pdf>

6. Nichughovsjka L.I. Matematyčne modeljuvannja v systemi ekonomichnoji osvity [Tekst] / L. I. Nichughovsjka ; Ukoopsilka, Poltavskijj un-t spozhyvchoji kooperaciji. Kafedra vyshhoji matematyky i fizyky. – Poltava : RVV PUSKU, 2003. – 289 s.

7. Nichughovsjka L.I. Adaptivna koncepcija matematyčnoji osvity studentiv VNZ i konkurentospromozhnistj vypusknjukiv: metodologhija, teorija, praktyka [Tekst] : monoghrafija / L. I. Nichughovsjka ; Poltavskijj un-t spozhyvchoji kooperaciji Ukrajinu. Kafedra vyshhoji matematyky i fizyky. – Poltava : RVV PUSKU, 2008. – 154 s.

8. Updating programs for basic general secondary education [Electronic resource] – Access mode: <https://www.ed-era.com/mon59/>

9. Sukhoivanenko L.F. Formation of interdisciplinary competence of future mathematics teachers in the process of teaching elementary mathematics // Visnyk of Cherkasy University. Series: Pedagogical Sciences. – Cherkasy: ChNU them. B. Khmelniysky, 2015. – Vip. 17 (350). – P. 85-90.

10. Fesenko G.A. «Preparation of future teachers of mathematics for financial education of pupils of the profile school // Collection of scientific works» Pedagogical sciences. – Kherson: KSU, 2016. – No. 71, Volume 2. – P. 148-153.

НИЧУГОВСКАЯ Л., БЕВЗ В.

ПОДГОТОВКА БУДУЩИХ УЧИТЕЛЕЙ МАТЕМАТИКИ К РЕАЛИЗАЦИИ В ШКОЛЕ АКАДЕМИЧЕСКОЙ ЛИНИИ «ПРЕДПРИНИМАТЕЛЬСТВО И ФИНАНСОВАЯ ЛИТЕРАТУРА»

В статье рассматривается актуальная для системы образования и всего общества проблема подготовки будущих учителей к работе в школе, к использованию компетентного подхода в процессе обучения математике. Освещаются особенности внедрения в систему образования Концепции новой украинской школы, в частности – реализации в общеобразовательных учебных заведениях компетентной линии «предприимчивость и финансовая грамотность». Рассматриваются пути подготовки будущих учителей математики к формированию у учащихся основ финансовой компетентности в процессе изучения отдельных дисциплин. Подаются отдельные примеры задач, направленных на реализацию в процессе обучения математике содержательной линии «предприимчивость и финансовая литература», которые целесообразно решать в высшей и средней школе.

Ключевые слова: компетентный подход, аксиологическая и деятельностная составляющие, сквозные линии ключевых компетентностей, предприимчивость и финансовая грамотность, задачи, будущие учителя математики, ученики.

NICHUGOVSKA L., BEVZ V.

PREPARATION OF FUTURE TEACHERS OF MATHEMATICS FOR IMPLEMENTATION OF ACADEMIC LINE «ENTREPRENEURSHIP AND FINANCIAL LITERACY» AT SCHOOLS

The article considers the problem of the preparation of future teachers for work in a modern school, relevant to the education system and the whole society, to the use of a competent approach in the process of teaching mathematics. The peculiarities of introducing the concept of a new Ukrainian school into the system of education are highlighted, in particular, the implementation of four cross-cutting lines of key competencies: «Environmental Security and Sustainable Development», «Civic Responsibility», «Health and Safety», «Entrepreneurship and Financial literacy», which are aimed at forming pupils ability to apply knowledge and skills in real life situations. The cross-cutting line «Entrepreneurship and Financial literacy» is aimed at developing leadership initiatives, the ability to successfully operate in a rapidly changing technology environment, and providing students with a better understanding of the practical aspects of financial issues (savings, investing, borrowing, insurance, lending, etc.). The ways of preparation of future teachers of mathematics for formation of the bases of financial competence in students during the process of studying of: – «Elementary Mathematics». – «Theory of Probability and Mathematics statistic». – «Higher Mathematics». – «Informatics». – «Methods of teaching

mathematics». – «History of mathematics» are considered. Certain examples in the course «History of Mathematics» students get acquainted with the entrepreneurship of the famous Greek mathematician Thales of Miletus, the history of the emergence and use of the concept of "percentage", with historical tasks of financial content. The course of «Elementary mathematics» is a real opportunity to show the connection between mathematics and human activity, and to consider more complex tasks that students will encounter in future pedagogical activities. In the context of research subject such course as «Theory of Probability and Mathematic statistic» has a considerable potential for the formation «entrepreneurial and financial literacy». The last is due to fact that researching economic phenomena is impossible without mathematical modeling, Regression correlation analyses, variance models, and other methods which are based on Theory of Probability.

In the course of «Methods of teaching mathematics», students (future mathematics teachers) consider the purpose, content, forms, methods and means of teaching mathematics at school. Since the content and purpose are specified in the normative documents, the question of the need for the implementation of the cross-cutting line «Entrepreneurship and financial literacy» is considered during the 3rd year (general methodology), during the 4th year (the methodology of teaching mathematics in the basic school) and during the 5th year (the methodology of teaching mathematics in senior specialist school). The current work of teachers and students is currently relevant. It is possible to formulate projects related to financial issues, namely «Currency Exchange», «Energy Conservation and Savings», «Charity in Ukraine», «My Family Taxes», etc.

Key words: *competence approach, axiological and activity components, cross-cutting lines of key competencies, entrepreneurship and financial literacy, tasks, future mathematics teachers, students.*

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