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Coexistence of Theory and Practice in Training the Future Mathematics Teacher: The Experience of the Russian Education System

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ABSTRACT
The relevance of the research: For the fourth decade, Russian education system has undergone constant changes at various levels: from preschool to higher education. Accordingly, the process of teacher's professional training is being modernized, including state educational standards, which assume significant strengthening of the role of practical training. In this regard, it becomes urgent to find a balance between the theoretical and practical training of the future mathematics teacher. The purpose of the study is to identify the optimal balance between theoretical and practical teaching in the process of professional training of the future mathematics teacher. The research was carried out based on the regularities of the methodological problems of pedagogical forecasting, including the expert evaluation method, historical analysis, practical methods (questionnaire surveying).

Keywords: historical analysis, practical training of the mathematics teachers, subject-based (scientific) training of the mathematics teachers

INTRODUCTION

The problem of training future teachers for the school is always topical. In a constantly changing educational environment, the school teacher should not only meet the requirements that the society puts forward, but also outstrip them. According to Voskresenskaya (2004), the level and nature of scientific knowledge on the subjects that teachers will teach at school is a significant problem while training educators in the world's leading countries. Many countries are trying to solve the problem of the correct relationship between the two main components of pedagogical education – knowledge on the subject-based and psychological and pedagogical training. In all countries, significant work is underway to modernize the content of education, new programs are being introduced, textbooks are being developed on an interdisciplinary basis, orienting students toward fundamental knowledge in the humanities and natural sciences, new standards are being developed for teachers' training. The problem reflecting the strategic aspect of university education is of particular importance at the present stage: the search for a balance between the theoretical and practical training of the future teacher, in general, and the mathematics teacher, in particular. This article deals with the search for solutions to this problem. In our opinion, it cannot be solved competently without a retrospective analysis of the mathematics teachers' training in the Russian pre-revolutionary (before 1917) and then in the Soviet higher school (1917-1992).

The aim of the study, the results of which are given in the article, is to find a balance between the theoretical and practical training of the future teacher. This aim can be achieved on the basis of solving the following tasks:

- making a retrospective analysis of the problem of teacher training in different historical epochs;

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Contribution of this paper to the literature

- It has been proved that the subject-related (mathematical) training is the key moment in instructing the mathematics teacher.
- A provision on the need for the professional training of a mathematics teacher based on preserving the traditions and continuity of the Russian and Soviet schools has been disclosed.
- It has been experimentally established that modern practicing mathematics teachers need to improve the level of subject training throughout their entire professional activities.

- making a quantitative analysis of the curricula used in the course of training the mathematics teacher in Russia from 1980 to 2017;
- studying the opinions of practicing mathematics teachers in the Lipetsk, Tula, Voronezh, and Orel regions of the Russian Federation on the role of theoretical and practical training at the university for their professional success.

LITERATURE REVIEW

The problem of finding an optimal balance between theory and practice in the future teachers' training has become recognized for the last few decades (Kuandykova et al., 2016; Borko and Mayfield, 2007; Greaves, 1994; Guyton and McIntyre, 1990).

The influence of the educational policy of the state on the theoretical and practical training of the mathematics teacher was shown by scholars in the framework of the international seminar in Princeton, who presented generalizing results based on the experience of Brazil, France, India, Japan, etc. (Ferrini-Mundy et al., 2001).

As noted by Greaves (1994), in the UK attention is increasingly being paid to pedagogical techniques, mastering specific skills in conducting educational and upbringing work, which are formed not only in the course of classroom activities, but also in drilling the skills of applying various (including innovative) forms and methods of work with students. According to Faust-Siehl (2000), the search for a combination of pedagogical theory and pedagogical practice in all phases and at all stages of studies is one of the main problems of teacher training in Germany.

Roulet (1996) suggests using information technologies as a tool enabling to synchronize the theory and practice of training mathematics teacher in Canada.

A detailed analysis of the need to combine the balance of theory and practice in training of a specialist in any educational program specialization in Russia was made by Sitnikov (1995).

The issue of finding a balance between the theory and practice in training a mathematics teacher was dealt with in a historical retrospective in the writings of Saltykov (1915), Young (1920), Voskresenskaya (2004), Senashenko and Tkach (2010). Aristotle defined the philosophical basis for determining this balance (2002).

In the works of Borko and Mayfield (2007), Greaves (1994), Guyton and McIntyre (2009), Jaworski and Gellert (2003) the preference is given precisely to practical training. Cañadas et al. (2013) describe the practical experience of instructing a mathematics teacher in Spain. Voskoglou (2006; 2009), analyzing the experience of training a mathematics teacher in Greece, concludes that one should focus on the social role of mathematics and its application in various fields. Povey (2014) points out that in the UK much attention is paid to studying the history of mathematics and acquaintance with teaching practices in specific institutions while educating a mathematics teacher for the primary level. Watson et al. (2012) draw attention to those mathematical data that are of practical importance at secondary school.

Oonk (2009) suggests using a multimedia environment to enrich theoretical knowledge with practical skills.

Opposite position is expressed in the works of Sitnikov (1995), who proves the priority of theoretical information over the practical one. The study of Leong (2013) shows that each class has features that must be taken into account in the actual practice of the mathematics teacher. The experience of teaching in one class cannot be transferred precisely in the same manner to another class. Hence it can be concluded that practical training will always be limited. And only by singling out general theoretical laws in teaching mathematics, one can achieve a good result.

The Russian scholar Kayumov (2014) substantiates the need to preserve the theoretical (fundamental) training of a mathematics teacher in the Russian education system and points out at the civilizational differences in education systems conditioned by the traditions of different civilizations as the main argument of this approach: the European education system relies on practice, while the Russian education system relies on theory.

Nowadays, future teachers are trained in Russia both by pedagogical institutions of higher education and by classical universities. The unity of this professional training should be ensured by the Federal State Educational

Table 1. Age composition and length of employment of mathematics teachers participating in questionnaire survey (2017)

Parameters	Years	Number of respondents
Age	25 – 35	7
	35 – 45	16
	Over 45	12
Length of employment	5-10	6
	10-20	10
	Over 20	19

Standard of Higher Pedagogical Education (the state standard was first introduced in the Russian Federation in 1995, and then it was amended thrice). However, in recent years, in connection with Russia's accession to the Bologna Declarations, the informative part of this document has not only been constantly revised, but is also becoming more and more vague, giving universities an unlimited freedom in determining the content of the teachers' training, especially training on the subject-matter discipline. The decision-making on the issue which teachers are needed by the school is made now rather by particular university than by the state (the Ministry of Education and Science of the Russian Federation).

The absence of the informative part in the state standards of vocational training for the future teacher raises the questions: is there a need for profound knowledge of the subject-based training for future teachers or will it be sufficient for them to have superficial understanding of the subject taught in the future? What should be the ratio of theoretical and practical components during training at a university?

METHODS AND MATERIALS

The tasks set up in the study were solved with reliance on:

- methodological problems of forecasting in general and the doctrine of civilization predetermination in education (Aristotle, 2002; Kayumov, 2014; etc.);
- historical method, namely: a retrospective analysis of the problem of teacher training in different historical epochs;
- factor analysis, including a content-related approach, i.e. referring to experience and deducing theoretical conclusions from it. The curricula for mathematics teachers' training were studied at the Yelets Bunin State University (YSU named after I. A. Bunin, 78 years of experience in the field of vocational training for future mathematics teachers), the Orel Turgenev State University (OSU named after I.S. Turgenev, 99 years of activity in the field of vocational training of future mathematics teachers); Orenburg State Pedagogical University (OSPU, 102 years of experience in the field of vocational training for future mathematics teachers);
- practical methods: questionnaire surveying, multifactor analysis of the results of the authors' own 25-year pedagogical experience in the field of vocational training of future mathematics teachers).

The questionnaire was developed by the authors of the article (see the text of the questionnaire below).

The participants of the 2016 questionnaire survey were 22 retrainees of Bunin YSU, they were mathematics teachers from schools in Yelets and rural schools in the Lipetsk, Tula and Voronezh regions of the Russian Federation. The length of employment of the survey participants as mathematics teacher was different ranging from 6 years to 45.

The participants of the 2017 questionnaire survey were 35 retrainees. They were mathematics teachers from schools in the Lipetsk, Tula and Orel regions. The length of employment as a mathematics teacher of the participants in the survey was different ranging from 5 years to 30 (for more details, see **Table 1**). Teachers of rural schools in the Orel and Tula regions took part in the survey remotely. The other participants filled in the questionnaire internally.

RESULTS OF THE STUDY

As early as at the beginning of the 20^{th} century, the problem of training mathematics teachers was one of the priorities in the proceedings of the International Commission on Mathematical Instruction (chaired by F. Klein) and of two All-Russia Congresses of Mathematics Teachers (1912–1914). A researcher Saltykov (1915) undertook a deep analysis of the foreign practices related to the training of mathematics teachers, focusing on the differences between the German and French systems. It is worth mentioning that, according to the pre-Soviet and European pedagogical traditions, the theoretical training of mathematics teachers used to be reduced to studying mathematics at the university. Our study suggests a somewhat wider scope of theoretical training, as it implies that apart from studying mathematics (i.e. pursuing subject-based or scientific training), university students should also learn psychological and educational disciplines, including the methodology of teaching mathematics.

The reflection about "theory" as spiritual contemplation of abstract ideas goes back to the Ionian school of philosophy. Aristotle (2002, p. 30) defines theory both in the context of "art" and "science," which are essentially the opposite of experience. According to him, "science and art come to men through experience; ... Now art arises when from many notions gained by experience one universal judgement about a class of objects is produced. For to have a judgement that when Callias was ill of this disease this did him good, and similarly in the case of Socrates and in many individual cases, is a matter of experience; but to judge that it has done good to all persons of a certain constitution, marked off in one class, when they were ill of this disease, e.g. to phlegmatic or bilious people when burning with fevers-this is a matter of art.

Nowadays, the Aristotelian concept of theory (art) has quite firmly asserted itself in the philosophical science, which states that "theory, as opposed to naked empiricism, is any unity of scientific knowledge wherein facts and hypotheses are tied together in a certain whole, i.e. such scientific knowledge where facts substantiate common laws and any relations between them are derived from consequences" (Gubsky et al., 1994).

A teacher-to-be is unable to acquire as little as superficial education on the sheer basis of his/her own experience. Reducing the learning process to discovering commonly known facts by the students on their own is absurd. How much time would it take the student to find out about mathematical theorems or teaching practices that are normally studied in educational sciences? It is through the process of theoretical learning that the teacher can pass students the knowledge they need, and this presents an opportunity for the teacher to not only introduce them to disparate facts, axioms, theorems, but also systemize them and show the correlation between individual structural components, as well as acquaint them with the methodology of learning; in other words – and this is very important – to help prospective teachers of this subject to shape their mathematical culture. On the other hand, it is safe to argue a priori that having a good command of the relevant system of subject-related knowledge is as much important for a teacher of physics, biology, history, etc.

Theory is a summarized set of practices that the humankind has been accumulating for thousands of years, so each new practical approach must rely on an already tested and proven piece of theory. On the assumption of this commonly known premise, practice ought to follow theory, and not the other way round, as is suggested in many Bachelor of Applied Science (BAS) degree programs. This concerns both the subject-based training (scientific and mathematical) and the educational training that a mathematics teacher has to receive. Komenskiy (1982) and Ushinskiy (1988) in their works for teachers summarized the long-term practical experience and developed general guidelines offering indispensable knowledge without which it would be impossible to streamline the educational process in a modern school. That is why learning pedagogy and subject-related teaching techniques should take place before practical training. Without having a deep theoretical knowledgebase, prospective teachers will start their career by simply repeating the numerous mistakes of thousands of their predecessors.

However, it is hardly right to underestimate the role of practice in learning. As Aristotle justly puts it (2002: 30), "experience is knowledge of individuals, art of universals, and actions and productions are all concerned with the individual; for the physician does not cure man, except in an incidental way, but Callias or Socrates or some other called by some such individual name, who happens to be a man. If, then, a man has the theory without the experience, and recognizes the universal but does not know the individual included in this, he will often fail to cure; for it is the individual that is to be cured" (Aristotle, 2002: 31). Clearly, practice should take a rightful place in the educational process, both as a criterion of truth and as the second required component of scientific training.

In the scope of a BAS degree program, practice becomes the leading method for acquiring professional knowledge and skills of a teacher-to-be, and this idea might at first seem attractive on many scales (from cutting the university's costs on teaching to the maximum alignment of the learning process with the future vocational activity).

The problem of theory-practice balance in the training of mathematics teachers was historically being solved in different ways. According to the pre-revolutionary educator Saltykov (1915), the training of teachers in France used to include several stages: 1) studying scientific disciplines at the university; 2) solidifying this knowledge with practical exercises and lectures in order to prepare for a teacher certification exam; 3) practical training, including teaching test lessons at *lycées*. I.e. in place of studying educational disciplines, the students were supposed to only have educational practice.

This system was slightly different to the German teacher training system, which did without "practical training." On top of the university courses, the students had to study "additional disciplines useful for a future teacher", such as history, philosophy, pedagogy, logics and psychology.

The topic of the comprehensive training of mathematics teachers was also discussed in the framework of the International Commission established in 1908 at the International Congress of Mathematicians in Rome. An active member of the Commission's U.S. committee, Professor Young (1920) identified the following ways of training a mathematics teacher: 1) by reading the published results of the experience of others; 2) by personal consultation with experienced teachers; 3) by observation of teachers at work; 4) by actual teaching.

Up until the early 20th century, the dominant opinion in Russia was that universities should be educational, scientific institutions in the first place, and to a lesser extent serve for training secondary education teachers; for that reason, any pedagogical training was limited to a few tutorial courses on elementary mathematics, history and philosophy of mathematics (Kolyagin et al., 2007).

The understanding of the fact that prospective teachers of mathematics in secondary schools need special pedagogical training only came to the Russian society at the end of the first decade of the 20th century, after Shelaputin Pedagogical Institute was opened in Moscow in 1911 (Kolyagin and Savvina, 2011).

The institute was in fact offering post-graduate education in pedagogy. Its purpose was to train "men with a degree to become teachers at secondary schools." The training course at this institute lasted two years.

Depending on the subjects they intended to teach in future, the students were divided (according to their own choice) in 5 groups by subject: 1) Russian language and literature; 2) mathematics, physics and cosmography; 3) Russian and world history; 4) natural science, chemistry and geography; and 5) ancient languages.

Graduates of higher educational institutions were admitted to the institute, that is, those who have already received academic (mathematical) training in a university or a higher technical educational institution. According to the 'general curriculum', all the classes at the institute were divided into two large groups: electives and majors.

Electives were taught to all the participants in a general cohort. As a report for a series of liberal arts, each participant was to present a credit test essay in one of these subjects as chosen based on the literature searches on the issue selected by them.

Below is a list of electives (indicating the respective *number of hours per week* for both academic years):

1. Logic – 3 hours (total 108 hours),
2. General and Educational Psychology – 3 hours (108 hours),
3. General Pedagogy and Pedagogical History – 4 hours (144 hours),
4. Practical Training in Pedagogy – 2 hours (72 hours),
5. School Hygiene – 2 hours (72 hours),
6. Physical Exercise – 2 hours (72 hours),
7. Music (for those wishing),
8. Singing (for those wishing).

Major classes were held in groups. They did not involve only lectures but also seminars, as well as practical training in teaching. For the department 'Mathematics, Physics and Cosmography', the following classes were planned:

1. Mathematics
   a) methods – 2 hours (72 hours),
   b) seminar – 4 hours (144 hours),
2. Physics and Cosmography
   a) methods – 2 hours (72 hours),
   b) seminar – 5 hours (180 hours).

Training seminars were interlocutory, with individual works and abstracts of participants serving as their subject. For example, a lecture was delivered by a participant based on the abstract titled 'The Importance of Mathematics in Aesthetic Education'.

Teaching exercises included 'listening' to classes, drawing up lesson notes and reports on the classes attended, as well as teaching itself.

To 'learn the fundamentals of educational duties', the second-year students undertook a teaching internship for one week in the boarding school at a gymnasium. In the course of this practice, they attended classes in the gymnasium, made themselves familiar with the interior routine of life therein and in the boarding school, conversed with the director, teachers, boarders, checked homework, etc., while continually staying within the walls of the boarding school. They reflected their impressions of the practice in reports they drew up in no particular format.

The uniqueness of the training in the institute was its predominantly practical focus, which was possible due to a close proximity of the institute with two secondary schools; they are non-classical secondary school named after A. Shelaputin and gymnasium named after G. Shelaputin with a boarding school. The non-classical secondary school and the gymnasium were located in the buildings adjacent to the institute, their directors were on the board of the institute, and therefore, the institute had an excellent base to arrange for teaching internship.

In the Soviet times, teacher's institutes were established to train secondary school teachers. In 1939, such an institute was opened in Yelets. In 2000, the institute was reorganized into a classical university named after I. A. Bunin. Thus, in Yelets State University named after I.A. Bunin, mathematics teachers have been trained for over 75 years.

Undoubtedly, the organization and syllabus of this training have been constantly reviewed, some changes have been made, but the basis remains the same and includes three core aspects: 1) theoretical knowledge in the field of psychological and pedagogical sciences; 2) solid and thorough subject-related knowledge (in mathematical disciplines); 3) broad options for verification of the acquired knowledge during education and teaching internships and on-the-job training.

Thus, in the process of training, two components can be conditionally distinguished: theoretical instruction, including students' academic research work, and practical training, to which different types of practices and student assessment can be attributed. And, no matter how the national educational standards have been changing, the block of theoretical instruction has always served as compulsory. In the practical part of mathematics teacher training, two aspects should be distinguished: 1) regular practical training and seminars, whereby theoretical scholarly knowledge is verified; 2) various types of teaching internship, whereby professional expertise and skills are developed and improved.

According to the State educational standard of higher professional education, in the specialty 'Mathematics with a collateral specialty' approved in 2000, with the training period of 260 weeks (5 years), 156 weeks were allocated to theoretical instruction, which made 60%. The total number of hours amounted to 8,884 hours. It is important to emphasize that in the standard itself, a list of the federal component disciplines (must-know) was defined with detailed indications of sections that were to be considered in the course of studying each particular discipline. 1,500 hours were allocated to the study of general humanities and socio-economic disciplines (the federal component – 1,000 hours, the national-regional (university) component and elective subjects – 500 hours); to the study of general mathematical and natural science disciplines – 1,000 hours (federal component – 850 hours, national-regional (university) component – 150 hours), to the study of general professional disciplines – 1,600 hours (federal component – 1,280 hours, national-regional (university) component and elective subjects – 320 hours), subject-based training courses – 2,834 hours).

A separate paragraph was dealing with subject-based training, with a list of disciplines and their sections, consisting of federal (2,344 hours) and national-regional (200 hours) components, of which the federal component included:

- Mathematical Analysis – 490 hours;
- Real Variable Functions Theory – 90 hours;
- Complex Variable Functions Theory – 90 hours;
- Differential Equations and Partial Differential Equations – 90 hours;
- Algebra – 400 hours;
- Geometry – 400 hours;
- Theory of Numbers – 90 hours;
- Numeral Systems – 90 hours;
- Mathematical Logic – 90 hours;
- Theory of Algorithms – 90 hours;
- Discrete Mathematics – 72 hours;
- Elementary Mathematics – 200 hours;
- Information Technology in Mathematics – 90 hours;
- History of Mathematics – 54 hours.

The enumerated disciplines were supplemented by electives with mathematical focus in the quantity of 300 hours. It is important to note that in general, the standard allocated 32% of the time from the entire curriculum to the study of subject (mathematical) disciplines.

In today's effective Federal educational standards for higher education in pedagogy, subject-based training for a future teacher is not mentioned at all. It creates the impression that a future teacher is not supposed to know the subject they teach students. Universities use their own discretion when deciding on the subject-based training of students and one cannot but hope that a sensible point of view will prevail among teaching staff when considering this problem.

Let us dwell in more detail on how the problem of keeping the balance between the subject-based and pedagogical training, theoretical and practical instruction of future mathematics teachers at Yelets State University named after I.A. Bunin is being solved.

In the basic curriculum for the degree 'Pedagogical Education' (majored in Mathematics, with four-year training term) implemented from 2009 to 2015, three quite extensive blocks of disciplines were involved to train a student for teaching activity.

1. Psychology – 360 hours (of which 144 hours of classroom work):
   - General Psychology – 108 hours (of which 36 hours of classroom work);
   - Developmental Psychology – 72 hours (of which 36 hours of classroom work);
   - Social Psychology – 72 hours (of which 36 hours of classroom work);
   - Educational Psychology – 108 hours (of which 36 hours of classroom work).
2. Pedagogy – 360 hours (of which180 hours of classroom work):
   - Introduction to Pedagogical Activity, General Fundamentals of Pedagogy – 72 hours (of which 54 hours of classroom work);
   - Learning Theory. Teaching Techniques – 108 hours (of which 54 hours of classroom work);
   - Theory and Methodology of Education – 108 hours (of which 36 hours of classroom work);
   - History of Pedagogy and Education, Philosophy of Education – 72 hours (of which 36 hours of classroom work);
   - Theory and Practice of Inclusive Education – 72 hours (of which 36 hours of classroom work).
3. Training and Education Methods (Mathematics) – 540 hours (of which 192 hours of classroom work).

   The listed subjects are the basis of a teacher's psychological and pedagogical training, they were listed in the standard as compulsory.

   The block of subject-based training was formed by the university independently, the following disciplines were included:
   - History of Mathematics – 72 hours (of which 30 hours of classroom work);
   - Mathematical Analysis – 612 hours (of which 198 hours of classroom work);
   - Algebra – 396 hours (of which 126 hours of classroom work);
   - Geometry – 540 hours (of which 144 hours of classroom work);
   - Mathematical Logic – 72 hours (of which 32 hours of classroom work);
   - Differential Equations – 144 hours (of which 48 hours of classroom work);
   - Theory of Probability and Mathematical Statistics – 144 hours (of which 36 hours of classroom work);
   - Real Variable Functions Theory – 144 hours (of which 36 hours of classroom work);
   - Complex Variable Functions Theory – 144 hours (of which 48 hours of classroom work);
   - Discrete Mathematics and Theory of Algorithms – 180 hours (of which 54 hours of classroom work);
   - Theory of Numbers – 108 hours (of which 36 hours of classroom work);
   - Elementary Mathematics – 396 hours (of which 122 hours of classroom work);
   - Numeral Systems – 108 hours (of which 32 hours of classroom work).

In 2015, having remained only for 6 years, the teacher training standard changed again; the Ministry of Education and Science of the Russian Federation approved the so-called standard 3+, whereby the number of compulsory subjects is reduced to only five, and the main emphasis is on competencies (basically, as well as in the previous standard) a future teacher should master (or, as it stands, a bachelor of teacher education majoring in 'Mathematics'). Unfortunately, this standard does not include subject disciplines among the required disciplines, and, even more regretfully, the list of competencies that are the basis for compiling a basic curriculum and syllabus does not contain requirements for the subject-based training of a future mathematics teacher.

Let us summarize the above illustrating the results by comparative **Table 2** on the requirements of educational standards of different years to the theoretical and, in particular, to the subject-based training of a future mathematics teacher, as well as on special aspects of their actual implementation in Yelets State University.

Analyzing **Table 2**, one can reveal interesting trends. The total number of hours allocated for teacher training in a university at first glance does not decrease; it even increases in the latter case despite the fact that the last two standards are to be implemented in four academic years instead of five, unlike the earlier ones. However, this is an

Table 2. The analysis findings on educational standards in higher education for future mathematics teachers

State educational standard	Federal State Educational Standard requirements			Actual implementation in the curricula (Yelets State University named after I.A. Bunin, Oryol State University named after I.S. Turgenev, Orenburg State Pedagogical University), average values		
	Hours in total *	Theoretical instruction (classroom) (% of *)	Disciplines of subject-based training (% of *)	Hours in total *	Theoretical instruction (classroom) (% of *)	Disciplines of subject-based training (% of *)
Mathematics with a collateral specialty (1995)	8,434	4,212 (47%)	3,924 (47%)	8,434	4,212 (47%)	3,924 (47%)
Mathematics with a collateral specialty (2000)	8,886	4,212 (47%)	2,836 (32%)	8,886	4,212 (47%)	2,836 (32%)
Teacher education (bachelor's program, 2009)	8,640	3,888 (88%)	n/a	8,640	3,888 (88%)	1,546 (30%)
Teacher education (bachelor's program, 2015)	9,004	3,032 (79%)	n/a	9,004	3,032 (79%)	1,100 (22%)

illusion, which is explained by the last column of the table: the hours allocated for theoretical instruction are reduced, and the requirements for subject-based training come to nothing.

At the same time, a review of the actual curricula for mathematics teacher training for the higher educational establishments mentioned above makes it possible to note that even in the absence of requirements for subject-based training, at least 20% of mathematical disciplines are retained in the plan. However, 1,100 hours of mathematics in the latest curriculum comprise only 0.25% of the mathematical training for graduates who studied 15 years ago in accordance with the 2000 standard. Having made such conclusions, one cannot help but ask the question whether present-day bachelors will be able to form the mathematical culture of students at an adequate level, to establish and teach serious mathematical elective courses in high school, or simply to give students good grounding to pass the unified state exam.

For ten years, Yelets University has been holding school teacher upgrade training courses where teachers are offered questionnaires that will later allow for correction of the syllabus based on their feedback.

The questionnaire contained eight questions, including:

- The length of your work at school is:
  - 5 – 10 years,
  - 10 – 20 years,
  - Over 20 years.
- How often do you consider it necessary to improve the level of your vocational training?
  - Annually,
  - Once every two years,
  - Once every three years,
  - Your own answer.
- What should be the correlation between theory and practice in the training of a mathematics teacher at a university?
  - There should be more theory,
  - There should be more practice,
  - The importance of theory and practice is equivalent.
- What disadvantages, in your opinion, can be distinguished in the syllabi of the courses you have completed? (More than one answer is possible.)
  - I am familiar with most of the knowledge,
  - The knowledge taught is obsolete,
  - A lot of theory with little practice,
  - Your own answer
- Evaluate the relevance of the knowledge received (more than one answer is possible).

- The knowledge is timely and necessary.
- Review of knowledge helps me in my current work.
- Training allows me to re-assess the quality of my work.
- Your own answer ____________________________________.

- Your suggestions for improving the quality of upgrade training courses:
  - I would like to improve my level of theoretical knowledge in the field of higher mathematics (specify the section (or sections): mathematical analysis, higher algebra, theory of numbers, analytical geometry, etc.)
  - I would like to improve my level of theoretical knowledge in the field of mathematics teaching methods,
  - I would like to increase my skill level to solve non-standard mathematical problems,
  - I would like to practically share my pedagogical experience and attend the classes of my colleagues,
  - Your own answer. ____________________________________.

The results of processing the questionnaire for students of the advanced training courses indicate that what the majority of participants would like to improve is the subject-based (theoretical) training. Most respondents in the survey (91% of those surveyed in 2016 and 93% in 2017) have noted that study of higher mathematics sections is essential for them. Preparing schoolchildren for the unified state exam in mathematics requires a high level of subject-based training specifically; therefore, knowledge of the sections of mathematical analysis, geometry, algebra, number theory is an important aspect of subject teacher's training as well. It should be noted that 87% of the interviewed would like to improve their level of skills to solve non-standard mathematical problems, and for this, one again turns to solid and thorough mathematical domain knowledge. Summing up, one can say with assurance that theoretical subject-based training is not a tribute to the past, but an urgent need of the present position in which a school teacher is.

DISCUSSION OF THE RESULTS

Turning to historical circumstances for vocational training, one can see an undeniable similarity of the provisions enshrined in the standard of applied bachelor's degree with workshop training that existed back in the Middle Ages. Advantages and disadvantages of this system were analyzed by Sitnikov (1995). Workshop training (or teaching in activity) involves mastering professional skills through a compulsory repetition of actions and manipulations under real-life conditions. The author notes that teaching in activity primarily forms the instrumental component of readiness for the future activity and does not presuppose a preliminary stage – an analysis of professional activity, which results in the mastery of technologies and their subsequent use occurring reflexively: they appear in an implicit form, that is, integrated into the initially ready-made chains of operations and actions, and this is how they are assimilated and applied in the future in independent professional activity. The implicit acquisition of professional knowledge and skills preconditions conservatism of professional excellence, which, in turn, leads to their poor adaptability to changing environment, which is manifested in a low productivity of the acquired skills, should there be any tasks requiring the introduction of changes in the composition of operations, especially in the composition of the technologies themselves, to be solved.

Foreign researchers Jaworski and Gellert (2003), in tune with the European tradition of training a mathematics teacher, give preference to the practical component specifically. This trend reflects in the Russian standards of higher professional education in 2000, 2009, and 2015.

As predicted by Kayumov (2014), the consequences of intercivilizational borrowing in recent years by the Russian system of education at the professional (pedagogical) level will be: a) a decline and a reversion from the fundamentality in education (with final transition from 'knowledge' to those 'competencies' that are in demand in the labor market); b) a rejection of universal, compulsory, and free education (with an inevitable division of society into castes in the future); c) a rejection of the leading role of the state and society in determining the goals and ideals of education (with reassignment to external goal-setting sources).

Thus, contrary to the official policy implemented by the standards of teacher training, the viewpoint prevails in the scientific community about the need to preserve fundamental (subject, theoretical) training (Sitnikov, 1995; Senashenko and Tkach, 2010; Kayumov, 2014).

It is the development of the professional activity knowledge base that has forced the entire world to abandon the system of workshop training (perhaps, excluding the spheres of ethnic tourism, traditional folk crafts, etc.). From the point of view of cultural and historical expediency, at the level of applied bachelor's degree, it is impossible to undertake a quality specialist training, including a mathematics teacher.

The curricula analysis (2000, 2005, and 2009) allows one to acknowledge that a dramatic reduction in the number of classroom work hours with practically unchanged total study time amount is associated with a time increment allotted for self-directed learning of students. However, an independent study of mathematical disciplines is quite a challenging task even for advanced students, while those less advanced hardly cope with it at all. Moreover, a classical university lecture of an experienced teacher is not only a means of transmitting information, laws or theorems, but also an incomparable form of communication between a teacher and a student.

As shown by the results of the questionnaire survey among participants of upgrade training courses (mathematics teachers from the Lipetsk, Tula, Voronezh, and Oryol regions), subject (theoretical, mathematical) training is not only in demand during training at a university but in postgraduate education as well.

CONCLUSION AND FORECAST

Theory is a generalized millennia-old human practice, and therefore, any new practice should be based on an already substantiated and proven theory; hence, in teacher training, it is practice that should follow the theory rather than the reverse.

The historical analysis of the problem has shown that the training of a mathematics teacher should include three core aspects: 1) theoretical knowledge in the field of psychological and pedagogical sciences; 2) solid and thorough knowledge of a subject (in mathematical disciplines); 3) broad options for verification of the acquired knowledge during education and teaching internships and on-the-job training.

Many years of the authors' own experience in the training of future mathematics teachers at university has led to the following conclusions:

- subject-based (mathematical) training is the key aspect in the mathematics teacher education;
- only comprehensive knowledge obtained as a result of studying theoretical sciences at higher school seriously can be the foundation for future professional practice;
- the range of conventional teaching methods – lectures, practicums, seminars – cannot be replaced by distance learning and electronic textbooks.

The results of processing the questionnaires of mathematics teachers demonstrate that most of them would like to improve their subject (academic) qualification.

An increase in the total number of hours allocated for teacher training in a Russian university over the last decade is an illusion. The time allocated for theoretical training is reduced, which lays the groundwork for a decline in subject-based (scientific) training of a mathematics teacher. Moreover, the amount of time devoted to teaching practice is also decreasing (according to the curriculum based on the 2000 standard, students were to do internship in the fourth and fifth year for nine and eight weeks respectively, whereas in the current curricula, provision is made for only one internship six weeks long at the beginning of the fourth academic year).

Thus, a new problem can be anticipated that is beginning to manifest itself at the present time and will reach its maximum in about ten to twenty years – a possible reduction in the level of mathematical education in Russian schools. To prevent further decline in the educational attainment, it is necessary to restore the scope of theoretical training in colleges in accordance with the traditions of the Russian school.

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