

Quality Management in Pedagogical Education based on the Diagnostics of Teachers' Professional Deficits: Theoretical and Methodological Aspect

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The paper presents the methodology of education quality management based on the identification of teachers' professional deficits. The methodology for evaluating the formation of the subject and methodological competencies is described. Assessment materials are developed in accordance with the requirements of the professional standard of the teacher and the Federal state educational standards of basic, primary and secondary education. It is supposed to implement an automated identification of professional deficits within teaching staff. The article presents empirical data on the results of the approbation of this technique. 624 teachers from rural and urban educational organizations of the Republic of Bashkortostan and 90 students of pedagogical specialties of the university participated in the testing. The analysis of the approbation results of the methodology and assessment materials showed that the developed methodology is applicable to identify professional deficits of teachers and students of teacher-training institutions for further construction of individual educational trajectories of the approbation participants.

Keywords: assessment of competencies, assessment materials, pedagogical education, teacher, quality of education, subject and methodological competencies, management, diagnostics, professional deficit, professional development, individual educational trajectories.

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Управление качеством педагогического образования на основе диагностики профессиональных дефицитов учителя: теоретико-методический аспект

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Представлена методология управления качеством образования на основе выявления профессиональных дефицитов учителя. Описана методика оценки сформированности предметных и методических компетенций, которая предполагает автоматизированное выявление профессиональных дефицитов у педагогических работников посредством оценочных материалов, разработанных в соответствии с требованиями профессионального стандарта педагога и федеральных государственных образовательных стандартов основного общего и среднего общего образования. Приводятся результаты апробации данной методики, включающие в себя в том числе и эмпирические данные. В апробации участвовали 624 учителя из сельских и городских образовательных организаций Республики Башкортостан и 90 студентов педагогических специальностей университета, при этом выявлено, что уровень сформированности предметных компетенций у всех участников выше уровня сформированности методических компетенций. Проведенный авторами анализ полученных результатов показал, что разработанная методика и оценочные материалы применимы для выявления

профессиональных дефицитов учителей и будущих педагогов, а также последующего построения индивидуальных образовательных траекторий участников апробации.

Ключевые слова: оценка компетенций, оценочные материалы, педагогическое образование, учитель, качество образования, предметные и методические компетенции, управление, диагностика, профессиональный дефицит, профессиональное развитие, индивидуальные образовательные траектории.

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Introduction

Modernization of the Russian education system is carried out in the development of a nationwide system of professional growth of a teacher. Professional competencies of teachers are a key resource for updating a modern school since the achievement of educational results directly depends on the level of their formation. The integral indicator «quality of education» expresses the measure of compliance with the topical ideas in society about the goals the educational process should serve. Quality management in education is associated with the problem of its measurement — compliance with educational and professional standards. When solving the problem of quality measurement, it should be taken in account that different «stakeholders» include different characteristics into the content of the concept.

The employer associates the quality of an employee's education with his/her ability to solve professional tasks quickly and effectively. For an employee, professional growth and self-realization are of great importance. The main component of the quality of education from the position of the founder of the

educational organization is the compliance of the results with the requirements of Federal state educational standards. From the teacher's point of view, quality is measured by the educational results of students and is often expressed by assessments based on the results of control activities, exams and tests. To one degree or another, all these indicators reflect certain areas of the definition of «quality of education» — multidimensional in its content [2; 17; 20].

Several approaches to the disclosure of the concept of «quality of education» have been formed [11]. The first approach is based on the methods of pedagogy, considering the quality of education as a multidimensional phenomenon. Therefore, its disclosure involves a theoretical description and complex scientific equipment. A.V. Tomiltsev and A.V. Maltsev point to the complexity and multidimensionality of the problem of developing methodological foundations for assessing the professional competence of a university graduate [19].

The second approach is associated with adapting the quality management methodology implemented in business/production to

the education system. The forms and methods of education quality management are developed based on of the universal quality management concept (TOTAL quality management-TQM) or the international quality standard of the ISO9000 series. However, such forms and methods in the conditions of the educational process may not be as effective as in production.

The third approach is based on the inclusion of the theoretical ideas of the previous two and involves the development of algorithms for assessing and managing the quality of education. As a result, we get a multi-level structure, with the upper level — general scientific theories and provisions of philosophy and systematics, and the middle-scientific theories and provisions of pedagogy. Due to our rationality, we will adhere to the following approach: on the one hand, assessment methods and algorithms for managing the quality of education should be based on general philosophical principles, management theory, quality science, and psychology; on the other hand, they should take into account the peculiarities of the educational process.

The implementation of the concept of quality management in education actualizes the problem: how should the autonomy of the education subjects be considered within the framework of external plan-oriented management? It is impossible to manage the quality of the educational process like industrial production since participants in the educational process are equal and active subjects with their values, beliefs, and will and characteristics. A significant role in education is given to introspection and self-assessment, self-realization, and self-management. Accordingly, along with teachers and students, the central place in quality management should be given to the educational organization as a social system.

Although there are different approaches to defining methods, identifying indicators and standards of education quality,

the interpretation of the word «quality» in two aspects remains indisputable. On the one hand, it is compliance with standards (specifications); on the other — compliance with consumer requirements. Accordingly, education is considered as the result of systematic assimilation of knowledge and the development of skills and intellectual qualities of a person, i.e., from the position of necessary conditions for his/her preparation for life and work.

Let us note the methodologically important provisions for understanding the phenomenon of the quality of education [2; 4; 11; 17; 19]:

— the quality of education is a set of characteristics that allows solving the problems of comprehensive education and harmonious development of students' personality;

— it is legitimate to consider the quality of education both as a whole and in terms of diagnostic procedures and results;

— the quality of education depends on its content and is determined by the basic system of human activity;

— the quality of education as a process is the quality of interrelated teaching and learning activities that take place within the framework of an organized educational process;

— the quality of training is associated with the possibility of forming such attributes of knowledge in the learner's system as completeness, depth, efficiency, flexibility, concretization, generalization, convolution, expansion, systematization, consistency, awareness, and strength;

— the quality of education should be considered based on system-structural positions, highlighting the defining properties in the context of the most significant external and internal links.

It can be concluded that the quality of education is directly related to the teacher training and retraining [14]. Accordingly, it is relevant to develop mechanisms for scientific and methodological support of teach-

ers to improve regional systems of general education.

Mechanisms of Education Quality Management

In Russian and foreign practice, there is sufficient experience in developing effective mechanisms for managing the quality of education. One of the directions of such work is identifying the conditions for the professional formation of a teacher in a digital educational environment. This, in its turn, implies an assessment of the quality of education as a multidimensional phenomenon, taking into account the contexts of the educational environment and the functions of the teacher himself, who implements the processes of learning, upbringing, and development.

International and Russian practices in evaluating the activities of teachers are systematized in the work of L.E. Kurneshova and D.V. Dydzinskaya [8]. The authors, based on the analysis of various tools for diagnosing teachers' competencies, note that "within the framework of international and all-Russian studies, two methods of evaluating teachers are mainly used: external formalized assessment in the testing format and self-assessment in the questionnaire format" [8, p. 76]. Moreover, standardization of the procedure based on these methods allows automated processing of diagnostic results for a large sample of respondents.

The international comparative study TALIS (Teaching and Learning International Survey), conducted by the Organization for Economic Cooperation and Development, is devoted to the issues of teaching and learning in secondary schools in different countries [7]. Along with the issues of teacher training and professional development, effective teaching methods and the level of professional abilities are being investigated. Thus, the priority direction of the research is to identify the competencies of teachers as a basis for designing their professional

development. In conclusion, we consider it necessary to note that conducting "spot" work with teachers to identify their reserves and problem areas will not only regulate the process of their professional growth, but also improve the quality of education.

The quality of training of future primary and secondary school mathematics teachers is assessed within the framework of TEDS-M (Teacher Education Study in Mathematics) on representative samples of graduate students of pedagogical specialties of the university. In addition, the level of mathematical training of future teachers was assessed based on the results of 'completing tasks from high school and higher mathematics courses in such sections as numbers and actions with them (arithmetic), algebra and functions, geometry and measurements, data and chances" [7]. The emphasis is on the continuity of teaching: teachers need to know the basic ideas and methods of the higher mathematics course, and subsequently prepare their students to study them.

The assessment of the methodological training of future teachers was carried out based on identifying knowledge of the content of the mathematics course, the ability to plan the learning process, and actively use teaching methods. An integrated approach to the design of tasks deserves special attention to evaluate the actual knowledge about the mathematical object and the ability to apply it in teaching. The methodology implemented in TEDS-M allows us to conclude that it is advisable to carry out the diagnostics of teachers' professional competencies through combined tasks where knowledge and methods on the subject are integrated with questions on the methodology of teaching it.

Methodological aspects of the organization of the procedure of independent assessment of professional competencies of future teachers and the results of its approbation are presented in work [10]. Diagnostics of

competencies was carried out by using tests on the profile of training with a choice of one out of four possible answers and pedagogical cases that implied a detailed answer to the professional situation. Since third-party experts are involved in evaluating the case tasks, there is some subjectivity in the evaluation process. This disadvantage can be eliminated by developing such techniques that would allow assessing the subject and methodological competencies of the teacher in an automated mode.

The issues of diagnostics of subject and methodological competencies of chemistry teachers are considered in research work [18]. By selecting methodological tasks of diagnostic work, the authors focused on "the components of the general methodological competencies of the teacher, regardless of methodological peculiarities of teaching the subject" [18, p.19]. Among the components of methodological competencies, the following are distinguished:

- knowledge of the regulatory framework for conducting General State Examination on the subject and understanding the features of available resources to achieve the planned learning outcomes;

- the ability to identify the main components of the methodology for the formation of subject learning outcomes;

- the ability to design a lesson and select the subject content depending on the learning objectives;

- the ability to plan the monitoring of the learning achievements for the academic year.

The assessment of professional competencies of teachers and graduates of pedagogical universities is based on the requirements of the professional standard of a teacher and Federal state educational standards of general education. When assessing professional competencies, one should take into account the teacher's abilities:

- to design a lesson and select material for its implementation,

- to search for mistakes in the students' works and be ready to explain them,

- to answer questions reasonably; and

- to evaluate students' fulfillment of tasks with a detailed answer according to the specified criteria.

In the context of the transformation of education, it is important to have objective information about the teacher's achievements and difficulties, which actualizes the problems of pedagogical diagnostics of his professional deficits in the educational process and the corresponding change in professional activity for its subsequent correction [15].

Assessment of Teachers' Professional Deficits

Among the methods of identifying professional deficits, the leading role is given to tests and questionnaires in which different blocks are distinguished, taking into account the structure of the activity. I.Y. Gutnik notes that "this approach does not allow the teacher to fully realize his professional deficits, as evidenced by interviews with teachers who had an experience of passing such a monitoring" [3, p. 34]. The analysis of regional practices makes it possible to identify the specifics of professional difficulties faced by modern teachers. The difficulties are mainly related to the teacher's unwillingness to solve professional problems in the changed working conditions caused by the processes of personalization in the digital educational environment; with the inability to solve the problems of individualization of education based on effective communication; with the inability to reflect on solving problems related to the nonlinearity of the educational process [3; 6; 9].

The trajectories of professional and career development in the context of the implementation of the national system of professional growth of teaching staff, as noted by T.I. Pudenko, "should become not only motivationally attractive to the teacher

but also depend on the current level of qualifications confirmed by independent assessment procedures, including the certification procedure" [13, p. 6]. An independent assessment is not just a confirmation of compliance with certain qualification requirements that are unified throughout Russia, but also the identification of professional deficits of a teacher, the elimination of which is possible based on a personalized approach to professional development.

As part of the development of a unified system for assessing the quality of education and the national system of teacher growth in the Russian Federation, a model for the level assessment of subject and methodological competencies of teachers based on the use of unified federal assessment materials (UFAM) has been developed [1]. The model is based on the following approaches:

- taking into account the requirements for knowledge and skills necessary to perform labor functions and labor actions defined in the professional standard "Teacher (pedagogical activity in the field of preschool, primary, basic, secondary education) (educator, teacher)";

- unity of the diagnostic work structure for all subject areas;

- unification of the requirements for the level of competencies.

The analysis of the Russian and international experience of education quality management based on models and mechanisms of independent evaluation allows us to conclude that the quality of education mainly depends on the competencies of teachers — direct participants in the educational process. In particular, it depends on how teachers implement the educational process, how they choose educational technologies, teaching tools, and teaching materials. Therefore, one of the directions of education quality management is the development of mechanisms for identifying teachers' professional deficits and support-

ing their individual educational trajectories. At the same time, we are convinced that an actual increase in the quality of education is possible with the use of a subject-subject approach in establishing social interaction between its actors — those teaching and trained (teachers), taking into account the individual qualities and competencies of the latter [16].

Methodology for Identifying Teachers' Professional Deficits

The methodology for identifying professional deficits in teaching staff (from now on the Methodology) was developed as part of the implementation of the research project «The development of a regional model of quality management in pedagogical education based on the identification of professional deficits and the construction of individual educational trajectories of teaching staff (including students — future teachers)» at Bashkir State Pedagogical University named after M. Akmulla. The project's main goal is to ensure the continuous development of teachers' professional competencies.

This Methodology makes it possible:

- to evaluate the subject and methodological competencies of teachers, providing the subject results of students mastering academic subjects / subject areas of the basic educational program of primary and/ or secondary education;

- to determine the level of competence formation of teachers and students — future teachers;

- to identify professional deficits among teaching staff (including students) in the subject and methodological competencies.

The Methodology is developed based on the following approaches:

- the focus of the assessment materials on identifying the readiness of teachers to perform labor functions and labor actions defined in the professional standard "Teacher (pedagogical activity in the field of preschool,

primary (grades 1—4), basic (grades 5—9), secondary (grades 10—11) education) (educator, teacher)";

— assessment materials content compliance with the requirements of Federal state standards of primary and secondary education and exemplary educational programs;

— practical orientation of assessment materials;

— taking into account the best foreign and Russian practices for assessing the competencies of educational organizations employees;

— involvement of the expert community in the research;

— providing limited access to the personal results of the competence assessment participants and depersonalization of the results during generalization and analysis;

— uniformity of the structure of diagnostic materials for different academic subjects / subject areas;

— taking into account the specifics of the content of the educational subject;

— automated verification of results and identification of professional deficits.

According to the results of the diagnostic work, the participant scores a certain number of points, which allows to determine the level of formation of competencies necessary for the implementation of professional activities. Also, a list of professional deficits identified based on the unfulfilled tasks is formed for each participant. In the context of this study, professional deficits are understood as the absence or insufficient development of professional competencies of teaching staff, which causes typical difficulties in performing certain labor functions.

To assess the results of the diagnostic study, 5 levels of competence formation were identified according to the total number of points scored by the participant for completing part 1, 2 or the entire work as a whole. The level of competence is considered low if the participant received less than 30% of the possible number of points, sat-

isfactory from 30 to 59%, basic from 60 to 69%, elevated — from 70 to 79%, and high when the final score of the participant is 80% or more of the possible maximum score.

The tools for identifying professional deficits and forming individual educational trajectories of teaching staff (as well as students — future teachers) include:

— sets of assessment materials for academic subjects: Biology, Mathematics, Social Studies, the Russian language, Physics, and Chemistry;

— questionnaires that collect contextual data about test participants;

— instructional materials for participants and organizers of testing.

At the first stage of the project (January — October 2021), the approbation of the developed tools and methods for identifying professional deficits of teachers was carried out. In addition, 17 scientific seminars (including webinars) were organized to discuss the interim results of the research and to plan the work of the temporary creative team for the upcoming period. In the approbation, the following subjects took part:

— 624 teachers of educational organizations of the Republic of Bashkortostan (including 145 teachers of Mathematics, 199 teachers of Russian, 62 teachers of Biology, 59 teachers of Chemistry, 63 teachers of Physics, 103 teachers of Social Studies; 7 teachers performed diagnostic work in two subjects);

— 90 students enrolled in the main professional educational programs of the bachelor's and master's degree in the field of "Education and Pedagogical Sciences"

— 14 teachers of "BSPU named after M. Akmulla".

For testing, special diagnostic tools were developed. They provided an assessment of the subject and methodological competencies, and the identification of professional deficits. The diagnostic tools include sets of measuring materials for teachers in 6 subject areas. Each set consists of a specification,

a codifier and 5 diagnostic options (including a demo version). The diagnostic work was developed taking into account the requirements of the professional standard "Teacher (pedagogical activity in the field of preschool, primary, basic, secondary education) (educator, teacher)" [12] and is aimed at assessing the teachers' readiness to perform the generalized labor functions "Professional activity for training and education of students in educational programs of primary, basic and secondary education", and "Professional training activity", labor action "Planning and conducting training sessions" in terms of possession of subject and methodological competencies in accordance with the requirements of the Federal state standard of primary and secondary education and exemplary educational programs.

A demo version of the diagnostic work is posted on the university's official website (https://bspu.ru/page/project_profdeficit) for preliminary acquaintance to all persons interested. Instructional materials have been developed for all categories of approbation participants. The approbation was carried out jointly with the Ministry of Education and Science of the Republic of Bashkortostan and BSPU n. a. M. Akmulla. Based on the results of the approbation, the following was presented: the analysis of the diagnostic work results in the context of subject areas, generalized indicators of the subject and methodological competencies of the teachers participating in the approbation, levels of the subject and methodological competencies, identified professional deficits, and recommendations for their elimination. To ensure the information openness of the project, a separate page was created on the official website of the BSPU n. a. M. Akmulla.

Description of Diagnostic Work

Diagnostics of subject and methodological competencies of teachers working in basic and secondary schools was carried out in 6 academic subjects: Biology, Math-

ematics, Social Studies, Russian, Physics, and Chemistry. Evaluation materials make it possible to estimate teachers' proficiency in the subject and methodological competencies, identify professional deficits and determine the educational needs of the teacher.

The results of the diagnostic work can be used to build an individual educational trajectory of the teacher, which helps to increase the targeting of the professional development system. It is also possible to update the professional core educational programs of higher education in terms of content, technologies and tools for assessing competencies.

Due to the assessment of competencies for teachers in the region, relevant areas of interaction between public, expert, and analytical organizations, executive authorities of the subjects of the Russian Federation managing education are being formed to improve the quality of education in the region.

Each variant of diagnostic work consists of 18 tasks divided into two parts: 10 tasks of part 1 in the test form for the assessment of subject competencies and 8 tasks of part 2 for the assessment of methodological competencies of the teacher, presented in the form of methodological tasks. A test participant was randomly offered one of 4 diagnostic options. The number of participants who performed different variants varied. The general structure of the diagnostic work option is presented in Table 1.

Part 1 of the diagnostic work contains 10 test tasks of five types:

- a) 3 closed-type tasks with the choice of one correct answer out of four proposed;
- b) 2 closed-type tasks with a choice of several answer options from the proposed ones (2 out of 5 or 3 out of 5);
- c) 2 closed-type tasks to establish compliance when the number of positions in the first column (questions, statements, facts, concepts) is less than the number of positions in the second column (list of statements, properties of objects) by 1—2 units;

Table 1

General Structure of the Diagnostic Work

Diagnostic work section	Number of tasks	Maximum score
Part 1. Tasks in the test form for the assessment of subject competencies	10	26
Part 2. Tasks-cases in a test form for the assessment of methodological competencies	8	22
Total	18	48

d) 1 closed-type task to establish the sequence;

e) 2 open-type tasks for the addition of a word or number.

The tasks of Part 1 are aimed at assessing the teacher's competencies and identifying his professional deficits in the taught subject area.

Part 2 contains 8 methodological tasks presented in the form of test tasks of different types. Methodical tasks allow assessing the teachers' possession of the methodological competencies necessary to perform the labor function, defined by the professional standard [12]. Methodological tasks are distributed in 3 blocks, in accordance with the main components of the teaching process:

— the "Goal setting" block (definition of goals, objectives, educational results) contains 2 tasks;

— the "Training" block (forms, methods, techniques, technologies, means, individualization of training) includes 4 tasks (2 tasks are for the assessment of basic methodological competencies, 1 task is for

the assessment of ICT competencies, 1 task is for the assessment of competencies necessary for the organization of persons with disabilities training).

— the block of "Assessment and control" (criteria assessment, forms, and types of control) — 2 tasks.

Diagnostic tasks have different levels of complexity (see Table 2).

Tasks are evaluated with a different number of points depending on their difficulty level. The evaluation of the tasks is carried out by the testing system in an automated mode, taking into account the evaluation instructions proposed for each task of diagnostic work and evaluation criteria.

Each task is associated with certain controlled content elements and professional deficits identified when this task is not completed. The paper [5] describes the diagnostic work in mathematics and provides the results of its approbation among teachers.

135 minutes are allocated for performing diagnostic work, including 15 min. to study the instructions for completing the tasks of

Table 2

Distribution of Diagnostic Work Tasks According to Levels of Complexity

Level of complexity	Part 1		Part 2	
	Number of tasks	Maximum score for the task	Number of tasks	Maximum score for the task
Basic	6	2	3	2
Elevated	2	3	4	3
High	2	4	1	4
Total	10	26	8	22

the work; 60 min. to perform the first part of the work; 60 min. to perform the second part of the work.

Generalized Results of Assessing Subject and Methodological Competencies of Teachers Participating in the Approbation

624 teachers took part in the diagnostic testing, among which 7 people performed 2 diagnostic works in different subjects. Thus, the results of 631 diagnostic work in six subject areas are analyzed: Russian (199 papers); Mathematics (145 papers); Social Studies (103 papers); Physics (63 papers); Biology (62 papers); Chemistry (59 papers).

90 students of M. Akmulla BSPU participated in the diagnostic testing, among them 23 students performed work in mathematics, 20 students — in Russian, 22 students — in Social Studies; 13 students — in Chemistry; 6 students — in Biology; 6 students — in Physics. Participation in the approbation of students was considered as a control group for comparison with the results of school teachers. The distribution of teachers and students by levels of competence is shown in Fig. 1 and 2.

The analysis of the results of performing diagnostic work tasks by teachers allows us to determine the proportion of teachers participating in the approbation who possess professional competencies (see Fig. 1): a low level is observed in 9.0% of participants; a satisfactory level — in 64.2% of participants; a basic level — in 19.0% of participants; an elevated level — in 6.7% of participants; a high level — 1.1% of participants.

At the same time, the level of proficiency in subject competencies is significantly higher than that in methodological ones. Thus, the share of teachers who have reached the basic (and higher) level of proficiency in subject competencies is 65%, while it is only 3.7% in methodical ones.

The analysis of the results of performing diagnostic tasks by students allows differentiating them by the level of professional competencies mastery (see Figure 2): a low level is observed in 12.2% of participants; satisfactory — in 62.2% of participants; basic — in 23.3% of participants; elevated — in 2.1% of participants; there are no high level results.

The students' level of proficiency in subject competencies is also significantly

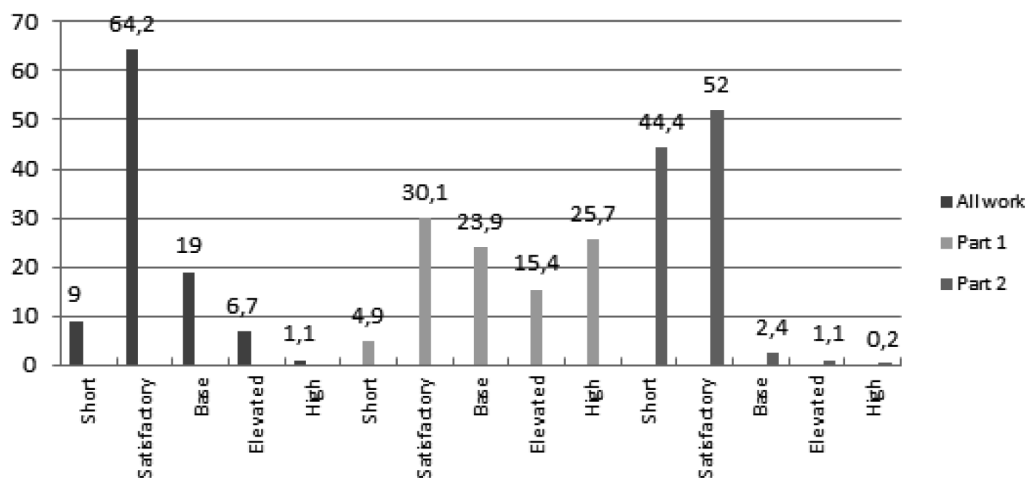


Fig. 1. Competence levels of teachers participating in the approbation

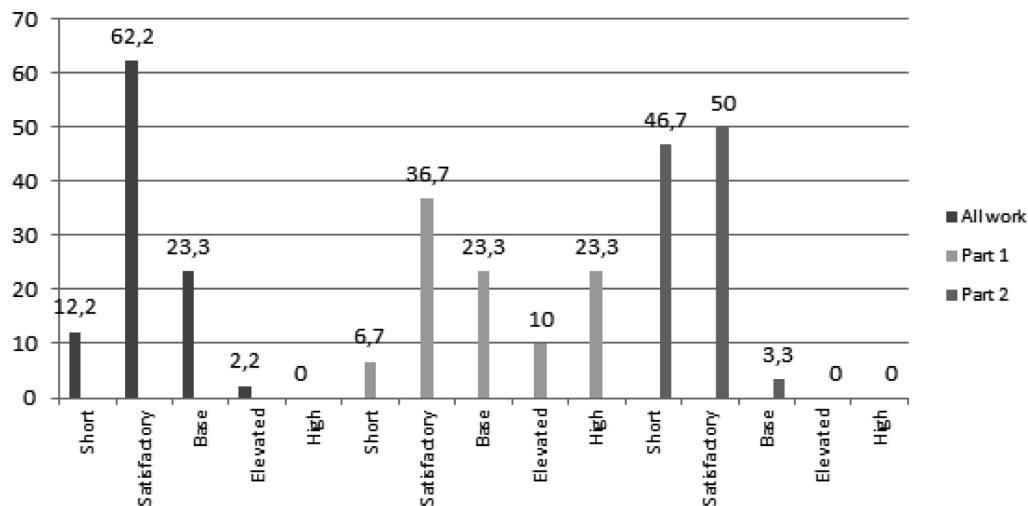


Fig. 2. Levels of competence of students participating in the probation

higher than in methodological ones. Thus, the share of students who have reached the basic (and higher) level of proficiency in subject competencies is 56.6%, while it is only 3.3% in methodical ones. Both indicators of students are slightly lower than similar indicators in the sample of teachers.

555 teachers from rural schools and 69 teachers from urban schools took part in the diagnostic testing. The results of the diagnostic work show that teachers of urban schools demonstrate a higher level of proficiency in subject competencies (see Fig. 3).

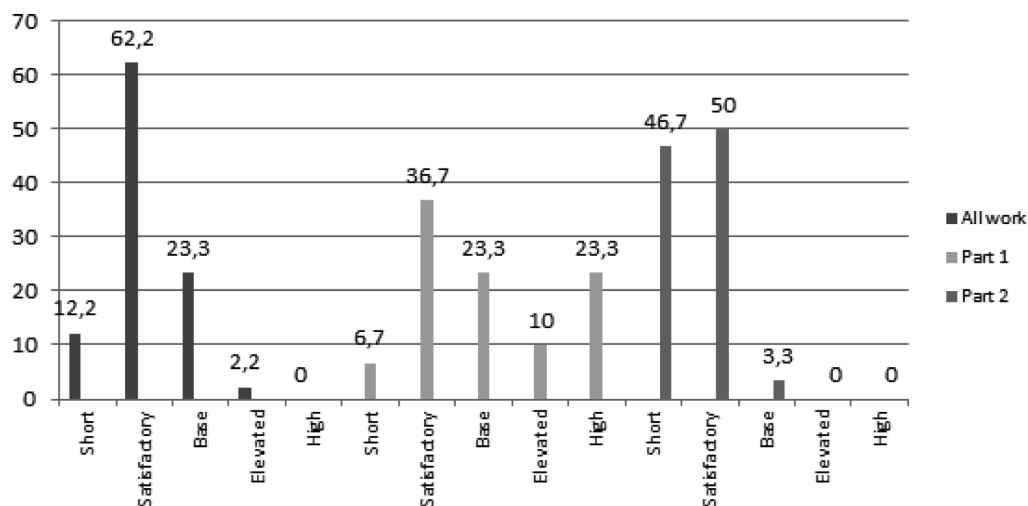


Fig. 3. Levels of subject competencies mastery by teachers from urban and rural schools

The results of the tasks of part 2 of the work indicate that the majority of participants have a satisfactory level of proficiency in methodological competencies: 62.5% of teachers of rural schools and 50.6% of teachers of urban schools (Fig. 4).

A small part of the approbation participants reached the basic level of competence development, and only 1.3% of participants from urban schools — advanced. It should be noted that a significant part of teachers demonstrated a low level of proficiency in methodological competencies (46% from rural and 31.9% from urban schools). This group of participants requires close attention to the identified professional deficits and the selection of

training activities set to improve the competence level.

The results obtained indicate the presence of professional deficits in both subject and methodological training for all participants in the diagnostics but to varying degrees (Fig. 5).

The diagnostic results make it possible to identify teachers who need help for the further development of their subject competencies. It is advisable to recommend such teachers to participate in advanced training programs aimed at expanding the general subject horizons, updating modern data on the sciences that are basic for the subject areas taught. The programs should be aimed at developing methodological competencies

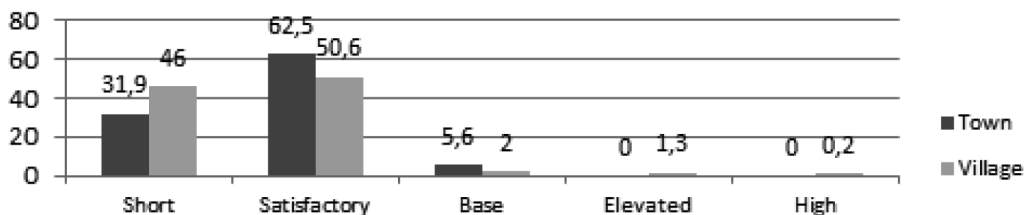


Fig. 4. Levels of proficiency in methodological competencies of teachers from urban and rural schools

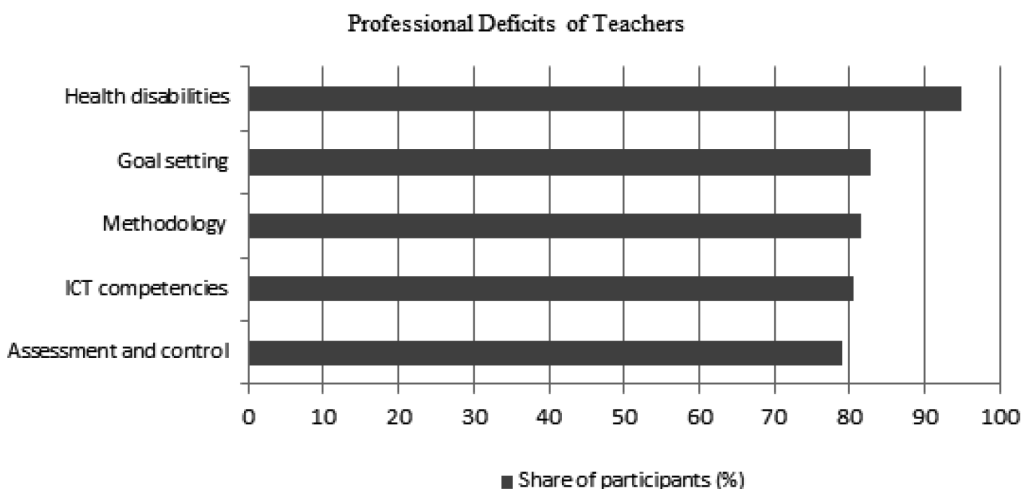


Fig. 5. Rating of identified professional deficits (methodological competencies) of teachers participating in the approbation

including basic issues related to teaching children with disabilities and the use of ICT in the educational process.

An integral part of the approbation is seminars with participants in each subject area, which are aimed at identifying self-assessment of the proficiency level in professional competencies.

Conclusion

The first stage of the project involved the development, approbation, and pedagogical community's initial examination of diagnostic tools meant to identify the subject and methodological deficits of teachers and students enrolled in the main professional educational programs of the bachelor's and master's degree in the field of "Education and Pedagogical Sciences".

References

1. Altynikova N.V., Muzaev A.A. Ocenka predmetnyh i metodicheskikh kompetencij uchitelej: aprobaciya edinyh federal'nyh ocenочnyh materialov [Subject and methodological competencies in teachers: testing the unified federal evaluation tools]. *Psichologicheskaya nauka i obrazovanie = Psychological Science and Education*, 2019. Vol. 24, no. 1, pp. 31—41. DOI:10.17759/pse.2019240102 (In Russ.).
2. Belotserkovsky A.V. K voprosu o "kolichestve kachestva" i "kachestve kolichestva" v sisteme obrazovaniya [On the quality of quantity and the quantity of quality]. *Vysshee obrazovanie v Rossii = Higher Education in Russia*, 2013, no. 7, pp. 22—29. Available at: <https://www.elibrary.ru/item.asp?id=20159448>. (In Russ.).
3. Gutnik I.Yu. Pedagogicheskaya diagnostika professional'nyh deficitov uchitelya v usloviyah transformacii sovremenogo obrazovaniya [Designing an evaluation inventory for identifying teachers' professionalism deficits in the context of transformation of contemporary education]. *Nauka dlya obrazovaniya segodnya = Science for Education Today*, 2021. Vol. 11, no. 4, pp. 33—45. DOI:10.15293/2658-6762.2104.02 (In Russ.).
4. Dorofeev A.V., Altynikova N.V. Diagnostika predmetnyh i metodicheskikh kompetencij uchitelya matematiki [Diagnostics of subject and methodological competencies of a mathematics teacher]. *Vestnik Bashkirskogo gosudarstvennogo pedagogicheskogo universiteta im. M. Akmully = Bulletin of Bashkir State Pedagogical University named after M. Akmulla*, 2021, no. 3(60), pp. 123—129. (In Russ.).
5. Dudina O.P. Monitoring professional'nyh deficitov pedagogicheskikh rabotnikov sistemy dopolnitel'nogo professional'nogo obrazovaniya kak instrument povysheniya kachestva realizacii programm [Monitoring the professional deficits of the workers of the additional vocational education system as a tool of the quality enhancement programs]. *Nauchno-metodicheskoe obespechenie ocenki kachestva obrazovaniya*, 2020, no. 1, pp. 113—118. Available at: <https://elibrary.ru/item.asp?id=42915576> (Accessed 20.10.2021). (In Russ.).
6. Konceptiya issledovaniya kompetencij uchitelej [The concept of the teachers' competencies study]. Available at: <https://tcs.statgrad.org/download/93714.doc> (Accessed 20.10.2021). (In Russ.).
7. Kurneshova L.E., Dydzinskaya D.V. Diagnostika professional'nyh kompetencij pedagogov v sootvetstvii s professional'nym standartom: obzor praktik, metodov, instrumentov [Diagnostic of Teachers' Professional Competencies in Accordance with Professional Standard: Overview of Practice, Methods, Tools]. *Nauka i shkola = Science and school*, 2016, no. 6, pp. 68—80. Available at: <https://www.elibrary.ru/item.asp?id=27656959> (In Russ.).
8. Lazarev M.A., Stukalova O.V., Temirov T.V. Professional'naya ustojchivost' budushchih pedagogov: potencial v processe podgotovki i kriterii ocenki [Professional Sustainability of Future Teachers: Potential in the Process of Preparation and Evaluation Criteria]. *Nauka i shkola = Science and school*, 2018, no. 2, pp. 62—68. Available at: <https://www.elibrary.ru/item.asp?id=34992697> (In Russ.).

9. Margolis A.A., Safronova M.A., Panfilova A.S., Shishlyannikova L.M. Testing of Assessment Tools of Future Teachers Professional Competence. *Psikhologicheskaya nauka i obrazovanie = Psychological Science and Education*, 2015. Vol. 20, no. 5, pp. 77–92. DOI:10.17759/pse.2015200507 (In Russ.).
10. Panasyuk V.P., Tret'yakova N.V. Kachestvo obrazovaniya: Innovacionnye tendencii i upravlenie [Quality of education: Innovative trends and management: monograph]. Yekaterinburg: Publishing House of the Russian State prof.-ped. un-ty, 2018. 201 p. Available at: <http://elar.rsvpu.ru/978-5-8050-0635-8> (Accessed 14.10.2021). (In Russ.).
11. Professional'nyj standart «Pedagog (pedagogicheskaya deyatel'nost' v sfere doshkol'nogo, nachal'nogo obshchego, osnovnogo obshchego, srednego obshchego obrazovaniya) (vospitateľ, uchitel')» (Prikaz Mintruda i social'noj zashchity RF ot 18.10.2013 № 544n; s izmeneniyami i dopolneniyami ot 5 avgusta 2016 g.) [Professional standard «Teacher (pedagogical activity in the field of preschool, primary general, basic general, secondary general education) (educator, teacher)» (Order of the Ministry of Labor and the Ministry of Education and Science of the Russian Federation dated 18.10.2013 No. 544n; with amendments and additions dated: August 5, 2016)]. Available at: fgosvo.ru/uploadfiles/profstandart/01.001.pdf. (Accessed 14.10.2021). (In Russ.).
12. Pudenko T.I. Konceptual'nye osnovy modeli professional'nogo rosta pedagogicheskikh rabotnikov na osnove ocenki urovnya vladeniya professional'nymi kompetencyami [Conceptual foundations of the teachers' professional growth model taking into account the possession of professional competencies]. *Upravlenie obrazovaniem: teoriya i praktika = Education management: theory and practice*, 2019, no. 4(16), pp. 4–13. Available at: <https://www.elibrary.ru/item.asp?id=42714420>. (Accessed 10.09.2021). (In Russ.).
13. Rasporyazhenie Pravitel'stva RF ot 31 dekabrya 2019 g. № 3273-r «Ob utverzhdanii osnovnykh principov nacional'noj sistemy professional'nogo rosta pedagogicheskikh rabotnikov RF, vkluchaya nacional'nuyu sistemu uchitel'skogo rosta» (s izmeneniyami i dopolneniyami ot 7 oktyabrya 2020 g. i 20 avgusta 2021 g.) [Decree of the Government of the Russian Federation No. 3273-r dated December 31, 2019 «On approval of the Basic principles of the National system of professional growth of teachers of the Russian Federation, including the national system of teacher growth» (with amendments and additions dated October 7, 2020, August 20, 2021)]. Available at: <https://www.garant.ru/products/ipo/prime/doc/73284005/#1000> (Accessed 14.10.2021) (In Russ.).
14. Rossiya 2025: ot kadrov k talantam [Russia 2025: from personnel to talents]. Available at: <https://vbudushee.ru/upload/iblock/6c6/6c6770e0c564c4192f6c3631c74c62fb.pdf> (Accessed 18.10.2021). (In Russ.).
15. Sagitov S.T. Social and Cultural Sphere and the Development of the Digital Economy. *Vysshee obrazovanie v Rossii = Higher Education in Russia*, 2019. Vol. 28, no. 10, pp. 97–105. DOI:10.31992/0869-3617-2019-28-10-97-105 (In Russ.).
16. Serditova N.E., Belotserkovsky A.V. Education, Quality and the Digital Transformation. *Vysshee obrazovanie v Rossii = Higher Education in Russia*, 2020. Vol. 29, no. 4, pp. 9–15. DOI:10.31992/0869-3617-2020-29-4-9-15 (In Russ.).
17. Slinkin S.V., Sadykova E.F., Klusova V.V. On Diagnostics Results of Subject and Methodological Competences for Chemistry Teachers. *Istoriya i pedagogika estestvoznaniya = History and Pedagogy of Natural Science*, 2019, no. 2, pp. 18–21. DOI:10.24411/2226-2296-2019-10202 (In Russ.).
18. Tomiltcev A.V., Maltsev A.V. The Problems of Professional Training Assessment: Methodological Approaches. *Obrazovanie i nauka = The Education and science journal*, 2018. Vol. 20, no. 4, pp. 9–33. DOI:10.17853/1994-5639-2018-4-9-33 (In Russ.).
19. Yakovleva I.P., Romanova M.L., Kiseleva E.S., Matveeva L.A. Sovremennye metody ocenki professional'noj nadezhnosti pedagoga [Modern methods of teachers professional reliability evaluation]. *Nauchnye trudy Kubanskogo gosudarstvennogo tekhnologicheskogo universiteta = Scientific Works of the Kuban State Technological University*, 2017, no. 2, pp. 259–269. URL: <https://elibrary.ru/item.asp?id=29952620> (Accessed 18.10.2021). (In Russ.).
20. Dorofeev A.V., Chirkina S.E., Gagloev D.V., Savina T.N. Vector modeling for diagnostics of future mathematics teacher methodical training in higher school. *EURASIA J Math Sci Tech Ed*, 2018. Vol. 14, no. 12. Article: em1617. DOI:10.29333/ejmste/94603

Литература

1. Алтыникова Н.В., Музаев А.А. Оценка предметных и методических компетенций учителей: апробация единых федеральных оценочных материалов // Психологическая наука и образование. 2019. Том 24. № 1. С. 31–41. DOI:10.17759/pse.2019240102
2. Белоцерковский А.В. К вопросу о «количестве качества» и «качестве количества» в системе

образования [Электронный ресурс] // Высшее образование в России. 2013. № 7. С. 22–29. URL: <https://www.elibrary.ru/item.asp?id=20159448> (дата обращения: 20.10.2021).

3. Гутник И.Ю. Педагогическая диагностика профессиональных дефицитов учителя в условиях трансформации современного образования // Наука для образования сегодня. 2021. Т. 11. № 4. С. 33–45. DOI:10.15293/2658-6762.2104.02

4. *Дорофеев А.В., Алтыникова Н.В.* Диагностика предметных и методических компетенций учителя математики // Вестник Башкирского государственного педагогического университета им. М. Акмуллы. 2021. № 4(61). С. 84—95.
5. *Дудина О.П.* Мониторинг профессиональных дефицитов педагогических работников системы дополнительного профессионального образования как инструмент повышения качества реализации программ [Электронный ресурс] // Научно-методическое обеспечение оценки качества образования. 2020. № 1. С. 113—118. URL: <https://elibrary.ru/item.asp?id=42915576> (дата обращения: 20.10.2021).
6. Концепция исследования компетенций учителей [Электронный ресурс]. URL: <https://tcs.statgrad.org/download/93714.doc> (дата обращения: 20.10.2021).
7. *Курнешова Л.Е., Дыдзинская Д.В.* Диагностика профессиональных компетенций педагогов в соответствии с профессиональным стандартом: обзор практик, методов, инструментов [Электронный ресурс] // Наука и Школа. 2016. № 6. С. 68—80. URL: <https://www.elibrary.ru/item.asp?id=27656959> (дата обращения: 20.10.2021).
8. *Лазарев М.А., Стукалова О.В., Темиров Т.В.* Профессиональная устойчивость будущих педагогов: потенциал в процессе подготовки и критерии оценки [Электронный ресурс] // Наука и школа. 2018. № 2. С. 62—68. URL: <https://www.elibrary.ru/item.asp?id=34992697> (дата обращения: 20.10.2021).
9. *Марголис А.А., Сафронова М.А., Шишлянникова Л.М., Панфилова А.А.* Апробация инструментария оценки сформированности профессиональных компетенций у будущих педагогов // Психологическая наука и образование. 2015. Том 20. № 5. С. 77—92. DOI:10.17759/pse.2015200507
10. *Панасюк В.П., Третьякова Н.В.* Качество образования: Инновационные тенденции и управление: монография [Электронный ресурс]. Екатеринбург: Изд-во Рос. гос. проф.-пед. ун-та, 2018. 201 с. URL: <http://elar.rsvpu.ru/978-5-8050-0635-8>. (дата обращения: 14.10.2021).
11. Профессиональный стандарт «Педагог (педагогическая деятельность в сфере дошкольного, начального общего, основного общего, среднего общего образования) (воспитатель, учитель)» (Приказ Минтрудсоцзащиты России от 18.10.2013 № 544н; с изменениями и дополнениями от 5 августа 2016 г.) [Электронный ресурс]. URL: fgosvo.ru/uploadfiles/profstandart/01.001.pdf (дата обращения: 14.10.2021).
12. *Пуденко Т.И.* Концептуальные основы модели профессионального роста педагогических работников на основе оценки уровня владения профессиональными компетенциями [Электронный ресурс] // Управление образованием: теория и практика. 2019. № 4(16). С. 4—13. URL: <https://www.elibrary.ru/item.asp?id=42714420> (дата обращения: 10.09.2021).
13. Распоряжение Правительства Российской Федерации от 31 декабря 2019 г. № 3273-р «Об утверждении основных принципов национальной системы профессионального роста педагогических работников Российской Федерации, включая национальную систему учительского роста» (с изменениями и дополнениями от 7 октября 2020 г. и 20 августа 2021 г.) [Электронный ресурс]. URL: <https://www.garant.ru/products/ipo/prime/doc/73284005/#1000> (дата обращения: 14.10.2021).
14. Россия 2025: от кадров к талантам [Электронный ресурс]. URL: <https://vbudushee.ru/upload/iblock/6c6/6c6770e0c564c4192f6c3631c74c62fb.pdf> (дата обращения: 18.10.2021).
15. *Сагитов С.Т.* Социокультурная сфера и развитие цифровой экономики // Высшее образование в России. 2019. № 10. С. 97—105. DOI:10.31992/0869-3617-2019-28-10-97-105
16. *Сердитова Н.Е., Белоцерковский А.В.* Образование, качество и цифровая трансформация // Высшее образование в России. 2020. Т. 29. № 4. С. 9—15. DOI:10.31992/0869-3617-2020-29-4-9-15
17. *Слинкин С.В., Садыкова Э.Ф., Ключова В.В.* О результатах диагностики предметных и методических компетенций учителей химии // История и педагогика естествознания. 2019. № 2. С. 18—21. DOI:10.24411/2226-2296-2019-10202
18. *Томильцев А.В., Мальцев А.В.* Проблемы оценки профессиональной подготовки: методологические подходы // Образование и наука. 2018. Т. 20. № 4. С. 9—33. DOI:10.17853/1994-5639-2018-4-9-33
19. *Яковлева И.П., Романова М.Л., Киселева Е.С., Матвеева Л.А.* Современные методы оценки профессиональной надежности педагога [Электронный ресурс] // Научные труды Кубанского государственного технологического университета. 2017. № 2. С. 259—269. URL: <https://elibrary.ru/item.asp?id=2995262> (дата обращения: 18.10.2021).
20. *Dorofeev A.V., Chirkina S.E., Gagloev D.V., Savina T.N.* Vector Modeling for Diagnostics of Future Mathematics Teacher Methodical Training in Higher School // EURASIA J Math Sci Tech Ed. 2018. Vol. 14. Issue 12. Article No: em1617. DOI:10.29333/ejmste/94603

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