Testing of Assessment Tools of Future Teachers Professional Competence

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The methodology of creation and experience of an independent assessment of student (future teacher) professional competence development constructed in accordance with the requirements of the occupational standard for teaching staff and the federal state education standards of general education was presented. Attention is drawn to the fact that the tools for independent evaluation were developed jointly with experts of the high schools participating in the project of teacher education modernization and the experienced teachers of their network partners (educational institutions of

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Introduction

The main content of the project of teacher education modernization lies in development of new models of teacher training in accordance with the requirements of the occupational standard for teaching staff and the federal state educational standards of general education [1—6].

During two years, 45 universities of Russia were practically approving the developed models of teacher training in the framework of four types of projects carried out by high schools — participants and their subcontractors: academic Bachelor’s program (eight projects), applied Bachelor’s program (seven projects), professional (pedagogical) Master’s program (six projects), research Master’s program (two projects). The projects practiced the conditioning for tasks for the activity professionally-oriented approach to teacher training, for transition to a modular principle of high school training, for involvement of schools as equal partners of the universities in teacher training on development of student professional competencies, for provision of different training and occupation-entry trajectories.

To assess the student professional competency level, testing and assessment materials (hereinafter referred to as TAM) were developed and practically approved; these included tests and cases in three training lines (teacher education, psychological and pedagogical education, special (special needs) education) and in six profiles: educator, primary school teacher, educational psychologist, basic general education teacher, secondary school teacher, special needs teacher.

Tool Development

The project resource center has arranged an activity complex aimed at developing the method, technique and logistics of the competency evaluation of students that followed the developed and practically approved educational modules at the high schools — participants of the pedagogical education modernization project.

Development of testing and assessment materials engaged 102 developers from 21 high schools — project participants including one Doctor in Pedagogy, 57 Candidates in Pedagogy, 10 Candidates in Psychology. 92 experts took part in the expert evaluation of testing and assessment materials. Of them, 51 experts from 15 high schools and 18 educational institutions including one Doctor in Pedagogy, 37 Candidates in Pedagogy, 5 Candidates in Psychology.

The experts evaluated compliance of contents of the developed tests and cases (aimed at checking development of professional competency of a teacher/educational psychologist) with the labor actions and competency contained in their occupational activity standards.

The expert evaluation was performed in several steps; the developer could adjust the task according to expert or test-specialist’s advice. Then, the test and case were handed over to two new experts. The result was compared to the reference specified by the developer. In case the opinions coincide,
Figure 1. Organizational structure of tool development in the pedagogical education modernization project
the test and case are forwarded to the testing and assessment materials bank.

The following results of the testing and assessment materials expert evaluation were obtained:

1) for tests — 1270 were developed, 300 rejected, 30 revised, 1000 tests included in the materials bank;

2) for cases: 225 were developed, 65 rejected, 6 revised, 166 cases included in the materials bank.

Figure 1 shows the main participants of development of tools for evaluation of development of professional competence of the students (graduates) of the basic professional educational Bachelor’s and Master’s programs (hereinafter referred to as the tools) and implemented objectives. The steps of development, expert evaluation and practical approval of independent evaluation tools are given in Table 1.

**Tool Description**

Qualification testing for students who have mastered the contents of practically approved educational modules consisted of a professional examination and case study.

**Table 1**

<table>
<thead>
<tr>
<th>Steps of development, expert evaluation and practical approval of the independent evaluation tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The Ministry of Education of Russia launches the pedagogical education modernization project</td>
</tr>
<tr>
<td>3. The project teams of high schools establish compliance with professional competency of the occupational standard for teaching staff (educational psychologists) and competency of the federal state education standards of higher education 3+</td>
</tr>
<tr>
<td>4. The project teams of high schools define a set of labor activities of the occupational standard for every module to be mastered by students in the course of training (a competency map for every module is developed)</td>
</tr>
<tr>
<td>5. The project teams of high schools develop and test new modules of the basic professional educational Bachelor’s and Master’s programs</td>
</tr>
<tr>
<td>6. The project operator develops proposals for the independent evaluation of student professional competency development</td>
</tr>
<tr>
<td>8. The resource center shapes inter-university working groups including TAM developers and experts</td>
</tr>
<tr>
<td>10. Professional tests and a case set are developed according to the occupational standard</td>
</tr>
<tr>
<td>11. Expert evaluation of the developed materials is performed, and TAM bank is formed</td>
</tr>
<tr>
<td>13. Demo-version of the student qualification testing is developed</td>
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<tr>
<td>15. The students of high schools — participants take online qualification testing on an additional day</td>
</tr>
<tr>
<td>16. The informational system automatically checks correctness of student answers to test tasks</td>
</tr>
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<td>18. Psychometric support specialists recommend threshold values for differentiating the obtained results</td>
</tr>
<tr>
<td>20. The high schools — participants review the testing results</td>
</tr>
</tbody>
</table>
A professional competence test that includes at least 100 line questions, and a set of cases. The case was a pedagogic situation simulating a professional task, problem and was aimed at checking the planning of professional activities sequence and their implementation completeness. Structured cases were used in this test proposing a student to solve four tasks to a single case. A test assignment was a short question with a possibility to choose from four possible answers.

Qualification testing contained a total of 1000 tests including 452 in Bachelor’s program, 548 in Master’s program and 166 cases including 100 in Bachelor’s program, 66 in Master’s program. Number of tests in training disciplines and specializations is given in Table 2, cases — in Table 3.

Test examples are given below:

Discipline: Psychological and pedagogical education

**Specialization**: Educator  
**Training program**: Bachelor’s program  
**Labor actions**:  
2.1.2. Participating in the creation of safe and psychologically comfortable educational environment of an educational institution by ensuring the safety of child’s life, maintaining emotional well-being of children during their stay in the educational organization.  
**Task**: Atypical adaptation of a three-year-old child to the kindergarten is manifested by  
**Option 1**: slightly decreased appetite  
**Option 2**: prolonged somatic interchanging diseases  
**Option 3**: tearfulness, lack of desire to explore the surroundings

### Table 2

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Specialization</th>
<th>Bachelor’s program</th>
<th>Master’s program</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychological and pedagogical education</td>
<td>Educator</td>
<td>91</td>
<td>77</td>
<td>168</td>
</tr>
<tr>
<td></td>
<td>Primary school teacher</td>
<td>142</td>
<td>85</td>
<td>227</td>
</tr>
<tr>
<td></td>
<td>Educational psychologist</td>
<td>No</td>
<td>116</td>
<td>116</td>
</tr>
<tr>
<td>Pedagogical education</td>
<td>Basic general education teacher</td>
<td>145</td>
<td>68</td>
<td>213</td>
</tr>
<tr>
<td></td>
<td>Secondary school teacher</td>
<td>No</td>
<td>103</td>
<td>103</td>
</tr>
<tr>
<td>Special (special needs) education</td>
<td>Special needs teacher</td>
<td>74</td>
<td>99</td>
<td>173</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>452</td>
<td>548</td>
<td>1000</td>
</tr>
</tbody>
</table>

### Table 3

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Specialization</th>
<th>Bachelor’s program</th>
<th>Master’s program</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychological and pedagogical education</td>
<td>Educator</td>
<td>27</td>
<td>7</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Primary school teacher</td>
<td>31</td>
<td>9</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Educational psychologist</td>
<td>No</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Pedagogical education</td>
<td>Basic general education teacher</td>
<td>19</td>
<td>8</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Secondary school teacher</td>
<td>No</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Special (special needs) education</td>
<td>Special needs teacher</td>
<td>23</td>
<td>15</td>
<td>38</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>100</td>
<td>66</td>
<td>166</td>
</tr>
</tbody>
</table>
Option 4:
child’s desire to stay by their educator’s side during the first two weeks
Right option: 2
Right answer justification:
All the manifestations of child’s adaption to the kindergarten during the first weeks of stay, except for prolonged somatic diseases, are typical.

Discipline: Psychological and pedagogical education
Specialization: Primary school teacher
Training program: Bachelor’s program

Labor actions:
1.1.6. Organization, implementation of control and evaluation of educational achievements, current and final results of the new education program mastered by the students

Task: A pupil has made a mistake in calculations: 97-81:9=16. What is the reason for mistake?

Option 1:
the rule of action order in math expressions was not mastered
Option 2:
mistake in calculations
Option 3:
arithmetic action was changed
Option 4:
approximate value was written down
Right option: 1
Right answer justification:
The pupil did not consider division, but subtracted 81 from 97 at once; it suggests that the pupil had not mastered the rule of action order in math expressions.

A case task example is given below.

Discipline: Psychological and pedagogical education
Specialization: Primary school teacher
Training program: Bachelor’s program

Labor actions:
1.2.6. Implementation of educational possibilities of various child’s activity kinds (educational, play, labor, sports, art and other activities).

Topic: Educational possibilities of various activity kinds
Instruction:
Read the pedagogical situation, its implementation context, documents and solve the case task.

Pedagogical situation description:
Pedagogical situation. Sports competitions at primary school (grade 1, September). Two pupils are the leaders: a boy and a girl. After the results of athletics competitions had been announced (the boy took the first prize), the girl beat the winner and said: "I am the first in everything and no one dares to occupy my place."

The context of the situation. The situation occurred at primary school (grade 1, beginning of the school year). A usual secondary municipal school where around 1,500 pupils study. The classmates are graduates of the same kindergarten. The girl came from another kindergarten. The teacher has teaching experience of over 15 years and holds the highest qualification category.

The girl is from an incomplete family, a late child, develops normally with a little advance, cannot accept a failure situation, there are many family members who love the child dearly indulging her whims and desires, which led to the formation of outsized self-esteem.

Video:
No

Additional materials:
Current year educational activity plan for Grade 1.

Task 1:
Analyze the educational activity plan from the point of view of different 1-grader educational possibility implementation (educational, play, labor, sports, art and other activities).
Task 2:
Explain the reasons for girl’s behavior.

Task 3:
Set the goal of girl’s individual development and offer an option for child’s pedagogical support program.

Task 4:
Develop a complex of activity forms to bring the classmates together and to include the children in different types of joint activities.

Tool testing
As part of the developed tool testing, the Resource Center of the Pedagogical Education Modernization (established on the basis of Moscow State University of Psychology and Education jointly with National Research University “Higher School of Economics”) performed a computer testing for the students of the participating high schools. Six tool sets in three training disciplines (pedagogical education, psychological and pedagogical education, special (special needs) education) and six specializations (educator, primary school teacher, special needs teacher, educational psychologist, basic general education teacher and secondary school teacher) were practically approved.

The practical approval of the tools was organized in an online form at “оценкакомпетенций.рф”. 3603 students and 38 high schools of Russia took part in the tool testing.

For each module, the developers of the participating high schools determined a set of labor actions of the occupational standard that the students master during module studying. During the tool testing procedure, only the labor actions expalined in the project module were checked in every student group.

Tool testing participants
Computer testing agreements were concluded with the participating high schools. High school participants provided data entries at “оценкакомпетенций.рф” for the student training groups studying new modules of the modernized basic educational Bachelor’s and Master’s programs in 2014 and 2015, entries of e-mails of the students participating in the computer testing (student details were not provided by high schools).

Number of students who have passed the testing is given in Table 4 by the training levels and programs.

Independent evaluation stages
The qualification testing included passing tests and cases.

The professional test was aimed at evaluating the level of professional knowledge, skills and competency in accordance with the occupational standard for teaching staff (educational psychologists). The control tasks of the professional testing included tests with several answer options.

Case set. Case solution was aimed at evaluating the level of development of professional competency required to carry out several labor actions in accordance with the occupational standard for teaching staff (educational psychologists). The case set included structured cases.

Figure 2 shows the independent evaluation diagram and stages.

Qualification testing was performed in the information system where student’s personal account (Fig. 3) contained information about the high school, specialization and training program, attendance method and data on the project and the modules the student followed.

Each group of students solved the tests according to the modules they were trained
by in 2014—2015, but at most three tests. One test comprised up to 20 tasks to be solved within 30 minutes, three tests — within 1.5 hours. Then, the students solved two cases according to the modules they were trained by. 30 minutes were given to solve one case. Thus, the qualification testing lasted 1.5 to 2.5 hours. To perform expert evaluation of the student case solutions, the project resource
Model of evaluation of student professional competency development

The qualification testing was aimed at evaluating the student professional competency development in accordance with specific labor actions of the occupational standard for teaching staff (educational psychologists) who studied the new modules of the modernized basic professional educational Bachelor’s and Master’s programs.

According to the developed model, the labor action was considered mastered:
- by a student if 50% of tasks (test tasks and cases) aimed at checking this labor action were solved correctly.
- by a group if at least 60% of the students who took part in the testing had mastered this labor action.

Practical approval results

The scores obtained by the practical approval participants are normally distributed (Diagram 1) implying technique validity.

The diagram shows that the obtained results of the practical approval of the technique have the distribution, which is close to normal.

Descriptive statistics of the testing results also prove that distribution of the test and case results is close to normal.

The performed comparison of the testing results using the t-Student test showed that no statistically significant differences were found (p = 0.180) between the test results and case results. It also confirms validity of the methodology.

There is also a link between the test and case results at the statistical significance level that proves Pearson’s correlation ratio r=0.396** (**. Correlation is significant at 0.01).

The level of student labor action development was also checked during the technique testing. 57 labor actions of the occupational standard for teaching staff were checked. The data on the special needs teacher specialization are not given because development of the occupational standard is currently under way. Development level of the labor actions was evaluated based on the solved test and case tasks.

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Fig. 3. An interface screenshot of the main page of Student A’s personal account
The percentage of mastered labor actions of the occupational standard for teaching staff amounted to 79% in accordance with the model. The data on mastered labor actions of the occupational standard for teaching staff in Bachelor’s and Master’s programs and for the specializations are given in Diagrams 2 and 3.

The diagram shows that the percentage of mastered labor actions is lower for Bachelor’s than for Masters in the occupational standard for teaching staff. The obtained dif-

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|}
\hline
 & Test results & Case results \\
\hline
N & 3469 & 3470 \\
Minimum & 7.00 & 0.00 \\
Maximum & 100.00 & 100.00 \\
Average & 58.6381 & 56.4624 \\
Standard deviation & 14.79475 & 23.85632 \\
Dispersion & 218.885 & 569.124 \\
Asymmetry & -0.072 & -0.226 \\
Standard mistake & 0.042 & 0.042 \\
Kurtosis & -0.133 & -0.586 \\
Standard mistake & 0.083 & 0.083 \\
\hline
\end{tabular}
\caption{Descriptive statistics of the results of technique testing}
\end{table}
ferences are proved by Student t-test. Thus, this technique has a differentiating ability.

For the Bachelor’s program, there is a result difference in training specialization at the level of statistical significance (p=0.048). For the Master’s program, no statistically significant differences were revealed (p=0.093). Dispersion analysis was used for comparing.

The performed analysis showed that the following seven labor actions out of 57 labor actions of the occupational standard for teaching staff had been mastered in all the projects (in two and more) where they were checked:

1.1.4. Planning and holding of classes;
1.3.2. Evaluating of parameters and designing of psychologically safe and comfort-
able educational environment, development of the programs for prevention of various kinds of violence at school;
1.3.5. Provision of the targeted aid to pupils;
1.3.7. Development (jointly with other specialists) and implementation of child’s individual development programs jointly with other parents (legal representatives);
2.1.11. Arrangement of constructive interaction of children in different activity types, creating the conditions for children so they could independently choose activities, joint activity participants, materials;
2.2.5. Education process arrangement taking into account peculiarities of the social situation of a first-grader development;
2.2.6. Adjustment of the educational activity based on the data on educational success monitoring taking into account lack of uniformity in individual mental development of primary school children (including due to age gaps, pre-school education conditions) and peculiarities of growth dynamics of boys and girls.

The following seven labor actions out of 57 labor action of the occupational standard for teaching staff were rather challenging for students:
1.1.1. Development and implementation of training discipline programs within the basic educational program;
1.1.7. Development of multipurpose training actions;
1.2.9. Establishment, maintaining the culture, environment and traditions of life of an educational institution;
1.3.4. Development and application of psychological and pedagogical technologies (also the inclusive ones) required for targeted activities with various contingents of pupils: gifted children, socially vulnerable children, children in difficult life situations, migrant children, orphans, children with special educational needs (autists, children with attention deficit disorder and hyperactivity, etc.), children with disabilities, children with behavior deviations, addicted children;
2.1.12. Active use of non-directive help and support for child’s initiative and independency in various activity types;
2.1.5. Participation in planning and adjustment of educational objectives (jointly with a psychologist and other specialists) based on the monitoring results taking into account individual development of each child of primary school and / or pre-school age;
2.2.3. Arrangement of metasubject competence, learning ability and universal educational actions to reach the level required for the development of educational programs of the basic general education.

The performed analysis allowed building the professional competency development profiles for the student studying according to the educational modules in the projects (Diagram 4).

Discussion of the obtained results
The obtained results require discussing on two bases:
• regarding interpretation of results of the student professional competency development;
• regarding practical approval of competency independent evaluation tools and its logistics.

Limitations in the evaluation of the obtained results of the student professional competency development include the following features of the project implementation course.
1. Lack of preliminary diagnosis of student professional competence, which did not allow to assess the dynamics and unambiguously interpret the good results as a consequence of a high efficiency of training in the developed modules.
2. The differences in the results of the study student groups that may be associated not only with the development of or failure to develop the professional competencies during training in modernized modules but also with the specifics of the training areas the students participating in the testing studied in, and with different volumes of professional knowledge obtained prior to the practical approval.

3. Unbalanced sets of tests and cases in the study groups by the level of their complexity (the tasks were randomly offered by the information system within the given educational module parameters).

4. Challenging labor actions in the occupational standard that require additional efforts in high school training of students for them to be ready to solve such actions.

The performed work produced the following results:

1) tool testing made it possible to differentiate testing and assessment materials by difficulty levels in test tasks and cases;
2) online testing occasionally revealed a necessity to perform independent control of the qualification testing conditions.

Conclusion

Tool testing showed its high potential for further development of independent evaluation of the graduate professional competency development allowing to obtain impersonal and accurate information on the quality of developed modules and programs for teacher training in future.
The developed informational system of online testing demonstrated its high reliability in dealing simultaneously with big student groups and experts when evaluating the cases solved by the student from different constituent units of the Russian Federations. In order to improve this procedure organization, it shall be completed as a final estimation of the professional competency in accordance with the occupational standard regardless of the chosen training models and mastered contents of the educational modules.

The revealed groups of tests and cases of different complexity levels allow for differential evaluation of the mastered professional competency by 3—4 complexity levels with development of the system for professional competency development of the teacher training program graduates.

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Апробация инструментария оценки сформированности профессиональных компетенций у будущих педагогов

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Представлены методология создания и опыт проведения независимой оценки сформированности профессиональных компетенций студентов (будущих педагогов), построенной в соответствии с требованиями профессионального стандарта педагога и федеральными государственными образовательными стандартами общего образования. Обращается внимание на то, что инструментарий независимой оценки был разработан совместно экспертами вузов-участников проекта модернизации педагогического образования и опытными педагогами их сетевых партнеров (образовательными организациями общего образования). В апрооабации инструментария приняло участие 38 вузов и 3603 студента. Проведенный анализ позволил построить индивидуальные профили сформированности профессиональных компетенций у студентов проекта по проверяемым трудовым действиям.

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