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TÍTULO: Aplicación de tareas orientadas a la práctica de la competencia "Profesor de primaria y secundaria" según los estándares WorldSkills en la práctica de enseñanza de disciplinas químicas fundamentales.

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RESUMEN: En el artículo está expuesta la experiencia de la aplicación de las tareas orientadas a la práctica de la competencia "Profesor del colegio primaria y secundaria" según los estándares de Worldskills en la práctica de la enseñanza del área de disciplinas "Química". Fueron descritos los materiales didácticos y metodológicos en las disciplinas del área de asignaturas "Química" de la línea de formación Educación Pedagógica del perfil Biología, Química. Los materiales didácticos y metodológicos están destinados para la formación de competencias profesionales previstas por el programa educativo y son consistentes con las funciones laborales del estándar profesional del pegagogo, así como con los requerimientos y criterios de la evaluación de la competencia "Profesor de primaria y secundaria".

PALABRAS CLAVES: estándares Worldskills, competencias profesionales, educación pedagógica, educación química, tareas prácticas.

TITLE: Application of practice-oriented assignments for the Competence “General and Secondary School Teacher” according to the WorldSkills Standards in the teaching of fundamental chemical disciplines.

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ABSTRACT: This paper provides an overview of the experience in applying the practice-oriented assignments under the competence Primary and Secondary School Teacher according to WorldSkills Standards in the teaching of the Chemistry subject area. The developed teaching and methodical materials on the disciplines within the Chemistry subject area under the program Pedagogical Education, Biology Chemistry specialty, are described. The teaching and methodical materials are intended to develop professional competences envisaged by the educational program, consistent with the job functions of a teacher in accordance with the Professional Standard for Teachers, and the requirements and assessment criteria of the competence General and Secondary School Teacher.

KEY WORDS: WorldSkills standards, professional competences, pedagogical education, chemical education, practical assignments.

INTRODUCTION.

The changes occurring in the socio-economic and technical-technological situation in the world require a qualitative transformation of general education. Such transformations are impossible without involvement of pedagogical universities training teachers for the needs of the general education.

The development and use of curricula for the training of students of pedagogical higher education institutions, preparing the future teachers for their job in compliance with the Federal State Educational Standards of Higher Education (hereinafter referred to as FSES HE), revised accordingly on the basis of the Professional Standard for Teachers, have led to certain changes in the content of basic professional educational programs. Such changes affected several aspects, and strengthening of the learning objectives towards practical orientation and application of a certain range of means to assess the achievement of desired outcomes of the university education from the competence perspective, were most prominent. Many components of the above-mentioned changes have been made possible by joint efforts of teachers and students through implementation of the relevant curricula and educational programs.

As evidenced by our practice, introduction in the educational process of the experience of participation in professional competitions, such as WorldSkills and I am a professional, may be viewed as one of the methods of practice-oriented training of future chemistry teachers.

While the introduction of WorldSkills standards of pedagogical competences in the disciplines of methodological nature does not cause any particular problems, their use for teaching the fundamental disciplines of the subject block is cumbersome. Therefore, the development of teaching and methodical materials and their introduction into the educational process is highly relevant, as it helps to strengthen the practical orientation of the educational process and the development of professional competences among students.

DEVELOPMENT.

Literature Review.

Since May 2012, Russia has been officially admitted to the international organization WorldSkills International. The Russian Federation became the sixtieth member of this organization (Bugaychuk et al., 2016, Zoyotareva, 2013).

The results of Russia's participation in WorldSkills International illustrate the popularization of the competitions' movement and the improved quality of specialists' training. In 2013 Russia took the 41st place by the team score at the international competitions, in 2015 – the 14th place at the WorldSkills International, in 2016 – the 1st place at EuroSkills (Fedotova, 2016, Shaforostova, 2018).

One of the main objectives of the higher education system is to improve the quality of teachers' training in order to keep pace with the current advances in education and to meet the expectations of employers (Chigisheva, 2015, Bolotov, 2014, Vachkova et al., 2018, Shahova, 2017, Arkhipova, 2018). One of the ways to tackle this objective is to explore and apply the global technologies in the educational process. Therefore, in 2017, the WorldSkills movement was expanded to include pedagogical competences (Trubina, 2018, Gayneev, 2017).

WorldSkills championships help to introduce teachers to new teaching technologies and new professional standards of international level and to contribute to the modernization of the education system. The results of the competitions are comprehensively analyzed by several parameters, it is a dynamic indicator of the entire system of personnel training – where and how we teach excellently, and where – poorly (Shkabura & Lysikova, 2017, Mikhaylova & Shafikova, 2017).

The WorldSkills is a purely practice-oriented competition of professional excellence. Competition tasks for the competence General and Secondary School Teacher according to the WorldSkills standards help to assess the students' level of professional skills, ability to plan and organize

curricular and extra-curricular activities, to conduct methodological work, and readiness to carry out professional teaching activities (Kochetkov, 2016). It is logical to use the forms of behavior and assessment criteria of competition tasks in the educational process of a pedagogical university within the framework of general professional and methodical disciplines, as well as in the organization of pedagogical practice (Dikova & Mashchenko, 2018, Aleksandrova, 2018, Kadakin, 2017).

Research methodological framework.

Research purpose: to provide scientific-methodical justification for the introduction of the elements of the WorldSkills competence "General and Secondary School Teacher" into the educational process in order to improve the practical orientation of the educational process in the pedagogical university.

Research objectives: development of teaching and methodical materials on individual sections of chemistry, consistent with the principles underpinning the competition tasks for competence "General and Secondary School Teacher" (2017); introduction of the developed teaching and methodical materials into the educational process; analysis of the results of pedagogical research.

The paper is based on the materials on the relevance of practice-oriented training of future teachers from the perspective of current requirements for future professional activities, analytical data from pedagogical, didactic and methodological literature in the attempt to find new forms of practice-oriented learning in our country and abroad. The research was carried out by using the methods of theoretical level, among which the priority was given to the analysis of literature, its summarizing in the aspects of high interest to us, as well as systematization of materials prepared and tested by the authors.

Analysis of the curriculum under the program Pedagogical Education, specialty Biology.

Chemistry, has shown that the study of fundamental disciplines of the Chemistry subject area is mainly aimed at the development of the following competences (FSES HE for program 44.03.05 Pedagogical education, approved by Order of the Ministry of Education and Science of the Russian Federation on February 9, 2016 No. 91):

– Readiness to implement educational programs on the subjects in accordance with the requirements of educational standards (PC-1);

– Ability to use most advanced methods and technologies of education and diagnostics (PC-2);

– Ability to use the resources of the educational environment to achieve personal, metasubject and subject-related learning results and ensure the high quality of the educational process through the subjects taught (PC-4);

– Ability to manage the learning and research activities of students (PC-12).

The indicated competences resonate well with the job functions prescribed by the Professional Standard for Teachers, as well as with the requirements and assessment criteria of the competence "General and Secondary School Teacher". Development of the indicated competences of future teachers is most fully achieved through the implementation of practice-oriented learning, while this principle applies to all disciplines on the curriculum.

Specifics of teaching General and Inorganic Chemistry discipline according to WorldSkills principles.

The General and Inorganic Chemistry discipline opens up the chemical training for students and lays the foundations for the chemical education of future teachers of chemistry, as well as development of general laboratory skills. As part of this discipline 23 laboratory works (e.g.,

preparation of solutions, speed of chemical reaction, chlorine and hydrogen chloride, nitrogen and its hydrogen compounds, etc.) are performed by students.

When performing laboratory works, each student gets acquainted with the purpose and rules of operation of the basic chemistry equipment for secondary schools, safety rules during the experiments; learns to assemble the simplest installations with reliance on the schemes and descriptions; master the method and technique of demonstration of school chemical experiments; ability to explain the phenomena demonstrated at the level of a secondary school teacher.

In the second semester, each student shall conduct a demonstration experiment on one of the studied topics. During the demonstration, the rest of the students listen, answer the questions, register the experiment in a workbook in the form of a table, which contains such entries as the experiment description; observations and equations of chemical reaction; conclusions.

After the demonstration, students analyze the performance of their classmate based on the below plan:

1. Explanation for choosing this chemical experiment.
2. Combination of narration and visual demonstration.
3. Use of research method in the experiment.
4. Quality of instructions to the experiment.
5. Student's technical skills in chemical experiment.
6. Observation of safety rules.

Specifics of teaching Physical Chemistry discipline according to WorldSkills principles.

Along with inorganic and organic chemistry, physical chemistry is one of the leading subject disciplines at pedagogical university. This discipline includes studying of the following sections: chemical thermodynamics, thermochemistry, chemical equilibrium and its dependence on external

conditions, chemical kinetics, dissolution and methods of expressing solution composition, colligative properties of solutions, electrolytic dissociation, electrolysis, electrochemical corrosion (Zhukova & Lyapina, 2017, Zhukova, 2017).

We have developed methodical recommendations for practical training in the form of a professional skills competition, which is supposed to substitute some traditional classes.

An example of a practical lesson on topic "Thermochemistry".

Lesson structure. Students receive assignments in advance. Their task is to prepare the necessary documentation for each assignment. At the lesson the whole group of students is divided into three subgroups (about 12–15 people are present at the practical lesson) representing the contestants, the experts and the students. Each of the contestants chooses assignment by casting lots, and using their home notes, demonstrates a fragment of the lesson as per the assignment. Experts evaluate the fragment according to the criteria outlined by the teacher. Respectively, the remaining students play the role of students.

Examples of assignments for students:

1. Develop a fragment of the chemistry class (lesson) on Thermal Effect of Chemical Reaction (8^{th} grade; lesson stage - learning a new topic). When developing the lesson scenario, it is necessary to ensure development of the students' ability to classify. The class (lesson) scenario should reflect the topic, purpose, objectives, stages, content of teacher's activity, content of students' activity, expected outcomes, methods of monitoring and evaluation.

2. Develop a scenario for an extra-curricular chemistry class on the topic Spontaneous and Stimulated Processes (9^{th} grade). The lesson should be aimed at organizing the students' project (research) activities. Please note that when working on the assignment, it is necessary to

demonstrate the ways of organizing the research or project activities of the students, which are appropriate for extra-curricular activities on the given topic.

3. Develop interactive educational content (interactive lecture) as an element of an information educational environment that enables learners to independently study the learning material of the Thermochemistry section.

Specifics of teaching Organic Chemistry discipline according to WorldSkills principles.

Organic chemistry is a mandatory component of the school chemistry course. Therefore, it is mandatory for students to present fragments of lessons as part of their studies on organic chemistry at the pedagogical university. With this purpose, the learning module was developed, in which the students during their third year (as part of organic chemistry studies) prepare scenarios (summaries) of the school classes (lessons).

Once a semester (before the examination session), a practical lesson is organized where students present fragments of the developed school lessons. Each student conducts one lesson on the topic chosen by the draw (exemplary topics: Classification of Organic Compounds (9^{th} grade); Saturated Hydrocarbons (9^{th} grade); Isomerism and Its Types (10^{th} grade), etc.). Students of first and second year play the role of a school class, and the delivered lessons are assessed by teachers and graduate students of the department and invited teachers of chemistry under the WordSkills standards.

Assessment criteria for practical assignments on the indicated disciplines, compiled by the authors on the basis of assessment criteria of competition tasks for the competence “General and Secondary School Teacher” (2017), are presented in Table 1.

Table 1. Assessment Criteria for Practical Assignments under WorldSkills Standards.

No.	Assignment type	Assessment Criteria
1	Lesson scenario	The scenario properly structures the lesson time
		The scenario specifies the lesson topic
		The scenario specifies the purpose and objectives of the lesson
		The scenario indicates the planned results to be achieved by students during the lesson
		The script offers algorithms for the teacher's actions
		The scenario indicates the lesson stages
		The content of the lesson is optimal for addressing the lesson objectives
		Materials to be used at each stage are included in the scenario
		Assignments for students are indicated for each stage
		Methods of control are indicated for each stage
		The scenario offers methods to evaluate performance of students
		The scenario lists the didactic tools used in the lesson
		Interactive teaching methods are included in the plan
		The scenario envisages a problem-solving way of working
		The scenario envisages forms of work in small groups or pairs
		The scenario includes a control stage
		The control stage involves self-assessment or mutual assessment of students
		The scenario discloses the sources of materials and tools used in the lesson
		The scenario is free of any grammatical or spelling errors
		The scenario design is clear and allows for reproduction of the lesson by another teacher
2	Lesson (class) demonstration	***Objective assessment***
		Observation of the safety rules
		All the necessary equipment is at the students' desks and ready for use
		Work is organized in small groups or in pairs
		Use of interactive board
		After the class, the teacher's workplace has been restored to its original condition
		Subjective assessment
		Visual presentation of the lesson's topic
		Appropriateness of space organization to the content of educational activities
		Coherence and clarity of the teacher's speech
		Brevity of the teacher's speech
		Logics in the teacher's explanations
		Fulness of coverage of the lesson's topic
		Quality of handouts

		Enabling context for assignment setting/acceptance
		Use of variety of organizational forms in the classroom
		The constructiveness of interaction with students
		Organization of interaction between students
		Meaningfulness of student interactions
		Correspondence of the content complexity to the age of students
		Quality of presentation of teaching materials on the interactive board
		Inclusion of students in the activities offered in the classroom
		Differentiation of control tasks by students
		Feasibility of ICT tools' use by students
		Use by students of content schematization in the classroom
		The clarity of the conclusions made by the students
		A variety of assessment forms (including self- and mutual assessment)
3	Interactive educational content (interactive lecture)	***Objective assessment***
		Presence of knowledge acquisition control blocks
		Presence of links to Internet sources
		Presence of cross links
		Subjective assessment
		Appropriateness of the lecture content for the students' age
		Originality of content
		Interactivity
		Presence of video fragments
		Presence of audio aids
		Observance of the requirements for the design of visual materials
		Wealth of the lecture's content
		Accessibility of information and ease of use of the interactive lecture
		Educational effect of the lecture materials
		Methodological value of the interactive lecture
		Technological optimality
		ICT competence of the author

Source: compiled by the authors based on the Technical description of competence "General and Secondary School Teacher" (2017).

Each "objective assessment" criterion is assigned 1 point; each "subjective" criterion is assigned 1 to 5 points.

When evaluating practical assignments, not only the organization of work during the demonstration of the lesson is assessed, but also consistency of the lesson with the scenario.

Specifics of teaching Analytical Chemistry discipline according to WorldSkills principles.

When training students under the program Pedagogical Education, Biology. Chemistry specialty, Analytical Chemistry discipline, the educational process is enriched with the elements of professional excellence championships on the competence “Laboratory Chemical Analysis".

The rules of the WorldSkills competition require a teamwork of the participants (2 persons in each team). Therefore, work in small groups is an essential requirement to be met when designing a lesson. In the course of the laboratory practice, the work is organized in such a way that one team member performs the analysis while the other one acts as an expert. For the next assignment, the participants change roles. Thus, before dealing with each assignment, the participant gets acquainted not only with the methodology of laboratory analysis, but also with the criteria of its assessment (Technical description of Laboratory Chemical Analysis competence, 2017).

This format allows to monitor the laboratory skills of each student. The teacher should monitor the work of the "experts" to ensure the objectivity of assessment. In this format, practical lessons were conducted on calibration of measuring glass ware and preparation of solutions for acid-base titration, etc.

CONCLUSIONS.

Teaching with the use of the developed teaching and methodical materials was conducted throughout the academic year. At the final stage students of the 1^{st} – 3^{rd} year of Biology. Chemistry and Biology. Geography specialty took part as spectators in the university qualifying championship WorldSkills for the competence “General and Secondary School Teacher”.

After the competition, the final seminar was held to discuss the competition tasks and actions of the contestants. The students who were trained based on the developed teaching and methodical materials (Biology. Chemistry specialty), made the competent substantiated analysis of the fragments of lessons presented by the contestants, put forward proposals for their improvement. While the students who did not participate in the experiment (Biology. Geography specialty), gave only an emotional assessment (like – dislike).

Thus, the practice of introducing the elements of WorldSkills competition tasks into the educational process made it more practice-oriented, contributing to the successful acquisition of professional competences by students. As a result, students have the opportunity to assess their strengths, to bolster their self-esteem, to demonstrate their professional knowledge and skills, to improve in the chosen profession, to expand the opportunities for development of their creative skills, communicative skills and professional thinking, to deepen interest in the disciplines under study, which makes their chemical knowledge more thorough and profound.

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