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COMPONENTS OF IMPROVING THE METHODOLOGY FOR DEVELOPING RESEARCH COMPETENCE AMONG MASTER'S STUDENTS IN CHEMISTRY

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Annotatsiya: *Maqolada oliy ta'lim muassasalari magistrantlarining ilmiy - tadqiqot kompetentligining mazmuni va metodologik asoslari ilmiy tadqiqot komponentlari asosida tahlil qilingan. Shakllantirilgan xulosalar asosida oliy ta'lim magistrantlarida ilmiy-tadqiqot kompetentligini rivojlantirish bo'yicha taklif va tavsiyalar ishlab chiqilgan.*

Tayanch so'z va tushunchalar: *ilmiy faoliyat, kompetentlik, ilmiy-tadqiqot kompetentligi, ilmiy-tadqiqot komponentlari, kognitiv(bilim), operatsion-amaliy, reflektiv, komunikativ komponentlar.*

КОМПОНЕНТЫ СОВЕРШЕНСТВОВАНИЯ МЕТОДИКИ РАЗВИТИЯ ИССЛЕДОВАТЕЛЬСКОЙ КОМПЕТЕНТНОСТИ МАГИСТРАНТОВ ХИМИЧЕСКОЙ СПЕЦИАЛЬНОСТИ

Аннотация: *В статье проанализированы содержание и методологические основы исследовательской компетентности магистрантов высших учебных заведений на основе компонентов научно-исследовательской деятельности. На основе сформулированных выводов разработаны предложения и рекомендации по развитию исследовательской компетентности магистрантов высших учебных заведений.*

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Ключевые слова: научная деятельность, компетентность, научно-исследовательская компетентность, компоненты научно-исследовательской компетентности, когнитивный (знаниевый) компонент, операционно-практический компонент, рефлексивный компонент, коммуникативный компонент.

COMPONENTS OF IMPROVING THE METHODOLOGY FOR DEVELOPING RESEARCH COMPETENCE AMONG MASTER'S STUDENTS IN CHEMISTRY

Annotation: *The article analyzes the content and methodological foundations of research competence among master's students of higher education institutions based on the components of scientific research activity. On the basis of the conclusions drawn, proposals and recommendations for the development of research competence among master's students in higher education have been developed.*

Key words: *scientific activity, competence, research competence (or scientific research competence), components of research competence, cognitive (knowledge-based) component, operational and practical component, reflective component, communicative component.*

In the course of conducting scientific activity and improving research competence, based on the analysis of concepts proposed by scholars, the methodology for developing research competence was refined, and the following key components were identified: cognitive (knowledge-based), practical (operational), motivational and value-oriented, reflective and evaluative, communicative, and personal components.

1. Cognitive (knowledge-based) component. The cognitive (knowledge-based) component served to develop the theoretical knowledge,

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scientific concepts, analytical thinking, and methodological foundations necessary for enhancing the research competence of master's students majoring in chemistry. The specificity of the chemistry discipline lies in the fact that scientific research is not limited solely to laboratory practices; rather, it requires profound theoretical preparation, as well as knowledge of complex scientific models and methods.

Providing master's students with fundamental theoretical training in chemistry constitutes the basis for improving the methodology of developing research competence. For example, within the course "*Research Methodology*," a master's student is expected to acquire the following elements within the cognitive component. Through theoretical knowledge, the cognitive component enables the student to understand fundamental concepts such as the essence, structure, and stages of scientific research; scientific problems; research topics, goals, and objectives; hypotheses and scientific assumptions; the differences between theory and concept; the classification of scientific methods; and the basics of experimental design. This, in turn, strengthens the student's scientific worldview.

As a researcher engaged in scientific reasoning, the cognitive component fosters the formation of scientific thinking, including the ability to provide scientific justification and argumentation, logically test hypotheses, and integrate theory with practice.

In addition, the master's student develops skills in working with scientific literature, learning criteria for selecting scientific sources, conducting systematic analysis of literature, identifying relevant scientific trends, preventing plagiarism, and analyzing scientific articles. As a result, the student becomes capable of distinguishing differences among existing theories, generating new knowledge from scientific literature, and substantiating scientific reasoning.

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The cognitive component, whose core lies in the ability to formulate scientific problems and develop hypotheses, plays a central role in research competence development. In particular, the course “*Research Methodology*” teaches master’s students to:

- distinguish scientific problems;
- identify research gaps;
- formulate scientific hypotheses;
- theoretically substantiate hypotheses;
- pose scientific questions.

These processes correspond to the highest levels of cognitive activity, namely:

- analysis,
- synthesis,
- generalization,
- abstraction.

Furthermore, the course provides opportunities for selecting appropriate research methods, including:

- empirical methods (observation, experimentation, measurement);
- theoretical methods (logical analysis, modeling, induction–deduction);
- statistical methods (correlation analysis, analysis of variance);
- chemical methods (spectroscopy, chromatography, titration).

Based on this knowledge, the master’s student is able to make informed decisions regarding which methods are suitable for testing hypotheses, which methods yield faster and more accurate results, and how combinations of methods influence research outcomes.

In analyzing research results, the student acquires skills in scientifically interpreting empirical data, reading and analyzing graphical and tabular

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information, drawing statistical conclusions, and linking results with theoretical frameworks.

Ultimately, the most important indicator of the cognitive component-the ability to transform information into scientific knowledge-is formed in the master's student.

2. Operational and practical component. The operational and practical component represents a key competence developed through the direct implementation of scientific research activities in practice, including conducting experiments under laboratory conditions, collecting data, processing measurement results, and drawing evidence-based conclusions, all of which are essential for enhancing the research competence of master's students majoring in chemistry. The operational-practical mechanism is closely associated with the experimental nature of the chemistry discipline and ensures the formation of experimental thinking, practical skills, technical proficiency, and laboratory culture required for the scientific activity of master's students.

Through the practical component, chemistry master's students acquire the ability to properly organize scientific research from a practical perspective, independently conduct laboratory experiments, perform reliable measurements, process experimental results, and formulate scientifically grounded conclusions.

Scientific research in the field of chemistry is conducted on the basis of strict laboratory regulations, technical protocols, and standard operating procedures (SOPs). Therefore, master's students develop the following skills:

- designing experimental plans;
- defining step-by-step procedures;
- preparing lists of reagents and safety guidelines;
- maintaining laboratory notebooks.

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These competencies contribute to the development of students' ability to systematically design and manage the scientific research process.

3. Communicative and presentational component. The communicative and presentational component is a significant structural element of research competence, as the ability of a master's student to communicate the results of their research to the scientific community, logically substantiate and justify scientific ideas, and present research findings is considered one of the key indicators of scientific maturity. In the fields of analytical chemistry, physical chemistry, colloid chemistry, and organic chemistry, the accurate interpretation and presentation of scientific results determine the scientific value of research.

This component aims to develop master's students' skills in presenting scientific information clearly and logically, both in written and oral forms, in accordance with academic standards, as well as actively participating in scientific collaboration and engaging effectively in collective scientific communication processes.

The formation of scientific discourse culture through mastering academic writing and the norms of scientific language constitutes the foundation of research competence development. Within this process, the following aspects are addressed:

- the structure of scientific texts, including the introduction, literature review, methodology, results, discussion, and conclusion;
- academic writing style, characterized by clarity, conciseness, logical coherence, and appropriate use of disciplinary terminology;
- international standards for citation and referencing of scientific literature (APA, Chicago, IEEE, ACS);
- working with the requirements of chemistry-related scientific journals (Elsevier, Springer, Wiley).

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At this stage, students process and refine research results in written form, which contributes to the consolidation of scientific thinking.

In preparing dissertation sections in accordance with academic requirements, master's students develop skills in writing concise and informative abstracts, presenting the core scientific ideas of the research in brief summaries, and formulating conclusions that synthesize key scientific findings. This process enhances the master's student's capacity for scientific generalization, analysis, and logical reasoning.

4. Reflective and self-assessment component. The reflective and self-assessment component is one of the key pedagogical mechanisms that contribute to the qualitative improvement of master's students' research activities. It is aimed at developing the ability of master's students to adopt a critical and conscious attitude toward their own scientific activity, to identify errors in a timely manner, to evaluate research results, and to plan subsequent activities. In the educational process, reflection shapes not only the students' knowledge and skills, but also their style of scientific thinking, decision-making culture, and self-development process.

This component fosters the formation of an independent, conscious, and systematic approach to the regular analysis of one's own research activity, the identification of errors, the evaluation of results, and the development of strategies for improvement.

Through maintaining a reflective journal and a research notebook, master's students record the tasks performed at each stage of their scientific activity, the questions posed, the problems encountered, the errors identified, experimental results, daily conclusions, and proposed recommendations in a dedicated journal. This practice significantly enhances metacognitive monitoring among master's students.



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