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THE ROLE OF CHEMICAL EXPERIMENT IN THE DEVELOPMENT OF STUDENTS' RESEARCH COMPETENCIES

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Abstract. The acquisition of research skills by a chemistry teacher is an obligatory part of the training of a specialist teacher. Only when the teacher has mastered the relevant competence can it become the reason for the formation of students' research skills.

Chemistry is a theoretical and experimental science. Thus, experiment is the most important method in his research as a means of obtaining concrete ideas and solid knowledge. Of course, the strongest trace in the memory of students are chemical experiments that he consciously carried out with his own hands, and the information he received, since in this case all types of memory and mental actions are included in the memory process.The modern quality of chemical education is determined by the formation of key competencies, where one of the main ones is research competence. Research competence presupposes the ability to independently apply knowledge in new, non-standard situations.

In modern conditions, the issues of choosing a strategy and methods for the formation of research skills of students are very relevant. These include the following sets of skills: planning your own research activities; setting a task; searching, analyzing and summarizing the necessary information; hypotheses; setting goals and objectives; choosing optimal research methods and techniques; the experiment itself; designing the results of work; formulation of conclusions and conclusions, etc.

The article examines the role of laboratory classes and conducted chemical experiments in the formation of research competence of students of pedagogical universities. When developing a methodology for the formation of students' research competence, we tried to develop a unified plan for the organization of students' research work, a laboratory workshop to ensure the formation of research competence.

Keywords: chemistry, research skills, research work, experiment, research competence, research skills, humic acid, scientific research

Basic provisions

In modern society, the concept of "competence" is considered as the main result of application in the educational process.

According to A.V. Khutorskaya, research competence is considered as the result of a person's cognitive activity in a certain field of science, the acquisition of research competence necessary to understand research methods and techniques, positions, value orientations that he must master in order to carry out research activities [1]. That is, research competence is a set of knowledge in a certain field, the presence of research skills (vision and problem solving based on the nomination and justification of hypotheses, setting and planning goals, collecting and analyzing necessary

information, conducting experiments, presenting research results), the ability to apply this knowledge and skills in a specific activity.

Introduction

Kazakhstan's entry into the world educational space requires the training of competent, competent specialists who adhere to the concept of "lifelong learning". The classification of competencies in education is diverse.

The authors A.V. Khutorskoy, O. E. Lebedeva, D. A. Ivanova, etc. [2] classify competencies related to the general content of education at three levels: subject, general thematic and meta-subject.

Meta-subject competencies include research competence, which combines a whole complex of mental, search, logical creativity.

One of the key competencies being formed in teaching chemistry is research competence. The concept of "research competence" is the knowledge, skills that a researcher demonstrates in the effective study of any problem, the ability to independently apply knowledge in new, non-standard situations. It is known that research competence is formed as a result of research activities. The research works themselves are divided into research and educational research.

As M. N. Artseva has shown, research activities are aimed at obtaining new objective scientific knowledge [3].

In addition, most of the students who have successfully mastered chemical theory, but do not sufficiently perform the received laboratory work, have difficulties in performing practice-oriented tasks. In this regard, the formation of research competence in chemistry lessons in chemistry becomes relevant.

Materials and methods

Research activity is a type of creative activity, therefore it should be considered as an integral part of the problem of the formation of educational and cognitive competence and the development of creative, mental abilities of students. The development of the student's personality, his intellect, feelings, will is carried out only in active activity.

Training of students in research activities, identification of cognitive and personal abilities with the help of various psychological questionnaires, organization of research work. The gradual increase of research competence is justified by ensuring the involvement of students in research work.

The main objectives of the study:

1. formation of research competence and organization of research work;

2. to determine the methodological ways and conditions for the formation of research competence in the learning process;

3. to develop a methodology for the formation of students' research competence through the organization of the work "obtaining humic acid from brown coal" ;

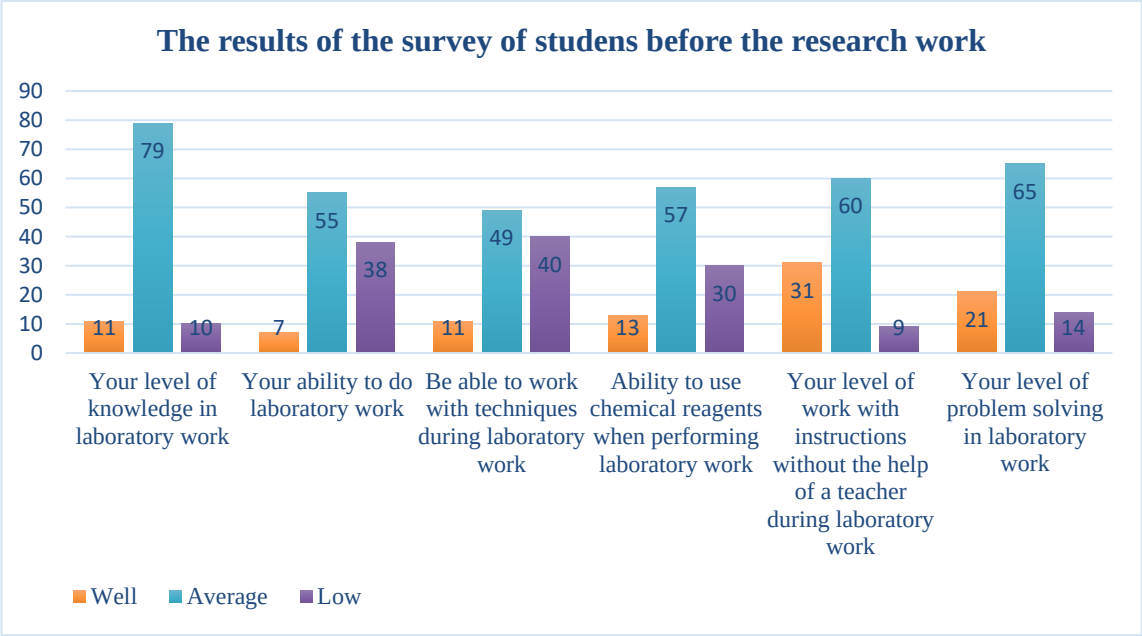
4. conducting a laboratory experiment and determining the effectiveness of the developed methodology.

The purpose of the article is to disclose the content of the methodology for the formation of research competence of students in the specialty «6B05301» chemistry. The formation of research competencies in chemistry lessons in the discipline

"Chemical Technology" is proposed. Research work in the lessons of chemical technology is carried out through the methodological manual "humic acids and methods of their production " [4].

Results

In the course of determining the ability of students to perform laboratory work on the first day of our lesson, a survey was conducted. The result of the survey is shown (Pic.1).



Picture 1- Survey of students before research work

At the research lesson, students master the methodology of scientific research, master the stages of scientific cognition, learn to formulate and solve research problems. BDuring the research work, students' laboratory work is carried out in the form of group and pair work.

This special practical lesson is designed for 4 hours a week, for a total of 15 hours. During the internship, the methodological manual "humic stains and methods of obtaining them" is used. For practical training, 3 lectures (6 hours), 5 laboratory and practical classes (9 hours) are methodically provided. The program of practical training (15 hours) is outlined (Table 1).

Table 1- Content of the research paper "Extraction of humic acid from brown coal" conducted at the chemical technology lesson

Type of practice	Practice content (number of hours)	Tasks	Key competencies
Lecture 1	Study of Humic (1 hour)	General characteristics of scientific research.	The ability to search for various databases, the ability to work in a

		Study of the structure and composition of Humins	team, the ability to independently improve knowledge
Laboratory practical lesson 1.	Familiarization with chemical technologies and training on how they work (2 hours)	Proficiency in working with analytical scales, magneto stirrer, muffle furnace	Competence to independently engage in the improvement of knowledge, to organize the relationship of knowledge, to extract from experience what is useful for yourself
Laboratory practical lesson 2	Acquaintance with chemical reagents, study of what purposes they are used for (2 hours)	Working with flasks, pipettes, measuring cups	Forming, systematizing nodal competencies
Laboratory work 1	Preparation of 4% NaOH solution (1 hour)	Preparation of the solution	Competence to independently engage in the improvement of knowledge, to organize the relationship of knowledge, to extract from experience what is useful for yourself
Laboratory work 2	Preparation of 5% HCl solution (1 hour)	Preparation of the solution	Competence to independently improve knowledge
Laboratory work 3	Isolation of humic acid from brown coal Oi-Karagai. Calculation of the output of the received products (3 hours)	Obtaining humic acid	Competence to independently engage in the improvement of knowledge, to organize the relationship of knowledge, to extract from experience what is useful for yourself
Laboratory work 4	Isolation of humic acid from brown coal sedges. Calculation of the output of the received products (3 hours)	Obtaining humic acid	Competence to independently improve knowledge
Laboratory work 5	Preparation of 4% NaOH solution (1 hour)	Preparation of the solution	Competence to independently improve knowledge

Lecture 2	Final lesson (1 hour)	Summing up the results of the practical lesson	Forming, systematizing, research key competencies

Students during the study: where to start the study? How to do it? How does the researcher behave? conducted a search for queries. Students at the first lecture session: what are Humins? The history of the discovery of humic acid?What is the structure of humic acid ?What is the composition of humic acid? The questions allow students to think about the practical application of search results and determine the prospects for further work.

Laboratory work 1,2: The students were divided into two groups. Our goal in dividing into groups is to determine from which type of brown coal humic acid is released in large quantities.

Group 1. Isolation of humic acid from brown coal Oi-Karagai. Calculation of the output of the received products.

Group 2. Isolation of humic acid from brown coal sedges. Calculation of the output of the received products.

When forming a component of laboratory work, a situational approach is proposed for setting goals and objectives. Students are offered ready-made goals and objectives, as well as questions are asked: what are we studying, from which coal is it more profitable to obtain humic acid? With this approach, students clearly define the property of this brown coal, namely, from which coal the largest amount can be obtained. Table №2 presents a methodological method for the formation of research competence, the ability to independently set goals and objectives.

Table 2- methodical method of formation of research competence-the ability to independently set goals and objectives

Method-goals independently set goals:	Group 1. Isolation of humic acid from brown coal Oi-Karagai.	Group 2. Isolation of humic acid from brown coal sedges.
Goals	Why was a large amount of humic acid isolated from brown coal Oi-Karagai?	Why was a small amount of humic acid released from brown coal sedges?
	Determine from Oi-Karagai brown coal humic acid is obtained in greater quantities due to its properties	Determine due to what properties humic acid is obtained from brown coal sedges in smaller quantities
Tasks	Preparation of 4% NaOH solution.	Preparation of 4% NaOH solution.
	Preparation of a 5% HCl solution.	Preparation of a 5% HCl solution.
	Filter with the installation of filter paper in the Buchner funnel	Filter with the installation of filter paper in the Buchner funnel
	Calculation of the output of the received products	Calculation of the output of the received products

When completing a task, students of each group first independently familiarize themselves with the instructions specified in the methodological manual, then prepare the necessary solutions for the work, summarize the research work.

Discussion

The students intend to implement the second part of the laboratory work with an interest in studying the properties of brown coal and Humins. In the laboratory work done above, a study is carried out by replacing the used solution with a 4% KOH solution. The purpose of the research work is to identify the possibility of changing the amount of the product obtained by replacing the solution when obtaining humic acid from two different brown coals.The groups are given a task, the solution of which they consider during the research work:

Task 1. From which type of brown coal is it most effective to obtain humic acid?

Task 2. What changes did you notice using a 4% KOH solution?

Most of the students were able to achieve the correct result: they determined the effectiveness of obtaining humic acid from pine brown coal and the possibility of obtaining a large amount of the product using a 4% NaOH solution.

The work of the groups was organized according to a predetermined plan, all groups worked with enthusiasm, were united. Each time during the research work, they adhered to the point of view: "we can find answers to difficult questions", "we perform complex tasks".

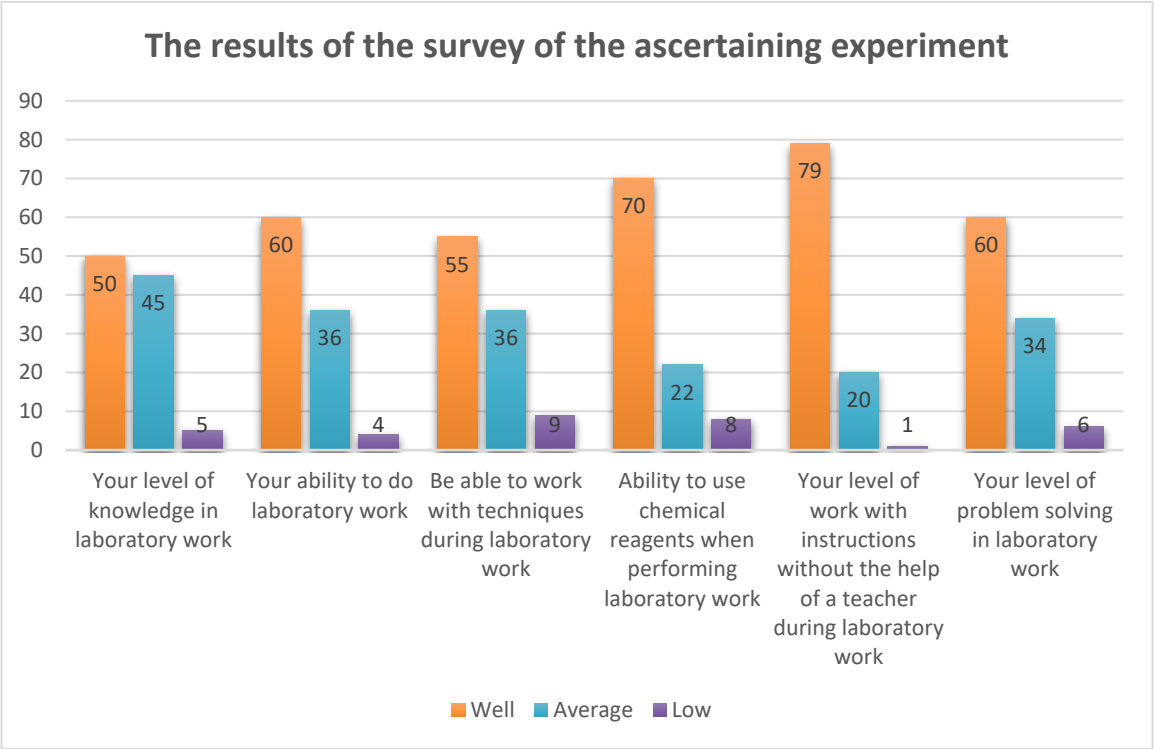
Thus, systematic work, situativeness, activity, individual approach, research work contributed to the formation of research competence.

At the end of the chemical technology lesson, during the identification of changes in the ability of students to perform laboratory work, the final questionnaire was received *Picture №2* in *Table №3*. In the initial result of the survey, the level of knowledge in laboratory work was 50% (good), the ability to perform laboratory work was 60% (good), and knowledge of chemical reagents and technology was 55-70% (good). The ability to do laboratory work and reports increased by 60-79% (good).

Table 2- Results of the survey of the definition experiment

At what level are you in this questionnaire	The first indicated result			The last received result		
Levels	Good	Average	Low	Good	Average	Low
Your level of knowledge in laboratory work	11%	79%	10%	50%	45%	5%
Your ability to do laboratory work	7%	55%	38%	60%	36%	4%
Your ability to do laboratory work	11%	49%	40%	55%	36%	9%
Be able to work with techniques during laboratory work	13%	57%	30%	70%	22%	8%
Ability to use chemical reagents when performing laboratory work	31%	60%	9%	79%	20%	1%
Your level of work with instructions without the help of a teacher during laboratory work	21%	65%	14%	60%	34%	6%

Your level of problem solving in laboratory work	10%	80%	20%	50%	45%	5%



Picture 2- Survey of students after research work

Statistical analyses of the questionnaires received and the results of laboratory work after their implementation were carried out. Each student was asked to make an application for laboratory work at the beginning and at the end of the educational process, as well as each group of students to present the output of products obtained during laboratory work.

Conclusion

In conclusion, it was possible to formulate a conceptual understanding of the knowledge gained about the way to obtain humic acid from brown coal for the development of students' research competencies. The course work carried out in a laboratory equipped with modern special equipment contributed to the training of students at a high level based on the curriculum. The course work carried out for the development of students' research competence helps to develop students' activity, formulate explanations to arguments.

Thus, the results of the study show that students have an increased level compared to primary education.

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СТУДЕНТТЕРДІҢ ЗЕРТТЕУШІЛІК ҚҰЗЫРЕТТІЛІГІН ДАМЫТУДАҒЫ ХИМИЯЛЫҚ ЭКСПЕРИМЕНТТІҢ РӨЛІ

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Аңдатпа. Химия мұғалімінің зерттеу жұмысының дағдыларын игеруі маман-мұғалімді даярлаудың міндетті құрамдас бөлігі болып табылады. Оқытушы тиісті құзыреттілікті игерген жағдайда ғана білім алушылардың зерттеу дағдыларын қалыптастыруға себеп болуы мүмкін.

Химия-Теориялық және эксперименттік ғылым. Сондықтан эксперимент оны зерттеу барысында нақты идеялар мен берік білім алу құралы ретінде ең маңызды әдіс болып табылады. Әрине, білім алушылардың жадындағы ең күшті із-ол өз қолымен саналы түрде жүргізген химиялық эксперименттер және өзі алған ақпарат, өйткені бұл жағдайда есте сақтау процесіне жадтың барлық түрлері мен ақыл-ой әрекеттері кіреді.Химиялық білім берудің қазіргі сапасы негізгі құзыреттіліктерді қалыптастырумен анықталады, мұнда негізгілерінің бірі зерттеушілік құзыреттілік болып табылады. Зерттеушілік құзыреттілік білімді жаңа, стандартты емес жағдайларда өз бетінше қолдана білуді қамтиды.

Қазіргі жағдайда білім алушылардың зерттеу дағдыларын қалыптастырудың стратегиясы мен әдістерін таңдау мәселелері өте өзекті. Оларға келесі дағдылар жиынтығы кіреді: жеке зерттеу қызметін жоспарлау; мәселені тұжырымдау; қажетті ақпаратты іздеу, талдау және жалпылау; гипотезалар ұсыну; мақсаттар мен міндеттер қою; зерттеудің оңтайлы әдістері мен әдістерін таңдау; эксперименттің өзі; жұмыс нәтижелерін жобалау; тұжырымдар мен қорытындыларды тұжырымдау және т. б.

Мақалада педагогикалық жоғары оқу орындарында студенттерінің зерттеу құзыреттілігін қалыптастыруда зертханалық сабақтар мен жүргізілетін химиялық эксперименттердің рөлі қарастырылады. Білім алушылардың зерттеушілік құзыреттілігіін қаыптастыру әдістемесін әзірлеу кезінде зерттеушілік білікті қалыптастыруды қамтамасыз

етуде білім алшылардың зерттеу жұмысын ұйымдастырудың бірыңғай жоспарын, лабораториялық практикумын жобалауға тырыстық.

Тірек сөздер: химия, зерттеушілік білік, зерттеу жұмысы, эксперимент, зерттеу құзыреттілігі, зерттеу дағдылары, гумин қышқылы, ғылыми зерттеу

РОЛЬ ХИМИЧЕСКОГО ЭКСПЕРИМЕНТА В РАЗВИТИИ ИССЛЕДОВАТЕЛЬСКИХ КОМПЕТЕНЦИЙ СТУДЕНТОВ

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Аннотация. Приобретение учителем химии навыков исследовательской работы является обязательной составной частью подготовки учителя-специалиста. Только при овладении преподавателем соответствующей компетенцией может стать причиной формирования у обучающихся исследовательских навыков.

Химия - это теоретическая и экспериментальная наука. Таким образом, эксперимент является наиболее важным методом в его исследовании как средство получения конкретных идей и прочных знаний. Безусловно, самым сильным следом в памяти обучающихся являются химические эксперименты, которые он сознательно проводил своими руками, и полученная им информация, так как в этом случае в процесс памяти включаются все виды памяти и умственные действия.Современное качество химического образования определяется формированием ключевых компетенций, где одной из основных является исследовательская компетенция. Исследовательская компетенция предполагает умение самостоятельно применять знания в новых, нестандартных ситуациях.

В современных условиях очень актуальны вопросы выбора стратегии и методов формирования исследовательских навыков обучающихся. К ним относятся следующие наборы навыков: планирование собственной исследовательской деятельности; постановка задачи; поиск, анализ и обобщение необходимой информации; выдвижение гипотез; постановка целей и задач; выбор оптимальных методов и приемов исследования; сам эксперимент; проектирование результатов работы; формулировка выводов и выводов и др.

В статье рассматривается роль лабораторных занятий и проводимых химических экспериментов в формировании исследовательской компетентности студентов педагогических вузов. При разработке методики формирования исследовательской компетентности обучающихся мы пытались разработать единый план организации исследовательской работы обучающихся, лабораторный практикум в обеспечении формирования исследовательской компетентности.

Ключевые слова: химия, исследовательские навыки, исследовательская работа, эксперимент, исследовательская компетентность, исследовательские навыки, гуминовая кислота, научное исследование

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