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LEARNING METHODS OF THE COURSE «CHEMISTRY AND TECHNOLOGY OF MICROHETEROGENEOUS SYSTEMS»

Abstract

This article is a study that examines the issues of teaching a chemistry course and its connection with the technologies of microheterogeneous systems. The article draws attention to the relevance of this topic, given the rapid development of modern science and technology.

Based on this, the basic methodological techniques for teaching a chemistry course are shown, and the role and significance of microheterogeneous systems in the educational process is also considered. The possibilities of effective and interactive teaching of chemistry are analyzed. The article is devoted to the use of modern information technologies in the educational process.

It also offers the use of interactive electronic resources, computer simulations, and virtual laboratories to visually and effectively explore the chemistry and technology of microheterogeneous systems.

The main focus of the article is on describing modern methods and approaches that help teachers effectively teach a chemistry course to students using microheterogenic systems technologies. The work is of interest to specialists in the fields of chemistry, materials science, pharmaceuticals, biomedicine, nanotechnology and physics. The article provides examples of practical exercises that will help students understand and apply their knowledge in real life. In addition, this article presented the results and studies of the classes conducted with students.

Key words: Chemistry course, effective methods, microheterogeneous systems, educational methodology, chemical technology, pharmaceutical, educational program.

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«МИКРОГЕТЕРОГЕНДІ ЖҮЙЕЛЕРДІҢ ТЕХНОЛОГИЯСЫ МЕН ХИМИЯСЫ» КУРСЫН ОҚЫТУ ӘДІСТЕМЕСІ

Аңдатпа

Бұл мақала химия курсының оқыту мәселелерін және оның микрогетерогенді жүйелер технологиясымен байланысын қарастыратын зерттеу болып табылады. Мақалада қазіргі ғылым мен техниканың қарқынды дамуын ескере отырып, осы тақырыптың өзектілігіне назар аударылады.

Осының негізінде химия курсының оқытудың негізгі әдістемелік тәсілдері көрсетіліп, микрогетерогенді жүйелердің оқу процесіндегі рөлі мен маңызы да қарастырылады. Химияны тиімді және интерактивті оқытудың мүмкіндіктері талданады. Мақала оқу үрдісінде заманауи ақпараттық технологияларды пайдалануға арналған.

Ол сонымен қатар микрогетерогенді жүйелердің химиясы мен технологиясын көрнекі және тиімді зерттеу үшін интерактивті электронды ресурстарды, компьютерлік модельдеулерді және виртуалды зертханаларды пайдалануды ұсынады.

Мақаланың басты назары мұғалімдерге микрогетерогенді жүйелер технологияларын қолдана отырып, студенттерге химия курсының тиімді оқытуға көмектесетін заманауи әдістерді және тәсілдерді сипаттауға бағытталған. Жұмыс химия, материалтану, фармацевтика, биомедицина, нанотехнология және физика салаларының мамандарын қызықтырады. Мақалада студенттердің алған білімдерін нақты өмірде түсінуге және қолдануға көмектесетін практикалық жаттығулардың мысалдары келтірілген. Сонымен қатар, аталған мақалада студенттермен өткізілген сабақтың нәтижелері мен зерттеулері ұсынылды.

Түйін сөздер: Химия курсы, тиімді әдістер, микрогетерогенді жүйелер, оқу әдістемесі, химиялық технология, фармацевтика, оқу бағдарламасы.

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МЕТОДИКА ПРЕПОДАВАНИЯ КУРСА «ХИМИЯ И ТЕХНОЛОГИЯ МИКРОГЕТЕРОГЕННЫХ СИСТЕМ»

Аннотация

Данная статья представляет собой исследование, в котором рассматриваются вопросы преподавания курса химии и ее связь с технологией микрогетерогенных систем. В статье акцентируется внимание на актуальности данной темы с учетом бурного развития современной науки и техники.

На основе этого показаны основные методические приемы преподавания курса химии, а также рассмотрена роль и значение микрогетерогенных систем в учебном процессе. Анализируются возможности эффективного и интерактивного преподавания химии. Статья посвящена использованию современных информационных технологий в образовательном процессе.

Также предлагает использование интерактивных электронных ресурсов, компьютерного моделирования и виртуальных лабораторий для визуального и эффективного изучения химии и технологии микрогетерогенных систем.

Основное внимание в статье уделяется описанию современных методов и подходов, которые помогают учителям эффективно преподавать курс химии с использованием технологий микрогетерогенных систем. Работа привлекает специалистов в области химии, материаловедения, фармацевтики, биомедицины, нанотехнологий и физики. В статье приведены примеры практических упражнений, которые помогут студентам понять и применить полученные знания в реальной жизни. Кроме того, в данной статье были представлены результаты и исследования проведенных занятий со студентами.

Ключевые слова: Курс химии, эффективные методы, микрогетерогенные системы, методика обучения, химическая технология, фармацевтика, образовательная программа.

Basic rules. The research objective is based on the use of a new teaching methodology for the course chemistry and technology of microheterogenic systems, which allows for a better study of colloidal disciplines at universities by creating an innovative educational environment. The research uses analytical, experimental, and statistical research methods. The main methods of creating MGS are synthesis, self-organization and self-assembly of micro- and nanoparticles, as well as combined methods. This study involved 10 third-year undergraduate students studying colloidal chemistry at the Faculty of Natural Sciences. The venues are lectures, seminars and laboratory work. Courses in chemistry and technology of microheterogenic systems will help students understand the basics and principles of how such systems work, as well as learn how to design and create their own microheterogenic systems. It will be useful for future careers in science, engineering, medicine and other related fields.

Introduction. Modern methods of teaching chemistry at universities are being actively introduced as part of the education reform [1]. One of these methods is the use of active forms of work, which contribute to the activation of students' learning activities and the development of their creative thinking.

In modern methods of teaching chemistry at universities in Kazakhstan, much attention is paid to practical work. Students are given the opportunity to conduct chemical experiments, observe chemical reactions, and study the properties of substances. This allows them to better understand the basics of chemistry and consolidate theoretical knowledge in practice.

Also, modern methods of teaching chemistry actively use interactive technologies. Students are encouraged to work with electronic textbooks, videos, and computer programs that help them better understand the material and allow them to study chemistry in an interesting and accessible way [2].

Another important component of modern methods of teaching chemistry is the individualization of the educational process. Teachers try to take into account the individual characteristics of each student, as well as their interests and needs. This helps create a comfortable learning environment and promotes more effective learning of the material.

Modern methods of teaching chemistry at universities in Kazakhstan are aimed at developing students, enhancing their cognitive activity and developing their interest in chemistry[3]. They contribute to a deeper understanding of the subject and the development of key skills necessary for further education and professional activities.

Based on this, we can determine the importance of courses in the chemistry of microheterogeneous systems technology. You need to pay attention to which ones are important for students for several reasons:

1. Understanding the basics of chemical processes: Courses in the chemistry of microheterogeneous systems technology help students understand the basics of chemical processes that occur at the micro level. This involves studying the properties and interactions of various microparticles such as colloids, nanoparticles and molecules.

2. Practical Application: Courses in the chemistry of microheterogeneous systems technology also help students understand how this knowledge can be applied in practice. They teach students to

use microheterogeneous systems to create new materials, devices and technologies that can be useful in many industries, including medicine, electronics and energy.

3. Development of critical thinking: Studying the chemistry of microheterogeneous systems technology requires students to develop critical thinking and analytical skills. They must be able to analyze and evaluate various chemical processes and apply their acquired knowledge to solve complex problems.

4. Preparing for Future Careers: Courses in the chemistry of microheterogeneous systems technology can also be useful in preparing students for future careers in science and technology. This knowledge can help them get jobs in laboratories, research centers or companies developing new materials and technologies [4,5].

Overall, microheterogeneous systems chemistry courses play an important role in shaping students and equipping them with the necessary knowledge and skills for a successful career in science and technology.

First, let's define this concept - Microheterogeneous systems (MHS) technology refers to the field of nanotechnology and is a method for creating materials consisting of micro- or nanoparticles of various compositions, sizes and shapes [6].

MGS are used in many fields, including medicine, electronics, pharmaceuticals, cosmetics, etc. They enable the creation of materials with unique properties, such as controlled structure, increased stability, improved solubility and bioavailability, and improved optical, magnetic or electrical properties.

Materials and methods. The main methods for creating MGS include synthesis, self- organization and self-assembly of micro- and nanoparticles, as well as combined methods. Synthesis can be carried out in a variety of ways, including chemical reactions, physical deposition, electrochemical methods, laser technologies, and others.

MGS have a wide range of applications. For example, in medicine, they can be used to deliver drugs to exactly the right place in the body, to create tissue engineered structures, or to diagnose diseases. In electronics, MGS can be used to create ultra-compact and high-performance devices. In pharmaceuticals, they can be used to improve the formulation of drugs.

MGS technology has great potential and continues to develop, opening up new opportunities for creating materials with unique properties and applications.

To teach students at universities in Kazakhstan a course in chemistry on the technology of microheterogeneous systems, the following methods and approaches can be used [14]:

Table-1. Presented methods for the course

№	Type of method	Meaning
1	Using interactive educational materials:	Creating interactive presentations, video lessons, animations, interactive tasks and tests. This will enable students to better understand the basic principles and applications of microheterogeneous systems.
2	Practical work and experiments:	Conducting laboratory work where students will be able to independently study and explore microheterogeneous systems. This will help them better understand the theoretical foundations and consolidate their knowledge in practice.
3	Project activities:	Organizing projects in which students will research and develop microheterogeneous systems. This will help them develop critical thinking, independence and creative problem solving.
4	Use of information technology:	Use of computer programs and simulations for visualization and modeling of microheterogeneous systems. This will help students to better visualize abstract concepts and processes

5	Interactive teaching methods:	Use of discussions, group assignments, games and role-playing to encourage active student participation in the learning process. This will help them better understand the material and develop communication and collaboration skills.
6	Using real-life examples:	Drawing on examples and applications of microheterogeneous systems from various industries and research. This will help students see the practical relevance and applicability of the material being studied

And also, teachers can teach colloid chemistry to students in this course. Colloid chemistry is a branch of science that studies colloidal systems. Colloidal systems are mixtures in which one or more components are dispersed in another medium. The main difference between colloidal systems and conventional solutions and suspensions is the particle size of the dispersed phase, which ranges from 1 to 1000 nanometers [7].

One of the key features of colloidal systems is their surface activity. Surfactants, such as soap or detergents, can reduce the surface tension of a liquid and increase its interfacial area. This property is widely used in industry, for example, in the production of detergents and emulsions.

Colloidal systems also have properties that distinguish them from solutions and suspensions. One of these properties is optical activity, which manifests itself in the ability of colloidal systems to scatter light[8]. Thanks to this property, we see different colors in colloidal solutions such as milk or dyes.

Colloid chemistry also has a wide range of applications in various fields of science and industry. For example, in medicine, colloidal systems are used to create dosage forms such as microcapsules or nanoparticles that can deliver drugs to exactly the right place in the body. In the food industry, colloidal systems are used to create stable emulsions, foams and gelling agents[9].

Colloidal chemistry is a fascinating and multifaceted science that studies invisible microworlds and their impact on the environment. Its principles and methods help us understand and control various physical and chemical processes, as well as create new materials and technologies.

Without colloidal chemistry, our understanding of the world would be significantly limited, so its study and development is an important task for modern science. Teaching methods in the course of chemistry and technology of microheterogeneous systems are an important component of the education process in the field of chemistry and technology [10].

This course is a comprehensive study of the properties and applications of microheterogeneous systems that play important roles in various fields of science and industry.

Microheterogeneous systems are materials or substances consisting of microscopic particles that have different physical and chemical properties. They are widely used in areas such as catalysis, electrochemistry, optics, biomedicine and others. Therefore, the ability to work with microheterogeneous systems is essential for chemists and technologists to develop new materials and technologies.

According to the course "Chemistry and technology of microheterogenic systems», classes were held for 3rd year students of Al-Farabi Kazakh National University. The survey was conducted on the Google Forms platform. The questionnaire questions are presented in the table:

Table-2. *Questionnaire questions*

Is it relevant to take the course «Chemistry and technology of microheterogenic systems»?	Yes No
Rate on a 10-point scale how important this is for your profession	Written response
What are the advantages and disadvantages of the course?	Written response

How is feedback conducted in the lesson?	Written response
Is the way of passing the lesson different from other subjects?	Yes No
Have the lectures been able to fully explain the subject for you?	Yes No
How was the laboratory work carried out?	Written response
Do you like the course «Chemistry and technology of microheterogenic systems»?	Yes No

Results. 10 students took part in the survey. The questionnaire was devoted to determining how understandable the materials developed for the course "chemistry and technology of Microheterogenic systems" are to students in general. It also allows you to assess how effective an educational and methodological complex can be using a questionnaire.

As a result of the survey, the vast majority of students left warm feedback that the lesson went well. The results of the test type survey are shown in figure 1.

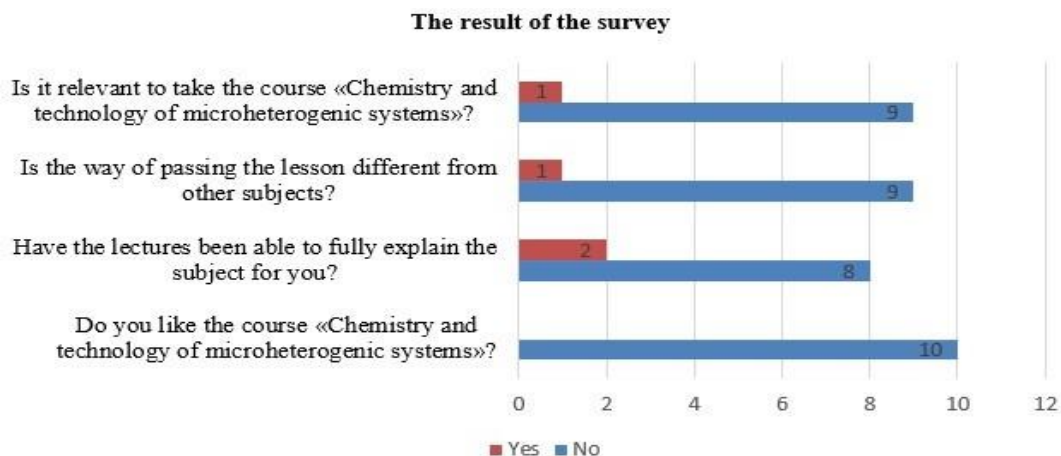


Figure – 1. Results of the survey in the form of a test

The result of the question «Rate on a 10-point scale how important this is for your profession» is shown in figure 2.

Rate on a 10-point scale how important this is for your profession

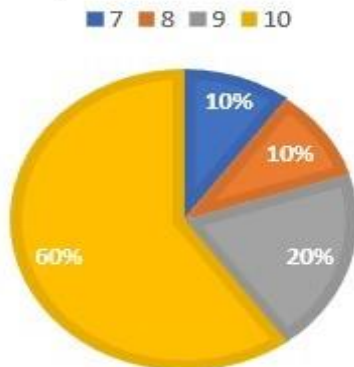


Figure – 2. The result of the question «Rate on a 10-point scale how important this is for your profession»

If we discuss the results of the written answer, «What are the advantages and disadvantages of the course?» on the question, many received answers that there is no disadvantage, the advantage allows you to study colloidal chemistry more deeply and the lesson was interesting. «How is feedback conducted in the lesson?» they answered the question very interestingly, and also gave examples of methods used in the classroom: poster protection, test tasks, QR code, Google, Quizizz, Learning apps, etc. The students left the following written answers about «performing laboratory work»: laboratory work was carried out in accordance with the workshop; all reagents and equipment were available, final reports were easily and quickly prepared and general laboratory classes were well conducted.

Discussion. Thus, the study of chemistry and technology of microheterogenic systems is of great importance for students with a chemistry course. This interesting line of research allows us to understand the basic principles of the interaction of various components in the system, their impact on reaction and transport processes, as well as the possibilities of application in various fields of science and technology. In addition to theoretical knowledge, students studying microheterogenic systems also gain skills in working with modern methods of analysis and synthesis of materials. This helps them to develop critical thinking, apply their knowledge in practice and create new innovative solutions.

Research in the field of microheterogenic systems opens up broad prospects for students for further professional growth and participation in various research projects. Understanding the principles of functioning of such systems will help them successfully apply their knowledge in their future careers in chemistry, biology, pharmacy, materials science and other related fields of science. All this makes the study of chemistry and technology of microheterogenic systems an important and promising field of study for students of chemical specialties.

The teaching of a course in the chemistry and technology of microheterogeneous systems should be organized in such a way that students receive a complete understanding of the properties and applications of microheterogeneous systems. To achieve this, various teaching methods can be used to help students learn the material more effectively.

One of the main teaching methods is the lecture course. Lectures allow the teacher to convey basic theoretical knowledge about microheterogeneous systems, their properties, methods of their preparation and applications. Students listen to lectures, take notes, and ask questions to encourage active participation in the learning process.

In addition to lectures, laboratory work plays an important role in training. They allow students to practically apply their theoretical knowledge, conduct experiments with microheterogeneous systems and study their properties. Laboratory work may include tasks such as the synthesis and analysis of microheterogeneous systems, measurement of their physical and chemical properties, and study of their interactions with other substances [11]. This allows students to develop skills in working with chemical equipment and instruments, as well as master methods and technologies for working with microheterogeneous systems.

Techniques such as group projects and discussions can be used to enhance the learning process. Group projects allow students to work in teams, combining their knowledge and skills to solve specific problems. This develops teamwork skills, critical thinking and a problem-based approach to the material being studied. Discussions can take place either in class or online and allow students to discuss issues, express their opinions and argue their points. This contributes to the development of communication skills and the ability to analyze and evaluate information [12].

An important element of the teaching methodology is also the use of modern information technologies. With the help of computer programs and interactive educational materials, students can study microheterogeneous systems interactively, perform virtual experiments and simulate the properties of their substances. This allows students to better understand complex processes and

phenomena, as well as develop skills in working with modern information technologies. Thus, teaching methods in the course of chemistry and technology of microheterogeneous systems should include lecture courses, laboratory work, group projects, discussions and the use of modern information technologies. This will allow students to gain a thorough understanding of microheterogeneous systems, their properties and applications, and develop the necessary skills to work in this field.

Today, the current teaching methodology for a course in chemistry and technology of microheterogeneous systems may vary depending on the educational institution offering this course. However, in general, training for this course may include the following elements [13]:

1. Lectures: students listen to lectures in which the teacher explains the basic theoretical concepts and principles of chemistry and technology of microheterogeneous systems. Lectures may cover topics such as the properties of microheterogeneous systems, their classification, synthesis methods and applications.

2. Laboratory work: Students conduct practical exercises in the laboratory, during which they study various methods for synthesizing microheterogeneous systems, analyze their properties and conduct experiments to obtain data on their chemical composition and structure.

3. Seminars: In seminars, students discuss and analyze problems and issues related to the chemistry and technology of microheterogeneous systems. They can also present their research or projects related to this topic.

4. Individual and Group Projects: Students may undertake individual or group projects in which they investigate specific aspects of the chemistry and technology of microheterogeneous systems. This may include reviewing the literature, conducting experiments, analyzing data, and presenting results.

5. Exams and Quiz: At the end of the course, students take exams and quizzes to test their knowledge and understanding of the material covered in the course.

It is also important to conduct regular assessments and assessments of students' progress to monitor their progress and adjust teaching methods as necessary.

Courses in the chemistry of microheterogeneous systems technology help students understand the basics of chemical processes that occur at the microlevel [15]. This involves studying the properties and interactions of various microparticles such as colloids, nanoparticles and molecules.

We also pay attention to practical application: Courses in the chemistry of microheterogeneous systems technology also help students understand how this knowledge can be applied in practice. They teach students to use microheterogeneous systems to create new materials, devices and technologies that can be useful in many industries, including medicine, electronics and energy.

Another important aspect is the development of critical thinking: Studying the chemistry of microheterogeneous systems technology requires students to develop critical thinking and analytical skills. They must be able to analyze and evaluate various chemical processes and apply their acquired knowledge to solve complex problems.

Preparing for Future Careers: Courses in the chemistry of microheterogeneous systems technology can also be useful in preparing students for future careers in science and technology. This knowledge can help them get jobs in laboratories, research centers or companies developing new materials and technologies.

Overall, microheterogeneous systems chemistry courses play an important role in shaping students and equipping them with the necessary knowledge and skills for a successful career in science and technology.

Conclusions. Around the world, courses on chemistry and technology of microheterogeneous systems for students will become increasingly important and popular [16]. With the development of science and technology, including nanotechnology, microelectronics and materials science, new opportunities and prospects in the field of microheterogeneous systems are emerging [17].

Courses in the chemistry and technology of microheterogeneous systems will help students understand the basics and principles of operation of such systems, as well as learn how to design and create their own microheterogeneous systems. This can be beneficial for future careers in science, engineering, medicine and other related fields [18].

In Kazakhstan, such courses can become part of a developing educational program. The country already has and is developing centers and laboratories that are engaged in research in the field of microheterogeneous systems [19]. Courses on chemistry and technology of microheterogeneous systems for students can be created through the joint efforts of educational institutions, scientific institutes and industrial enterprises [20].

Such courses will help prepare a new generation of specialists who will be ready to apply knowledge and skills in the field of microheterogeneous systems to solve real-world problems and challenges. In addition, the development of such courses can stimulate research and innovation in this field, which in turn can contribute to the development of the country's scientific and technological potential.

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ЖАРАТЫЛЫСТАНУ ЖӘНЕ МАТЕМАТИКА ПӘНДЕРІН ОҚЫТУ НЕГІЗІНДЕ ОҚУШЫЛАРДЫҢ СЫНИ ТҰРҒЫДАН ОЙЛАУ ДАҒДЫЛАРЫН ДАМУ

Аңдатпа

Берілген мақалада қазіргі кезде өте өзекті болып саналатын тақырып қарастырылды. Мақаланың тақырыбы: Жаратылыстану және математика пәндерін оқыту кезінде интерактивті оқыту стратегиялары арқылы оқушылардың сыни тұрғыдан ойлау дағдыларын дамыту. Неліктен бұл тақырып өзекті? Мақалада Lesson Study тәсілін ұйымдастыру тәжірибесі қарастырылады және оны қолданудың тиімділігі негізделеді, өйткені сабақты зерттеу мұғалімнің кәсіби дамуына, оны оқытуға және қолдауға бағытталған. Оқытудың әдіс-тәсілдерін жетілдіруге мүмкіндік беретін және әрбір оқушының білім деңгейін арттыруға көмектесетін оқытуға деген көзқарасты өзгерту үрдісі ашылды. Сондықтан, оқушылардың жаратылыстану пәндеріне қызығушылықтарын арттыру өзекті болып саналады. Мақалада жаратылыстану ғылымы – химия, география, биология, математика пәндерінің адамзатқа пайдасы өте зор екені келтірілді. Атап айтатын болсақ, қазіргі біздің қолданып жүрген тұрмыстағы заттары- мыз, тамақ өнеркәсібі, кір жуу, қолданатын дәрілеріміз және т.б көптеген заттардың барлығы жаратылыстану пәндеріне тікелей байланысты. Сондықтан да жаратылыстану пәндері адамзат үшін өте пайдалы ғылым болып саналады. Сондай-ақ мақалада жаратылыстану пәндерінен оқушылардың қызығушылықтарының төмен болу себептері айқындалды, әдебиет- терге шолу бөлімінде химия пәнінен ғалымдардың мектеп оқушыларына сабақ өту барысын- да жүргізген зерттеулері, химия пәнінен мектеп оқушыларының қызығушылығын арттыратын оқыту технологиялары мен әдістері қарастырылды. Зерттеу әдістерінде жалпы барлық дәйектерге және өзіндік тәжірибелерге сүйене отырып ортақ мәліметтер негізінде жұмыстар жасалды. «Не себепті жаратылыстану пәндері оқушылар үшін қиындық туғызады, оқушыларды жаратылыстану пәндеріне қалай қызықтыра аламыз?» деген сұрақтардың жауабы табылды және оқушылардың жаратылыстану пәндеріне қызығушылығын арттыруға бағытталған зерттеулер жүргізілді. Зерттеу әдістерінде оқушыларға интерактивті оқыту стратегиялары арқылы жаратылыстану және математика пәндерін оқыту кезінде сыни ойлау дағдыларын дамытуға қаншалықты көмектесетіні бойынша эксперимент жүргізілді. Осы стандартқа бейімделген оқушылар міндетті түрде жаратылыстану пәндері мен математиканы түсіне алады және қызығушылықтары артады. Оқушыларға жүргізілген зерттеулер арқылы оқушылардың жаратылыстану пәндеріне білім деңгейлері мен қызығушылықтарының төмен болу себептері анықталды.

Түйін сөздер: зерттеу, аргумент дағдылары, интерактивті оқыту стратегиялары, жаратылыстану және математика пәндерін оқыту, сыни тұрғыдан ойлау, Lesson study.