ХИМИЯНЫ ОҚЫТУ ӘДІСТЕМЕСІ
МЕТОДИКА ОБУЧЕНИЯ ХИМИИ
METHODS OF TEACHING CHEMISTRY

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Methodology and psycho-pedagogical research in realizing profile elective course of Chemistry

The programme of the pre-profile elective course «Chemistry around us, or what you will not learn on the lesson» was designed for 34 hours. When conducting a course at the specialized boarding school «Daryn» among 9th grade students, the following general didactic principles were guided, namely scientific character, accessibility, systematic, voluntary, safety, and visualization. The psychological and pedagogical diagnostics of students for group interaction, the study of personality, the motivation for chemistry teaching process, the study of difficulties and anxiety, as well as age characteristics, were carried out. The determination of the personality result showed a slight increase in the number of ambiverts after the elective course, and the average psychodynamic properties score remained at the same level. Motivation to learn chemistry in the group increased. Testing the control lessons and final testing in chemistry among 9-grade students showed the following results, namely 3 students received «Satisfactory», 5 students obtained «Good», 2 students scored «Excellent». The quality of knowledge was 70 %. On the basis of the obtained data we can draw a conclusion that the course increased knowledge of pupils to studying of a subject.

Keywords: elective course, specialized training, laboratory work, testing, household chemicals, questioning, motivation, students, the programme.

Introduction

The history of the development of specialized training in the Republic of Kazakhstan has for decades. The first stage of the organization of profile education in our country was the Concept for the development of the secondary school of the Republic of Kazakhstan (1996). The second stage of the implementation of the idea of profile education is the realization and introduction of the State Compulsory Standard of Secondary General Education of the Republic of Kazakhstan «Basic Provisions» (SES 2.003–2002) [1].

Subject programmes on the basis of the standard were developed in two areas of study: in natural-mathematical and socially-humanitarian. For the first time domestic specialized textbooks and educational-methodical complexes appeared. They were experimentally tested. And now they are used in 10th grade of secondary schools.

The next stage was the State programme of 12-year education of Kazakhstan 2005–2010. The current stage of the implementation of school education reform in the Republic of Kazakhstan can be called the stage of preparation for the introduction of specialized education. The considerable practical experience was accumulated in organizing teaching on directions and profiles. Thus, in Kazakhstan there are a conceptual and methodological basis for improving the regulatory framework and the scientific and methodological support for the organization of specialized training.

The results of psychological and pedagogical research in the profile chemistry elective course «Chemistry around us, or what you will not learn in class» are presented in this paper. The course programme is designed for 34 hours and is intended for students of the 8–9th grade of the secondary school [2].

Aims and objectives of programme are deepening the basic knowledge of students in chemistry, increasing creative activity and expanding the outlook of students, scientifically substantiate the importance of maintaining a healthy lifestyle through:

– detailed description of substances used by humans (their classification, origin, nomenclature, production, use, properties);
– simulation of the effects of drugs on the human body;
– imparting an applied focus of practical research work to develop students' competent behavior on contact with household chemicals and cosmetics;
– the formation of skills for a healthy lifestyle;
– formation of bright visual images of chemical production.

The content and forms of the elective course should contribute to a deeper and more comprehensive perception of the educational material of the basic course of chemistry.

Lessons in accordance with the programme of the course involve:

– repetition of theoretical issues studied in primary school, their deepening and expansion;
– application of theoretical knowledge in practice;
– familiarity with the main types of chemical production;
– teaching students for independent work using various literature.

Achievements are fixed in the completeness and correctness of the students performing tasks. The requirements for knowledge and achievements of students should not be exaggerated in no case. Excessive requirements generate overload and leads to the extinction of interest. The course should help students to understand their interest level in chemistry and assess their capabilities, fully supported and developed through the accumulation of assessments of individual student achievement.

Experimental

This elective course was introduced in the specialized boarding school «Daryn» in Karaganda city, among 9th grade students, which is confirmed by the introduction act.

We have proposed the following sections of this programme:

I. History of chemistry — 3 hours;
II. Chemistry and production — 4 hours;
III. Ecological chemistry and medicine — 7 hours;
IV. Household chemicals — 4 hours;
V. Food chemistry — 12 hours.

In general, 12 hours were selected for students in grade 9 (16 students).

Preliminary testing was carried out.

Test results were as following: 3 students obtained scores of «Unsatisfactory», 6 students received «Satisfactory», 7 students scored «Good». The quality of knowledge was 44 %. This indicated a lack of information to students in grade 9 on these issues. Students do not know the answers to such questions as:

– What scientist proved the complex composition of air?
– What is another name for acetylsalicylic acid?
– What vitamin deficiency results in form of disease «scurvy»?

After conducting the elective course «Chemistry around us or about what you don’t learn in class» at the 12th control lesson we obtained following results: 3 students received «Satisfactory», 5 students obtained «Good», 2 students scored «Excellent». The quality of knowledge was 70 %.

The theoretical part of the pedagogical experiment was held at the «Daryn» school. Laboratory work was carried out at the base of Inorganic and Technical Chemistry Department of the Ye.A. Buketov KarSU. The development of a laboratory work of the elective course is showed below.

Lesson 1. Laboratory work «Chemistry and Washing» — 1 hour [3].

Objective: to explore the properties of detergents, to continue the formation of experimental skills, to develop the ability to analyze the results.

Experience number 1. First, take some chalk or dry egg shells. Then the shell and chalk grind to powder, and then place it in a test tube. Then pour 10 % vinegar there.

What should we watch? The content in the test tube will begin to sizzle and foam. Check what gas is released during the reaction. As soon as the test tube contents begin to hiss and foam strongly, take a match and put it inside the tube. Did the flame go out? It should be so. After all, chalk and egg shell are made up of the same substance — calcium carbonate, which dissolves in vinegar. The carbon dioxide released during this process does not sustain combustion, then match blows out. Write down passed reactions.

Experience number 2. Pour water up to half a clean test tube and add 8–10 drops of soap solution. After closing the neck of the tube with your finger, shake it several times. Foam appeared in the test tube. Then pour 4–6 drops of liquid resulting from the reaction of chalk with vinegar into a test tube with soap suds.

What should we watch? The foam in the test tube will disappear and a white coagulating precipitate will begin to stand out from the soapy water. This is the number one enemy of cleaning and washing.

Conclusion: Calcium compounds are «real thieves of soap». They not only steal soap. The resulting white precipitate is deposited on fibrous tissues and destroys them. It was interesting that experiments showed that after 50 washes in hard water, the strength of linen fabric decreased by 25 %, and cotton by 45 % more than after washing (also 50 times) in soft water. What to do with hard water? After all, it is still necessary to erase! Chemistry comes to the rescue.

Experience number 3. Let's do another experience. Pour water into test tube such that half of test tube is filled with water and add a few drops of the solution, which we got at the beginning of experiment from chalk and vinegar. Add half a teaspoon of soda, close tube and shake it well. After some time, the liquid will become transparent, and small sediment will be visible at the bottom. Carefully pour the transparent liquid into another test tube, add a few drops of soap solution and shake. Foam appears in the tube. This means that the soda has helped: the calcium compounds have disappeared. They were isolated in the form of sediment, which settled on the bottom of the first tube. Hence the conclusion to soften the water should always use soda.

Experience number 4. Add 10 drops of solution of chalk with vinegar to the tube containing water. We will have transparent water which contains many compounds of calcium. Let's take any liquid detergent and we will pour 8 — 10 drops of soap solution in a test tube with hard water.

What must we observe? Having stirred up a test tube, we will see that in it quite good foam turned out after all. The synthetic washing substances are not afraid of hard water. Now we see that chemists do not neglect questions of washing, and combat «thief» of soap.

For production of soap there is a large amount of animal and vegetable fats which should be saved. Now chemists learned to do detergents of oil and coal. They are cheaper than soap and it is more convenient in use. They were convinced what huge role is played by chemistry in washing?

Not always the person resort to washing to put clothes in order. Dresses, suits, trousers, a coat are usually cleaned in the chemical way. However quite often it happens so that on a clean dress accidental pollution — drops of oil or ink, juice, parts of food get. Then it is unlikely it makes sense to give clothes to a dry-cleaner. Most often spots remove in house conditions.

Removal of spots of a grass. In free time you decided to lie down on a grass. At the same time on clothes spots can appear. It is unpleasant, ugly to walk in such clothes. It will be better if you, do not shelve, remove spots especially as it will not take you a lot of time. So, we start removal of spots from a grass on your clothes. At first we will wipe a spot with solution of table salt. For this purpose previously we will prepare it: let's take 2 weight parts of table salt and 10 weight parts of clear water. We remember that fresh grass spots on clothes disappear as well after washing by hot water. If they at the same time do not disappear, use solution of table salt with the subsequent washing by warm water.

Removal of spots from berries. All of us, probably, like to regale in the summer on strawberry, raspberry, currant, etc. But at the same time it is possible that you, having been fond of berries, you will soil the clothes. How to remove spots? For this purpose try the next way: at once fill up a fresh spot with table salt, wash at first with clear water, and then wash off in the usual way.

Removal of spots from fat. Let's put under a spot the soft rag which is easily absorbing liquid. Let's moisten a spot by means of solvent and we will wipe it around or better from edges of a spot to the middle, at first slightly, then stronger. After removal of spots we will wash off these places, then we will wipe with the rag moistened with clear water.

Results of the lesson. Reflection.

Homework. Check out the laboratory work in the form of a report.

In the course of introducing the elective course, psychological and pedagogical diagnostics of students was conducted to study the motivation for the chemistry learning process according to the following psychological developments [4]:

– diagnosis of the structure of educational motivation of the student;

– learning cognitive difficulties;

– degree of interest in chemistry.

Below are the results of each of the ongoing psychological and pedagogical studies of students and a comparative analysis before and after the introduction of the course.

The definition of motives was carried out according to seven parameters: emotional, cognitive, communicative, external, achievements, self-development, the position of the student.

Among these parameters, i.e. types of learning motives 3 dominant motives were identified before and after the introduction of the elective course which are presented in Table 1.

As can be seen from Table 1, the most dominant motive in the group is emotional. The remaining motives prevail in different degrees of significance.

Table 2 presents the dominant motives after the experiment. Here the most dominant motive in the group is now achievements, i.e. motives have changed. The motives of the second and third place also changed.

Table 1

Determination of the dominating motives before the experiment

Group	Studied motive
1st place	Emotional
2nd place	Achievement
3rd place	Informative

Table 2

Determination of the dominant motives after the experiment

Group	Studied motive
1st place	Emotional
2nd place	Achievement
3rd place	Informative

Thus, with the study of the course, the motives of the teachings became more serious. New motives that students are guided by have become more suitable for obtaining high learning outcomes. When comparing the results, it can be seen that the quantitative characteristics of each of the motives in the experimental group before and after the experiment have changed significantly, they have increased.

In the study of cognitive difficulties, the following results were obtained: the question «What in itself does not allow you to study well?» (Before the experiment. Fig. 1). The pupils responded as follows: 30 % of students do not always understand the new material, other 10 % cannot find application of their knowledge in practice, 10 % of students complain of poor memory, 20 % admit that they do not know how to organize their classes, 20 % of students do not have enough time, and 10 % cannot be attentive for a long time during the lesson.

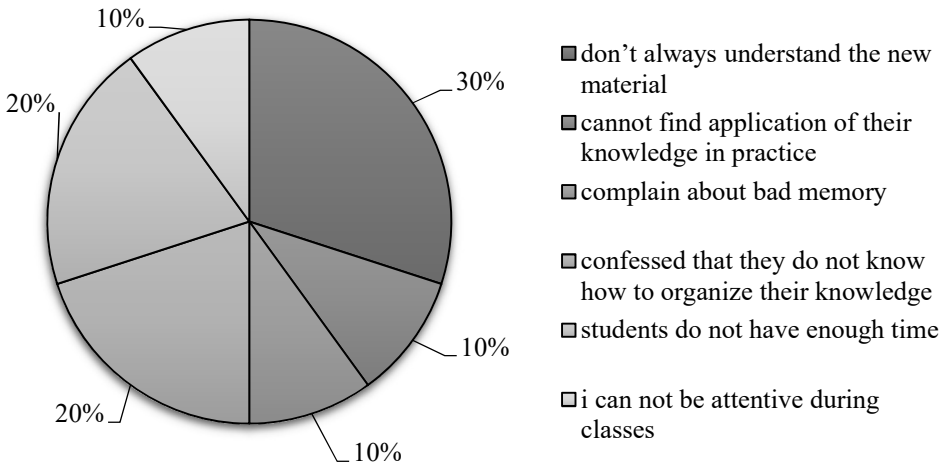

Figure 1. Analysis of the results of studying the internal causes of difficulties in the study group of an experimental group before the experiment

After the experiment (Fig. 2), the question «what doesn't allow you to study well in yourself?» the children answered as follows: 10 % of students do not always understand new material, another 20 % cannot find application of their knowledge in practice, 10 % of students complain about bad memory, 30 % confessed that they did not know how to organize their classes, 20 % of students did not have enough time, and 10 % could not be attentive for a long time during the lesson.

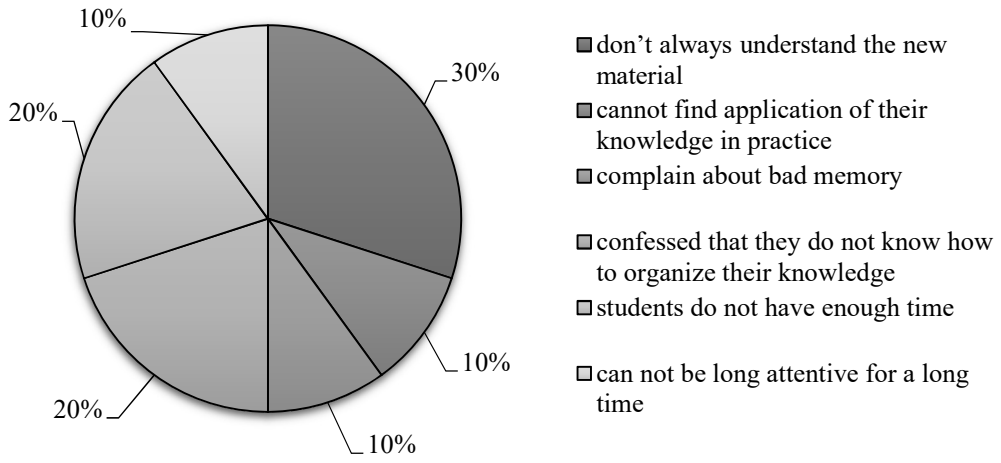

Figure 2. Analysis of the results of studying the internal causes of difficulties in the study group after the experiment

Before the experiment (Fig. 3), to the question «what kind of help do you need first of all?» 10 % of students want to learn how to organize their day correctly, 30 % want to know more about their abilities and capabilities, 20 % want to overcome learning difficulties, 10 % dream of learning some useful practical work, another 20 % want to engage in sections and circles, and 10 % of students need help in studying individual subjects.

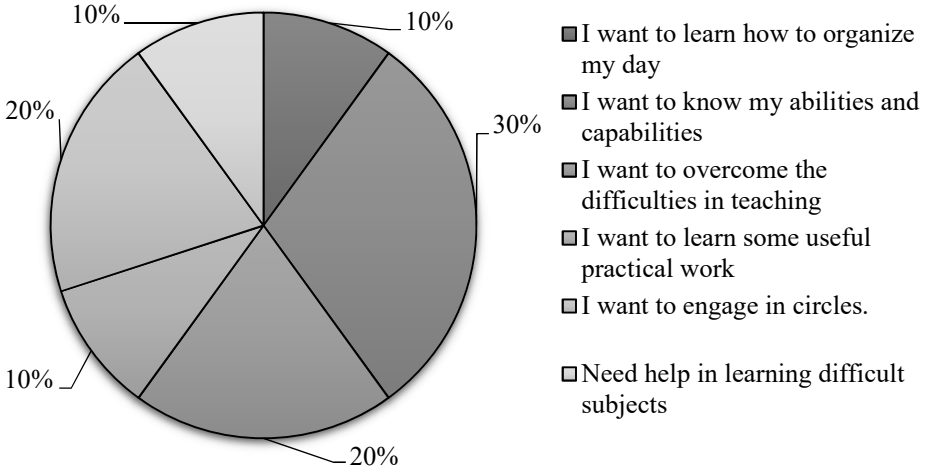

Figure 3. The analysis of results of identification of the necessary help of experimental group before carrying out an experiment for increase in motivation to process of the doctrine

After carrying out an experiment (Fig. 4), on the matter of 20 % of students confessed that they wanted to be learned to be organized correctly during the day, 20 % want to learn more about the abilities and opportunities, 20 % wish to overcome difficulties in the doctrine, 20 % dream to learn some useful practical business, 20 % wish to be engaged in sections and circles.

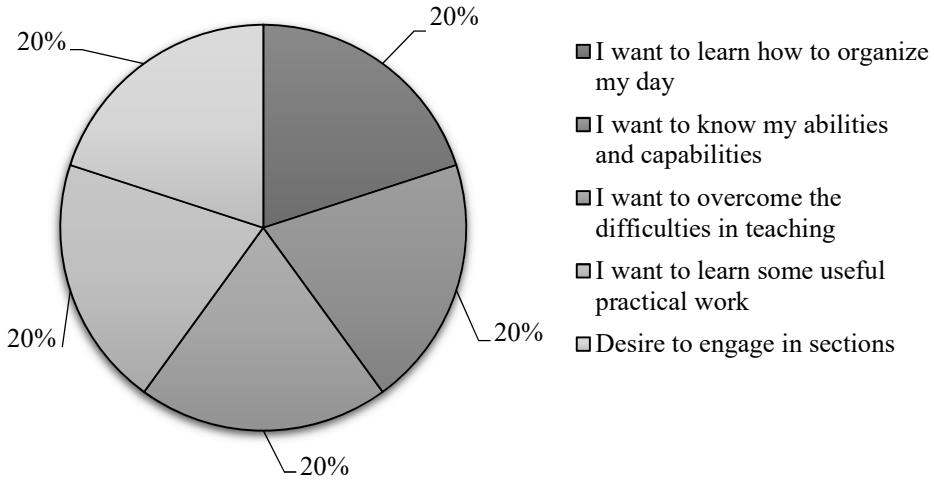

Figure 4. Analysis of the results of identifying the necessary assistance of the experimental group after the experiment to increase the motivation to the process of learning

To determine the degree of interest of students studying chemistry questions were developed:

1. Do you like chemistry?
2. Do you think this is an important science?
3. Would you like to continue to study chemistry?
4. Do you like to solve problems?
5. Do you agree with the statement: «Is everything that surrounds us a chemistry?»
6. Do you consider your chemistry teacher is a strong teacher?
7. Have you ever missed a chemistry lesson without a reason?
8. Do you think chemistry will help you in the future?
9. Do you think your chemistry scores are low?
10. Do you agree with the statement: «Most students do not understand chemistry»?
11. Have you ever written off chemistry tasks?
12. What do you think, additional chemistry lessons will help students to deal with the accumulated questions?
13. Have you ever attended additional chemistry courses?
14. Do you read any literature on chemistry?
15. Did you like the extra chemistry lessons?

Results and Discussion

Based on the data obtained prior to the experiment, the average score of the group is 19 points, which indicates the average degree of interest in chemistry in the group. This is due to the fact that only two students of the 9th grade attended additional courses in chemistry.

After the experiment, the group average score is 24, which indicates a moderately high degree of interest in chemistry for the group. This is due to the fact that during the whole elective course the group worked hard, which contributed to the improvement of interest in this discipline. The main factor is that after the experiment, 8 people answered positively to the question «Did you want to continue studying chemistry», although there were only 3 people before the course.

This indicates that this elective course helped students to establish themselves in a reasonable choice of chemical specialized training; with the role of chemistry in industry, agriculture, medicine, construction, transport, art and other industries and human activities.

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Г.Т. Кокибасова, А.Т. Дюсекеева, А.Е. Казтаева

Химияның бейінді элективті курсын жүзеге асырудың әдістемесі мен психологиялық-педагогикалық зерттеулері

«Бізді қоршаған химия, немесе Сабақта үйренбейтін қызықтар» бейіналды элективті курс бағдарламасы 34 сағ құрайды. Элективті курсты өткізу кезінде «Дарын» мамандандырылған мектеп-интернатының 9-сынып оқушылары жалпыдидактикалық қағидаларына бағынды: ғылыми бірізділігі, қолжетімділігі, жүйелігі, өз еріктері бойынша, қауіпсіздігі, көрнекілігі. Оқушылардың топтық оқыту бойынша психологиялық-педагогикалық диагностикасы жүргізілді, тұлғаны зерттеу, химияны оқу кезінде оқушылардың ынтасын арттыру, қиындықтар мен алаңдаушылық деңгейін анықтау және олардың жас ерекшеліктері зерттелді. Тұлғаны анықтауға арналған зерттеу нәтижесі элективті курс өткізілгеннен кейін сыныптағы оқушылардың арасында амбиверттер санының артқанын көрсетті, ал психодинамикалық қасиеттерінің орташа балы өзгеріссіз қалды. Топтың химияны оқуға ынтасы артқаны байқалды. 9-сынып оқушыларының арасында химия пәні бойынша алынған бақылау жұмыстары мен қорытынды тестілеу апробациясы бойынша: 3 оқушы — «қанағаттанарлық», 5 оқушы — «жақсы», 2 оқушы «үздік» нәтиже көрсетті. Білім сапасы — 70 %. Алынған нәтижелер бойынша келесі қорытындыға келуге болады: оқытудың интерактивті әдістерін қолдана отырып, өткізілген «Бізді қоршаған химия, немесе Сабақта үйренбейтін қызықтар» бейіналды элективті курсы оқушылардың пәнді оқуға деген қызығушылығын арттырды, олардың болашақта таңдайтын бағытын таңдауға мүмкіндік тудырды.

Кілт сөздер: элективті курс, бейінді оқыту, зертханалық жұмыс, тестілеу, тұрмыстық химия, сауалнама жүргізу, ынталандыру, оқушылар, бағдарлама.

Г.Т. Кокибасова, А.Т. Дюсекеева, А.Е. Казтаева

Методика и психолого-педагогические исследования при реализации профильного элективного курса химии

Программа предпрофильного элективного курса «Химия вокруг нас, или О чем не узнаешь на уроке» рассчитана на 34 ч. При проведении курса в специализированной школе-интернат «Дарын» среди учащихся 9 классов руководствовались следующими общедидактическими принципами: научность, доступность, систематичность, добровольность, безопасность, наглядность. Проведена психолого-педагогическая диагностика учащихся на групповое взаимодействие, исследование личности, мотивации к процессу обучения химии, изучение затруднений и тревожности, а также их возрастных особенностей. Результат на определение личности показал незначительное увеличение числа амбивертов после проведения элективного курса, а средний бал психодинамических свойств остался на прежнем уровне. Мотивация к обучению химии в группе увеличилась. Апробация результатов контрольных уроков и итогового тестирования по химии среди учеников 9 классов выявила следующее: 3 ученика получили отметку «удовлетворительно», 5 учеников — «хорошо», 2 ученика — «отлично». Качество знаний составило 70 %. На основании полученных данных можно сказать, что проведенный предпрофильный элективный курс «Химия вокруг нас, или О чем не узнаешь на уроке» с использованием интерактивных методов обучения повысил интерес к изучению предмета, перед учащимися появился выбор будущего профиля.

Ключевые слова: элективный курс, профильное обучение, лабораторная работа, тестирование, бытовая химия, анкетирование, мотивация, учащиеся, программа.

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