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DIDACTIC OPPORTUNITIES TO IMPROVE CHEMISTRY TEACHING METHODS BASED ON INNOVATIVE APPROACHES

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The rapid development of science, engineering, production and technology has opened up new prospects for development in all spheres of life, as well as one of the main tasks is to improve the science of teaching chemistry in pedagogical institutes on the basis of innovative approaches.

The following scientists have worked hard to clarify the didactic principles of teaching chemistry, to create a scientific basis for science. From the description of the names of hard-working scientists, it is necessary to answer the question of what is the didactic-didactic process, didactic words. In the process of teaching, the actions of teachers and students, graduate students come together as a whole, this process is called the didactic process.

On the development and application of didactic materials in the teaching of chemistry and its departments, methods of effective organization and management of chemistry education, the use of algorithms and programs in teaching chemistry, forms of organization of chemistry education, the relationship of chemistry teaching methods with other disciplines, the use of innovative methods in chemistry E.G.Polupanenko, V.A.Kuzurman, I.V.Zadorozhniy, E.E.Minchenkov, M.S.Pak, D.K.Bondarenko, S.S.Kosmodemyanskaya, S from foreign scientists on the study of theoretical foundations The work of I. Gilmanshina and others is noteworthy.

The main goal of didactic learning theory is to make future chemistry teachers meaningful, interesting, and visual, not to convey the accumulated chemical knowledge in a ready-made way, but to pass it on to future generations.

The term didactics was first coined by the German teacher Wolfgang Ratke Ratichius, who called the art of didactic teaching "the universal art of teaching everything to everyone," while the German educator Johann Friedrich Gerbart called didactics "a holistic and coherent theory of educational education."

In pedagogical institutes, chemistry didactics is a science and education considered as a subject and is one of the modern pedagogical disciplines that has a specific object and subject of research. On the other hand, chemistry didactics is a new subject and it is understood to train a modern chemistry teacher. Traditionally, chemistry teachers develop many teaching, learning, and control didactic materials to organize the learning process wisely. How can this be achieved?

requires the development and use of "universal" tools (especially didactic materials) that perform a variety of educational functions (teaching, learning, supervision and self-monitoring, assessment and self- assessment , education and development). requires. It also contributes to the formation of systematic knowledge in students, forming a positive motivation for learning universal learning skills and actions, attitudes towards teaching and learning.

Other requirements (didactic tools) for modern chemical education tools are long-term (“long play”) and universal.

The “long play” feature of these didactic materials is ensured by the integrated integration of the most important components in it, including the essential content (many lessons, study topics, sections, blocks) that implements a set of learning objectives and functions.

The universality of didactic information includes the concept of module, which provides the definition of didactic completed information nodes of modular-educational content. In the given literature, the concept of "module" is given in different ideological meanings. The module is:
- a block of content that can be easily replaced by another block of equal value;
- relatively independent study of the subject ;
- structural or functional component of the system ;
- relevant educational sciences or disciplines ;
- didactic completed information and functional unit.

We use the term “module” in a broad sense, in all the senses shown .

statistic module is supplemented by a specific content of the chemistry subject , while in dynamics it works due to one or another learning technology , which provides students with didactic guidelines for mastering the content of education

active module it is necessary to distinguish the following components : purposeful , needs - motivational , content-constructive , technological , regulatory , control-corrective, performance- evaluative .

didactic material modules can be presented in a compact localized or "diffuse" form .

convenient form of presenting chemical information in paper and electronic form is a table. Such (integra ts ion,

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modular, "Tables with "universal" didactic materials are called IMJ (integrative-modular tables) .

The use of a single integrated module table in modern chemistry and educational technology (instead of multiple cards for the formation and development of a particular chemical concept) allows to save a lot of energy , paper and ammunition and time for didactic development . (chemistry allows the implementation of an important principle of ergonomics in shooting).

main principles in the development and implementation of integrative-modular tables are :
- Conformity of the content of didactic material modules to educational standards ;
- Didactic value of the information contained in them ;
- Integrity of intra-subject and inter-subject information provided in didactic material modules;
- "universality" of educational functions performed by didactic material ;
- Possibility to use system-based knowledge, universal learning skills and movements in the learning process , positive motivation for the study of chemistry and person - centered technology that contributes to the formation of psycho - emotional potential in the classroom ;
-Development of universal educational skills and actions (concise and consistent expression of ideas, implementation of intra-subject and inter-subject integration , application of chemical knowledge in dialogue , substantiation of their answers, in the process of frontal , group and pair learning activities , as well as).

Tables, the implementation of a large number of options (frontal, independent , control) cognitive tasks is provided. If the table has, say, only 4 rows and 5 rows , then only 20 (4x5) different options can be implemented. Given the number of different (2, 3, etc.) "vertical" and "horizontal" combinations presented in the columns and rows of the table , the number of options increases almost infinitely (see Table 1) . .

The chemistry teaching methodology involves the implementation of 4 relatively independent modules (information-functional nodes) with conditional names in the integral-modular table (IMC) for teaching the subject " Classes of Inorganic Compounds" developed in chemistry . :

Table 1
Oxides, bases, acids and salts

Options	A	B	S	D
1	Me_xO_g	$Me(OH)_m$	H_nE or H_nEO_m	Me_xE_g or $Me_xE_gO_Z$
2	K_2O, CaO	KOH, $Ca(OH)_2$	H_2S, H_2SO_4	K_2S, K_2SO_4
3	? + ZnO →	? + $Fe(OH)_2$ →	? + H_2SO_4 →	? + $CaCO_3$ →
4	SO_3 +? →	NaOH +? →	HCl +? → H_2 + ...	$CuCI_2$ +? → Cu + ...
5	→ H_2O	→ $Ca(OH)_2$	→ H_3PO_4	→ $CaSiO_3$
6	→ oxide	→ basis	→ acid	→ tuz
7	AI_2O_3 +….	→ $Fe(OH)_3$ + ...	→ HNO_3 + ...	→ $ZnCI_2$ + ...
8	$m = \rho \cdot V$	$n = \frac{m}{M}$	m(эритма)	$n = \frac{V}{V_m}$
9	$CuO + H^+ \leftrightarrow$ $\leftrightarrow Cu^{2+} + H_2O$	$2H^+ + 2OH^- \rightarrow$ $\rightarrow H_2O$	$2H^+ + CO_3^{2-}$ $\rightarrow H_2O + CO_2$	$Ba^{2+} + SO_4^{2-}$ $\rightarrow BaSO_4$
10	O = C = O	Na-OH	H-CI	Na-CI

Q are schematically coded in modules:
1) general formula of oxides (option A1), bases (option B1), acids (option C1), salts (option D 1);
2) oxides, composition, chemical properties, extraction, calculation of h , ionic equations (option A);
3) bases, composition, chemical properties, production, calculation of h , ionic equations (option B);
) about acids (composition, chemical properties, production, calculation of h , ionic equations (option C);
5) salts, composition, chemical properties, extraction, calculation of h , ionic equations (option D);
6) general formulas of oxides, bases, acids, salts (option 1);
7) composition of oxides, bases, acids and salts (option 2);
8) chemical properties of specific substances belonging to different classes of inorganic compounds (zinc oxide, iron (II) - hydroxide, sulfuric acid, calcium carbonate , etc.) (options 3, 4);
9) obtaining specific substances by the compound reaction (water, calcium hydroxide , phosphoric acid , calcium silicate , belonging to different classes of inorganic compounds (option 5);
10) extraction of oxides, bases, acids and salts (at the discretion of the student) (option 6);
11) production of specific substances belonging to different classes of inorganic compounds by decomposition or exchange reactions (option 7);
) Solve or construct computational chemical problems using the formulas shown for the relationship between physical quantities (mass, density of substances, volume , volume of substances) (option 8);
) development of full ionic and molecular reaction equations describing the chemical properties of substances (oxides, bases, etc.);
14) graphic formulas of substances (oxides, bases, acids, salts);
types of chemical bonds .

Frontal work technology with integrative-modular table (IMJ) . It is advisable for each student to fully comply

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with the schedule (IMJ "Classes of Inorganic Substances") used by the teacher in the classroom (in paper or electronic form) . Shooter during frontal operation :

The table indicates the task option (for example, option A1);
qforms the function itself according to the given variant (formulate the general formula of oxides or the formula of manganese (IV) -oxide) .

Calls the student's name for the answer ;
- The student answers intelligently, does not go to the board while answering, does not even get up (this is done to maintain the optimal pace in the classroom) ;

Students attending the class control the accuracy of the answer given by the student , if the answer is correct, the teacher offers the respondent (or another student) a new task (example: Option A2: "What chemical data can be obtained from this formula?").

If a student answers incorrectly or notices an error, the student corrects his or her peer’s answer with the teacher’s permission;
If the answer is incomplete - additions are made with the permission of the teacher;
Once the answer is satisfactory, a new task is offered (e.g., option 3: “What substances can zinc oxide react with?” Or option B6: “Name the methods of obtaining acids”), and so on.

Working with the table does not last long (5-10 minutes), but it happens very quickly, so every student is mentally stressed, but not in a stressful situation because he is always able to express his thoughts because the student is a teacher or other can participate in a conversation with the student and substantiate their answer.

Working at a fast pace forces each student in the group to work with full dedication, self-control, self-assessment of chemical knowledge and actions (general logic, general education, general labor and special subject), gaining confidence in their cognitive abilities. The teacher, on the other hand, has the best opportunity to assess the students ’academic achievements and observe their actual achievements in the chemical-educational process. Using an integrative-modular table (IMJ), individual work technology has virtually unlimited possibilities and depends on its didactic objectives. Possible groups of task options for students ’reproductive and effective independent work (see IMJ“ Classes of Inorganic Substances ”).

Group 1 of the options in the IMJ is one task for each option (A1 to D10), with a total of 40 tasks in this group. We have shaped it accordingly by giving each of these assignments a reproductive and productive feature, a paper and an electronic version.

Let's give examples. Option: A3 function. "What substances can zinc oxide interact with? What substances can be formed in this case? Give the formulas of these substances."

Group 2 of the options in the IMJ is 2 “vertical” tasks in the option (e.g., A1 and A2, A1 and A3, A2 and A3, B2 and B7, B5 and B7). The options in this group are more complex than the previous ones and should be taken into account when setting learning time to implement them, as well as when solving tasks.

Option: A3 and A4 functions. "What substances can zinc oxide interact with? What substances can be formed in this case? Give the formulas of these substances." "What substances can interact with sulfur (VI) oxide. What substances can be formed in this case? Give the formulas of these substances."

3rd group of options in the IMJ is 2 “horizontal” tasks in the option (e.g. A1 and B1, B1 and S1 , S 1 and D 1, A5 and B5, S 4 and D 4)

Option: Functions A5 and B5. "Show me how to get water . Under what conditions do chemical reactions take place in a laboratory (industry) to produce water ? " " Indicate the methods of obtaining calcium hydroxide . Under what conditions do chemical reactions based on the production of calcium hydroxide in the laboratory (industry) take place ?"

Groups 4 and 5 of the options in the IMJ are 3 tasks (for example, A 1 , A2 and A 3 ; B7, S 7 and D 7) and so on , each "vertical" and "horizontal" in the option .

Option: Functions A 1 , A2 and A 3 . "What chemical information does the general formula in Task A1 give you? Give the chemical formula of an oxide. What qualitative and quantitative information can you extract from the given chemical formula?

What is the chemical formula in Task A2 ? What substances can be formed from the interaction of zinc oxide with nitric acid (task a A 3) ? How much substance (nitric acid) is needed to react with 2 moles of zinc oxide ? How much substance (sulfuric acid) is needed to react with 2 moles of zinc oxide ? How much substance (phosphoric acid) is needed to react with 2 moles of zinc oxide ?

Implementation of options A, B, C and D requires students to be able to combine knowledge on this module (only one of the classes of inorganic substances) and options 1,2,3,4,5,6,7,8,9,10 requires the ability to combine knowledge of different modules (for all classes of inorganic compounds) .

However, options A, B, C, and D each contain 10 tasks , while options 1-10 contain only 4 tasks . To do this , the reader must be very careful and objective in determining the complexity and difficulty of the assignments (especially in evaluating the answers) .

Technology of combining frontal and individual work using IMJ. The main group of students works on a single task (for example, variant A1-A4), then engages in a frontal dialogue with the shooter on the right; weak students complete assignments on options 1, 2 and 3 (1-2 tasks in each) ; stronger students are complex options of type A1-A8.

Technology of multi - step learning activities . Integral module tables provide great opportunities for organizing different levels of learning activities: reproductive, reproductive-productive and effective .

Option: A 3 function. Task for Reproductive Activity: " Write the reaction equation between zinc oxide and hydrochloric acid . " Task for reproductive and productive activity : " Draw the equations of reactions between zinc oxide and acids ." Task for development activities : " What

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substances can zinc oxide interact with ? Write the equations of possible reactions of zinc oxide with these substances . "

Options that include leadership tasks (8, 9, and 10) allow students to better understand intra-subject and inter-subject relationships . These options of tasks can be effectively used in the process of paired reading and cognitive activity technology . In the study of chemistry , the following forms of paired learning are distinguished and used :

1. Pair of permanent members. Many psychologically compatible students enjoy learning in pairs , helping each other overcome learning difficulties and achieving learning goals , and enjoying personal and objective results .

2. A pair with a variable composition. In the formation of pairs of variable composition , the student must, of course, take into account not only the ability of each student to learn , but also their psycho - physiological qualities . Usually in shooting practice and q quiet couples are formed from strong and weak student ardan , as well as strong students. The formation of pairs of weak students does not apply in practice.

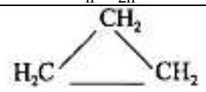
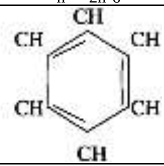
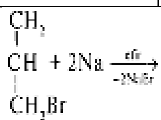
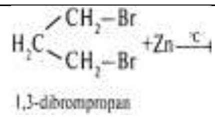
example , we give an integral-modular table (IMJ) used in the study of organic chemistry in the study of methods of teaching chemistry (see Table 2).

see , six relatively independent modules are coded in the table, which can be called conditionally : alkanes , alkenes , d ienes , alkynes , ts ikloalkanes , a renns .

Options 1-10 allow you to combine the chemical data in the q house:

1) General molecular formula of different classes of hydrocarbons;
2) Properties of the carbon chain structure of hydrocarbon molecules belonging to different classes;
3) Empirical formulas of the most important representatives of hydrocarbons belonging to different homologous series ;

Table 2 _
Classes of organic compounds

Options	A	B	V	G	D	E
1	$S_n H_{2n+2}$	$S_n H_{2n}$	$S_n H_{2n-2}$	$S_n H_{2n}$	$S_n H_{2n}$	$S_n H_{2n-6}$
2	C-C-C	C = C-C	C = C = C	C-C≡C		
3	CH_4	C_2H_4	C_4H_6	C_2H_2	C_3H_6	C_6H_6
4	-an	-en	-dien	-in	tsiklo ... an	benzene
5	R-I + Na →	$CH_3 - CH_2OH \xrightarrow{H_2SO_4}$		$CH_2 = CH_2 + +$ $Br_2 \rightarrow$		CH≡CH →
6	$? + Cl_2 \xrightarrow{hv}$	$? + H_2O \xrightarrow{H_2SO_{4(\text{конц})}}$	$? + HCl \rightarrow$	$? + H_2 \xrightarrow{t^\circ, kat.}$	$? + H_2 \xrightarrow{120-180^\circ C, kat}$	$? + Cl_2 \xrightarrow{FeCl_3}$
7	$CH_4 + Cl_2$	$C_2 H_4 + HBr$	$nC_4H_6 \xrightarrow{t^0, \text{кат.}}$	$3\ C_2H_2 \xrightarrow{t^0, \text{кат.}}$	$C_6H_{12} + Br_2$	$C_6 H_{6+}$ _ $HNO_3 \rightarrow$
8	$\rightarrow CH_4$	$\rightarrow C_2H_4$	→ dien - lar	$\rightarrow C_2H_2$	→ cyclo-alkanes	$\rightarrow C_6 H_6$
9	sp^3 - hybridization	sp^3 - hybridization	conjugated the garden	sp- hybrid- lanish	saturated garden	aromatic garden
10	exchange reactions	substitution reactions	- stage coupling reactions	Combination and substitution reactions	and hydrogenation reactions	is easier than the accumulation reaction

4) Named after a radical properties in the nomenclature of hydrocarbons ;
5) Production of different classes of hydrocarbons and their derivatives ;
6) Properties of chemical properties of hydrocarbons of different classes, conditions of occurrence of chemical reactions characterizing them ;
7) Chemical reactions describing the chemical properties of these hydrocarbons, representing different homologous series;
8) Methods of obtaining different classes of hydrocarbons;
9) Specificity of chemical bonds in the molecules of various hydrocarbons ;
10) Chemical reactions specific to this class of hydrocarbons .

Taking into account the coded chemical information about hydrocarbons , individual- oriented tasks of different levels of complexity (frontal , group , paired , stratified , individualized; reproductive, reproductive-productive, productive and creative) are formed and used .

Technology of using the IMJ on the subject of "Hydrocarbons" in the subject of teaching chemistry is as diverse as the use of the IMJ on the subject "Classes of Inorganic Substances" in the department of inorganic chemistry of this subject. Tasks can be formulated in a manner

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similar to the tasks above. The number of these tasks is practically unlimited.

IMJ can also be used successfully to implement reproductive, reproductive-productive and productive activity technology . Options 1, 3, 7 can be used to perform reproductive (reproductive) activity, as these reference signals, e h timol, have been used in the study of relevant reading material .

Options 2, 4, 6, 8, 9, and 10 require reproductive (independent work by analogy) and effective learning activities (if the task is subjectively performed for the first time). The following forms of learning activities in the group can be used:

1. Normal guru h work, h each guru h students complete a specific version of the assignment . For example,

Group 1 students complete option A (“Alkanes” topic) .
Group 2 students complete option B (“Alkenes” topic) .
Group 3 students complete option V (the topic of “ Diens ”).
4-guru h students complete option D (“Alkynes” topic).

2. Cooperative-guru h work, h each guru h students perform the name of the general task separately . For example,

- Group 1 students studying the chemical composition and chemical structure of alkanes (options A1 and A2);
- Group 2 students study the homologous series of alkanes , their physical properties (options A 3 and A4) ;
- Group 3 students studying the nomenclature of alkanes (variant A5);
- Group 4 students study the chemical properties of alkanes (variants A6 and A7) and h okazos .

collaboration of the efforts of all groups of students is aimed at fulfilling the specific tasks of the overall task (the topic of " Alkanes ") .

3.Differential ialized work, h each guru h students complete assignments at different levels . For example,

Group 1 students perform a reproductive task (options 3, 7, 8);

2 students perform tasks of a reproductive and productive nature (options 1, 2, 3, 5 , 6, 9, 10);

Group 3 students complete an assignment of a productive nature (2, 4, 5, 6, 9, 10).

organizing the work in differentiated groups , the student must take into account not only the psychotypological characteristics and learning abilities of each student , but also the formation of tasks to give them a certain character of cognitive activity (reproductive or productive) .

4. Individual-group work , in which the specific (individual- oriented) tasks , taking into account the learning abilities of each student in the group :

In Group 1 ("Alkanes") , a student studies the physicochemical properties of methane (options A 3 , A7);

In group 1 (topic " Alkanes ") another student studies the chemical structure of methane homologues (options A2, A4, A9),

In Group 1 (the topic of “ Alkanes ”) , the third student studies the chemical properties of methane homologues and others .

Group 2 (" Alkenes "), one student learns a laboratory method of obtaining ethylene (option B8) ,

In group 2 ("Alkenes") another student studies the coupling reactions of alkenes (options V6, B7),

In Group 2 ("Alkenes"), the third student studies the chemical bonding properties of alkene molecules (variant V9) and so on.

The experience of the use of integrative-modular tables in the teaching of chemistry teaching methods of students of the 3rd stage of Chemistry education in pedagogical higher education institutions shows that their use helps to:

-implementation of the principles of humanization, technology and optimization of the educational process, expansion of opportunities for integration, universalization, differentiation and individualization in the teaching of chemistry;

-creates psychological comfort in the classroom due to the formation of students' systematic knowledge, universal learning skills and actions, positive motivation to study chemistry and multi-stage learning and cognitive activity in students;

-in addition to the implementation of interactive teaching methods, the student actively influences his teacher through a system of control (and self-reflection), assessment (and self-assessment) and knowledge and objective actions;

-Development of students' experience of active use of chemical language, methods of chemistry, skills (and actions) to apply knowledge in communication with teachers and other students, substantiation of their answers, self-monitoring and evaluation, confidence in chemical knowledge, their learning activities and capabilities to win;

Chemistry teaching methodology also serves to save the time of teachers and students in the context of its constant shortage by updating the subject in the teaching process on the basis of modern didactic tools.

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