USE OF GAMING TECHNOLOGY IN THE STUDY OF CHEMISTRY

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Abstract

Purposes: In article influence of a game method of training on the formation of interest at seniors in profound studying of a subject of chemistry is considered. Game technologies in teaching are used for a long time, but their importance inactivation of cognitive activity of students does not lose relevance. By means of a didactic game, it is possible to realize with success everything the leading functions of training: educational, bringing up and developing.

Methodology: Authors describe the scenario of a lesson game of chemistry on the subject "Hydrocarbons" for students of the 10th classes, do the analysis of results of the performance of tasks at all stages of a game and give criteria of estimates.

Results: Following the results of the questioning which is carried out among school students the conclusion is drawn that thanks to a game method at a lesson, it was succeeded to increase interest in a subject, the level of digestion of material, to make active orientation on the acquisition of knowledge and motivation of success. During the game, the creative atmosphere reigns in a class thanks to what such lessons promote the maximum realization of abilities of each pupil and develop skills of group interaction. Didactic games can be used at all stages of the process of training: when studying a new subject, fixing of the gained knowledge, at the control of results.

Implications/Applications: Implementing new methods in the study can aid the audience to be prospered. Game theory can be the practical inefficient study of chemistry.

Novelty/Originality: The research of the influence of didactic games on the formation of informative activity of students was conducted in the form of the quest with the subject devoted 190-year since the birth of A.M. Butlerov.

Keywords: Educational Technologies, Training Methods, Didactic Play, Cognitive Activity, Motivation, Assimilation of Knowledge, Social Activity.

INTRODUCTION

Development of the country in modern conditions assumes training of the highly qualified specialists competent not only in a certain subject domain but also the practical problems and conscious definition of the purposes of the further self-development having universal skills of the decision. In this regard in the educational system, there is continuous modernization of methods of training for stimulation of the vigorous cognitive activity of students. Substantially it concerns disciplines of a natural-science cycle, including chemistry. Afonina, J. V., & Khanova, T. G. (2017).

The big role in the formation of interest in studying a subject at school students is carried out by the training games. In a game, the child actively thinks, feels, uses all the creative skills (Mikhaylenko, 2011; Belinskaya, 2003). Though game technologies in teaching are used for a long time, their importance in activation of cognitive activity of students does not lose relevance. By means of a didactic game, it is possible to realize with success everything the leading functions of training: educational, bringing up and developing (Lykova, 2009; Ushinsky, 2014). Being a powerful pedagogical factor of impact on personality, educational games promote an increase in the informative abilities of students, formability to apply the gained knowledge to the solution of specific objectives without fear to make a mistake (Traynev, 2006; Traynev, 2005).

METHODS

The purpose of real research is to increase students of informative activity and formation of interest in studying chemistry.

Research object: students 10B and 10G of classes of lyceum No. 121 in the city of Kazan.

In the course of student teaching within two years, a large number of didactic games at various stages of a lesson was held: information games - for the offer of new knowledge; training games - for formation of abilities; games in the form of fairy tales - for fixing of the mastered knowledge at a lesson; control games - for check of the acquired knowledge.

Form and content of games were developed taking into account the age features of students. Preference was given to playful ways of the tasks demanding own conclusions of participants, for example in the 10th classes - a conference, chemical court, an auction of knowledge, etc. A number of interesting intellectual and entertaining games were developed for lessons of chemistry: "What? Where? When?", "Brain ring", "The game", KVN, etc. (Afonina & Khanova, 2017). These games are attractive both to participants and to fans who with pleasure join the in-game process.
When holding a game due attention is paid to the assessment of an emotional condition of students as in a business game they are in an active position not only in relation to the subject but also the social party of their activity that favorably influences durability of assimilation of knowledge (Novoshinsky & Novoshinsky, 2015; Murasheva et al, 2018).

RESULTS AND DISCUSSION

At a preparatory stage observation of the activity of students in the educational process was carried out, the analysis of grades in chemistry in magazines of progress was carried out.

Questioning for the purpose of identification of the relation to studying chemistry on indicators was carried out:

1. Orientation on assessment.
2. Orientation on the acquisition of knowledge.
3. The motivation for success and fear of failure.

For the experimental definition of these indicators, the generalizing lessons on the subject "Hydrocarbons" in two classes were conducted: in 10G - in a traditional form and in 10B - in the form of a business game.

Description of a lesson game

Lesson Purpose: to develop at students' cognitive interest in studying chemistry, to enrich an outlook with additional knowledge.

Problems of a lesson

- Informative - to generalize knowledge of the subject "Hydrocarbons", to review, be prepared for active participation in the game process;
- Developing - to continue development of skills of logical thinking, to teach to get quickly into gear, to be able to choose the necessary information, it is correct to interpret it and to apply;
- Bringing up - motivation of healthy rivalry and mutual support in collective in the course of the game.

The planned results of training

- Subject - to describe and distinguish organic compounds of class hydrocarbons; to call the general chemical properties characteristic of various hydrocarbons; to make formulas of organic compounds of the studied class;
- Meta-subject - to classify the studied objects and the phenomena; to draw conclusions and conclusions; to structure the studied material and to analyze information obtained from various sources;
- Personal - development of such qualities as self-checking and a self-assessment; formation of abilities to operate the cognitive activity; operating time of skills effective communications.

Preparation stage: Three days before the planned occupation the pupil declared the forthcoming carrying out the generalizing lesson in honor of the 190 anniversary since the birth of the great Russian scientist A.M. Butlerov on the subject "Hydrocarbons" and gave homework:

1. To be divided into five teams on five people, to elect captains and the name of teams.
2. To be prepared for the forthcoming lesson and to work the set material on the subject "Hydrocarbons" (Gabrielyan, 2009; Ostroumov & Gabrielyan, 2013).
3. To study information on the scientific heritage of A.M. Butlerov (Bykov & Butlerov, 1978).
4. To prepare the paper on the subject "the 190 anniversary since the birth of A.M. Butlerov".

Structure of a game: The game way of a lesson passes through three stations, on each of which performance of the corresponding tasks is necessary:

1. Questions of the first station are devoted to generalization of the passable subjects according to section hydrocarbons. Each right answer corresponds to one point.
2. Questions of the second station are devoted to the definition of various organic substances, it is correct to the ability to make their structural formulas, to define the type of the nomenclature to which there correspond their names. For each correctly performed task, one point is put.
3. At the third station, the solution of a crossword puzzle on the subject "Homologs" and "Isomerism" and also the questions connected with the theory of a chemical structure of A.M. Butlerov is necessary. Each right answer corresponds to one point.
Lesson course

Organizational moment: As the introduction serves A.M. Butlerov’s words: "Easily and freely is to science only where it is surrounded with full sympathy of society. The science can count on this sympathy if society is pulled rather together with it”.

Names of teams are chosen:
1. "Alkanes"
2. "Alkenes"
3. "Alkynes"
4. "Alkadiens"
5. "Arenas"

Stage of updating of knowledge: Message about the lesson purpose: to gain additional knowledge of chemistry on the basis of scientific achievements of A.M. Butlerov, having in detail studied the subject "Hydrocarbons”.

Motivation stage: Announcement of rules of the game. Representation of judges to teams.

Rules of the game: a game consists of three stations with various tasks. For each correct answer to 1 question, the team gets 1 point.

Main stage

Station 1: It is offered to answer the following questions:

1. Organic chemistry initially was called the chemistry of the substances received from organisms of plants and animals. Mankind was familiar with such substances from an extreme antiquity. People were able to receive vinegar from sour wine, and essential oils from plants, to allocate sugar from a sugar cane, to extract natural dyes from organisms of plants and animals. The term "organic chemistry" was entered by this scientist in 1806. Call the scientist (the answer: Jens Jacob Berzelius)
2. What basic chemical element is a part of an organic substance? (Answer: Carbon)
3. To what geometrical figure in space does there correspond the methane molecule? (Answer: To a tetrahedron)
4. The name what state, has similarity to the name of one of the saturated hydrocarbons? (Answer: Butane)
5. What acid is applied to the conservation of vegetables? (Answer: Acetic acid)
6. "I sat and wrote the textbook, my thoughts soared somewhere away. I turned a chair and dozed off. Atoms began to jump before my eyes again, long lines coiled as if snakes. One of the snakes grabbed their own tail. As though the flash of lightning woke me”. What structural formula of substance was opened that night by Kekule and to what class of organic substances it belongs? (Answer: Benzene. A class - aromatic hydrocarbons.)
7. How reaction of the accession of molecules of ethylene to each other is called? (Answer: Polymerization)
8. Call substance of which natural rubber consists (Answer: Isoprene)
9. What Russian scientist for the first time in the world developed synthetic rubber? (Answer: S.V. Lebedev)
10. A process of heating of synthetic rubber with sulfur at a temperature of 130-140° C? (Answer: Curing)
11. Call a surname of the Russian scientist who offered a receiving method from acetylene of acetic aldehyde which name called reaction (Answer: M.G. Kucherov)
12. What theory proves a benzene structure? (Answer: Theory of a structure of organic compounds of A.M. Butlerov).

Table 1: Evaluation points for the tasks of the station 1

| Teams       | Number of points earned |
|-------------|-------------------------|
| Alkanes     | 8                       |
| Alkenes     | 9                       |
| Alkynes     | 11                      |
| Alkadiens   | 10                      |
| Arenas      | 5                       |

Station 2: It is offered to write structural formulas of the following substances:

1. Dimetilmetan (Answer: $CH_3-CH_2-CH_3$ - the name according to the rational nomenclature).
2. 2,2 dimethylpropane (Answer: C\(_2\)H\(_5\)C(CH\(_3\))\(_2\)CH\(_3\) - the name according to the systematic nomenclature of IYPAK).
3. 2,3 dimethylbutane (Answer: CH\(_3\)-CH(C)(CH\(_3\))-CH(C)(CH\(_3\))\(_3\) - the name according to the systematic nomenclature of IYPAK).
4. Dimetiletilen (Answer: CH\(_3\)-CH=CH\(_2\) - the name according to the trivial nomenclature).
5. Propylene (Answer: CH\(_3\)-CH=CH\(_2\) - the name according to the trivial nomenclature).
6. 2-methylpropene-1 (Answer: CH\(_3\)-C(CH\(_3\))=CH\(_2\) - the name according to the systematic nomenclature of IYPAK).
7. Acetylene (Answer: CH≡CH - the name according to the trivial nomenclature)
8. Dimetiletsetilen (Answer: CH\(_2\)-C≡C·CH\(_3\) - the name according to the trivial nomenclature).
9. 3,3-dimethyl-butyn-1 (Answer: CH\(_3\)-C(CH\(_3\))\(_2\)C≡CH - the name according to the systematic nomenclature of IYPAK).
10. 1,3 butadiene (Answer: CH\(_2\)=CH-CH=CH\(_2\) - the name according to the systematic nomenclature of IYPAK).
11. Isoprene (Answer: CH\(_2\)=C(CH\(_3\))=CH\(_2\) - the name according to the trivial nomenclature).
12. 1,3 cyclohexane (Answer: CH\(_3\)-C\(_6\)H\(_10\)-CH\(_3\) - the name according to the systematic nomenclature of IYPAK).
13. 1,4 dimethyl benzene (Answer: n-CH\(_3\)-C\(_6\)H\(_12\)-CH\(_3\) - the name according to the systematic nomenclature of IYPAK).
14. Metaxylol (Answer: m-CH\(_3\)-C\(_6\)H\(_12\)-CH\(_3\) - the name according to the trivial nomenclature).

Students write down answers on sheets of paper and hand over on check of the jury. In total at the 2nd station, 14 questions are asked; the greatest possible number of points for answers to them is equal to 14. The results of the performance of tasks are presented in the tab. 2.

**Table 2**: Evaluation points for the tasks of the station 2

| Teams       | Number of points earned |
|-------------|-------------------------|
| Alkanes     | 12                      |
| Alkenes     | 9                       |
| Alkadiens   | 10                      |
| Arenas      | 9                       |

**Station 3**: Sheets of paper with tasks are distributed.

1. To solve a crossword puzzle.
2. The class of organic compounds containing an atom of carbon is able to sp\(^3\) hybridizations. (Answer: alkenes)
3. The most ordinary representative of saturated hydrocarbons. (Answer: methane)
4. The alkyne having a molecular formula C\(_5\)H\(_8\). (Answer: pending)
5. To what class of substances does connection which formula C\(_4\)H\(_{10}\)? Belong (Answer: alkanes)
6. Name of the radical C\(_2\)H\(_2\)· (Answer: spent on drink)
7. To what geometrical figure in space does there correspond the ethylene molecule fragment? (Answer: triangle)
8. The substances differing on the group -CH\(_2\) (Answer: homologs)
9. General signs of cycloalkanes and alkenes. (Answer: interclass isomers)
10. Synonym of the name of alkanes. (Answer: paraffin)

The main composition of gasoline. (Answer: hydrocarbons)

2. To choose among the given substances:
1. Molecules with sp3 hybridization of atoms of carbon.
   a. methane;   b. 4 methyl pentane;   c. 2,2 dimethylbutane;   d. cyclopropane; (Answer: and, c)
2. The connections belonging to the class of alkanes.
   a. C\(_5\)H\(_5\);   b. C\(_5\)H\(_{12}\);   c. C\(_{12}\)H\(_{26}\);   d. C\(_8\)H\(_{18}\);
3. The substances reacting replacements.
   a. propane;  
   b. hexane;  
   c. C4H10;  
   d. methane;  
   (Answer: and, in, d)

4. Isomers.
   a. butane and 2 methylpropene;  
   b. pentane and 2 methylbutane;  
   c. pentane and 2,2 dimethylpropene;  
   d. 2 methylpentane and 2,3-dimethlbutan;  
   (Answer: and, in, d)

5. Homologs.
   a. C3H8 и C5H12;  
   b. CH4 и C3H6;  
   c. C4H10 и C2H6;  
   d. C5H12 и C8H18;  
   (Answer: and, c)

6. Final product of reaction of CH4 + Cl2
   a. CH3Cl;  
   b. CH2Cl2;  
   c. CCl4;  
   d. CHCl3  
   (Answer: c)

7. Product of reaction of CH2 = CH2 + HBr
   a. CH3-CH3;  
   b. CH3Br-CH2Br;  
   c. CH2Br2-CHBr2;  
   d. CH3-CH2Br  
   (Answer: d)

8. High-quality reaction to acetylene:
   a. C2H2 + H2;  
   b. C2H2 + HCl;  
   c. C2H2 + Br2;  
   d. C2H2 + HBr  
   (Answer: c)

9. The reaction of the interaction of rubber with sulfur:
   a. sulphur forming;  
   b. curing;  
   c. sulphur;  
   d. isomerization  
   (Answer: b)

10. For the first time benzene was found in structure:
    a. oil;  
    b. coal;  
    c. plants;  
    d. calcium carbide  
    (Answer: b)

Total on 3 stations 20 tasks are performed, the maximum number of points is equal to 20. Results of performance by teams of tasks for 3 stations are presented in tab. 3.

| Teams     | Number of points earned |
|-----------|-------------------------|
| Alkanes   | 15                      |
| Alkenes   | 13                      |
| Alkiny    | 19                      |
| Alkadiens | 16                      |
| Arenas    | 8                       |

Summing up

The jury announces game results. The results are presented in fig. 1.

The Alkynes team which gathered in the sum of 41 points takes the 1st place and is awarded the certificate of appreciation.

For identification of the dominating motives of educational activity of school students after carrying out a lesson in experimental 10B and control 10G classes repeated questioning for identification of orientation on assessment, knowledge, and success was carried out. A comparison of answers before carrying out a lesson in both classes is presented in figures 2, 3, 4.

The orientation on assessment after carrying out a lesson in 10B a class considerably increased in a playful way (figure
2).

**Figure 1**: The final results of the tasks of the game teams

**Figure 2**: Motivation for evaluation

Level of knowledge after carrying out a lesson game in 10B a class grew significantly whereas in 10G a class in which the lesson was conducted in a traditional form changed slightly (figure 3).
Figure 3: Change in academic performance in 10B and 10G classes

The orientation on success at students before carrying out an experimental lesson in both classes differed slightly. After carrying out a game lesson in 10B a class this indicator significantly increased (figure 4).

![Figure 4: Focus on success](image)

Interest in a chemistry subject is in both classes at the level above an average. After carrying out the generalizing lessons this indicator in 10B a class promoted more, than in 10G a class (figure 5).

![Figure 5: Focus on knowledge](image)

Data of surveys conducted in both classes before carrying out an experimental lesson confirm the efficiency of occupation in a playful way from the point of view of the extent of digestion of material, motivation on the acquisition of knowledge, interest in a subject of chemistry, orientation on success.

SUMMARY

1. The analysis of results of a lesson in 10B a class allows us to note that thanks to an educational game it was succeeded to strengthen interest in a subject, to increase the level of digestion of material, to make active orientation on the acquisition of assessment and motivation of success.

2. During the game, the creative atmosphere reigns in a class thanks to what such lessons promote the maximum realization of abilities of each pupil and develop skills of group interaction.

3. Results of questioning show that most of the students (56%) voted for carrying out lessons with the application of educational games. By means of game technologies, it is possible to solve all main objectives of the educational process: subject, meta-subject and personal.
CONCLUSIONS

The results of the conducted research demonstrate the efficiency of use in the educational process of game technologies. They promote the formation of the creative potential of students, develop vocational guidance of seniors and are an important condition of raising achievement.

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