

## Dialogue as a Component of Basic Skills in Teaching Chemistry and Environmental Protection

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### ABSTRACT

*The article gives ideas for pedagogical communication, which helps for cognitive activity and emotional value relations in the learning process. When the student is given the opportunity to participate in a dialogue for didactic purposes, reflection, the ability to self-knowledge and self-assessment develops. Dialogue is an immanent characteristic of the learning process in which the culture of communication and personal development is formed and developed. Interactive teaching methods and techniques help.*

*Keywords: communication, dialogue, education, interactive methods.*

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### INTRODUCTION

If the monologue is used during teaching process where students receive "ready knowledge and information" (usually passively), it is not possible to form cognitive activity and intrinsic motivation to learn. In the knowledge economy, memorizing facts and procedures is important, but not enough to make progress and success.

In our rapidly changing society, skills such as problem-solving, critical thinking, the ability to cooperate, creativity, computational thinking, and self-regulation are more important than ever. They are the means to put what we have already learned into practice to create new ideas, new theories, new products and new knowledge [1]. With the development of modern technologies, the Internet and social networks, it is necessary

to rethink and introduce some new approaches in the learning process.

Dialogue, as an aspect of interpersonal communication, has unlimited possibilities for transformation of its participants. It is known that in school and university teaching two main forms of communication are used: authoritarian and dialogical. The dialogical form of teaching and communication has a significantly greater effect on personal and intellectual growth than the authoritarian one. The dialogue also introduces certain personal elements in the transmitted information through argumentation of ideas, through evidentiary descriptions or through logical connections. Developing dialogue skills is also a process of personal growth.

Dialogue in the learning process must be

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sustainable in order to serve as a means of feedback. Dialogic forms of learning, interactive methods - are methods in which the leading role is played by students. Interactivity “refers to the interaction between the student and the teacher, as well as between the learners themselves or, more broadly, between the members of a study (working) group” [2]. Interactive methods require partnerships, communication in the form of dialogue (based on pre-specified arrangements and procedures). As a result of the interaction during the dialogue, it is possible to influence, enrich and/or change the initial opinion and position on a certain issue in both subjects involved in the interaction (trainee and trainer).

Pedagogical interaction is a natural process for making personal changes due to the obligatory reflection, self-reflection and making choices in changing situations [3].

Herein, we report examples from the practice of positive and negative dialogue, its introducing in the process of training in Chemistry and Environmental Protection teaching and we reveal some conclusions based on the experience gained.

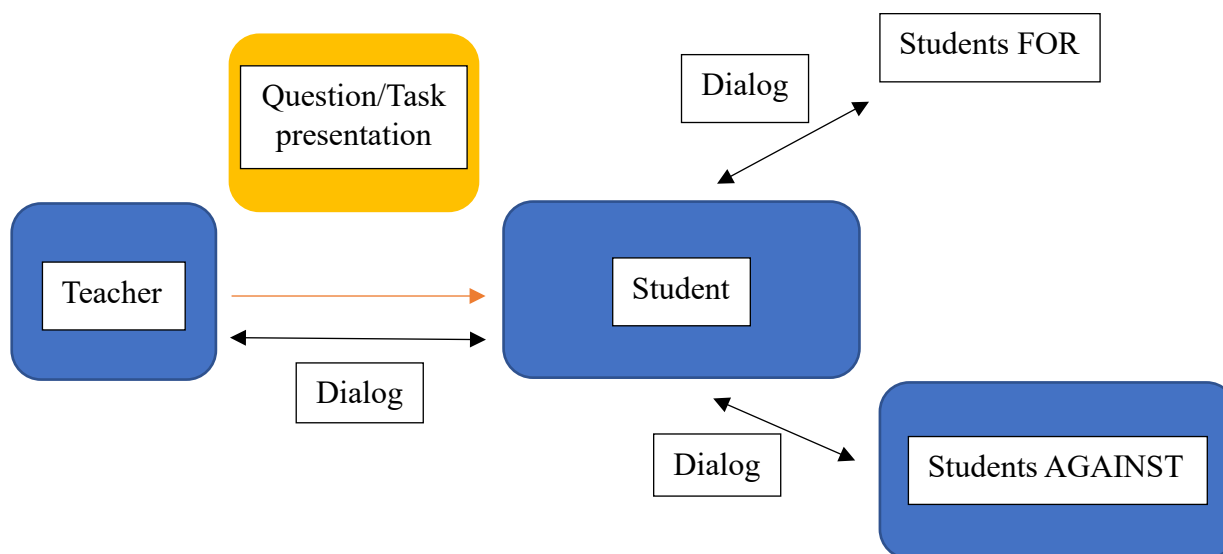
The study is conducted with 52 students from the Mathematic High School “Dr Petar Beron”, Varna, studding according to the new teaching

program on Chemistry and Environmental Protection and acquire secondary education in 10th grade - first stage of high school. Scheme 1 presents the main model of this study.

## RESULTS AND DISCUSSION

The students in secondary school better understand and memorize new knowledge when it is presented in the form of dialogue in its three categories: “address-question”, “address-correction” and “address-incitement to action”. Often the wrong answer in one of the three situations and its correction through dialogue with explanations, leads to the acquisition of lasting knowledge related to the involvement of not only mechanical but also other types of memory, such as situational, visual and others. It should be noted that an important point is the correct use of the above categories in the dialogue. If they are not used in good faith and correctly, this can lead to delusions in students, which will be permanently remembered and in a subsequent situation such an approach will cause them hesitation, insecurity and lack of desire to communicate.

For example, in the study of the compulsory topic “Chemical elements of group IIA of the



Scheme 1. Model of the study.

periodic table” from the program in Chemistry and Environmental Protection for 8th grade, after explaining that the elements of group IIA of the periodic table have 2 electrons in their outer electronic layer, two forms of further communication are applied:

- The students were asked: “Taking into account the above mentioned and that the chemical elements calcium Ca and magnesium Mg are situated in group II A of the periodic table, how many electrons they should have in their outer electron layer?” The logical and correct answer that most of students give is the correct one - 2 electrons.

- The definition of question is also transformed to: “The elements calcium Ca and magnesium Mg occupy different places in the periodic table, respectively 3 and 2 period. How many electrons should they have in their outer electron layer? Most of the students were hesitant, looking for logic in the above proposition. Some of them orient themselves correctly by giving the correct answer 2 and an explanation follows that it is related to the group number of the two elements in the periodic table. But major part of the students were mistaken in their answer and some of them point out 2 and another part 3 electrons related to the period of both elements.

Another possible example is reveal in the topic “Metals in group IIIA (13) of periodic table. Aluminium.” If students were given preliminary information that aluminum is a metal similar to the alkali and alkaline earth metals studied so far, guess what its properties will be. They would all correctly define the studied interactions with acid oxides and acids, they will wrongly define similarly to metals of groups IA and IIA interaction with water and none of them would predict the amphoteric nature of aluminum and its ability to interact with alkali bases.

Faced with such a next situation, they would look for the trick, not focus on the logic of reasoning.

The topic “Drugs” is part of the curriculum in

chemistry and environmental protection studied in 9th grade. It always arouses interest among students, as it addresses one of the most important social problems of modern society. Lecture on drugs is not the best way to form an attitude to the problem. Better results are achieved by using dialog and interactive methods to stimulate students to exchange information and opinions, share personal impressions, discuss actions in a specific situation. Therefore, various methods and techniques can be used in the study of this topic, for example: SWOT-analysis, pyramid, Brainstorming, Brainwriting, Avalanche. The experiment is defined as following: The class is divided into two groups and the teacher sets the topic to be worked on: “Drugs - risks, addiction and prevention. I chose to say NO, and you?” After completing the group work, the group speakers present the summarized theses in the form of a dialogue.

The next task that the teacher assigns to the groups is an analysis of the “Tree of Problems” - working with a flipchart in groups. Students are divided into two groups, each receiving a flipchart with a painted tree with large roots and branches with leaves and fruits. The following problems are written in the trunk of the tree:

- Simona - 18 years old, pregnant in the third month, has been living with the HIV virus for 4 months, uses drugs.

- Alexander, 19 years old, injects drugs into his veins and lives on the street.

Each group thinks about the possible causes of the problem and writes them down at the roots of the tree, then does the same with the consequences and writes them down on the branches and fruits. The group discusses in the form of a dialogue the connections between the individual factors, marking them with arrows. Students analyze possible strategies, steps to solve (reduce) the problem.

For the next task the class is divided into 4 groups and each group must solve one case.

*Case 1:* Several times your best friend

borrow money, but delays their return with various explanations. You understand that he has started taking hard drugs. You grew up together, you know his family, and you consider him extremely erudite and intelligent. Will you try to help him? How?

*Case 2:* Returning from lectures, a girl finds her brother in their home unconscious. She reveals that his condition is the result of the use of an overdose or a poor-quality drug/poisoning with impurities/. What should the girl do?

*Case 3:* You are at a party where all your acquaintances are smoking cannabis. Only you stand aside and get bored. But suddenly you notice that they are calling you to join them as if your friendship depends on it. What are you going to do?

*Case 4:* Passing by the bag of his girlfriend, Peter most unexpectedly sees a syringe and reveals that she taking drugs. What should he do?

After 10 minutes of discussion, the selected representative of the group presents their solutions to the others, in the form of a dialogue with another participant, which the group proposes for the given case and answers the questions of the others. Our research shows that the teacher's participation in active dialogue with students on a topic on the one hand guides and directs them in their thinking, and on the other hand prevents the process of increasing tension and the emergence of controversial situations.

The topic "Importance of halogen elements" is part of the curriculum in chemistry and environmental protection studied in 7th grade. It

introduces students to the positive and negative aspects of the studied halogen elements. The lesson was organized in the form of a discussion. Two groups of students with one speaker each participate. The first group is "for" the use of halogen elements in practice, and the second group "against" their use. The other students are given a worksheet in which they note the positive and negative features of each of the halogen elements commented on during the dialogue (Table 1).

For each chemical element in the form of a presentation, brief information about its discovery is presented. In the course of the dialogue the areas of application of the respective element and its harmful effects are revealed. Finally, a table is designed showing the content of halogens in the body and the toxic dose of each of them.

Nowadays information technologies are introduced strongly in the learning process. The interactive approaches in the form of games are also increasingly used. Such a game was developed by Benava et al. in the textbook on Chemistry and Environmental Protection for 8<sup>th</sup> grade [4]. The game consists in the acquisition and creation of lasting knowledge concerning the metals of the periodic table and the chemical reactions in which they participate. The game is developed in the form of dominoes, as one part of the domino tile contains a chemical element, its chemical symbol or a compound of a chemical element. The other side of the tile contains a physical or chemical property of a chemical element or reaction in which it participates.

Table 1. Comparison of positive and negative features halogen elements.

halogen element	Importance for the organism	Positive effects for organism	Negative effects for organism
fluorine			
chlorine			
bromine			
iodine			

Through the “domino game” students easily and fully assimilate and consolidate new knowledge concerning the cited part of the material. The assembly of each domino tile is accompanied by a dialogue between the students, as well as between the teacher and the students, explanations are given by the teacher, which supplement and present in their entirety the necessary new knowledge. Such a game can be developed in the form of a puzzle or other kind of enigmatic game that is fun and facilitates the acquisition of knowledge.

In a lesson for chemical element copper in Chemistry and Environmental Protection, 10th grade, basic facts and concepts are given [5]. The methodological structure of lesson is presented in Table 2.

The new knowledge that students must acquire in the lesson about copper are: the physical and chemical properties of copper and its compounds, its physiological action, production, use and distribution. Herein of course the traditional methods of teaching can be used to build needed knowledge (textbook, periodic table, diagrams, models of the atomic structure of copper, etc.).

But better results are achieved by creating a problem situation and using dialog to discuss and reveal properties of copper. Example: Design an atomic model of copper and characterize its structure.

When students can build hypotheses with the available theoretical knowledge, a problematic situation can also be created. Example: What is the chemical nature of the element copper? What are its properties based on its place in the periodic table?

### Examples for tasks to resolve

*Task 1:* Introduce copper in several testing tubes and add subsequently in every tube:

- water, diluted sulfuric acid, concentrated sulfuric acid, sodium hydroxide solution

Based on the obtained results from the reaction conclude what kind of element is copper (metal or non-metal)

*Task 2:* Reveal and describe place of copper in the periodic table. Describe his main properties based on his place in the periodic table.

*Task 3:* Describe chemical equation of interaction of copper with other chemical elements and

Table 2. Methodological structure of lesson “Copper”.

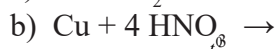
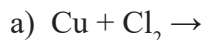
Didactic structure	Logical-psychological structure	Methodological structure
Update of knowledge and skills	Creating a problem situation - awareness of the need for knowledge for work	Dialog and self-work
Acquisition of new knowledge and skills	Main problem - what properties have copper? What properties have its compounds? Building a hypothesis - statement of assumptions based on the knowledge of the place of copper in the periodic table Proof of hypothesis - experimental and theoretical	Heuristic talk and self-employment Dialog Demonstrations, Demonstration of samples, schemes, tables
Formation of knowledge	Finding the place of knowledge about copper and its compounds in a system	Dialog and self-work



determine degree of oxidation of copper. Make a conclusion for its properties of reducer or oxidizer.

*Task 4:* Calculate what quantity in grams of copper contain 5 kg  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ , with purity 96 %?

*Task 5:* Complete chemical equations:



All revealed facts for copper are presented by students on the white board and they are object of deep discussion during their development.

All our experiments reveal that using dialogue as an active form of knowledge transfer and acquisition gives the following benefits:

- developing the ability for self-learning and decision-making in real situations;
- developing key decision-making skills in ambiguous situations;
- acquiring communication skills and reaching the right decisions through dialogue.

## CONCLUSIONS

The teaching of “ready-made knowledge” and its mechanical memorization, without active independent activity and their connection with a certain logic, situation or aspect, is short-term and transient. Dialogue, as the determinant in the development of the personality, should be the leading form of organization of the educational activity. Lack of communication skills limits the effectiveness of interactive learning [6]. How to ask questions, how to present their idea or decisions, how to persuade and defend their opinion, are questions that stand not only for students but also for teachers.

The use of interactive methods in teaching chemistry and environmental protection

increases the motivation to learn, as students take responsibilities and actively participate in the process of acquiring knowledge. Teachers are collaborators, partners who help students learn how to make optimal use of information resources in the global information system and how to choose the most appropriate learning materials. Active communication and interaction lead to decision-making and taking responsibility in the presentation process and thus increases students' self-esteem and confidence.

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