

Saidanvar Umarov 

Applicant of the Khujand State University named after academician B. Gafurov,
Khujand, Tajikistan

anvar.8889@mail.ru

Farhod Sirojov,

Applicant of the Khujand State University named after academician B. Gafurov,
Khujand, Tajikistan

farhod_sirojov94@mail.ru

METHODS OF INCREASING COGNITIVE ACTIVITY ON THE TECHNOLOGY OF DEVELOPING CRITICAL THINKING IN CHEMISTRY LESSONS

***Annotation.** This article proposes increasing cognitive activity using technology for developing critical thinking in chemistry lessons. To achieve this goal, an analysis of the scientific literature was carried out, which made it possible to identify the capabilities, advantages and benefits of this method, the purposes of its application and provide examples of the classification of critical thinking. The article provides examples of learning situations that can become the basis for the development of critical thinking.*

***Key words:** critical thinking, chemistry, lesson, teaching critical thinking, technology.*

***Анотація.** У статті пропонується підвищити пізнавальну активність за допомогою технології розвитку критичного мислення на уроках хімії. Для досягнення поставленої мети було проведено аналіз наукової літератури, який дав змогу визначити можливості та переваги даного методу, цілі його застосування, навести приклади класифікації критичного мислення. У статті наведено приклади навчальних ситуацій, які можуть стати основою для розвитку критичного мислення.*

Ключові слова: критичне мислення, хімія, урок, навчання критичного мислення, технологія.

Introduction. Improving the effectiveness of the lesson is the main task of the teacher. The success of its solution largely depends on the teaching methodology, which allows to equip students with deep and solid knowledge, teach them to work with interest and independently. It is obvious that their interest in studying and creativity makes them more active in the educational process, which leads to greater motivation, the manifestation of their talents and the achievement of success in the study of science [1]. In the organization of this kind of activity, the so-called critical thinking technology becomes one of the promising learning technologies. This technology is a synthesis of problem-based learning, information and communication technologies, and the project method.

The aim of the article is to reveal the methods of increasing activity on the technology of developing critical thinking in chemistry lessons/

Research results. The method of developing critical thinking through reading and writing was developed in the USA at the end of the 20th century (Charles Temple, D. Still, K. Meredith) and is associated with the concept of student-centered learning, which was developed by Davydova and Zankova in primary school. These programs are provided with didactic material and methodological equipment. The technique of critical thinking is based on the proven ideas of J. Piaget and L. Vygotsky that thinking develops only in a situation of developmental problems, in the case when the child himself “collects» the concept of the subject, his own idea of the subject. What happens to this subject if a teacher gives a student a ready-made task on a topic and asks him to reproduce it in the form of an answer, and then he violates his natural desire for scientific and cognitive activity? Thus, the «construction» of one’s own knowledge as part of one’s search activity is the main thesis of the entire technology.

The tradition of critical thinking in education has been much more prominent in the US than in Europe. The 1996 National Committee on Science Education

Standards and Assessment's report (National Research Council, 1996), influenced US policies on science education and critical thinking. It emphasized good thinking, higher-order thinking, reflective thinking and the kind of thinking that involves judgment and active combination of a number of intellectual faculties. Such an approach has ancient origins, but was reintroduced to US education by John Dewey. Dewey (1933) visualized the reflective thinker as a person who could adjust their thinking, decision-making and conclusion reaching through the combination of external information and internal experiences. Dewey's influence on the subject of thinking and thought formation was significant, as he diverted teaching practices and learning experiences away from memorising a textbook into thinking about the information found in textbooks and making sense of it [2, p. 19].

In modern discussions about the nature of higher education, the concept that emerges most widely is the idea of critical thinking. The obvious importance of critical thinking is evident in many academic teaching practices. In many academic assignments and abstracts intended for students, a basic intellectual task is often based on the idea of critical evaluation in some way: critically analyze X or give a critical discussion of Y.

For example, chemistry as a science has a pluralistic constitution, which can be characterized by epistemological, ontological, methodological and axiological aspects. The discipline has a dual character, as it has features of Natural Sciences and technology. The goals of a chemical enterprise are inextricably linked to basic human goals and objectives. A variety of social, political, economic, environmental and ethical implications of chemical thinking and action have been analyzed in several studies on the history and philosophy of chemistry [3, p. 2].

Chemistry has been taught using several strategies like problem-based learning, concept mapping and lecture method but students still find it difficult to link some concepts to daily activities when confronted with abstract tasks that require critical thinking [4, p. 4].

Critical thinking is one of the types of human intellectual activity, which is characterized by a high degree of perception and objectivity in relation to the surrounding information field.

In the process of applying critical thinking technology:

- knowledge, abilities, skills and a general way of thinking are acquired;
- it becomes possible to combine individual disciplines;
- conditions are created for change and differentiation of education;
- attention to self-awareness is formed, an individual technology for their education is developed.

To think critically is something that society expects citizens to do well for their individual as well as for the collective wellbeing. This is why it is important to develop critical thinking during the schooling career when students are both impressionable but also demonstrate great capacity for learning.

Learning chemistry is therefore learning slowly but steadily to combine processes of action and processes of thought. The challenge for the chemistry teacher, at the other end of the spectrum, is to ensure that in a classroom of students with different approaches to learning everyone manages to follow on building these combinatory processes of action and thought, when each student builds their own individual process. Accepting that “a critical approach to teaching science is less concerned with students accumulating undigested facts and scientific definitions and procedures, than with students learning to think scientifically” the study aims to focus on how the process of learning chemistry can enhance students’ critical thinking skills and dispositions [2, p. 43].

The purpose is to study the effect of various substances on human health.

The composition of fruits and vegetables includes various chemical elements and substances. 100 g of apples contain 86 g of water, 0,8 g of starch, 278 mg of potassium, 110 mg of copper, 26 mg of sodium, 16 mg of calcium, 11 mg of phosphorus, 9 mg of magnesium, 2,2 mg of iron, 2,0 mg of iodine, 0,047 mg of manganese, 2 mg of folic acid, vitamins A, B, C, H, K, PP. Apples are considered a useful product for humans. Vitamin C is involved in redox reactions, promotes the

absorption of iron. Iron is involved in the transport of oxygen and the maintenance of immunity. Potassium is responsible for regulating the water and electrolyte balance. Plants can absorb from the soil saturated with fertilizers much more nitrogen compounds than they need for development, so sometimes due to improper cultivation apples contain nitrates, up to 30-50 mg. In the human body, nitrates under the action of the enzyme nitrate reductase are reduced to nitrites, which interact with hemoglobin in the blood, which leads to the oxidation of ferrous iron in it in the trivalent. This produces methemoglobin, unable to transfer oxygen to tissues and organs, resulting in reduced physical and mental activity. For an adult, the toxic dose becomes 600 mg [3, p. 3].

What foods (of plant or animal origin) contain large amounts of nitrates?

How can I reduce the number of nitrates in vegetables?

Why spinach and parsley grown on the same soil contain different amounts of nitrates?

What nitrogen-containing fertilizers are best used to reduce environmental risks?

In this task, students are invited to speculate what chemical elements a person receives from food and whether "useful" products are always useful. Additional questions can also be added here (What form do these elements appear in? Is it the form of any chemical compounds?). Also, students can be given tips from biology, explaining the metabolism in the body.

Thus, this task allows students to develop critical thinking, as it requires the knowledge of chemistry and ecology and the ability to draw conclusions and analyze the available and received information.

Conclusions. Thus, it can be concluded that critical thinking plays an important role in education, as it can be applied in all areas of knowledge, as well as in everyday life. This suggests that it needs to be developed. According to the results of the survey, critical thinking plays an important role in the educational process, which must be taken into account in the training of future teachers. Future teachers are not only familiar with this concept, but also interested in learning more about it for application in their educational practice.

References

1. Umarov S.A., Sirojov F.Z. The system of independent work of students in the 10th grade. *Collection of articles of the first international scientific and practical conference «Prospects for the development of research in the field of chemistry of coordination compounds and aspects of their application», dedicated to the memory of Professor Saodat Mukhammedovna Basitova, the 80th anniversary of her birth and the 60th anniversary of the pedagogical and research activities of Doctor of Chemical Sciences, Professor Azizkulova Onajon Azizkulovna, March 30-31, 2022.* – Dushanbe.

2. Panagiota Axelithioti. Critical thinking in chemistry education: a study for practical application in secondary education based on questions, explanations, and arguments. A thesis submitted to the University of Birmingham for the degree of doctor of Philosophy School of Education College of Social Sciences University of Birmingham, May 2018, 268 pp.

3. Critical thinking in STEM (science, technology, engineering, and mathematics). Pensamiento crítico en CTIM (ciencia, tecnología, ingeniería y matemáticas). Utopía y Praxis Latinoamericana publica bajo licencia Creative Commons Atribución-No Comercial-Compartir Igual 4.0 Internacional (CC BY-NC-SA 4.0). URL: <https://creativecommons.org/licenses/by-nc-sa/4.0/> (last accessed 2023/10/30).

4. Okafor Ngozi and Nwonu Hyacinth. Promoting critical thinking skills of secondary school chemistry students' through 7e-learning cycle model. *Tropical Journal of Education*, 2021. № 3(1/2). P. 16 – 27. <http://doi.org/10.47524/tje.v3i1.17>
URL:
<https://credencepressltd.com/journal/uploads/archive/202216473360449736014674.pdf> (last accessed 2023/10/30).