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TRANSFER OF ACCENTS IN PHARMACEUTICAL EDUCATION DURING THE WAR: CHEMICAL DISCIPLINES

The field of education is one of the most important aspects of Ukraine and performs the function of national security. The trends of modern society form new requirements for the education system. Ukraine's education sector has undergone major changes under martial law. Forced evacuation, physically destroyed educational institutions, the need to simultaneously study and work in order to survive, the loss of housing – all these are the consequences of the war.

Ukrainian education is forced to survive, adapt to the new realities of life, transform, and, as always, find a way to salvation¹.

The transformation of the educational process is carried out in parallel with the transformation of educational disciplines – there is a transfer of accents on the study of the most relevant concepts, methods, objects.

«Transformation of education» is a creative process of transferring the essential features of innovative achievements of a certain profile of education to another profile of education with the aim of combining them. Transformation reveals the dependence of the present on both the future and the past. In the researches of pedagogues, philosophers, psychologists, when revealing the phenomenon of «educational transformation», certain changes in the methodology of science are outlined, which causes serious transformations in the system of the educational process (fig. 1):

1 Law of Ukraine "About education" № 2145-VIII of 05.09.2017. URL: <http://zakon.rada.gov.ua/laws/show/2145-19>. The Concept of the implementation of state policy in the field of reforming general secondary education "New Ukrainian school" for the period up to 2029. Approved by the order of the Cabinet of Ministers of Ukraine dated December 14, 2016. № 988-r. URL: <http://www.kmu.gov.ua/control/uk/cardnpd?docid=249613934>.

Source: Author's research.

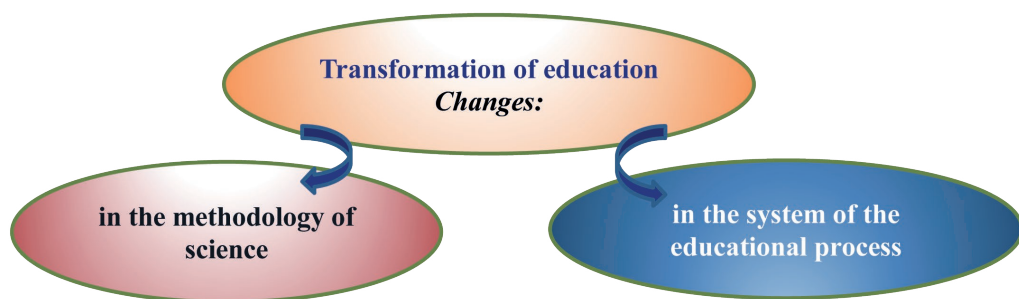


Figure 1. Basic vectors of Transformation processes in education

At the Faculty of Pharmacy, students – future pharmacists study 8 chemical disciplines: organic chemistry, inorganic chemistry, physical and colloidal chemistry, analytical chemistry, biological chemistry, pharmaceutical chemistry, toxicological and forensic chemistry, theoretical bases of the synthesis of medicinal substances and the «structure-activity» relationship.

Among the chemical disciplines, there are 6 basic disciplines and 2 elective disciplines. Toxicological and forensic chemistry is elective discipline².

Toxicological and forensic chemistry is a science that studies the methods of isolation, purification, qualitative detection and quantitative determination of poisonous and toxic substances, as well as their metabolites in objects of various nature: in biological material and human biological fluids, material of animal and plant origin, waste industrial enterprises in the form of wastewater, emissions into the atmosphere and soil, in agricultural products, etc. Toxicological chemistry is of great importance in the diagnosis of poisonings, in the fight against crime.

The conclusions of toxicological chemists about the presence and amount of poison in the investigated objects provide great help to forensic medical experts (to establish the causes of poisoning), and to judicial and investigative bodies in solving crimes.

According to the chemical and toxicological classification, poisons are classified into:

«Volatile» poisons — substances isolated by steam distillation (cyanides, alcohols, phenols, AlkHal, etc.);

«Metallic» poisons are substances isolated by the method of mineralization of biological material (compounds of Zn, As, Mn, Hg, Cd, etc.);

2 Nizhenkovska, I.V., Welchinska, O.V. & Kucher, M.M. (2020). Toxicological chemistry: textbook. 3-d ed. K., Medicina, 372 p. +XII. Welchinska, E.V. (2017). Toxicological and forensic chemistry (Criminal analysis). Poisonous substances and their biotransformation: textbook. K., PE Lopatina O.O. 392 p.

«Medical» poisons — substances isolated by polar solvents (barbiturates, alkaloids, salicylates, etc.);

Pesticides — substances that isolate with organic solvents (OP, OCl, carbamates, phenols, pyrethroids);

Substances isolated by water extraction (*salts, alkalis, acids*);

Substances isolated by special methods (*fluorides*);

Substances analyzed directly in biological material (CO, H₂S, NH₃).

Some representatives of the classes of poisonous substances remain relevant and are actively used in preparation for military operations or terrorist attacks. A prominent representative of the «Volatile» class of poisons is hydrocyanic acid and cyanides – a common tool for poisoning since ancient times. Arsen (“poison of kings”) is one of the oldest and most famous “metallic” poisons, which has been used in intentional poisonings since ancient times.

During the war events, a transformation took place in the education system, namely, during the study of the discipline «toxicological and forensic chemistry», the emphasis on the study of poisonous substances shifted (tabl.1).

Table 1

Classes of poisonous substances

Source: Author's research.

Before the war events in Ukraine	During the war events in Ukraine
«Volatile» poisons	«Volatile» poisons
«Metallic» poisons	«Metallic» poisons
«Medical» poisons	«Medical» poisons
Pesticides	Pesticides
Substances isolated by water extraction (salts, alkalis, acids)	Substances isolated by water extraction (salts, alkalis, acids)
Substances analyzed directly in biological material (CO, H ₂ S, NH ₃)	Substances analyzed directly in biological material (CO, H ₂ S, NH ₃)
	Combat poisons (CWA), antidotes

Medicines in toxic and lethal doses belong to the class of «medical» poisons: strychnine, clonidine, amphetamines, phenothiazine and 1,4-benzodiazepine derivatives, as well as alkaloids. Special attention should be paid to the study of the class «combat poisons» and antidotes. Today forces us to transform the educational process and shift the emphasis to the study of aggressive chemical poisons that are actively used in times of war.

These are combat poisonous agents (CWA): nerve-paralytic (OP) series: V, G, A; vesicants, irritants (lacrimating agents, sternits, algogens), psychotropic agents, cellular and chemical asphyxiants, pulmonary toxicants. Methods of isolation from objects, qualitative detection and quantitative determination of CWA have their own characteristics and are not used in the study of other poisonous substances.

For example, for *vesicants* – definition by Sulfur: mineralization in a Schöniger flask, volumetric determination of sulfate (Fritz and Yamamura), method of quantitative determination of Sulfur in phosphorus-containing OP (according to Preglem), method of quantitative micro determination of Sulfur in sulfur-containing and chlorine-containing OP (titration of $\text{Ba}(\text{ClO}_4)_2$ with dichlorofluorescein solution, titration with AgClO_4 solution.

For *nerve-paralytic (OP) agents* – definition by Phosphorus: combustion in a Schöniger flask, combustion in an Erlenmeyer flask, method of quantitative determination of Phosphorus in fluorine-containing or sulfur-containing OP in the form of quinoline molybdenum phosphate, Tsintsadze's reaction.

For *irritants* – definition by Halogen:

– Chlorine-containing Agents: method of mineralization in the Schöniger flask, methods of quantitative determination of Chlorine in the composition of OP Chlorine is determined according to Folgard, by the acidimetric method, by mercurimetric titration with diphenyl carbazone as a quality indicator or argentometric titration with an indicator dichlorofluorescein;

– Flour-containing Agents: method of mineralization in Wurtzschmidt's universal bomb.

Nerve-paralytic agents include carbonimidic phosphorus halides. Among them – a family of 100 compounds, which received the name «Novichok» of the A series. By chemical nature, these compounds belong to binary organophosphorus compounds.

«Novichok-7» (A-234) in 10 times more toxic than Zoman.

The large-scale invasion on the territory of Ukraine radically changed the course of all social processes in Ukraine, including the sphere of higher education. Higher education is designed to play one of the main roles in strengthening the resistance and minimizing the harmful effects of military actions on Ukrainian youth.