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The Feature of Scientific Explanation in the Teaching of Chemistry in the Environment of New Information of School Students' Developmental Education

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The aim of this article is to disclose features of scientific explanation in teaching of chemistry in the environment of new information of school students' developmental education. The leading approach to the study of this problem is the information and environmental approach that comprehensively address the problem of scientific explanation in the teaching of chemistry, to identify its characteristics and its role in the didactic system of developing training. In the article the concept of "informational-educational environment" and "personal information culture", identified the main function as the primary explanation of the procedure of scientific thinking in the teaching of chemistry. The features of scientific explanation in teaching chemistry in the new educational environment due to six types of relationships induction and deduction in explaining chemical phenomena, theories and laws. The choice of the ratio of induction and deduction affect the chemical nature of the studied object, the problem of knowing the object, the logical links between the structure of the object and the structure used to explain knowledge. It was found that the role of scientific explanation in the didactic system of developing education in the new information environment is the development of students forming their scientific outlook, logical thinking and culture of information activities.

Keywords: chemical education, scientific explanation, informational and educational environment.

INTRODUCTION

Urgency of the problem

Modern developmental chemical education is impossible without the active use of information technology. Computer animation and virtual models of chemical and

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man-made phenomena, systems and objects have become part of digital educational resources in the teaching of chemistry. Developed and implemented workshops virtual labs using the original authoring software and specialized software. However, most computer workshops using illustrative models studied phenomena without scientific explanation of their essence. Such an understanding of the role of computer workshops and virtual labs come into conflict with the priorities of the modern educational process (gain practical orientation). Necessary means of computer analysis and simulation of ecological and chemical problem situations to teach students the methodology of scientific research, research activities to obtain new knowledge to the student for the purpose of scientific explanation of chemical phenomena, theories and laws.

Informational culture of the teacher of chemistry requires certain personal qualities, such as the need for self-development and self-improvement, a comprehensive ability of independent search of information, analyze, perform, transmit it, to simulate chemical processes for the purpose of scientific explanation and to train school students.

Therefore, pedagogical research questions of scientific explanation in teaching chemistry in terms of developmental education students in the systematic implementation of inter-subject relations chemistry - informatics has become an urgent problem of modern didactics, although questions of informatization of education (Abasov and Abdullaev, 2011), (Ivshina and Ismagilov, 2010) and scientific explanation in natural science (Vilkeev, 1982) (Gabidullin 1984), (Harvey, 1969) have always attracted the attention of researchers. Therefore, this article is aimed at the disclosure of particular scientific explanation in the teaching of chemistry in the environment of new information of school students' developmental education.

METHODOLOGICAL FRAMEWORK

The leading approach to the study of this problem is the informational-environmental approach that comprehensively addresses the problem of scientific explanation in the teaching of chemistry, to identify its characteristics and role in the didactic system of developmental education with an emphasis on methods of scientific knowledge. The basis for this approach is the dialectical understanding of the process of scientific explanation in modern information-educational environment of the school developing education. The attraction of information and environmental approach for the study is that it is not just a theory, but also management technology educational environment taking into account the modern period in the development of society and information technology. Of fundamental importance to the concept of information-environmental approach is to define the environment within the meaning of developmental funds, which involves indirect control through the medium of formation and development of the individual student. In the framework of information and environmental approach implemented the principles of integration and multidimensionality. The principle of integration requires with the scientific explanation of chemical phenomena using modern information technology, computer technology and traditional means of teaching chemistry, as well as the functions of the interpenetration of the subjects of the educational system, allowing for a consistent interaction with each other to improve the effectiveness of developmental education. The principle of integration creates the conditions for a permanent interaction of the educational system, which is a sign of the effectiveness of stability bonds in solving common problems of developing education. The principle requires a multidimensional information culture and critical thinking in the scientific explanation of chemical phenomena, theories and laws. The essence of the principle of multidimensionality is that the student affected

by many factors contributing to its development and the formation of personal qualities appropriate goal-setting of the educational process.

RESULTS

New informational-educational environment and features models of scientific explanation in teaching chemistry

Information and educational environment, the content of which is an ordered system of information, transfer of experience provides the information activities of mankind. Under the educational environment we mean a set of conditions to ensure the reflection of the real world (educational information, are the subject of storage, transmission, transformation and management). In the new information-educational learning environment developing scientific explanation of chemical phenomena involves the formation of the corresponding qualities of the person as a result of combination of information tools, united in the collection, storage, processing and distribution of chemical and other natural science information. For this important mission, it is necessary to prepare students - future teachers of chemistry in the learning process at the university.

Considering the informational and educational environment of the school developing education it can not be ignored the issue of information culture of the teacher. Informational culture is understood as a component in the structure of cultural identity associated with its activity-party information, including as an essential component of scientific ability to explain natural and manmade phenomenon.

It is important for teachers is that when teaching chemistry the use of electronic educational resources as part of information technologies allows harmonious, concentrated and unobtrusively integrated chemical education in developing material that can generate interest. This biographical information about the scientists explain mysteries of nature, the virtual rational and the irrational use of natural resources, and others. In addition, to demonstrate without harm to the environment impact of chemical production (its waste or harmful chemical emissions), exhaust, unauthorized storage of waste on the environment, present computer animation and virtual models of human events and disasters. Computer technology in chemical education in the educational process allows to combine playing and learning cognitive activity. All knowledge begins with wonder. The surprise caused by the new leads to the development of curiosity, followed by the formation of students' interest in sustainable chemistry and motivation for its study, the needs of self-development and self-improvement.

However, it should be recognized that the skills formed in the virtual world are not always adequate in relation to the real objects and are applicable in the real world. In the new informational and educational developing environment, the role of real scientific explanation of natural phenomena, in particular chemical, taking into account public concern ecological and chemical problems in the world.

Briefly distinguish main functions as an explanation of the basic procedure of scientific thought in the natural sciences and chemistry, including:

1) it is a specific explanation of the logical-didactic way disclosure of the studied theories, laws, concepts;

2) an explanation - it is a way of comprehensive theoretical analysis of the studied any object of natural science;

3) explanation is the way to prove the truth, the logical validity of conclusions about the nature of the studied natural science facts, laws, phenomena.

It was found that from the perspective of didactic explanation of how the scientific process used in the study of Science subjects in school, also has a number of important features (epistemological, psychological, didactic aspects), to be aware of the teacher.

The pedagogical activity is important epistemological aspect of the explanation, namely, that an explanation is causal, genetic, functional, structural, and etc. When planning the logic of presentation of knowledge in the classroom teacher should think about optimal logic explanation, i.e. make a choice of inductive or deductive explanation, the explanation by analogy or a model of explanation. Accounting for the psychological aspect as the most important explanation of the method of training involves the right choice relation logical relationship known to students knowledge and new knowledge expounded. (The account of this relationship allows for the transfer of learned knowledge to new teaching and educational situation and to define ways to transfer.) The didactic aspect involves keeping pedagogically optimal ratio methods of presentation of knowledge by the teacher in the classroom and independent mental activity of pupils for the extraction of knowledge in the classroom.

In view of these aspects explain, and also features objects of knowledge (chemical phenomena, processes, theories, laws, and etc.), Objectives of the study of these objects, the teacher selects the type of explanation, a logical way to explain the levels of migration of known knowledge in a new situation with a view explain new phenomena and the level of cognitive independence of students in the classroom. At the same time in the new information and educational developing environment is important to consider the main types of relations of induction and deduction as elements of scientific and pedagogical aspect of teacher thinking.

On the choice of the appropriate ratio of induction and deduction the first of all affects the nature of the object under study (empirical or theoretical, material or ideal is the object of study), and at the second the problem of knowledge of the object (necessary to obtain empirical data to predict the existence of the object in theory to explain the object), thirdly, the logical links between the structure of the object and the structure used to explain knowledge.

Consider the types of relationships induction and deduction, the use of which is possible with scientific explanation in chemistry.

The first type is the ratio of induction and deduction corresponding to the inductive construction of educational material, includes three species. In disclosing the chemical concepts and empirical classification applies first appearance. In the case of solving the problem in heuristic conversation during the opening of causality, a second look. Intuitive solution of chemical problems corresponds to the third species of inductive explanation.

The second type is the ratio of induction and deduction, having two species corresponds to hypothetical-deductive method of studying chemical phenomena. In this case, the induction serves as a means of generating hypotheses, hypothetical-deductive method - as a means of verification. To formulate hypotheses two options grounds. The first option - a result of the generalization of the experimental data is formulated inductive inference. The second option - on the basis of everyday knowledge is formulated assumption (output) on how to solve a particular chemical cognitive task. Further, in both cases, the conclusion is justified theoretical knowledge and takes the form of a hypothesis. Then the hypothesis is attached to the new facts for the purpose of explanation, as well as deepening and proof of the hypothesis.

Pedagogical Studies (Gabidullin, 1984) found that the successful use of hypothetical-deductive method on the lessons of chemistry and physics teacher should first: consider logical path and instructional techniques summing students to the basic hypothesis to address the expected cognitive task; prepare some private hypothesis or hypotheses of a lower order of the hypothesis of a higher order; provide a test of the hypothesis of a lower order fulfillment corresponding experiment; consider the questions and tasks that serve as management tools

search activity of pupils at hypothesizing lower and higher order and experimental proof of the possible consequences of the hypotheses.

The third type of relation of induction and deduction corresponds to the case when in the process of observation is fixed close interaction of theoretical knowledge and sensory knowledge. And here the induction, in contrast to the previous type, serves only as a tool for the synthesis of sensory data by categories of science (in the second type of induction and deduction ratio inductive inference obtained by formal-logical generalization of sense data). The essence of the categorical synthesis - summing up the sense-data under the relevant category. The result is not a formal and meaningful generalizations.

In other words, the object of knowledge deductively transferred to the category of science, then by the inductive generalization of sensory data on the object being created for students intuitive guesses about how the disclosure of the chemical facility. It is notable that the statements guess the rationale is required. This allows us to consider the hypothesis of a guess. The next step is to check the validity of the hypothesis of relevant experience.

In pedagogical literature (Vilkeev, 1982) focuses on the fact that because the logic of disclosure of conflicting relationship itself is controversial and is deployed as a heuristic process, the disclosure of objective contradictions in fact the object of knowledge causes great difficulties.

Heuristic process - a form of the movement of thought from the detected object in the contradictory relations of knowledge to their reflection in the thinking as two opposite judgments (as the problem-antinomy). During the theoretical explanation of the result of comparison and dialectic synthesis of contradictory propositions (theses and antitheses) resolution of the problem occurs, the antinomy (knowledge of explained by the fact supplement explaining the law and compliance with established between them).

Thus, the logic of dialectical explanation of the objective contradictions in chemistry can be represented as follows (Figure 1). However, in explaining the conflict unresolved and may be, but the fact - unexplained. With this outcome it is necessary to review selected to explain the law.

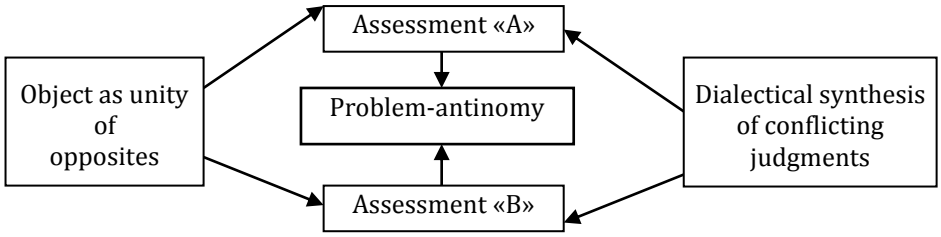

Figure 1. Structural and functional model of dialectical explanation of the objective contradictions

The fourth type is the ratio of induction and deduction in explaining the contradictions between latched explains the fact and explain the law clearly can be represented as shown in Figure 2.

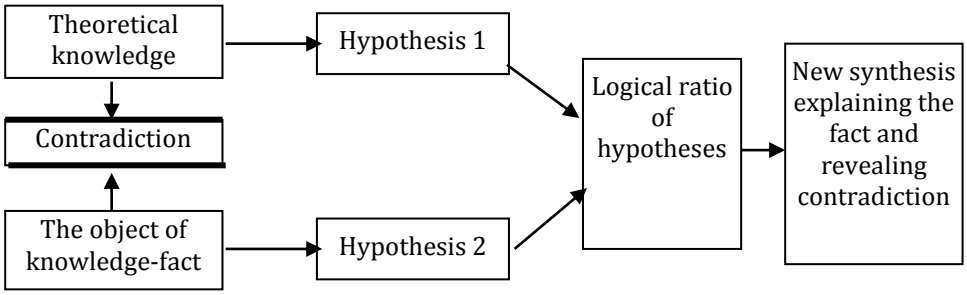

Figure 2. Structural and functional model of explaining the contradictions between the fact and the law

The fifth type of ratio of induction and deduction corresponds to deductive foreknowledge of facts that significantly increases the proportion of theoretical knowledge (Figure 3).

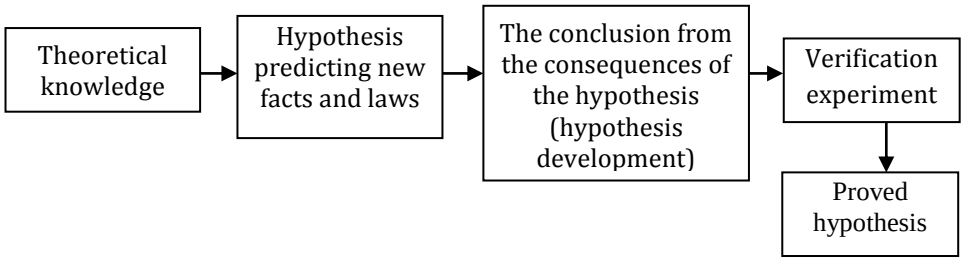

Figure 3. Structural and functional model with the deductive explanation of the facts of foresight followed by experimental verification

The hypothesis in this case is derived directly from the known theoretical knowledge (students think hypothetically; their cognitive activity is heuristic).

The sixth type of ratio of induction and deduction is realized in an environment where knowledge flows only at a theoretical level (Figure 4). When deductive construction of educational material postulated theoretical position is taken as a hypothesis that does not require experimental verification, and prove only logically.

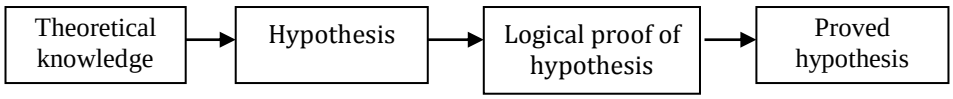

Figure 4. Structural and functional model of explanation in the deductive construction of educational material

During explanations in the new information-educational environment of developmental education is needed to demonstrate not only the source of the facts necessary for the construction of the theory, but also necessarily experimental confirmation of the theory of justice. Experimental verification of the theoretical consequences provides a huge opportunity for the effective application of the problem method of teaching chemistry.

A feature of the professional activity of the teacher of chemistry is the specific activities related to the formulation and conduct chemical experiments. Moreover, given that the future teacher will work with the generation that will begin to work actively in the society in 10-15 years, and came face to issues of energy conservation and environmental management (Gilmanshin, Ferenets and others, 2015), inevitably raises the question about the use of professional activity mainly environmentally sound experiments. This fact increases the importance of environmental training (Gilmanshina and Gilmanshin, 2015) from the perspective of the future teacher of the formation of its ecological orientation of professional thinking that considered in detail (Samigullina, Gilmanchina and others, 2015).

Thus, the implementation of a new information-educational environment contributes to developing scientific and pedagogical aspect of professional thinking of a teacher, which is formed in the process of mastering the knowledge of relevant science (in this case chemistry) as well as in the process of explaining this knowledge. Elements of scientific and pedagogical aspect of thinking Chemistry teacher ratios are the main types of induction and deduction in explaining chemical phenomena, theories and laws. The choice of the ratio of induction and deduction affect the chemical nature of the studied object, the problem of knowing the object, the logical links between the structure of the object and the structure used to explain knowledge. Experimental verification of the theoretical consequences allow

for the effective application of problem teaching method, raises the importance of environmentally sound experiences in the developmental education.

The role of scientific explanation in didactic system of developmental education

An important indicator of professional development of the teacher, his professional competence is the development activities of the individual student. Chemistry teacher (all theoretical principles presented in the study, apply equally to the teacher of any other Science subjects) should not only possess modern methods of transmission of chemical knowledge and practical skills of students, it is obliged to develop them (by means of chemistry to develop a sustained interest in the subject, logical thinking, universal education and action, etc..) to raise (using the educational potential of chemistry to form the scientific worldview, ecological culture, personality and metasubject educational outcomes). Modern teacher must be in accordance with the humanistic and personal orientation of chemical education reflected in the training material experience of creative activity of scientists and personal attitude to universal values (education, information, knowledge, etc.), Without entering thus in contradiction with the fact that without the knowledge and skills can not learn experience of creative activity. This is the essence of professional competence of the teacher in system of developing education in the new educational environment.

In connection with the above stated a teacher of chemistry at the explanation of educational material forming pedagogical skills in teaching methods of chemistry.

The scientific explanation for teaching chemistry involves not only knowledge of the characteristics of chemical theories and laws, but also the ability to didactically interpret the logic and methods of chemical science in the context of teaching in the school, taking into account psychological patterns of assimilation of chemistry students, while creating their humanistic orientation means of chemical science. The aim of such an interpretation and adaptation of scientific explanation and methods of chemistry in emerging school is reflected in the minds of students of chemistry as a combination of its teachings and the connections between them in the context of the specific vital complex problems (eg, ecological, chemical and health preservation) and human values. You must use the laws of scientific explanation in chemistry for humanitarian purposes, while educating students, creating personal educational outcomes.

Undoubtedly, one of the objectives of the new educational environment of developmental education is to prepare students for the ability to use a hypothesis as a form of scientific reasoning to explain the chemical phenomena. This requires a special operation conducted by teacher training students to apply the hypothesis in cognitive activity in close connection with the methods of developing training.

In didactics logical methods were seen as the logical aspects of the teaching methods. It was stressed that the logical methods and techniques included in the structure of teaching methods allow variably used teaching methods, selecting in each case not only the method of teaching, but also its logical option suitable explanation. It should be remembered that the choice of the learning process logical method depends on the stage of explaining the study of a training course, the students solved features a cognitive task and the level of preparedness of students.

We believe that the solution to the issue of teacher practices scientific explanation of the new material is not that other, as the question of the logic of the learning process, because the logic implicit in the methods of teaching, initiates mental activity of students. However, now in didactics and methods in choosing the way of educational material explaining the section or topic often come from single-

sided and not quite correct settings. It recommended difficult topics to present inductive and simple theme - deductively. In junior high, and even the middle tier is proposed to give preference to induction, and in high - deduction.

It should be noted that as a result of a simple, unscientific generalization induction is carried out by the external signs of the facts and phenomena that makes deep and substantial knowledge of the subject, does not allow to know some of the objects of science presented in the content of school subjects. Furthermore, it spent a lot of time on training students to a proper settlement of self-imprisonment. The deductive method, although considered to be the primary method of scientific explanation, and can not perform the functions of the basic method of training knowledge. It is therefore necessary interpenetration of these methods are explained in the form of the above six types of relationships inductive and deductive.

Next, a brief look at the logical aspect of the didactic system of developing training methods with emphasis on methods of scientific knowledge. Methods of scientific knowledge are divided into general scientific (induction, deduction, modeling) and special scientific methods. Special scientific methods unique to a particular science or cycles Sciences. For example, the method of thought experiment, and hypothetical-deductive method applied in the field of natural sciences, the most commonly in physics and chemistry. The methods of the individual sciences, because of their specificity, can not be presented in a logical aspect of the whole system of didactic teaching methods. In the adapted form they act as methods of teaching in lessons on specific academic subjects. The didactic classification they are implemented mainly through the structure of the research method.

Research method teachings - is adapted to the laws and principles of the system of training methods (rules) for a separate scientific method in the process of learning, which allows students to optimally deal with this method adequate educational problems, to carry out teaching and research assignments (Andreev, 2015).

The research method of explanation is widely used in the school chemistry lessons. The teacher in the course of their professional activities and plans to choose, in other words, the algorithm creates a research school, which includes a list of methods and rules used by the scientific method in order to explain the phenomenon under investigation.

Research method doctrine (explanation of educational material) has the structure: 1) a brief update of the studied material related to the topic of the lesson by the question posed to the class; 2) familiarity with the history of the issue (in other words, when you put the studied problem and how to solve, that is played embryology certain scientific truth); 3) the creation of the problem situation by sharpening the contradictions between the new facts and phenomena that require disclosure and the lack of sufficient knowledge of students for the assignment; 4) Provide students with the algorithm of actions aimed at the study, respectively, a new phenomenon or substance; 5) The compilation of the experimental part, adopted as a hypothesis; 6) the theoretical justification of the hypothesis; 7) the experimental validation of our hypothesis, ie its verification; 8) frontal conversation teacher with students, showing the degree of assimilation of new material.

Present structure of the research method allows to take into account the peculiarity of scientific explanation in teaching chemistry - the ratio of six types of induction and deduction - in didactic system of developmental education.

Thus, the role of scientific explanation in didactic system of developmental education students in the new informational environment is the development of students forming their scientific outlook, logical thinking and culture of information activities.

DISCUSSIONS

Previous few studies on this issue have been devoted to explaining the elements of the didactic theory in physics A.M. Sochor (1988), the use of hypothetical-deductive method explanation for teaching physics at school, D.V. Vilkeev (1982), A.S. Gabidullin (1984), I.P. Merkulov (1980), at training school chemistry N.A. Paravyan (1975), explaining the new material as the logic of the educational process J.K. Babanskii (1988), the scientific explanation in geography D. Harvey (1969), the role of scientific explanation in the formation of professional thinking of a teacher of natural sciences S.I. Gilmanshina, R.N. Sagitova and others (2015).

However, analysis of scientific papers devoted to the problem of scientific explanation in the teaching of chemistry in the new educational environment of developmental education students is extremely small, and they have only fragmentary-controversial nature.

CONCLUSION

The concepts of "information-educational environment" and "personal information culture" are grounded. It has been identified the main function as the primary explanation of the procedure of scientific thinking in the teaching of chemistry. The feature of scientific explanation in the new educational environment of the teaching of chemistry has been shown due to six types of relationships between induction and deduction in explaining of chemical phenomena, theories and laws. On the choice of the ratio between induction and deduction the following features have affect: the nature of the object under study, the problem of knowing the object, the logical links between the structure of the object and the structure used to explain knowledge.

It was found that the role of scientific explanation in the didactic system of developing education in the new informational environment is the development of students forming their scientific outlook, logical thinking and culture of information activities.

RECOMMENDATIONS

The content of the article have practical value for university teachers working with students - future teachers of chemistry, for young chemistry teachers, for students of extension courses.

In view of the results of this study can identify a number of scientific problems and promising areas for further consideration: the deepening and widening of certain provisions contained in the article related to the formation and accumulation of psychological-pedagogical potential of scientific explanation in teaching chemistry; development of scientific and methodological provision of electronic scientific explanation in teaching chemistry with the aim of developing the unified educational space.

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