



**PLOVDIV UNIVERSITY "PAISII HILENDARSKI"**

**FACULTY OF CHEMISTRY**

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**Annotation of the materials under art. 65 (1) of the Regulations for development of academic staff of PU "Paisii Hilendarski", including self-evaluation of overall contributions and input**

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**1. M. Minevska, J. Stefanova. Comparison of the ‘Life Skills’ Strategy with PISA, Programme for International Student Assessment. Chemistry, Vol. 20, Iss. 2, 2007, p. 99-107, ISSN 1313-8235**

This paper compares the ‘Life Skills’ Strategy with PISA, the OECD Programme for International Student Assessment. The similarities and differences of both programs are exhibited. Recommendations for the application of these programs in our school practice are given. We place special emphasis upon ‘scientific literacy’ of the pupils because this literacy affects essentially the work of Chemistry teachers at school.

**2. Yordanka Stefanova, Maria Minevska, Svetla Evtimova. Scientific literacy: teachers’ and students’ opinions. Chemistry, Vol. 20, Iss. 6, 2011 p. 496 – 506, ISSN 1313-8235.**

Undoubtedly the scientific literacy should be considered as an important element of science education in school. The article collects opinions both of teachers and prospective teachers about the meaning of scientific literacy, its forms and its importance. We try to establish through these opinions what kind of skills, mastered in school, are considered as useful for the future life and career and which of these skills can be considered as elements of the scientific literacy. We have not established any difference in the opinions expressed by teachers or by students.

**3. Yordanka Stefanova, Maria Minevska. Perceptions of the world: the role of scientific explanation in science education for forming the worldview of students. Chemistry: Bulgarian Journal of Science Education, Volume 21, Number 5, 2012, p. 655 – 668, ISSN 1313-8235.**

Everyone has his/her own view of the surrounding world. The school has a significant role in shaping these views. Therefore, targeted actions are needed in the classroom to build an adequate scientific insight and understanding of the relations: human – nature and human - society. The explanation is a cornerstone of science education. Roads to enforce the educational process in the development of the student’s worldview are outlined in this article.

**4. Yordanka Stefanova. Explanation of facts and phenomena in chemistry education – constructivist approach. Chemistry: Bulgarian Journal of Science Education, Volume 22, Number 5, 2013, p. 682 - 694, ISSN 1313-8235**

In our days the development of science education is based on the constructivist ideas. In these ideas most important for studying is the own experience of the students in their interaction

with the environment. Considering the goals of chemistry education, the special features of chemistry knowledge, the necessity of education orientated to the students and the opportunities for change in the school, we introduce in the present article a didactical model for explaining the facts and phenomena in the light of basic ideas of constructivism. The model was carefully defined and approved by practice.

**5. Yordanka Stefanova, Petia Gerasimova. Key competences through the eyes of science teachers – results of the survey. Pedagogy Volume 93, Number 4, 2021, p. 525 – 536, ISSN 1314–8540**

In this article the authors provide the results of a study on science teachers' views about key competences. This survey has two directions: direction 1 – discusses knowledge about the essence of key competences; direction 2 – explores contemporary approaches and methods that teachers apply in education in order to develop key competences.

**6. Yordanka Stefanova. Application of the inquiry-based approach for the development of scientific literacy in the study of chemical processes in Chemistry and environmental protection in the 10th class. Accepted for printing in: Strategies for Policy in Science and Education Volume, Number 4, 2021, ISSN 1314–8575, Abstracting/Indexing WEB of SCIENCE**

For the future life of young people their scientific education will allow them to live and act adequately in a society influenced by the ideas and values of science. Therefore, in the center of many educational systems an emphasis is placed on forming and developing scientific literacy in students. Inquiry-based approach in education is one of the important means for its formation and development as it puts the students in a situation where they carry out research activity, describe and analyze its results.

In this article is presented an attempt to use inquiry-based approach in in the study of chemical processes in Chemistry and environmental protection in the 10th. class. For its implementation a methodical model for application of scientific approach based on constructivist theories in education is developed. The results of a conducted experimental training for the determination of the expediency of the model are presented. A test is developed for establishing the training of students with an emphasis on scientific literacy. Testing results show that the developed methodical model creates good conditions for the development of scientific literacy.

**7. M. Panayotova, M. Minevska, S. Karakexaiova, J. Stefanova. *Application of the “Lifeskills“strategy in the Biology and Chemistry education in the penitencery conditions. Balkan Scientific Conference of Biology, 2005, Plovdiv University.***

We deem that the Life Skills strategy can be successfully applied to biology and chemistry education in penitentiary schools. We consider that details can be highlighted in the subject matter, which would arouse interest and correspond to the students' needs. This will assist knowledge acquisition and the formation of Life Skills, helping the prisoners' reintegration into society after release.

**8. С. Каракехайова, М. Панайотова, М. Миневска, Й. Стефанова. *Уменията за живот през погледа на студенти – педагози, биолози и химици. Сборник III-та конференция на ФНПП, СУ “Климент Охридски”, Издателство “Веда Словена-ЖГ”, София, 2005, с. 421-423.***

In this article are presented the results of a study aimed at: determining the significant life skills of students from different specialties - social pedagogy, preschool pedagogy and foreign language, biology and chemistry and computer chemistry.

The methodology and the organisation of the research are described. The obtained results show that the choice of life skills of young professionals correlates directly with personal qualities and attitudes, value orientations, reflected in the choice of specialty. Gender differentiation is observed in the selection of skills. The positive and responsible attitude to the work on the questionnaires gives grounds to assume that students appreciate the importance of life skills for full participation in social and economic life.

**9. Yordanka Stefanova, Maria Minevska. *Some social aspects of students' results in chemistry. The 5th international Balkan education and science congress, Edirne-Turkey. Congress full textbook. Vol. 2, pp 608 – 612, ISBN 978—975-374-110-1.***

In recent years the issue of improving the quality of students' education has been brought to the scientists' attention. The main reasons about this problem are the intensive processes of globalisation and the dynamic social life. Both require greater society awareness. Schools have to prepare young students for the future life. Therefore, on first place students have to improve their abilities to achieve individual and collective goals.

According to the written above we set our goals to examine students abilities of social importance.

To achieve our goals we conducted a study limited to some specific areas of scientific knowledge, scientific abilities. It also involved limited number of participants. The results from this study led us to conclusions about the level of scientific abilities of the students, which is related to the education quality.

**10. Y. Stefanova, M. Minevska. Explanation Models in the Chemistry Teaching. Khimiya, Volume 14, Issue 6 (2005), p. 522-528,**

This article grounds the necessity of the knowledge about the technological models of the explanation in the chemistry teaching. There is a model of the deductive explanation of the facts and a model of the inductive explanation as well which are both used in the chemistry teaching.

**11. Maria Minevska, Jordanka Stefanova, Petya Petrova. Scientific literacy as an object of Programme for international student assessment (PISA). Scientific Researches of the Union of Scientists, 2005, Plovdiv, Book VII, p. 202 – 205, ISSN 1311-9192.**

This Article presents an analysis of the scientific literacy competency which is described in the PISA. Its main components were considered in a contents and an operational aspect. The teachers can use this analysis in their work by the choice and the construction of the items for an assessment of the scientific literacy of students.

**12. Y. Stefanova, M. Minevska, P. Petrova. Tasks for assessing students' scientific literacy in chemistry. University of Plovdiv „Paisii Hilendarski“ – Bulgaria, Scientific Papers, Vol. 34, Book 5, 2006 – Chemistry, p. 149 – 156, ISSN 0204-5346**

This article presents examples of the appropriate items for assessment of scientific literacy in accordance with OECD/PISA definition. This items require to use chemistry knowledge and the processes by which this knowledge is developed, to draw evidence – based conclusions in order to understand and to make decision about natural world.

The chemistry teachers can use this examples to make their choice and to construct like items.

**13. Yordanka Stefanova, Maria Minevska. Constructivist learning: description, explanation, prediction in a chemistry classroom. Problems of education in the 21<sup>st</sup> century. 2009, Vol.17, pp 196-202, ISSN 2538-7111, Abstracting/Indexing EBSCO**

This article presents the results of a theoretical study, which purpose is to identify opportunities to update the learning process. Subject of study is the formation of scientific literacy among students in Bulgarian schools.

Our study has two aspects: scientific literacy in the normative documents regulating the teaching of science in the Bulgarian school; approaches, methods and tools for the formation of scientific literacy. The analysis of normative documents is discussed in relation to scientific knowledge and scientific processes for the formation of scientific literacy among students in secondary schools in Bulgaria. Need for changes in science teaching is discussed in terms of: the choice of approaches, methods and tools for the formation of scientific literacy among students, the creation of appropriate tools, including questions and problems, case studies pertaining to specific situations and require even critical attitude towards the statements and opinions expressed and decisions on important life issues, creating the right environment in which students work together as active learners and that could lead to the development of student's knowledge necessary for life.

**14. Yordanka Stefanova, Maria Minevska, Svetla Evtimova. *Scientific literacy: problems of science education in Bulgarian school*. Problems of education in the 21<sup>st</sup> century 2010, Vol.19 (19), pp 113-118, ISSN 2538-7111, Abstracting/Indexing EBSCO**

This article presents the results of a theoretical study, which purpose is to identify opportunities to update the learning process. Subject of study is the formation of scientific literacy among students in Bulgarian schools.

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students work together as active learners and that could lead to the development of student's knowledge necessary for life. **Cited by: 22**

**15. Й. Стефанова. Личностно-ориентированное обучение химии с применением конструктивистского подхода – решение проблемы. В Сборник научных трудов „Актуальные проблемы химического и экологического образования”, Санкт-Петербург, Издательство РГПУ имени А.И. Герцена, 2013, р. 245 – 250, ISBN: 978-5-8064-1818-1**

The article is about the constructivist's theory in pedagogy and mainly in chemistry education. According to the objectives of chemistry education a model for students' preparation is made to find a solution for cognitive problems when studying chemical processes. This model is developed corresponding to the ideas of constructivist's theory. According to this theory the personal experience of every student when interacting with the surrounding world is of exceptional importance for learning.

**16. Y. Stefanova. The students' attitude towards science subjects studied in school. Educational Alternatives, 2014, Volume 12, Pages: 685-697, ISSN 1314-7277, Abstracting/Indexing: Scientific Electronic Library eLIBRARY Russia, China National Knowledge Infrastructure (CNKI) Scholar, Polish Scholarly Bibliography.**

Our time is characterized by increasingly significance of science in daily needs of people and the necessity of sufficient knowledge to understand the processes and phenomena in the surrounding reality. At the same time people express their proven opinion, that the interest of young people in science tuition decrease.

This article presents the results of a survey of students attitude towards science classes at school. Research in several areas: a) interest in learning science; b) knowledge of the character of natural knowledge; c) the applicability of natural knowledge; d) understanding of the cognitive processes inherent in natural scientific knowledge; e) the ratio of students to scientists engaged in science. For all who work in the field of natural scientific education in Bulgaria, but also for those who have interest in education in our country, it would be useful to know the students view on science classes at school. We regard that this would help compilers of school programs and teachers to develop educational strategies aimed to increase the student's interests in sciences. Anonymous survey reveals that students believe their education in school doesn't contribute significantly to acquaintance them with the character of natural knowledge.

Curriculum content in these disciplines do not assist them in making decisions about current life problems. **Cited by: 1**

**17. Y. Stefanova, S. Stefanov, G. Antova. Do young people understanding the information on food labeling? Journal of EcoAgriTourism, 2014, Vol. 10, № 1(28), Pages: 129 – 133, ISSN: 1844-8577. Abstracting/Indexing: CAB Abstracts**

This article presents instruments for researching the understanding of information on food labels from young people. It is developed an inquiry, which contains 14 questions, separated conditionally in three groups. Through them we search the answers of the following questions: (a) Do the young people use the information on the labels? (b) Do they know the basic nutrients, which are marked on food labels? (c) Do they understand the information on food labels? The first results show that the developed inquiry is hopeful instrument for researching the knowledge of young people about the information on food labels. This gives us grounds to continue the research, which refer to obtaining reliable and objective results. **Cited by: 6**

**18. Yordanka Stefanova. Cooperative learning – application in chemistry education in bulgarian schools. Educational Alternatives, 2015, Volume 13, 2015, Pages: 607-614, ISSN 1314-7277, Abstracting/Indexing: Scientific Electronic Library eLIBRARY Russia, China National Knowledge Infrastructure (CNKI) Scholar, Polish Scholarly Bibliography.**

Modern views about education set focus on student's activity and his cognitive activity which both are part of forming knowledge and skills. These ideas about education and its results are the basics of a new direction in natural science education, an education based on the main principles of constructivism.

Estimating the tasks in chemistry education, the features of chemical knowledge and the need of education oriented to the student and the possibilities of changing the learning environment, some methods for cooperative learning are characterized in this article.

**19. Yordanka Stefanova, Zlatka Garova. Didactic test “the soil – our wealth” (10th grade). Educational Alternatives, 2016, Volume 14, Pages: 500-508, ISSN 1314-7277, Abstracting/Indexing: Scientific Electronic Library eLIBRARY Russia, China National Knowledge Infrastructure (CNKI) Scholar, Polish Scholarly Bibliography**

In the article are presented stages of building and realization of didactic test for diagnostics of student's level of knowledge and manifestation of some skills. The test is picked



out in real conditions during the term in chemistry classes in the 10th grade. We present an analysis of the approbation results and based on them we make the corresponding summary to chemistry education in high school.

**20. С. Стефанов, Й. Стефанова. *Нанотехнологиите в хранително-вкусовата промишленост*. В *Нанонауки и нанотехнологии*. УИ на ПУ"П. Хилендарски", с. 112-123, ISBN: 978-619-202-282-2**

The Nanoscience and Nanotechnology Handbook aims to briefly present to science teachers aspects of the relationship between nanotechnology and the modern sciences of physics, chemistry and biology. The idea is to provide an informational curriculum of a thematic course of the same name, designed to enrich the scientific knowledge of teachers, organized by the Faculty of Chemistry of Paisii Hilendarski University of Plovdiv. In chapter "Nanotechnologies in food industry" the main directions in application of nanotechnologies in food industry are analysed.

#### **Монографии**

**1. Йорданка Стефанова. *Съвременни образователни технологии в обучението по химия и опазване на околната среда*. УИ „Паисий Хилендарски“, Пловдив, 2020, ISBN 978-619-202-620-2, с. 135.**

The aim of the monograph is to reveal some of the characteristics of educational technologies with an emphasis on teaching Chemistry and Environmental Protection. New opportunities have been sought to enrich the theory and practice of chemistry education through the description of good practices.

It is designed for teachers, students and professionals in the field of education who ask questions and seek ambiguous answers. For this reason, emphasis is put on educational technologies oriented to the student as an active subject in the process of training, education and development. On the other hand, it is especially important for the modern student to have competencies that allow him to cope with the challenges of the modern world. It is possible for all of this to be organized in school environment by knowledgeable and assertive teachers, able to choose from a variety of theories and who build their own ideas rather than prescribed rules of action. Some of the ideas were implemented for the first time in the context of teaching chemistry in the Bulgarian school.

The first chapter of the monograph is devoted to the problem's relevance for the application of personality-oriented educational technologies in education. The paradigm, where

the activity of the student is leading in the process of mastering knowledge, skills and habits, and the teacher is only the organizer of his activity, is the basis of personality-oriented learning.

The second chapter is devoted to the distinctive features of educational technologies used for the school subject “Chemistry and environmental protection”, which are determined by the specifics of the educational process, by the participants in this process and the particularity of the content studied.

The third chapter outlines the features and essential characteristics of collaborative learning, inverted classroom and project-based learning. From the variety of educational technologies in teaching, the monograph examines the above for several reasons: they have proven their effectiveness in different countries around the world; they are the easiest to fit into the learning process in the conditions of the existing classroom system in our country. They allow to follow the educational content set by the DOI for the compulsory education; when integrated in the real learning process, they allow the achievement of educational goals while preserving the tradition in the field of methodology of teaching chemistry; the application of these technologies in teaching chemistry ensures the assimilation not only of the study material but of the moral and intellectual development of students, their independence, kindness to each other and to the teacher, communication etc. as well.

**2. Йорданка Стефанова. Обяснението в обучението по химия и опазване на околната среда в средното училище. УИ „Паисий Хилендарски“, Пловдив, 2021, ISBN 978-619-202-686-8, с. 110**

Knowing the processes inherent in scientific knowledge is necessary for every person in order to be able to estimate the aspects of his life that are influenced by science; to understand and realise the importance and significance of scientific knowledge; to distinguish the questions that science can answer from those that it cannot. This will help adolescents to make decisions “for or against” a course of action on a personal, social or global level.

Chapter one of the monograph presents a brief analysis of the problem of reflecting explanation in scientific knowledge. The evolution of the ideas of the explanation in philosophical-methodological aspect which have a direct relation to the application of the explanation process in teaching natural sciences, incl. chemistry, is reflected.

Chapter two of the monograph outlines the didactic aspects of the explanation in teaching. The explanation is characterized as a method of teaching where through the essence of the studied objects is revealed as well as a cognitive procedure in the activity of the students. On this basis, different models for inductive and deductive explanation of facts and a system of different types of explanatory tasks are compiled.

Chapter three is devoted to the explanation process in chemistry education based on the constructivist approach. The constructivist theory is leading in teaching natural sciences, incl. chemistry. It focuses on creation of knowledge rather than its transmission. It shares experience in applying the ideas of constructivism in explaining facts and phenomena in chemistry education. The proposed methodological ideas have been experimented in a real learning environment and have proven their effectiveness.

**Self-assessment of the scientific contributions of the submitted materials for participation in the competition for the academic position of "Associate Professor" in the scientific specialty Methodology of chemistry education can be grouped in several areas:**

**I. Forming and developing scientific literacy.**

Forming and developing scientific literacy is a modern trend in science education, which is aimed at updating the objectives of education in the direction of forming knowledge, skills and competencies for solving problems in a real context. The candidate has been working in this field since 2005 together with Assoc. Prof. Dr. Maria Minevska.

➤ Scientific literacy is subject to evaluation by the OESD program, which develops and implements the Program for International Student Assessment, PISA. Its goal is to establish cyclically how well the school prepares adolescents for life. The concept of scientific literacy is key to the concept of this program. The three types of literacy underlying the study of this program are characterized (*publication 11*). Building scientific literacy by the bulgarian students would be possible if teachers, current and future, are prepared to achieve this goal. In this regard, an analysis of the state documents regulating the educational process in our country was conducted in order to establish the reflection of the problem in them (publication 14). The similarities and differences between the International Skills for Life Strategy and the Program for International Student Assessment, PISA (Publication 1) are outlined.

➤ A study of the notions of scientific literacy in teachers and students – future science teachers is translated. The research is conducted in two directions: a) What abilities should high school graduates have? and b) Which of these abilities do teachers and students associate with scientific literacy? (*publication 2*). The study involved students from two major universities in the country, which train teachers in natural sciences - the Faculty of Chemistry and Biology of Plovdiv University "Paisii Hilendarski" and the Faculty of Biology of Sofia University "St. Kliment Ohridski" as well as biology, physics and chemistry teachers, who have different qualifications and experience from Plovdiv and Sofia. The participation of teachers and students - future teachers make it possible by analyzing to obtain information about the

relationship between professional experience and understanding of scientific literacy, which must be built in students in the process of teaching science. The study was conducted for two school years 2009 - 2010 and 2010 - 2011. The data obtained from the survey is oriented to the compilers of curricula and programs, as they provide information about some characteristic features of the curriculum in chemistry and biology, namely insufficiently represented practical application of the studied knowledge.

➤ Scientific literacy assumes the application of natural science knowledge to: identify those real problems that can be solved on their basis; to draw evidentiary conclusions, to make decisions and express opinions on issues concerning nature and its changes as a result of human activity. This has a direct impact on the nature of the educational content, on its orientation, caused by the possibilities for its application to solve real life problems. In this regard, a study of the attitude of students to science is conducted and conclusions are made about their interest in them and the applicability of scientific knowledge studied in school are made (*publication 16*).

➤ Based on the analysis of the tasks included in the chemistry textbooks and chemistry teaching aids on the indicators: connection of the tasks with specific life situations; showing a critical attitude to statements and opinions expressed; making decisions about current life problems, questions and tasks have been compiled, suitable for establishing the scientific literacy of the students on the basis of their knowledge in chemistry (*publication 12*).

**II. Application of a constructivist approach in teaching chemistry.** The topic of constructivist theory and practice is leading in pedagogy and in chemistry education. The constructivist approach in teaching emphasises how to learn and brings to the fore the development of the student's personal qualities. The main point of constructivist practices is the personal experience of students in their interaction with the world around them and the stimulation of students to formulate and ask questions. This experience helps students to acquire knowledge and transform what they already know. Based on the main ideas of constructivism, methodological models for describing, explaining, predicting facts and concepts (*publications 4, 13, 18*) for solving cognitive problems in the study of chemical phenomena (*publication 15*) have been compiled. Based on the constructivist approach, an attempt to organise training based on research in the study of specific curriculum from the curriculum in Chemistry and Environmental Protection in 10th grade (*publication 6*) is presented.

### **III. Forming and development of key competencies**

Forming and development of key competencies in students mainly depends on the teacher. Moreover, it is considered to be crucial, as teachers have a significant set of various

didactic tools to support this process. Teachers not only need to know the key competencies, but also to master different strategies and approaches for their forming and development. In this regard, representatives of science teachers were examined for key competencies (*publication 5*). The notions of students in Plovdiv University for the groups of abilities that young people should receive are researched. (*publication 8, 9*).

#### **IV.      Обяснението в обучението по химия**

Explanation occupies a central place in every science, including chemistry. In modern trends for the development of education, explanation is one of the aspects of scientific literacy. In order to support the activity of teachers and students in its construction, models for inductive and deductive explanation of facts and concepts have been developed (*publication 10*). Knowledge of the processes inherent in scientific knowledge is necessary for every person to be able to make an assessment of the aspects of his life that are influenced by science; to understand and appreciate the importance and significance of scientific knowledge; to distinguish the questions that science can answer from those that it cannot. Based on the outlined relations between the explanation and the worldview, recommendations have been made regarding the process of teaching natural sciences, considering the successful realization of the worldview function of the natural science knowledge studied at school (*publication 3*).

Prepared by .....  
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