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# STRENGTHENING THE COMPETENCE ORIENTATION OF THE NATURAL SCIENCE SCHOOL EDUCATION CONTENT AS CONDITION OF ALL-ROUND DEVELOPMENT OF A PERSONALITY

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**Abstract.** *The article addresses an issue of structuring the natural science school education content and substantiates the trends of its modernization under orientation at the all-round development of a personality. The features of implementation of the crosscutting lines into the content of the basic courses reflecting socially and personally important ideas and relating the relevant key competencies are determined. The necessity of strengthening the competence orientation of the natural science component of the content of basic secondary education is substantiated. In particular, it is stressed the topicality of orientation towards a system of values and competencies that determine the ability to successfully operate in practical educational and life situations, to be responsible for his/her actions in nature and society. It is proved that updating of content is a condition for successful deployment of crosscutting content lines. Their mastery by students involves the use of methods and forms of instruction that maximize the activity, competence and personally oriented approaches aimed at solving practical learning and life situations, stimulate formative learning.*

*The authors underlined that the increase of attention to the effective component of the content of education, strengthening its role in the formation of subject and key competences, specifying the state requirements to the training level of general education students in the educational field “Natural Sciences” are the main directions of modernization of school natural science education content.*

**Key words:** *development of a personality; natural science school education content; competence orientation; key competences.*

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## INTRODUCTION, PROBLEM STATEMENT

The problem of development of a personality as a socio-cultural phenomenon is actualized under the global social, economic, and cultural transformations. The formation of skills to interact of a young person with the nature and society in a civilized way, which is socialization, is one of the priorities.

Socialization is a complex process of personality formation, during which a personality is integrated into the system of social relations through the acquisition of social experience, values and norms. At the same time, personal qualities are developing and the activity and integrity of the individual are forming (Kremen, 2008).

Today, education as the basis for the intellectual, spiritual, physical and cultural development of the individual plays the leading role in ensuring the successful socialization of a young person. V. Kremen rightly remarks that education is a practice of socialization and succession of generations, and its content may be limited by standards that take into account the nature of human interaction with cultural values, the extent and degree of their assimilation and creation (Kremen, 2009).

School science education, which has significant potential for students to develop value orientations that are crucial for effective interaction with nature and society is of particular importance in this context.

## LITERATURE REVIEW

The problem of improving school science education as a powerful factor in the comprehensive development and socialization of personality is highlighted in the works of didactics and methodologists. In particular, O. Liashenko emphasizes that the modernization of science education projecting it on the problem of improving its content, which is one of the main indicators of the overall status and quality of education, its innovation and perspective (Liashenko, 2009).

According to O. Liashenko, the methodology for updating content is transforming within its reorientation to values and educational goals; focus on the knowledge, skills and values to take account of the personal experience of a student, influence educational environment for its formation. Accordingly, knowledge and skills do not become the purpose of learning, but the basis in mastering the subject and key competences (Liashenko, 2011).

O. Topuzov substantiates the feasibility of enhancing the competence orientation of the content of the astronomical, geographical, physical, chemical constituents of the educational field "Science". In particular, the scholar notes that the content of school geography should be based on the optimal combination of person-centred and problem-based learning approaches. This, therefore, will create conditions for intensifying the process of personal development, active knowledge of the laws and patterns of the world, creative transformation of information. It will give a strong impetus in the cognitive and creative activity of an individual in later life (Topuzov, 2012).

L. Velychko underlines that the school chemistry course is still regarded as the didactic equivalent of the chemistry as a science. However, it is more important for a student not to possess certain knowledge, but to acquire the ability to learn, the necessity and the ability to expand and deepen knowledge. Accordingly, the competence-oriented education that is characterised by the active, practice-oriented content of education is important. It is one of the signs of the modern content of chemical education (Velychko, 2014).

M. Golovko underlines the necessity to increase attention to the effective component of the learning content. He stresses its role in the subject and key competencies formation as the main directions of modernization of school astronomy and physics (Golovko, 2015). In 2014 a comprehensive analysis of the general secondary education content was conducted by the National Academy of Educational Sciences of Ukraine. The scholars of the Academy confirmed the necessity of:

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- specification of subject competencies in natural science subjects,
  - definition of their contribution to the natural science competence field formation and the feasibility of its structure and content,
  - supplementing the role of the natural science subject field to form a holistic natural science picture of the world of students,
  - specification of state requirements to the level of general attainment of students within educational field “Natural Science” (Kremen (ed.), 2015b: p. 74).

Therefore, strengthening the competence-based orientation of the natural science school education content is the priority direction of its improving.

The article purpose is to analyse the features of the school natural science education content formation in the modern school and identify trends in its improvement under direct focus on the comprehensive development of an individual.

## **METHODOLOGY**

The methods of analysis, comparison and interpretation study was used in the article.

## **MAIN RESULTS**

The Law of Ukraine “On Education” (2017) states that the general secondary education provides comprehensive development, education and socialization of a person who is able to live in a society and civilized interaction with nature, has a desire for self-improvement and lifelong learning, life choices and self-fulfilment, responsibility, work and civic activity. The goal of school education is ensured by the formation of key competences that are necessary for every modern person to live successfully. They are fluency in the state language, ability to speak mother tongue and foreign languages, mathematical competence, competence in science, engineering and technology, innovation, environmental expertise, information and communication competence, lifelong learning, civic and social competences, cultural competence, entrepreneurship and financial literacy, other competences provided for by educational standards (art. 12) (Pro osvitu..., 2017).

Accordingly, the State Standard for Basic and Comprehensive General Secondary Education (2011) is based on a competence-based approach that is implemented in the educational fields and reflected in effective content components.

The introduction of new content of general secondary education aimed at the formation of key competences is condition of modernization of general secondary education in accordance with the Concept of the New Ukrainian School (2016).

Ensuring development of students’ holistic view of nature and man’s place in it, values to preserve nature, a harmonious interaction between the man and the nature, sustainable development ideas, appropriate behaviour in the natural environment is one of the priorities of the educational sector “Natural Science” under the outlined problems (Derzhavnyi standart..., 2011).

The achievement of these tasks is aimed at forming students’ natural science key and subject competencies as components of the general culture of a personality and the development of his/her creative potential. The main components of the educational field “Natural Science” (natural science, Astronomy, Biology, Geography, Physics, Chemistry, Ecology) are aimed at assimilation of scientific facts, concepts and laws by students as the basis of their scientific outlook, formation of value attitude to the categories of “life”, “nature”, “health”, understanding of environmental problems in everyday life, in teaching and in future professional activity, ability to assess the role of natural sciences for the social development and existence of the biosphere, compliance with the rules of environmentally sound behaviour in the environment.

Thus, the competence potential of the educational field “Natural Sciences” is quite powerful,

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but at the same time, its full realization is not ensured. According to the results of TIMSS the peculiarity of school natural science education is orientation at the formation of reproductive knowledge. The natural science subject test contained 35% of biology tasks, 20% of chemistry tasks, 25% of physics tasks and 20% of geography tasks. The tasks were divided into three groups by types of educational and cognitive activity: tasks – knowledge (35%), tasks – application (35%), tasks – justification (30%). At the same time, the highest grade point average was given to students for completing tasks focused on the use of knowledge in standard situations, the lowest – for applying knowledge (Prokopenko, 2013).

Accordingly, the level of theoretical knowledge of students in science subjects is quite high. However, the orientation the instruction to the reproduction of the acquired knowledge does not provide the implementation of the skills and their practical application to solve tasks. Students were found to have significant difficulties in comparing tasks, formulating valuation judgments and understanding nature as a coherent system. As a rule, theoretical knowledge is not related to practice, so it is difficult for students to use it in new practical situations. Mostly, students demonstrate the ability to solve standard algorithm tasks, while the life practice tasks require a creative, non-standard approach, activation of search and learning activities. Students are knowledge-oriented and do not possess technologies that to act independently to obtain results (use of educational resources and information and communication technologies).

The students' ability to take the initiative, plan the expected results independently, and make informed decisions about ways to achieve them (in particular, during the school experiment), which is extremely important for the successful socialization of a young person and their effective life in the future, are formed insufficiently.

In 2015, the scholars of the National Academy of Educational Sciences of Ukraine carried out the analysis of the content of secondary education. The analysis was aimed at defining the directions of modernization of the content of general secondary education. The research findings are reflected in the scientific and analytical report "On the Content of General Secondary Education". In particular, it was found that:

- the content of the school subjects is mainly aimed at the formation of subject competences, while the key ones are insufficiently formed;
- there is an inconsistency of some of the educational material with the age peculiarities of the children development (the material is submitted at a high theoretical level, inaccessible to students);
- there is a discrepancy between the content of different subjects within the educational fields;
- the curriculum of specific science subjects do not take into account the contribution of other science subjects to the formation of educational results to achieve the general goals of science (there is imbalance in the content of science courses, physics, biology, geography, chemistry, and at different levels of study cross-curricular level).

Attention is drawn to the need for cross-curricular harmonization of curriculum in natural science subjects, and their complementarity with generic cross-curricular topics that are focused on forming a coherent scientific picture of the world. It is emphasized that it is expedient to specify the subject competences for each natural science subject and to determine their contribution to the development of key competences of students. The need to modernize the content of education in accordance with the system of values and competencies that determine the ability of an individual to successfully solve life situations, his/her beliefs, outlook and active civic position as a condition for full integration into the socio-cultural environment is substantiated (Kremen (ed.), 2015a).

Thus, the modernization of the content of general secondary education is an important condition for solving the key tasks of the modern school (Topuzov & Holovko, 2018).

Based on the results of the analysis of the natural science content component of basic general secondary education an important conclusion is made about the necessity of updating the

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content lines defined by the State Standards. It is important to introduce crosscutting content lines responsible for the process of formation of key competences.

The idea of updating the content of basic secondary education within the priorities of the Concept of the New Ukrainian School was realized through the separation in the curriculum of natural science subjects, namely of such cross-curricular content lines as “Environmental Security and Sustainable Development”, “Civil Responsibility”, “Health and Care”, “Entrepreneurship and Financial Literacy”. These content lines are a means of integration of educational content, which directs the deployment of educational and cognitive activities of students to master the content on the formation of values and ideological orientations of the students of basic education.

Thus, the cross-curricular content line “Environmental Security and Sustainable Development” is focused on the formation of students’ social activity, responsibility and environmental awareness, willingness to participate in the preservation of the environment and development of society, awareness of causation in nature and its integrity, the importance of sustainability development for future generations.

The purpose of the cross-curricular content line “Civil responsibility” is to form a responsible member of a community and society, who understands the principles and mechanisms of its functioning. It is a free person who recognizes universal and national values and is guided by the moral and ethical criteria as well as a sense of civic responsibility. He/she possesses teamwork skills, can implement socially significant educational projects; has responsible attitude to the tasks defined by the team; possesses awareness of the responsibility for learning outcomes that may affect the country’s development in the future; an has active attitude to bad habits and the need to participate in protection of the environment preserving it for future generations.

The cross-curricular content line “Health and Care” ensures that a student becomes a spiritually, emotionally, socially and physically fit member of society, able to maintain a healthy lifestyle and to create a safe living environment.

The purpose of the cross-cutting content line “Entrepreneurship and Financial Literacy” is to provide a better understanding of the practical aspects of financial issues (savings, investing, borrowing, insurance, lending, etc.); the development of leadership initiatives, the ability to successfully operate in a rapidly changing technological environment; mobilize practical experience and value installations in situations of choice and decision making.

These cross-curricular lines are expanded to direct the learning process of natural science subjects to:

- forming an understanding of the interconnections of the components of the ecosystem, the need to protect nature, the ability to comply with environmental ethics in human behaviour in nature, the conservation of protected areas as a major factor in biodiversity conservation and balance, civic position, conservation of nature;

- application of the acquired knowledge for the prevention of infectious and parasitic diseases, the detection of poisonous fungi, the elimination of the negative effects of the consumption of products affected by mould fungi; developing the ability to characterize and evaluate the benefits and potential risks of using genetically modified organisms (biology course, grades 6-9) (Bioloheia..., 2017);

- application of acquired knowledge to assess the value and impact of natural components for human life and activity, the consequences of its activity in the environment; formation of knowledge about dangerous natural objects and phenomena and their impact on human life, about the safety of goods and services of which consumers are students; skills and behaviours of safe behaviour in nature, in the face of adverse physical and geographical phenomena and processes, work in a group on geographical research and projects on the basis of cooperation, consumer behaviour oriented to the national producer and rational resource consumption at domestic, regional, national and global levels awareness of the impact of human activity on the country’s natural complexes;

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– formation of installations for the use of healthy and safe food; identifying and understanding the impact of meteorological factors on human health; awareness of the importance of sanitary and hygienic living and eating conditions for the preservation of life and health of people, understanding the importance of preventive measures during foreign trips (geography course, grades 6-9) (Heohrafiia..., 2017);

– use of the acquired knowledge for critical evaluation of the results of human activity in the natural environment, economical use of nature, preservation of own health and health of other people, forecasting of ecological and social consequences of using the achievements of science and modern technologies, making informed decisions that will contribute to scientific technological, economic, social problems;

– formation of readiness and ability to adhere to the rules of safety of life during carrying out of educational experiments, in emergencies of natural or man-made character, to participate in environmental measures, proper utilization of household waste, to effectively work in a team on the implementation of environmental projects, to solve problems for long-term of this family, understanding that the level of well-being of society depends on the development of high-tech production and, accordingly, the development of education and students, to evaluate the need for the acquired knowledge to effectively solve everyday problems and future professional activity (basic physics course, grades 7-9) (Fizyka..., 2017);

The implementation of end-to-end lines in the content of the basic courses of natural objects is not associated with the addition of content, its expansion or deepening. Since end-to-end content lines reflect socially and personally significant ideas and are correlated with relevant key competencies, their deployment is ensured by the updating of such elements of the corresponding subject content, the mastery of which involves the usage of methods and forms of training organization, maximizes the implementation of active, competency-based and personality-oriented approaches aimed at the practical educational solution and life situations, stimulate the wording of students summarize and appraisal judge. An important role in this context is given to educational projects included in the curriculum in natural subjects as independent elements.

## CONCLUSIONS

Analysis of the content of the natural component of basic secondary education shows its focus on the system of values and competencies that determine the ability to successfully act in practical educational and life situations, to be responsible for his/her actions in nature and society. Based on the criteria of socialization of a modern individual (the content of the formed attitudes and stereotypes, values and worldview, the level of independence, confidence, initiative, lack of integrity, the ability to realize one's creative potential and harmonious relations with society) (2008), we can conclude that the competence potential of school natural science education is both a prerequisite and an important mechanism for the successful socialization of an individual.

## REFERENCES

- Bioloɦiia: 6 – 9 klasy. Navchalna prohrama dlia zahalnoosvitnikh navchalnykh zakladiv* (2017) [Biology. Grades 6-9. Curriculum for general educational institutions]. Retrieved 2019 from <https://mon.gov.ua/storage/app/media/zagalna%20serednya/programy-5-9-klas/onovlennya-12-2017/15.biologiya-6-9.docx>
- Derzhavnyi standart bazovoi i povnoi zahalnoi serednoi osvity* (2011) [State standard of basic and complete general secondary education]. Retrieved 2019 from <http://www.guonkh.gov.ua/content/documents/22/2144/Attaches/Derzh.standart.doc>
- Fizyka: 7–9 klasy. Navchalna prohrama dlia zahalnoosvitnikh navchalnykh zakladiv* (2017) [Physics. Grades 7-9. Curriculum for general educational institutions]. Retrieved 2019 from <https://>



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- mon.gov.ua/storage/app/media/ zagalna%20serednya/programy-5-9-klas/onovlennya-12-2017/7-fizika.doc
- Golovko, M. (2015). Trends in the modernization of the content of school physical and astronomical education. *Collection of scientific works "Pedagogical education: theory and practice"*, 18, 237–242.
- Heohrafiia: 6– 9 klasy. Navchalna prohrama dlia zahalnoosvitnikh navchalnykh zakladiv* (2017) [Geography. Grades 6-9. Curriculum for general educational institutions]. Retrieved 2019 from <https://mon.gov.ua/storage/app/media/ zagalna%20serednya/programy-5-9-klas/geografiya-6-9-14.07.2017.pdf>
- Khimiia: 7–9 klasy. Navchalna prohrama dlia zahalnoosvitnikh navchalnykh zakladiv* (2017) [Chemistry. Grades 7-9. Curriculum for general educational institutions]. Retrieved 2019 from <https://mon.gov.ua/storage/app/media/ zagalna%20serednya/programy-5-9-klas/onovlennya-12-2017/10-ximiya-7-9.doc>
- Kremen, V. (2008). *Entsyklopediia osvity* [Encyclopedia of Education]. Kyiv: Yirinkom Inter.
- Kremen, V. (2009). *Filosofia liudynotsentryzmu v stratehiakh osvitnoho prostoru* [Philosophy of human-centrism in strategies of educational space]. Kyiv: Pedahohichna dumka.
- Kremen, V. (ed.) (2015a) *Pro zmist zahalnoi serednoi osvity: Naukovo-analitychna dopovid* [On the content of general secondary education: A scientific-analytical report]. Kyiv: NAPN Ukraine.
- Kremen, V. (ed.) (2015b). *The content of general secondary education: Scientific analytical report*. M.: APN of Ukraine.
- Liashenko, O. (2009). *Zmist fizychnoi osvity: yakym yomu buty?* [Content of physical education: what should it be like?]. *Fizyka ta astronomiia v shkoli*, 6, 3–6.
- Liashenko, O. (2011). *Onovlennia zmistu zahalnoi serednoi osvity – stratehichne zavdannia sohodennia* [Updating the content of general secondary education is a strategic task of today]. *Zbirnyk naukovykh prats kamianets-podilskoho natsionalnoho universytetu imeni Ivana Ohienka (Seriia pedahohichna: Innovatsiini tekhnolohii upravlinnia kompetentnisno-svitohliadnym stanovlenniam uchytelia: fizyka, tekhnolohii, astronomiia)*, 17, 44–46.
- Nova ukrainska shkola: kontseptualni zasady reformuvannia serednoi shkoly* (2016) [The New Ukrainian School: Conceptual Foundations for High School Reform]. Kyiv: MON Ukraine.
- Pro osvitu: Zakon Ukrainy*, 2017. [About education: Law of Ukraine]. Retrieved 2019 from <http://zakon2.rada.gov.ua/laws/show/2145-19/page>
- Prokopenko, N. (2013). *Osnovni rezultaty mizhnarodnoho porivnialnoho doslidzhennia yakosti pryrodnycho-matematychnoi osvity TIMSS 2011* [The main results of the international comparative study of the quality of natural and mathematical education TIMSS 2011]. Retrieved 2019 from <http://education-ua.org/ua/analytics/68-osnovni-rezultati-mizhnarodnogo-porivnyalnogo-doslidzhennya-yakosti-prirodnycho-matematichnoji-osviti-timss-2011>
- Topuzov, O. (2012). *Teoretyko-metodychni zasady osobystisno oriietovanoho navchannia predmetiv pryrodnychoho tsyклу* [Theoretical and methodological basis of personality oriented teaching natural subjects]. *Ridna shkola*, 1–2, 13–17.
- Topuzov, O. & Holovko, M. (2018). *Modernizatsiia zahalnoi serednoi osvity yak umova profesiinoho rozvytku osobystosti* [Modernization of general secondary education as a condition for professional development of the individual]. *Nauka. Edukacja, wychowanie i praca. Ksiega jubileuszowa dedykowana Profesowi doktorowi habilitowanemu Franciszkowi Szloskowi*. Warszawa – Siedlce: AKKA.
- Velychko, L. (2014) [Methodological guidelines for designing the content of chemistry education in a primary school]. *Metodychni vkazivky shchodo proektuvannia zmistu osvity z khimii v pochatkovii shkoli. Biolohiia ta khimiia u ridnii shkoli*, 1 (101), 34–37
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