Meta-methodological implementation of creativity in ecogeographical education disciplines

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Abstract. Traditionally, learning is the result of explanatory and illustrative education methods. The process of retaining information is linked to the process of understanding, using creative methods. The difference between "knowing" and "understanding" information lies within the ability to mentally structure and organize said information. In order to provide a high quality school education and implement creative learning strategies in subjects related to geography, biology, etc. it is imperative to bridge the gap between theoretical knowledge and creative exploration, which can be done by using meta methodological practices along with the learning systems already in place for these subjects.

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Introduction

Russia participates in the UNESCO program "Public Education system for the XXI Century." The world community confronts a number of strategic objectives in education, including the formation of a holistic picture of the world in youth, creating a dialect based relationship between science and humanitarian subjects, and using this as a basis for the understanding of various phenomena, as well as developing humanistic values.

In the process of reforming the Russian school system there was not only a significant reduction in the number of hours devoted to the study natural sciences, but also a reallocation which resulted in the level of fundamental natural science disciplines declining significantly.

Although the hours spent on the natural science disciplines were reduced, the content of these disciplines remained the same, which has resulted in the overworking of students and reduction of the quality of education.

According to V.V. Krayevsky, educational content is essentially pedagogically adapted scientific knowledge, professional experience, experience of various types of creative activities, and emotional-evaluative environmental relationships.

When teaching Geography, Biology, Chemistry, Physics, the main idea when selecting learning content and organizing the learning process should be the translation of scientific principles to students.

As for the experience of creative activity in practice, it is not implemented enough.

There is barely enough time to process and retain information, and many courses rarely, if ever, have creative assignments planned.

Units of knowledge form by means of informative and reproductive learning techniques: the teacher's explanation, repetition, and arbitrary storage (mostly memorization). Human memory is limited, but creativity as we known it does not have limitations.

According to psychological assessments, memorization and retention of information are different processes. When memorizing, only the functions of memory are engaged. During retention, both memory and thinking are engaged, thus the process of storing information is performed involuntarily. The result of learning is knowledge, which is defined as a certain amount of memorized information, often without any understanding of its practical application. In the process of formal educational students are learning material without a clear understanding, and as a result, students are not learning the necessary skills to apply this information [1].

In contrast, the result of the retention of information are beliefs, which in this sense are methods that use information to aid in performing practical tasks. The information itself is stored spontaneously over the course of its application, while performing reproductive and creative tasks. Memory is engaged in informative and reproductive methods, whereas assimilation and retention are engaged in creative methods.

The process of learning is closely linked to the process of understanding. The understanding of educational material is an important indicator of the quality of the learning process. Understanding can not be equated with knowledge, since its ability to "grow" is not a result of the acquisition of new information, but a result of organization and

structuring in accordance with personal meanings and perceptions [2]. Therefore, understanding as a cognitive phenomenon is not associated with obtaining new knowledge of reality, but with its development and practical usage for the person who is learning.

Traditionally, the outcomes of learning are organic links in the system of explanatory and illustrative education, otherwise known as "school memory". School achievement tests are wholly directed at measuring the amount of information memorized and retained. Introduction of the United State Exam in high school and academic achievement tests in universities is aimed only at coaching students to answer test questions. This testing has nothing to do with the diagnosis of the quality of thinking, the understanding and application of information and skills.

Thus, a positive trend on the results of the 2006 Physics exam was observed in tasks that test for reproductive memorization and understanding of basic formulas from a school Physics course. An analysis of results on the understanding of various concepts, values, and laws, and the ability to explain physical phenomena, could not factor into record growth in the quality of test performance. Something similar can be noticed in Geography education. Students have a much easier time digesting facts than cause and effect ties and generalizations, because facts are retained much faster than skills are acquired. The most difficult part of using learned material in Geography is performing tasks that involve the creative application of knowledge and skills in a new, and different learning situation. [3]

Results of the Geography USE in 2007 allow us to state the presence of certain stereotypical patterns of thinking, which are not due to gaps in factual knowledge, but to a lack of important skills, a lack of understanding of key geographical terminology that is the basis for the formation of competence, and belief in misconceptions (increasing atmospheric pressure and temperature with altitude, and the distribution of heat and moisture on the surface of the earth, etc.) One of the important subject skills in Geography, which should be formed in the learning process, is the ability to formulate thoughts using geographical terms and concepts, record reasoning when solving various problems, both instructional and those emerging from daily activities [4].

On the Biology USE students had a difficult time with solving problems that involved sequencing objects, processes, and phenomena. Graduates were not able to establish the sequence of the manifestation of recessive traits in offspring, processes in geographic speciation, occurrences of aromorphosis in animals and plants, and adaptations in the process of evolution. Low results on Geography and Biology USEs are also linked to questions on the causes of the greenhouse effect in the biosphere; boundaries and constraints of the biosphere, and the biogenic migration of atoms [4, 5].

Reduced USE results from 2007 in Geography, Biology, Chemistry, and Physics were linked to the types of test questions being asked. In 2007 questions became much more about the application of knowledge and skills, instead of just memorizing facts (describing the chemical properties of a substance, etc.) The low test results reaffirmed the need for greater attention to the process of repetition, generalization and systematization of material, focusing skills, and establishing cause and effect connections.

To ensure the quality of modern school Geography, Biological, etc. special attention should be given to building skills for the proper application of knowledge in a new situation, building comparisons, establishing cause and effect relationships, and performing practical tasks.

Information is given mostly through descriptions, with a subject based, elemental approach instead of a task oriented one. There is a gap between theoretical knowledge and active creative thinking. Creative reasoning seems not to be in high demand in fundamental disciplines. The active thinking methods take on a more empirical role, their process lacks an analysis of the information and how it should be used. Activities should be directed at the ability to produce, not just remember information [6].

As a result, modern school education in Russia is undergoing a crisis of understanding, it "knows a lot, yet understands very little." A shift from the world of signals to the world of common sense. Modern pedagogical ideas are based on the phenomenological concept of meta-methodology.

According to V. Bazarniy, in Russian pedagogy the retention of knowledge is not in any way connected with the world of human needs. One can note the transition of children from the inner thinking processes based on imagination (illumination, enlightenment), to the external instructional and informational psycho-constructive educational process. The highly programmable left hemisphere is taken into account and the creative, emotional right hemisphere is ignored. This incongruity often leads to increased stress in students [6, 7]. In the early 1990's a new and unusual phenomenon appeared, physical and psycho-emotional "burnout" syndrome [6].

So, having established a common problem, we now wonder if it is possible to solve it using some

kind of unified effort to help develop creative thinking, solve pertinent real life issues, and tear the subject based" fiefdom", to form a unified picture of the world?

In teaching and pedagogics, there are two methodological vectors- subject techniques, which help overcome subject based stereotypes and meta-methodology.

Modern didactic theory can apply to meta-methodology, only if it declines irrevocable extradition, and the keeping of subject based knowledge and its inherent laws.

In reality any educational method contains meta-methodological elements, such as the strive to overcome the rigid borders of one particular discipline.

The subject of meta-methodology is the human being as a “thinking” and “speaking” species.

Meta-methodology is built on the ideas and principles of general scientific, methodological, and philosophical areas of knowledge [Table. 1].

Table 1. Basic ideas and principles of meta-methodology

Basics of metamethodology	
Principals	**Ideas**
Scientific functions: systemic, planetary evolution.	**Basic science:** atomism, action at a distance, the wave-particle duality, conservation, relativity, cell structure of living organisms, genetic ideas about the origin and development of life on earth, the notions of interaction between humans and the environment, global problems of the modern world, art styles and trends in art.
	Methodological: Specific scientific Knowledge, artistic reflections of the world, stages of scientific knowledge, scientific methods (observation, experiment, analysis, synthesis, interpretation, etc.), forms of scientific knowledge (facts, laws, hypotheses, theories, scientific ideas, scientific problems), the specificity of historically successive pictures of the world.
Philosophical: the material unity of the world, the Universal interrelation of all phenomena (the irreversibility of cause and effect.)	**Philosophical:** Materiality of the world, the theory of knowledge, the objectivity of scientific laws, forms of existence (substance and plane), the indestructibility of matter, concepts of space and time, ideas about the origin of life, the development of man, humanity, and language culture, the role of the subject in modern perceptions of the world, the nature and mechanisms of reflection.

Analysis of the research in this field of education (A.S. Belkin, V.G. Kinelyev, K.K. Comyn, G.M. Romancev, E.V. Tkachenko, A.V. Usova, etc.) shows a consensus of scientists on the fact that the modern scope of activities are subject to trans-professionalism, knowledge that borders in between different subjects and has to constantly keep up with changes in fundamental scientific knowledge. The main task of the educator is to reveal the integrity of the basic sciences, to develop a holistic fundamental education which should become the basis for the formation of general and professional culture, rapid adaptation to new occupations, professions, and specializations, a theoretical framework for applied research and development.

In practice, meta-methodological skills and abilities need to be learned by teachers. These skills include the formation of interdisciplinary knowledge and skills, designing content integrated lessons, the selection of necessary information in related disciplines, including complex tasks and independent creative work for interdisciplinary lesson plans, and urging students to seek information from related disciplines, etc.

The difficulty of teachers using meta-methodology is associated with the falling out of interdisciplinary connections, which are the underlying foundation of the meta-methodological approach, from educational standards. Every school subject has its own structure of educational material, but excluding interdisciplinary areas of study will never lead to a holistic and practically oriented education.

K.D. Ushinsky, giving priority to the development of students' thinking, first put forward the idea that knowledge by itself should not be the target of the learning process.

A striking example of an idea that is meta-methodological in its nature, was expressed by K.D. Ushinskiy. He spoke of the fact that knowledge, which serves as a means for the development of theoretical and empirical thinking, should be introduced through complex integrated problems (CIP). In tackling the CIP one uses semantic and formal symbols to express relationships between real objects.

The methodological basis for constructing CIP are theories, which involve the development of conceptual knowledge, reflecting the evolution of science (Geography etc.), formation of theoretical systems and concepts in school courses, integration of didactic units and retention learning (for coagulation, condensation, and concentration of educational information), sharing instructional techniques that require integration of informational and skill based components.

The basis for solving CIP is the classification of long-term, episodic memory (retains episodes, changes after new information), semantic thinking (plays all close, similar category elements), grouping (restoring elements, categories with similar attributes), forming networks (by associations and relations), and modeling comparative semantic features.

For generalized universal knowledge and skills, complex tasks can be traditionally double faceted (linear with elements brought in from different subjects, in the beginning and the end), and multifaceted.

L.N. Tolstoy claimed that knowledge is only knowledge, when it is achieved through the efforts of thought rather than exclusively memory. The importance lies not with knowing that the Earth is round, but rather in knowing how we have achieved this knowledge.

Sometimes, a small statement is enough. A statement that at first surprises students, then makes them ponder long and hard about the content of the main idea. When studying the topic "The cycle of matter in nature", to "introduce" students into the act of deciphering hidden global processes, lines from L.N. Gumilev's "Ethnogenesis and the Biosphere" can be used. "This stone was growling at some point, this ivy floating in the clouds."

CIP may be of different levels of complexity, from analogous work from samples to using acquired information in new, unfamiliar, or more general situations. The level of generalization and ability to transfer acquired skills to new situations, their complexity and dynamics on a higher level, are a means by which to index the development of creative abilities of an individual.

According to M.M. Levina, when solving interdisciplinary cognitive tasks, a student directs his activity to find unknown relationships, which are used to test knowledge, or to form new, generalized concepts [8]. Generalizations, in all of their universality, should not lose their sense of objective, otherwise they will become empty abstractions and unproductive cognition. Generalizations of knowledge increase learning activity, and strengthen its cognitive motivation especially in dealing with non-standard creative tasks [9].

CIP are unique constructs that allow simulation and modeling (simplification, complication, the use of different terminology) levels for the teacher himself to control and mold. Solving CIP helps form creative thinking techniques which include: identifying common patterns, formulating possible hypotheses, analyzing, formulating general statements, using different language means (semantic, verbal, graphic) in a complementary and convincing manner to classify and unify different concepts, include newly acquired knowledge in communication [10].

"Discoveries" made by the students while solving interdisciplinary tasks are more weighty and subjectively important than success in the standardized aspects of the subject. Students' cognitive activity is set on trying to remember when, in connection to which questions from another studied subject, have they dealt with this information before. In this kind of situation, one must concentrate the memory to "withdraw" previously acquired knowledge from the cognitive space in which it is stored, transfer and incorporate it into the new system at hand [3].

During this whole process one uses active cognitive methods, the kind of active thinking that S.L. Rubinstein called analysis by synthesis. The mechanism of synthesis is not simple. As an example for the synthesis of qualitative- quantitative interpretation and skill based components (the combination of figurative and logical, qualitative and quantitative, visual and abstract) we can use a tiered problem:

Level I. A student eats a sandwich with butter (100 gr. Bread + 20 g. butter) gets 1600000 J. How high uphill can this schoolboy climb if he weighs 40 kg, taking into account the energy in the sandwich, if all of the energy contained in the sandwich turned to muscle?

Level II. In order to energize learning activities, we decided to transform a routine task into a situational one by creating a symbolic analogy, i.e. using poetic imagery and metaphors to formulate the problem. We used an excerpt from A.P. Chekhov's "On impermanence" to present the problem.

After completing the known algorithm (formulating concepts, generalizations, and problems, choosing methods for collecting and processing data put forth by the hypothesis, testing the hypothesis,) we must answer the question, what caused Mr. Podtykin's seizure? The history of this sybaritic man's life shows that his main problem laid in the fact that the food he consumed was not "worked off" through any activity, thus the energy he was acquiring was not released by physical means.

Chekhov's story is a prime example of how connected society and the world at large are. An example of how something as abstract as a theory in physics, over time begins to change the overall mindset of the environment in which it has evolved, even to the point of being included in literary works.

This process illustrates how it is possible to expand the limits of applicability of the first level questions following through with the associated content, caloric content of foods and muscular release of energy.

Using additional sources of information, such as real-life situations during Geography lessons will contribute to students' unceasing cognitive work, and result in endless joy and excitement when they finally unveil the truth.

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