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UNIVERSAL MATRIXES OF KNOWLEDGE AS INTERDISCIPLINARY INSTRUMENTS OF SCIENTIFIC RESEARCH AND STUDENTS' TEACHING MEANS

The main idea of the universal matrixes of knowledge as interdisciplinary instruments of scientific research and students' teaching means is given to overcome the information boom revealing the argent necessity to substantiate some universal knowledge basis for all sciences. This basis is built on the universal matrixes of knowledge being the realization of the phenomenon of wholeness of the Universe embodying in the fundamentality of educational content and pedagogical integration. The major four matrixes of knowledge are connected with some pedagogical, scientific and philosophical problems. 1. The problem of genesis / creation of the world: the corresponding matrix of knowledge № 1 shows the universal way of world's genesis. 2. The problem of general system theory concerning the task of reality modeling: the corresponding matrix of knowledge № 2 realizes the universal system principle of world organization. 3. The problem of the development of the world and all its phenomena is solved with the universal paradigm of development being the corresponding matrix of knowledge № 3. 4. The problem of man as a complex entity uniting the physical and spiritual aspects of the Universe is realized in the sphere of a colossal research instrument – the concept of functional asymmetry of the hemispheres of man's cerebrum being the corresponding matrix of knowledge № 4.

Key words: *information boom; universal matrixes of knowledge; interdisciplinary instruments of scientific research; genesis / creation of the world; general system theory; the universal paradigm of development; the concept of functional asymmetry of the hemispheres of human brain, fundamentality of educational content, pedagogical integration.*

The urgency of the problem. The amount of information on our planet doubles each 10–15 years. The deepening of the process of sciences specialization has brought about the situation when the volume of publications in some sciences is practically boundless. In the process of any research the scientist often spends a lion's share of time for studying the newest literature on the specialty. Thus the information boom earlier or later will force our civilization to give up the classical tradition to cite all the predecessors; cognition and the history of cognition will have to be separated. That is why complex studies, directed at the synthesis of scientific views and facts within certain set of problems, are of particular interest. It is quite understandable why modern science as a form of social consciousness is tending to holistic reflection of reality, why scrupulous investigations of separate problems are being gradually replaced by the attempts to bind into a single wholeness an enormous array of uncoordinated branches of knowledge, thus not only describing, but explaining a vast ensemble of facts, accumulated by the mankind.

Analysis of recent research and publications. So, the aspiration of modern scientific world to the synthesis of knowledge due to the interdisciplinary research presupposes the development of complex studies focusing on fundamental problems of the world (F. Capra, A. P. Dubrov, A. Maslow, G. I. Naan, V. N. Pushkin, Yu. A. Urmantsev, etc). Moreover, the achieving of understanding a certain phenomenon requires its holistic envelopment, when the fathoming of a certain scientifically important fact needs going out of the limits of concrete ontological and gnoseological context of its actualization. And this can be done on the ways of complex integrated investigation of the Universe.

Thus any phenomenon of our world can be studied within the framework of concrete problems of this or that scientific discipline, but the maximum full and adequate reflection of a certain fragment of reality presupposes its all-embracing study thus enabling a scientist to rise over the horizon of specialized scientific branches. So, only interdisciplinary researcher, who is eager to interpret a certain problem in the fullness of its ontological, praxiological, gnoseological and axiological constituents, has every chance to achieve the understanding of the fragmented scientific data.

If understanding is a phenomenon of wholeness, since any understanding is directed, first of all, at reaching the conceptual unity and congruity of facts within the framework of certain thinking methodological tradition (paradigm), then interdisciplinary research can be called the most preferable instrument enabling to reach the fullest degree of comprehension of a certain phenomenon.

It should be noted that if the understanding of a certain subject presupposes its total outlining, then the realization of man's understanding being the holistic entity requires an application of mythological views besides scientific theories, since myth, as it is well known, deals with the simplest holistic metaphoric categories. That is why the process of understanding the world and its aspects cannot be one-sidedly expressed only by the language of physics, mathematics, or science in general, since such a way moves us away from the holistic embracing of

the subject, in the process of which all forms of world's cognition (religion, science, philosophy) are to be realized in their integrity thus revealing a new and simultaneously well forgotten cognition aim – ***the wholeness.***

On the level of educational systems the wholeness is embodied in such important aspects of education as ***fundamentality of educational content, pedagogical integration and universality of knowledge.*** Information boom requires the corresponding orientation of education, specifically the system of professional training, at fundamentalization and universality of knowledge, their interdisciplinary nature, the formation in the prospective specialists the ability to use this knowledge in the condition of rapid changes in the fields of modern production and educational technologies.

The pedagogical integration in the context of the educational process involves the comprehensive application of both philosophical and general scientific, and specialized knowledge – their synthesis – when the transfer of ideas and methods from one science and theoretical plane to the other is the basis of a creative approach to man's scientific, engineering, artistic activities in contemporary conditions of scientific and technological progress and civilization changes.

The essence of the principle of ***fundamentality and universality of knowledge*** can be expressed in a number of provisions:

1. Fundamental interdisciplinary knowledge is not limited to the fundamentals of scientific knowledge.
2. Fundamentality of scientific knowledge is not limited to scientific and rational knowledge, it also involves scientific intuition.
3. Fundamentality of knowledge is based on the scientific and philosophical reflection of the teacher, although this knowledge is adapted by the "conceptual system" of the student.
4. Fundamental interdisciplinary knowledge includes both knowledge on man's reflection and meta-knowledge, thus realizing the unification of knowledge.
5. Fundamentality of knowledge means its versatility and focusing on the perception and understanding of the world ascertain wholeness.
6. Holistic knowledge system is the most important criterion for its fundamentality, so fundamentality of knowledge reveals its integrity, non-classical and problem character.
7. Formation of fundamental knowledge being one of the most important processes of fundamentality of education and pedagogical integrating presupposes its systematization, taxonomy, qualification, methodology, cybernetization, problemization, mathematization, cyclization in the organization of knowledge.

The purpose of the article. On the level of the wholeness the system of knowledge is realized in the sphere of the universal matrixes of knowledge. The outlining of some of its major knowledge matrixes is the purpose of the article.

The scientific results and their discussion. We live in a holistic world where everything is interconnected and stands in universal bonds with everything (the dialectical law of universal ties of all phenomena of our world) due to the cause-effect relations (total determinism when, according to synergetic methodology, even chaos can be understood as order constituting phenomenon). This truth is realized in such theoretical and practical entities.

1. The concept of fractal-holographic building of the Universe.
2. The paradoxical phenomenon of quantum physics: on the fundamental photon level of the Universe (the level of minimum portion of energy of the world) it is a holistic entity where such oppositions as the part and the whole, inner and outer, the simple and the complex, past and future, cause and effect… are not differentiated.
3. The anthropic cosmological principle according to which the physical laws regulating the existence of our Universe are in very subtle reciprocal coordination, thus creating the conditions for man's existence.

So we can talk about very few fundamental physical laws and regulations which in their turn are embodied in very few universal matrixes of knowledge (refer: ***Fig. 1***).

In modern educational establishments the students are taught approximately to 1 % of A, to 10 % of B and 90 % of C.

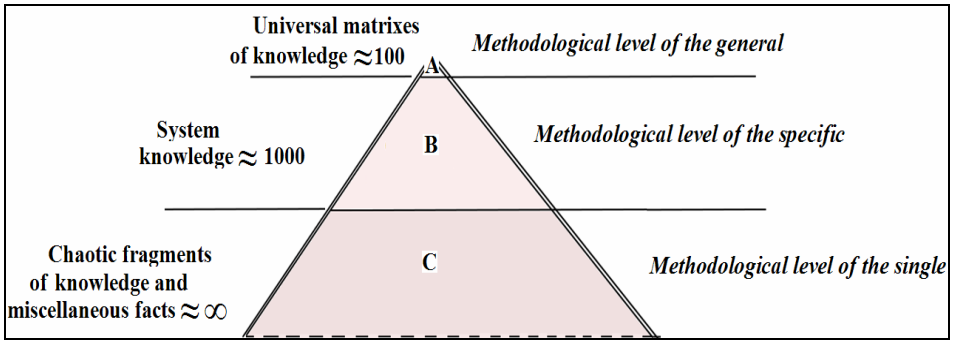

Fig. 1. The pyramid of knowledge

Let us dwell on some major matrixes of knowledge.

1. The process of genesis / creation of the world as universal matrix of knowledge № 1.

The universal matrixes of knowledge № 1 express the idea about the ***process of genesis / creation of the world.*** According to the newest physical theories the world appeared due to splitting (differentiation, division, and excitation) of the physical vacuum (nothingness, nil, ether) into the opposites: plus and minus. Modern cosmology interprets the process of Universe's creation in the same way, when it confirms that the Universe emerged as a result of "blast" from "symmetrical" "primordial matter" (fundamental vacuum symmetry, singular state of the substance, etc) by means of its fission into substance and field forms. As G. I. Naan writes, the birth of the Universe is a process of dualization of Nothingness into Something and Anti-something (surplus and insufficient entities, plus and minus), that brings about the actualization of all known physical phenomena and laws [1]. Eventually these oppositions are mutually annihilated thus revealing physical vacuum.

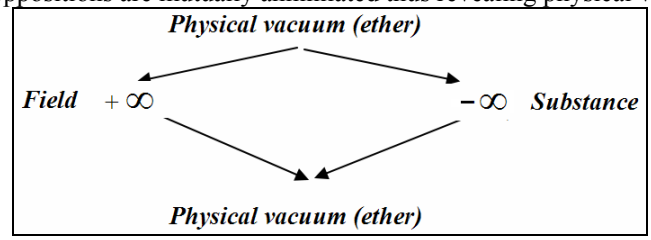

Fig. 2. The process of genesis of the world: scientific view

Religious-mythological thinking, being the expresser of the right hemispheric holistic-syncretic understanding of the world, put forward the thought, that everything is created by God from "nothing" by means of its fission, splitting (dichotomized dualization) into light and darkness (something positive and negative, male and female...). This brings about the existential state of creating the world (as a phenomenon of asymmetry – let us recall the words of P. Curie about the dissymmetry as a cause of action, motion, and the world itself). Eventually, the opposite principles are mutually compensated and restore the state of initial unity, the "prodigal son" returns to his father and the man, as Lao-tsi indicates, connects in one person opposite principles: "learns the state of femininity being masculine".

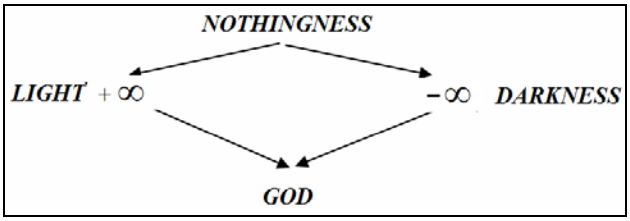

Fig. 3. The process of creation of the world: religious view

2. General system theory as universal matrix of knowledge № 2.

"The law of system rearrangements" (which, as Yu. A. Urmantsev believes, is a system universalia revealing seven possible fundamental types of all systems) states that any object as a system entity is reconstructed (transformed) in seven ways: by changing the quantity, quality, relationships between the elements, or one of the possible combinations of these features. If the presented characteristics are designated as: A (relationship), B (quantity), C (quality), and then we get four additional connections: AB, AC, BC, ABC. Consequently, there are seven methods of forming systems: A, B, C, AB, AC, BC, ABC.

In a graphical form, this procedure takes this form.

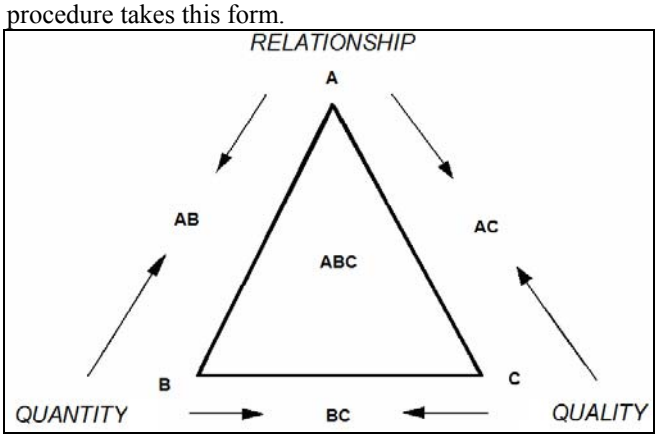

Fig. 4. The principle of system representation of reality according to Yu. A. Urmantsev

Color interpretation of the universal principle of the system organization of reality as an expression of the objective state of things serves as a visual demonstration and definite proof of the basic model of the general theory of systems.

Fig. 5. Color interpretation of the principle of a system representation of reality

Let us consider the model of pedagogical space.

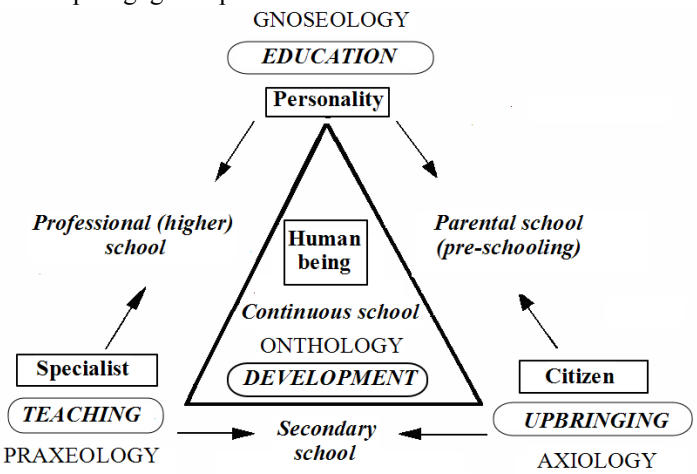

Fig. 6. Model of the space of pedagogical reality

The presented model of the space of pedagogical reality finds realization in practical aspects of the achievement of the three pedagogical goals: due to the analysis of the educational documents of Ukraine and Russia, the goal of education is the formation of a harmonious personality, a patriotic citizen and a competent specialist, which corresponds to three pedagogical goals (teaching, upbringing and developing), as to three social forms of human development (education, upbringing, education), as well to three ways of transformation and development of reality by a man (axiology, praxeology, gnoseology).

3. The main aspects of the universal paradigm of development being the universal matrix of knowledge № 3:

Any motion is, first of all, a wave, whose structure is universal, since it fixes ascending and descending branches, as well as the points of maximum, minimum and zeroes of the function, being the wave's "beginnings of stabilizations" ***(fig. 7).***

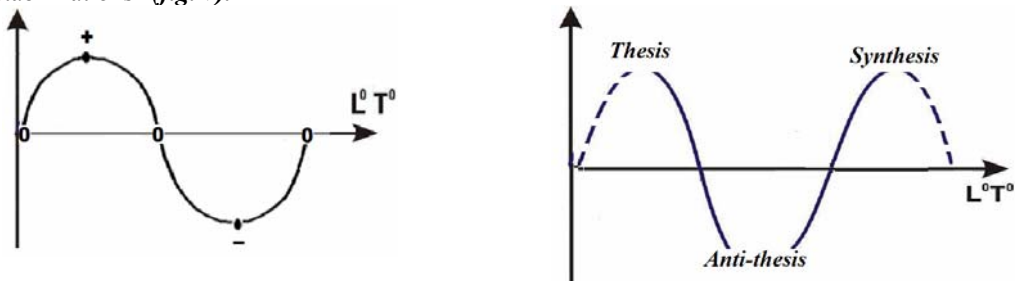

Fig. 7. Sinusoidal development model

The wave is a universal form of realization of any movement, change, development: it combines the diachronic and synchronic aspects of the Universe. For on the one hand a sinusoidal, or conical spiral, being the fundamental image of the wave, reflects the linear-sequential development process, and on the other – it basically reiterates the same pattern when it executes a constant return to the maximum (or minimum) points, which is embodied in the phenomenon of particle-wave dualism, theoretically regulated by N. Bohr's principle of complementarity, affirming the unity of the continuous and discontinuous, wave and corpuscular: opposites are

not polar, but complementary, that is, they represent oneness. Thus we have the Hegelian triad developmental model: ***thesis → antithesis → synthesis:***

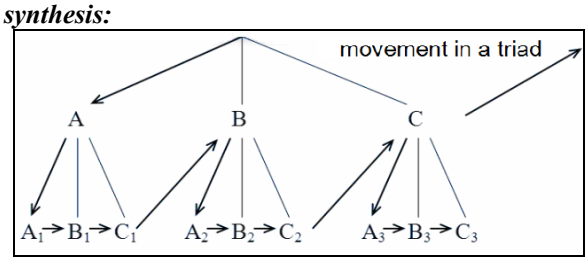

Fig. 8. Hegelian triad developmental model

Thus, the development of the triad of the original notion from A to C and then the transition to the next level is carried out through three subordinate triads formed by moments A, B and C, fixed as independent notions ***(fig. 8).*** But this means that somehow the third moment of the first member of the triad (C1) turns out to be practically identical to the second member (B), and the third member of the second member (C2) – to the third member (C). If we carefully trace these two processes, the whole principle of the Hegelian logic movement becomes clear (the transition from C to the next higher level of the notion can not be considered, since it simply repeats one of these transitions within the outer triad).

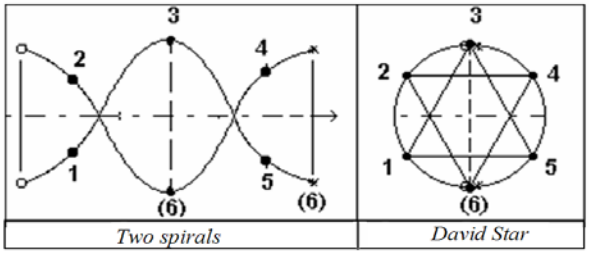

Fig. 9. The principle of the identity of the dynamic (two spirals) and structural (David Star)

The principle of isomorphism of structural and dynamic aspects of the world (***synergetics shows that in nonlinear systems processes near the centre at present go, as they went in the whole system in the past, and on the periphery of the structure they are going, as they will go in the whole structure in the future***), from which we proceed while conceptualizing the universal model of development, allows to draw a conclusion about existence of certain universal paradigm of any development / motion, idea of which is found in the works of practically all well-known thinkers. Like Aristotle and Kant, Hegel maintains that life's essence should be searched for in a certain goal, being the cause of existence / development of life. Hegel writes that end, or result, is in the same way the first one, with which the motion starts. This creates a situation when the beginning and end are necessarily bound with each other, like the Northern and Southern poles.

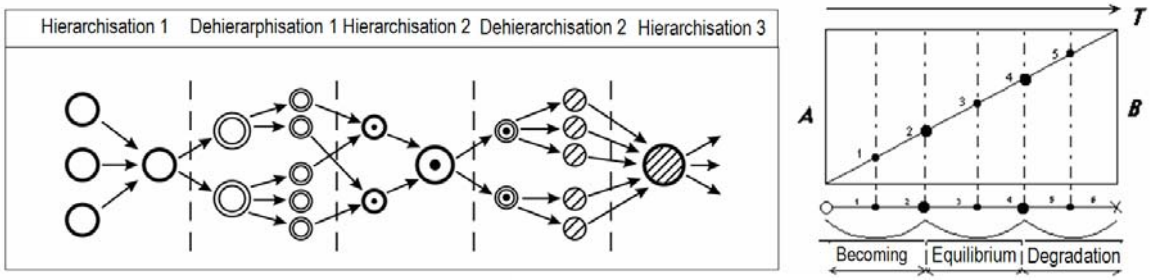

Fig. 10. Synergetic three and six phase models of development

This structural parallelism of any process is illustrated by K. Kielmeier with the help of the "law of parallelism", which E. Haeckel named "the biogenetic law": a specimen during the period of quick and short time of its ontological development reiterates the most important of those changes of the form, through which its ancestors have passed during slow and long pathway of their paleonthological development according to the laws of heredity and adjustment.

Unity of synchronism and diachronism (the synthetic and linear) is found on the level of abstract-logical reasoning, where, on the one hand, there are synchronic (synthetic) elements – axioms of logics, having logical immunity: they are impossible to be proved or rejected. On the other hand, we have diachronic (analytic) elements – the unfolding chain of thoughts in the process of logical proving. It is clear, that synchronism and diachronism are interconnected and do not exist one without the other. Besides, here we can find the dichotomy of analytical and synthetic judgments, as well as analytical and synthetic aspects of knowledge, which are mutually determined, when analytical unwinding of thought reveals only that what has been in it in synthetic

state. Hegel maintains that analytical statement contains the problem as already resolved, and as L. Wittgenstein writes, in logics the process and result are equivalent when proof is only a mechanical way to make easier the recognition of tautology where it is complicated [2] Kant interprets synthetic judgments as increasing our knowledge, and analytical – as explaining what has already been contained, though in latent way, in the premises.

4. The concept of functional asymmetry of the hemispheres of man's cerebrum as universal matrix of knowledge № 4.

On the level of higher psychic functions (on the level of cerebrum hemispheres), we can also observe the realization of the principle of holomity, since both hemispheres reflect and master the world in the opposite ways:

right hemisphere embodies *continuous-field* aspect of the world, forming an ambiguous polysemantic, artistic context of world view, building sacral-religious, metaphoric reality [3; 4; 5];

left hemisphere, on the contrary, embodies *discrete-substance*, plural aspect of the Universe, forming strictly one-semantic, unambiguous, abstract, discursive-theoretical world understanding, constructing rational-technocratic reality.

Functional unity of the hemispheric information processing strategies, which is found, as EEG studies indicate, in meditation state [6: 34–40], enables to actualize "the moment of truth", illumination, authentic, intuitive-meditative perception of the Being, being here both single, and plural, both complex, and simple... when actually-real, on the one hand and potentially-possible, on the other, are not differentiated (which, by the way, is observed on the fundamental quantum level of the matter).

So, we have every reason to state that such a regulator is actualized on the basis of the functions of hemispheres of man's cerebral cortex, about whish B. G. Anan'jev wrote as far back as sixties. As appropriate experiments show, the hemispheres may be possibly considered a psycho-physiological focus of human organism, since with their functions such sides of human entity are related, as the mechanisms of aim creation and searching for the ways of achieving the aims [7], energetic and informational regulation of people's behavior, empathy and reflection, extroversion and introversion, automatic and spontaneous psychic activity, first and second signaling systems, power and weakness of nervous processes, their lability and inertness, excitation and inhibition, I and non–I, ergotrophic and trophotrophic functions, volitional and non-volitional psychic spheres, sympathetic and parasympathetic branches of vegetative nervous system, etc.

The man's development in onto- and phylogenesis reveals the phenomenon of step by step increasing the hemispheric asymmetry (in a baby the state of functional symmetry of cerebral cortex takes place when the hemispheres work according to the functional pattern of the right hemisphere), the greatest expression of which is reached at a mature age. Afterwards, the hemispheric asymmetry is being gradually leveled thus the condition for functional synthesis of the hemispheres is revealed when elderly person, enriched in life experience, factually transforms himself into a child with its plastic psyche, spontaneity, frankness and openness of perception of the world.

Here we have a generally known philosophical idea about development (thesis → antithesis → synthesis) when the third stage of the development dialectically reiterates the first one, but on the higher level of development.

The mentioned data can be extrapolated on educational systems: the state of hemispheric harmony presupposes a sufficient developmental level of the two hemispheres. A traditional educational paradigm focuses mostly on the development of abstract and analytic (left-hemispheric) thinking, thus revealing the fact of certain underestimation of the importance of right-hemispheric (emotional and imaginative) processes of psychic activities. But relevant investigations show that right-hemispheric function activation ensures a respectively significant stimulus for the development of left-hemispheric form of psychic activity [8: 55]. Thus it is urgent to work out ***a new post-nonclassical paradigm of education*** which must provide the unity of sensational-empirical and abstract-theoretical spheres of personality's actualization. So, the unfolding of the right-hemispheric aspect of a person is argent, thus revealing the theoretical and applied value of this new paradigm having much in common with ***pedagogical synergetic.***

Conclusions. The information boom (that creates the situation when science as the form of social consciousness in the process of scientific research discards the classical tradition to cite all the predecessors when cognition and the history of cognition will have to be separated) reveals the argent necessity to substantiate some universal knowledge basis for all sciences. This basis is built on the universal matrixes of knowledge (these are about 100) being the realization of the phenomenon of wholeness of the Universe. The major four matrixes of knowledge are connected with argent scientific and philosophical problems [9].

1. The problem of genesis / creation of the world: the corresponding matrix of knowledge № 1 shows the universal way of world's genesis.

2. The problem of general system theory concerning the way to represent the reality in the system way: the corresponding matrix of knowledge № 2 realizes the universal system principle of world organization.

3. The problem of the development of the world and all its phenomena is solved with the universal paradigm of development being the corresponding matrix of knowledge № 3.

4. The problem of man as a complex entity uniting the physical and spiritual aspects of the Universe [10] is realized in the sphere of a colossal research instrument – the concept of functional asymmetry of the hemispheres of man's cerebrum being the corresponding matrix of knowledge № 4.

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Вознюк О. В. Універсальні матриці знань як міждисциплінарне знаряддя наукового дослідження та засіб навчання студентів.

Основна ідея універсальних матриць знань як міждисциплінарних інструментів наукових досліджень реалізує потребу в подоланні інформаційного буму, що виявляє необхідність обґрунтувати універсальну основу знань для всіх наук. Ця основа будується на універсальних матрицях знань, що є реалізацією явища цілісності Всесвіту та втілюється у педагогічній інтеграції та фундаменталізації знань. Основні чотири матриці знань пов'язані з певними педагогічними та науково-філософськими проблемами. 1. Проблема генезису / створення світу: відповідна матриця знань № 1 демонструє універсальний спосіб ґенези світу. 2. Проблема загальної теорії систем, пов'язана із завданням системного моделювання реальності: відповідна матриця знань № 2 реалізує універсальний системний принцип організації Всесвіту та його аспектів. 3. Проблема розвитку світу та всіх його явищ вирішується за допомогою універсальної парадигми розвитку, яка є відповідною матрицею знань № 3. 4. Проблема людини як складного суб'єкта, що поєднує фізичні та духовні аспекти Всесвіту, реалізується у сфері колосального дослідницького інструменту – концепції функціональної асиметрії півкуль головного мозку людини, що втілюється у відповідній матриці знань № 4.

Ключові слова: *інформаційний бум; універсальні матриці знань; міждисциплінарні інструменти наукових досліджень; генезис / створення світу; загальна теорія системи; універсальна парадигма розвитку; концепція функціональної асиметрії півкуль людського мозку, фундаменталізація змісту освіти, педагогічна інтеграція.*

Вознюк А. В. Универсальные матрицы знаний как междисциплинарный инструмент научного исследования и средство обучения студентов.

Основная идея универсальных матриц знаний как междисциплинарных инструментов научных исследований и обучения студентов – преодолеть информационный бум, обнаруживающий необходимость обоснования некоторого универсального базиса знаний для всех наук. Этот базис построен на универсальных матрицах знаний, являющихся реализацией феномена целостности Вселенной и воплощением педагогической интеграции и фундаментализации знаний. Основные четыре матрицы знаний связаны с некоторыми педагогическими и научно-философскими проблемами. 1. Проблема генезиса / создания мира: соответствующая матрица знания № 1 показывает универсальный путь генезиса мира. 2. Проблема общей теории системы, связанная с заданием системного моделирования реальности: соответствующая матрица знания № 2 реализует универсальный системный принцип организации Вселенной и ее аспектов. 3. Проблема развития мира и

всех его явлений решается с помощью универсальной парадигмы развития, являющейся соответствующей матрицей знания № 3. 4. Проблема человека, как сложной сущности, объединяющей физические и духовные аспекты Вселенной реализуется в сфере колоссального исследовательского инструмента – концепции функциональной асимметрии полушарий мужского головного мозга, которая воплощается в соответствующей матрице знаний № 4.

Ключевые слова: *информационный бум; универсальные матрицы знаний; междисциплинарные инструменты научных исследований; генезис / создание мира; общая теория системы; универсальная парадигма развития; концепция функциональной асимметрии полушарий человеческого мозга, фундаментализация содержания образования, педагогическая интеграция.*