Improving the Health-Preserving Competence of a Physical Education Teacher on the Basis of Spatial Value Interpretations of Nikolai Bernstein's Theory of Construction of Movements

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Abstract: In the article, based on the integrative use of Nikolai Bernstein's theory of movement construction, virtual reality technologies, and spatial and ecological approaches, ways of improving the methodology of developing the health-preserving competence of a Physical Education teacher in the conditions of postgraduate education are considered. Based on the use of AR/VR technologies a software application "Virtual Model Illustrating Nikolai Bernstein's Theory of Movement Construction" was developed. The stated model is one of the tools of the "Methodology of development of the health preserving competence of a Physical Education teacher on the basis of Nikolai Bernstein's theory of the levels of movement construction". The experimental study determines that the application of the virtual model within the stated methodology is an effective tool for the development of the health preserving competence of a Physical Education teacher. The application of the virtual model allows the actualization of the health preserving, conceptual, gnoseological, biomechanical, inclusive, corrective potentials of Nikolai Bernstein's theory of movement construction.The use of the virtual model presents the ways of targeted and meaningful use of Nikolai Bernstein's theory of the levels of movement construction by a Physical Education teacher and the improvement of physical and recreational technologies and concrete physical exercises and movement modes. Due to the application of virtual reality tools, health-preserving, preventative, corrective and developmental strategies are being formed among which the significant ones are: "Application of synergistic movements to adaptation to movement activity, and recreation", "Application of spatial movements for actualization of the orientation and search activities and development of spatial thinking", "Use of movements with a complicated algorithm for intellect development". In order to ecologize and anthropologize and for the health-preserving oriented disclosure of human bodily-motor-spatial phenomenology, a spatial approach was applied and positive results were obtained in the training of Physical Education teacher.

1 INTRODUCTION

The application of digital technologies in education is a priority vector of innovative development, which gives the chance to disclose the potential of a personality and education. Burov et al. (Burov et al., 2020) speak of the significance of digital technologies for education, "...integration of virtual reality technologies into the educational process would facilitate the increase of the quality of education". These scientists note that this would facilitate the achievement of the "flexibility of the educational process". The stated scientists emphasize that the use of modern digital technologies in the field of education can be viewed as an opportunity for improving education accessibility for children with disabilities as well as children with special educational needs (Osadchyi et al., 2020). An important idea of these authors is that "the described technologies will allow to minimize the link of the educational process to a certain place or time as well as

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enable the access to educational resources in a form that would suit the learner. . . " (Burov et al., 2020).

The stated digital technologies are significant for the development of a health preserving competence of a Physical Education teacher in conditions of post-gradual education (Klochko et al., 2020a,b). This is caused by the need of an educator to perceive a person in conditions of movement activity at a qualitatively new level. The demand for such a perception, apart from health preservation, is the importance for prevention of various disorders as well as the need in the improvement of the skills of a Physical Education teacher related to working with the movement sphere of a person (Klochko and Fedorets, 2022). We actualize the need to use digital technologies, particularly, of virtual reality technologies, to increase the qualification level of a Physical Education teacher in conditions of post-graduate education, first of all, for the study of complicated movements spatial and anthropological phenomena and theories, which they disclose.

Movement as a manifestation of human nature and a way of existence, personality formation and development and its corporality in the professional activity of a Physical Education teacher is a central phenomenon that he or she works with. Therefore, a person's health is also perceived and interpreted in the format of movement activity (Klochko and Fedorets, 2022). At the same time, the nature of movement activity, which includes the knowledge and the practically oriented perception of its in-depth, neurological and systemic mechanisms is currently not fully understood by a Physical Education teacher. Consequently, the knowledge about movement as the essence of human existence is not fully used in the professional activity, primarily, within the health preserving aspect. The insufficient understanding of the in-depth and systemic physiological, neuro-physiological and psychophysiological mechanisms of movement activity by a Physical Education teacher is caused by a number of factors. Among the above mentioned factors, the following main ones can be singled out: the complexity and specificity of the issue; the insufficient understanding of its practical and technological significance; the need to study the neurological foundation of movement; domination of practical and technological training without proper consideration of the knowledge about the nature of movement; underestimation of the importance of the theoretical knowledge about the nature of movement for a professional and thus its insufficient operationalization (in the sense of transformation of theoretical concepts into practices and technologies) as well as targeted use in health preserving technologies and practices of physical education. The stated vector, which discloses the nature of movement activity, is primarily, even though incompletely, studied within the framework of formation and development of the professional competence.

In Ukraine, an important factor of insufficient actualization of knowledge about the nature of movement activity, were the limitations to studying biomechanics, which existed in the former Soviet Union. In the former Soviet Union,the foundations of biomechanics as a science that discloses the nature of movement were made by an outstanding scientist Nikolai Bernstein (Klochko and Fedorets, 2022; Bernstein, 1990; Devishvili, 2015; Latash and Latash, 1994; Bernstein, 2020; Talis, 2015; Bongaardt and Meijer, 2000; Meijer and Bruijn, 2007) at the end of 1940-s. One of the focal points of biomechanics is the theory of the levels of movement construction developed by Nikolai Bernstein. In the 1950-s, Nikolai Bernstein and his movement theory were severely criticized and essentially forbidden, and the scientist was persecuted (Klochko and Fedorets, 2022; Talis, 2015; Meijer and Bruijn, 2007) because of the fact that sociocultural processes, including the educational ones, are somewhat inert, biomechanics as a science that discloses the nature of movement and is even currently insufficiently used in the training a Physical Education teacher and development of his health preserving competence. Accordingly, this also applies to the issues of insufficient application of biomechanics, namely, Nikolai Bernstein's classic theory of movement construction in the course of post graduate training of Physical Education teachers.

The current processes of European orientation and humanization of the Ukrainian education as well as the active use of the child-centric, inclusive (Fahr et al., 2020; Safonicheva and Ovchinnikova, 2021), competence based and innovative approaches, determine the new intellectualized and humane format of Physical Education (Klochko and Fedorets, 2022; Aksonova, 2010; Barnard, 2000; Bykhovskaya, 1991; Dmitriev, 2014; Donskoy and Dmitriyev, 1999; Efimenko, 2011) as a diverse creative anthropological practice and as a variant of a "technology of self", improvement of both the movement sphere and corporality as well as self-realization and personal development and creativity. In this aspect the application of a personality-oriented approach is relevant as it includes the need to consider the personal and age biomechanical peculiarities of a child. One of the main aspects in setting this problem is the introduction of inclusive education. The inclusive paradigm determines the need for a Physical Education teacher to develop intellectual skills of taking into consideration the sensor and motor capabilities of children with

special educational needs. Accordingly, in this aspect it is important that an educator gains knowledge and skills that make it possible to correct the sensor and motor disorders with Physical Education (Fahr et al., 2020; Safonicheva and Ovchinnikova, 2021).

The above mentioned tendencies determine professionalization and a central vector in post-graduate training of a teacher. This creates a need for a practice oriented disclosure of the mature of movement, both in the state of norm and pathology caused by certain motor disorders. An important aspect of actualization of the stated problem is also the issue of primary diagnostics of the state of the motor system, which includes the teacher's understanding of the peculiarities of its neurological foundations in order to personalize and optimize the motion activity at Physical Education lessons (Klochko and Fedorets, 2022). Diagnosing of the peculiarities and the state of the motor system, based on the knowledge about its nature is significant for health preservation as it allows the teacher to design and organize movement activities of the pupils using a targeted, conceptual and nature corresponding approach as well as correct those activities in the course of the classes. In conditions of commercialization and competition it is important for a Physical Education teacher from the point of their professional and social adaptation and self-realization.

The peculiarity of Nikolai Bernstein's theory of the levels of movement construction (Klochko and Fedorets, 2022; Bernstein, 1990; Devishvili, 2015; Latash and Latash, 1994; Bernstein, 2020; Bongaardt and Meijer, 2000) is its systemic nature and the fact that it is rather difficult for perception as well as practical application. That is why, effective representation tools are needed in order to present this theory in conditions of post-graduate education and with the focus on its practical implementation. The possibility of using the augmented reality technologies is one of such effective tools. Apart from general tendencies towards digitalization of education, the determining reasons for choosing technologies of virtual and augmented reality include the possibility to work with spatial objects, which is important for biomechanics, which studies mostly spatial changes and movement of a human body; another important factor is the time factor – the need to cover complex scientific theories in the context of their practical application within a short period of time, which is always the case in conditions of post-graduate training; another significant factor is the representative and sense-forming potential of augmented and virtual reality.

The need to use a spatial approach in this methodology is determined by the visual turn and spatial turn, which are important trends in modern science and the socio-cultural sphere, including education. An important factor in the actualization of the spatial approach, in addition to the indicated paradigmatic transformations, is the bodily-spatial, motor-spatial, spatial-cognitive and visual-spatial of physical culture and sports. This determines the need to know the motor sphere of a person not only as a being that moves in a "neutral" space.

The application of the spatial understanding of a person and his motor activity reveals ways to the development of the student's intentions, visions, interpretations and understanding of himself as a person who is spatial and is closely connected with the planet Earth and its landscapes, which are considered as special "spatial earthly values" and "value-meaning contexts". Spatial understanding is also aimed at the student's awareness of himself as a person of culture. This spatial approach is ecologically and anthropoculturally oriented. Accordingly, it represents human nature through its value-oriented spatial interaction with the planet Earth, which we consider as one of the central intentions in maintaining health. In the system of spatial and ecological interpretations of the phenomenon of man, his corporeality and motor activity indicated above, human health is considered classically as agate (well-being), which includes eudaemonia (happiness) (according to Aristotle). The implementation of the indicated "health-well-being" and "health-happiness" becomes possible under the condition of harmonization of man and the Earth.

In the scientific pedagogical literature, the problem of the integrative application of N. Bernshtein's movement theory, augmented reality technologies, and spatial and ecological approaches for the development of the health-preserving competence of the Physical Education teacher in the conditions of postgraduate education is not sufficiently disclosed. Together with the health preserving significance of Nikolai Bernstein's theory of the levels of movement construction, which is being disclosed using augmented reality, it is relevant for the development of the professional competence of a Physical Education teacher as well as for working with children with special educational needs. The mentioned aspects of problematization together with the scientific and practical significance of the problem presented above aimed at preserving the health of students, environmentalization and digitalization of the educational process, as well as at the professional development of the Physical Education teacher define this research as relevant.

Purpose. Improvement of the methodology for the development of the health-preserving competence of a Physical Education teacher in the conditions of

postgraduate education based on the integrative use of Nikolai Bernshtein's movement construction theory, virtual reality technologies, and spatial and ecological approaches.

2 SELECTION OF METHODS AND DIAGNOSTICS

The following approaches were used in the study: analysis of the scientific literature; competence based; systemic; morphological-functional; anthropological (Tkhostov, 2002); biomechanical (Klochko and Fedorets, 2022; Bernstein, 1990, 2020; Devishvili, 2015; Bongaardt and Meijer, 2000; Dmitriev, 2014; Donskoy and Dmitriyev, 1999; Efimenko, 2011); ontological, neurophysiological, spatial, pathopedagogical (V. Fedorets); hermeneutic, inclusive (Klochko and Fedorets, 2022; Fahr et al., 2020; Safonicheva and Ovchinnikova, 2021).

The following concepts were applied: anthropologization Ushinskii (Ushinskii, 1950a,b) and knowledge transfer Nonaka and Takeuchi (Nonaka and Takeuchi, 1995).

Anthropologization. The methodologically defining idea of anthropologization was formed by Ushinskii (Ushinskii, 1950b). He presents the essence of anthropologization in his classic work "Man as a subject of education. Experience of pedagogical anthropology" (Ushinskii, 1950a,b). In this book, Ushinskii (Ushinskii, 1950a) reveals the fundamental system-organizing methodological message, – "If pedagogy wants to educate a person in all respects, then it must first of all get to know him in all aspects" (Ushinskii, 1950a). In the context of the ideas of anthropologization, the teacher must know, understand the child and interpret his nature and problems humanly and multidimensionally. At the same time, the teacher should consider the child as a special anthropic, biomechanical, spiritual, psychological, cultural, age-related, physiological, existential phenomenon. Anthropologization is considered as a determining factor in the professionalization of the Physical Education teacher and the development of his vision-saving and professional competences based on the actualization of a multidisciplinary, multidimensional, holistic and systemic vision of the child. This, first of all, also includes the teacher's knowledge of certain specific phenomena of a different nature (biomechanical, spatial, psychological, etc.). In this study, we integratively consider mainly biomechanical and spatial phenomena. The indicated idea of anthropologization is a way of both humanizing the teacher and the educational process, and it is also a way of implementing the child-centered and humanistic ideas embedded in the Concept of the "New Ukrainian School" (Anosov and Stanishevska, 2018; Elkin et al., 2017; Ministry of Education and Science of Ukraine, 2019; Zhorova et al., 2022). Anthropologization, in addition to general ideas about human nature, also includes knowledge of certain specific anthropological phenomena and private problems. Therefore, anthropologizing as an idea and as a direction is one of the fundamental methodological directions and, accordingly, it determines the logic of this research. Anthropologization as a way of humanization and professionalization is the methodological basis of this pedagogical system, a fragment of which is presented in this study. Anthropologization corresponds to the modern ideology of the anthropological turn in philosophy, in education, which includes humanistic and existential (Abbagnano, 1969) transformations of educational practices and traditions.

Knowledge transfer. We apply the concept of knowledge transfer as one of the central and cross-cutting strategies. Knowledge transfer is applied in two directions – "methodical professional-personally oriented" and "methodological-innovative". It is part of the foundations of the methodology of this pedagogical system and, accordingly, of this study. The first "methodical professionally and personally oriented direction" of applying knowledge transfer is based on the SECI model (Nonaka-Takeuchi model) (Nonaka and Takeuchi, 1995). This model reveals the process of transition of implicit (tacit, implicit, background) knowledge (Chergui et al., 2020; Hélie and Sun, 2010) into explicit (explicit, formalized, codified) knowledge (Weinberger and Green, 2022). The SECI model also represents the following transformation of explicit knowledge into implicit knowledge. The indicated metamorphoses of knowledge constitute one cycle or circle of knowledge, which is a component of the spiral of knowledge. To clarify, we note that the specified SECI model defines four interrelated epistemological processes of knowledge transformation: "S" – socialization, which consists in the formation of collective implicit (tacit) knowledge by a group of persons; "E" – externalization is the transformation of implicit knowledge revealed in the process of socialization into explicit knowledge; "C" – combination consists in the fact that the formed explicit knowledge through combination, systematization, categorization and integration acquires a new qualitative level by being represented in understandable verbal formulations; "I" – internalization is manifested by the fact that the formed explicit knowledge is transformed into the implicit knowledge of a specific teacher, entering into his intellectual potential

(Nonaka and Takeuchi, 1995).

The SECI model is used in the educational process for health-oriented understanding of N. Bernstein's movement theory. This model is used for the purpose of deepening, expanding, updating, specifying knowledge, as well as for the formation of new knowledge. The SECI model is also used for health-preserving, anthropologically valuable and ecologically valuable interpretations and practical directions of knowledge, as well as for their axiologisation, anthropologization, phenomenology, aestheticization, existentialization, technologization, and psychologization. In the context of the integrative application of N. Bershtein's theory of building movements and the spatial approach, a significant and relevant aspect of knowledge transfer is the growth of knowledge and its practical orientation, direction and concretization. The indicated epistemological transformations of knowledge are, first of all, necessary for the teacher to acquire the ability to solve a certain amount of specific practical problems of a biomechanical nature aimed at preserving the student's health. The decisive factor in this aspect is that the student's specific "biomechanical" problems, which are related to his motor sphere and physicality, respectively, can be solved on the basis of the optimal organization by the Physical Education teacher of children's motor activity based on his application of N. Bershtein's theory of building movements.

As a result of the process of knowledge externalization, professional experiences and practically directed personal knowledge of biomechanics and health preservation are formalized and unified. Accordingly, such knowledge becomes available, comprehensive and understood by participants of the educational process both for theoretical understanding and for practical application. It is significant that such knowledge becomes conventional, that is, recognized as relevant by the professional community. In turn, as a result of the process of internalization, theoretical knowledge of biomechanics and theoretically understood professional experiences are included in the intellectual potential of the teacher. Accordingly, the specified internalized knowledge is included in the cognitive-value component of the health-preserving competence of the Physical Education teacher. In this component, knowledge of human biomechanics and preservation of health become the knowledge base of health-preserving thinking. This includes the teacher's formation of metacognitive strategies (Fedorets et al., 2022), as well as typical health preservation strategies and algorithms.

The second "methodological and innovative direction" of the application of knowledge transfer, which is the main one in this study and is innovative in its essence, represents the process of transformation of scientific (in this case, biomechanical) and applied knowledge into educational and professional knowledge (Levchenko and Zhukova, 2011). The considered educational and professional knowledge is necessary for professional development in the conditions of postgraduate education. This direction also includes the application of the SECI model (Nonaka-Takeuchi model) (Nonaka and Takeuchi, 1995) for methodological and educational purposes. The formed world-professional knowledge is directed to the targeted use in the final epistemological process in postgraduate education and the professional activity of a teacher, which is the internalization of knowledge, as a result of which it becomes personal (according to Polanyi (Polanyi, 1964)). In this pedagogical system, knowledge transfer is used for the formation of educational and professional health-preserving knowledge, which is carried out using knowledge of biomechanics, medicine, hygiene, neurophysiology, psychophysiology, psychology, anthropology, and systemic, existential, and spatial approaches.

The indicated "methodological and innovative direction" of the application of knowledge transfer is implemented within the framework of a significant modern trend – the knowledge triangle (Unger and Polt, 2021). The concept of the triangle of knowledge is aimed at effective innovative interaction, and in fact the integration of science, education and innovation. In this study, we reveal the scientific knowledge of N. Bernstein's theory of movement construction and their educational and practically oriented understanding in the conditions of postgraduate education, representing it in an innovative aspect with the use of digital technologies (AR/VR technologies) and a spatial approach. The innovative aspect consists in the creation of a new educational product through the spatial-valued understanding and practical-technological orientation of N. Bernstein's theory of building movements. Although the specified theory is basic in biomechanics, at the same time, it is not sufficiently applied in health pedagogy and in the educational health-preserving practices of the Physical Education teacher. From the innovative and economic standpoint, the application of the knowledge triangle concept in this study has the final economically and socially significant goal of preserving and forming the health of students. The implementation of the indicated goal by improving the health-preserving competence of the Physical Education teacher contributes to the development of health capital, which is a basic component of human capital (Ogundari and Awokuse, 2018), which ensures inno-

vative development in which education and health are important (Iacopetta, 2010).

Digital technologies. Digital technologies were used (Prokhorov et al., 2022; Semerikov et al., 2022; Osadchyi et al., 2020; Klochko et al., 2020b,a). The study worked with the Internet-resources of the technology of virtual reality, namely the software application "Virtual Model Illustrating Nikolai Bernstein's Theory of Movement Construction" (Fedorets & Klochko, 2022; CoSpaces Edu, 2023). The CoSpaces Edu software was used to develop and view the virtual reality software application (CoSpaces Edu, 2023).

Methods of mathematical statistics. Wilcoxon's rank sum test (Wilcoxon, 1945; Wilcoxon et al., 1963). In order to confirm the statistical significance of the difference in the results of solving the control problems of Physical Education teachers before and after the experiment, we used Wilcoxon's rank sum test. The criterion is used to compare the indicators of the same sample in two different conditions. In this case, the "typical" shift is considered to be a shift in the direction of increasing the values of the studied feature.

We formulate hypotheses:

H_0: The values of the indicators after the experiment exceeds the values of the indicators before the experiment at the level of significance $p < \psi$.

H_1: The values of indicators after the experiment are less than the values of indicators before the experiment at the level of significance $p < \psi$.

The calculation of the sum of the ranks of "atypical" shifts T_{emp} is carried out according to the formula

$$T_{emp} = \sum_{i=1}^{k} r_i, \tag{1}$$

where k is a number of atypical shifts, r_i is the ranks of atypical shifts $(i = 1 \dots k)$.

T_{cr} is found in the table for a given n (number of indicators) according to the level of significance ψ. ψ is determined in accordance with the problem $0,05$ or $0,01$, ie $p < 0,05$ or $p < 0,01$. If $T_{emp} \leq T_{cr}$ at the level of significance p¡ψ, the shift in the "typical" direction in intensity with high probability prevails, we accept hypothesis H_0. If $T_{emp} > T_{cr}$, with an intensity with high probability is dominated by a shift in the "atypical" direction, we accept hypothesis H_1 at the level of significance $p < \psi$.

Methodological concepts developed by V. Fedorets and O. Klochko. The developed "Virtual Model Illustrating Nikolai Bernstein's Theory of Movement Construction" is the determining, conceptualizing and system organizing part of the study. The stated virtual model is a part of the "Methodology of development of the health preserving competence of a Physical Education teacher on the basis of Nikolai Bernstein's theory of the levels of movement construction" (developed by V. Fedorets). This methodology is formed on the basis of using pedagogical tasks, analysis of movements and movement modes as well as on the study of practically all significant situations, issues and biomechanical and anthropological phenomena in the normal and pathological states. A significant component of the methodology is the implementation of tasks aimed at the development and correlation analysis of physical exercises and movement modes based on the application of N. Bernstein's theory of movement construction (Klochko and Fedorets, 2022; Bernstein, 1990, 2020; Devishvili, 2015; Bongaardt and Meijer, 2000; Dmitriev, 2014; Donskoy and Dmitriyev, 1999; Efimenko, 2011). The important approaches used within the framework of this methodology include problem based learning and flipped learning as well as game-based teaching methods and Socratic (maieutic) methods. The analysis and study of pedagogical, movement and sport experiences and practices of Physical Education teachers seems important.

Within the stated methodology, we use our own methodological technique "Wheels of problems and senses". This technique represents a broadened and adapted to practical use "version" of the hermeneutic circle. In the course of its development we used the holistic and systemic approaches as well as ideas of contextual learning. The developed "Virtual Model Illustrating Nikolai Bernstein's Theory of Movement Construction" (developed by V. Fedorets and O. Klochko.) (Fedorets & Klochko, 2022; CoSpaces Edu, 2023) was used throughout the stated methodology and represents its "central" and sense-forming component.

Methodology of control over the efficiency of application of "Virtual Model Illustrating Nikolai Bernstein's Theory of Movement Construction" as a part of the methodology (developed by V. Fedorets). The basis of the control methodology is presented by 10 interrelated questions. The questions are given in the form of a test (Yevtuch et al., 2021b). A Physical Education teacher needs to choose one correct answer of the four suggested options. This is done to form a systemic and practically oriented understanding of this issue in a teacher as well as to develop his skill of conceptualizing relevant issues of motor activity in a practical way with the focus on health-preservation. Here is the list of the question.

Question (Yevtuch et al., 2021b):

1. From the list of movements select those in which level A is the leading one.
2. From the list of movements select those in which

level B is the leading one.

3. From the list of movements select those in which level C is the leading one.
4. From the list of movements select those in which level D is the leading one.
5. From the list of movements select those in which level E is the leading one.
6. Which movement level (choose from A, B, C, D, E) domineers in dancing or physical exercises that have a relatively complex algorithm or scenario? How can this be used at the lessons of Physical Education from the point of health-preservation and personality development?
7. At which level of movements (choose from A, B, C, D, E) the movements are implemented with minimal energy losses? How can this be used from the point of health-preservation in organization of workout process at Physical Education lessons?
8. Development of which level of movements (choose from A, B, C, D, E) is the basis of praxis? How can this be used at the lessons of Physical Education from the point of health-preservation and personality development?
9. At which movement level (choose from A, B, C, D, E) basic motor disorders are formed in conditions of infantile cerebral paralysis? Is it possible to consciously and arbitrarily influence this level?
10. Which of the levels of movements (choose from A, B, C, D, E) is associated with orientation and search activity, and can be fully realized thanks to the visual analyzer. The formation of which thinking is facilitated by the actualization of this level of movements? How can this be used at the lessons of Physical Education from the point of health-preservation and personality development?

Spatial aspect of methodology. An important professional aspect of considering a person as a spatial being in relation to the earth's space is both a philosophical-methodological and a purely practical-technological issue, which is determined by the complex biomechanics of a person. Clarifying this provision, we focus on the phenomenon of spatiality, which is contextually present both in biomechanics and directly in the practices and technologies of physical culture and sports. In his professional activity, in the process of organizing motor activity, a Physical Education teacher constantly works with the spatiality of a person, with the existentiality of space, with the existentiality of corporeality (Binswanger, 1942), and also reveals for himself the phenomenology of cultural space, physical space as the space of the Earth, presented in the format of its natural and anthropogenic landscapes.

In this pedagogical system, for an ecologically valuable, health-oriented and aesthetic understanding of the phenomenology of the spatial organization of the human body, its physicality and motor activity, as well as the space of the Earth, terrestrial landscapes as natural and anthropogenic, in particular, architectural structures, the theory of construction is used movements of M. Bernstein and its "digital illustration" "Virtual Model Illustrating Nikolai Bernstein's Theory of Movement Construction". Accordingly, the theory of M. Bernshtein is interpreted culturally, ecologically-valuably, aesthetically and health-oriented.

The "Methodology for the development of the health-preserving competence of the Physical Education teacher based on M. Bernstein's theory of the level construction of movements" includes consideration of environmental and health-preserving problems. These problems are considered based on the application of a spatial approach. For this purpose, appropriate health-preserving and ecologically oriented narratives, "Virtual Model Illustrating Nikolai Bernstein's Theory of Movement Construction", photographs, diagrams and images of people and natural and anthropogenic landscapes, objects, as well as architectural structures and works of art were used. The use of images, architectural, works of art and images of landscapes and landscapes also aims to aestheticize the learning process and activate emotional intelligence and stimulate the emotional and aesthetic factor of creativity and intellectual activity.

To diagnose the effectiveness of training, we used the questionnaire developed by us "Fedorets Questionnaire for the definition of ecological value and health-preserving reflection of the earth's space and human motor activity based on the spatial interpretations of M. Bernstein's theory of movement construction", which is presented below.

"Fedorets Questionnaire for the definition of ecological value and health-preserving reflection of the earth's space and human motor activity based on the spatial interpretations of N. Bernstein's theory of movement construction".

When processing the questionnaire, it is necessary to choose one of three answers.

1. A person's own inner space and world in bodily-motor representation can to some extent be represented by the level of tonic movements (level A) according to N. Bernstein. Under the influence of external conditions, social and psychological factors of a person at the indicated level can be

formed (according to V. Reich) ... .

Variants of answers: muscle clamps and carapace of the character, protrusion, blood circulation disorders.

The correct answer: muscle clamps and armor of character.

2. In a person, his inner space and world, which in motor activity is represented by pendulum-like, repetitive, balancing movements that create a spatial effect of "mixing" and close interaction of the inner human and outer earthly space, represented by the level of synergistic movements according to N. Bernstein, determines the relevant for health preservation ... aspect.

Variants of answers: neuronal, recreational, volitional.

The correct answer: recreational.

3. From an ecological and value point of view, the implementation of "level C – Spatial movements" according to N. Bernshtein, which defines the possibility of active movement of a person in space, can be considered as a universal way ... .

Variants of answers: formation of stress resistance; harmonization and knowledge of the Earth, the world and man; development of entrepreneurial competence.

The correct answer: harmonization and knowledge of the Earth, the world and man.

4. Level D – substantive actions according to N. Bernshtein, which determines the formation of a special anthropogenic space of objects, tools, buildings, which from the standpoint of the concept of sustainable development should be ... to the earthly world and space.

Variants of answers: ecophobic and competitive; ecophilic and harmonized; active and enterprising.

The correct answer: ecophilic and harmonized.

5. The development of "level E – intellectual (speech) movements", according to N. Bernstein, is an anthropogenic and mental prerequisite for the formation of a special shell of the Earth, which V. Vernadsky defined as ... .

Variants of answers: lithosphere, hydrosphere, noosphere.

The correct answer: noosphere.

Let's consider the main ideas and meanings on the basis of which the "Fedorets Questionnaire for the definition of ecological value and health-preserving reflection of the earth's space and human motor activity based on the spatial interpretations of N. Bernstein's theory of movement construction" was developed. The questionnaire is based on a worldview concept inherent in many secular and religious systems, namely, the ancient anthropocosmic idea of the macrocosm – the harmonious world in which we exist, and the microcosm – the special inner world of man, which is within us. The microcosm is essentially seen as a version of the big cosmos (microcosm). Therefore, by influencing the inner world, we can change the outer world. The microcosm of a person, as well as his essence as a whole, manifests itself through motor activity.

The methodological and worldview value of N. Bernstein's theory of building movements lies not only in its systematicity but also in its cosmos. It reveals the motor sphere of a person as a special harmonized World – "Cosmos of movement". Cosmos in classical ancient Greek ideas is a harmonized, aestheticized, ordered, stable and living world. Ancient ideas are indicated, which fully correspond to the currently dominant concept of sustainable development, which is aimed at building a harmonious "anthropo-earthly" world.

N. Bershtein's theory reveals to us a unique cosmos of motor activity, which is primarily based on harmony between different levels of movements. Violation of this harmony forms pathologies. Thus, the "internal" (anthropic) cosmism of the motor sphere of man as a manifestation of his high "spiritual-motor" nature revealed by N. Bershtein in the specificity of the organization of certain levels (A, B, C, D, E) must be correlated with the "external" anthropocosmism earthly world. We consider motor activity as spatial and oriented towards the disclosure and formation of ecological values and intentions. This is realized through a person's understanding of its spatiality, spatial values in interaction with the disclosure of the value of earthly spaces (landscapes). The questionnaire contains five questions, which corresponds to the number of levels in N. Bernstein's theory of movement construction. Accordingly, in each question, in addition to the characteristics of a certain level of movements, the spatial, anthropological and ecological aspects that it reveals are reflected.

Question № 1 – "A person's own inner space and world in bodily-motor representation can to some extent be represented by the level of tonic movements (level A) according to N. Bernstein. Under the influence of external conditions, social and psychological factors of a person at the indicated level can be formed (according to W. Reich) ..." (Gilbert, 1999) – the presence of changes at level A in the format determines the "bodily-spatial" phenomenon, which is important for the corrective and preventive work of a Physical Education teacher – muscle tension. The essence of the phenomenon of muscle tension is that un-

der the influence of both external life (psychological-physical-social) factors and conditions, tension zones (muscle tension) may appear at the said level. The specified tension zones are subsequently fixed and manifest outwardly over time in barely noticeable peculiarities of a posture and motor activity. Internally, a human feels discomfort in certain areas of the body. In addition, bodily changes relate to certain psychological problems and affect a personality and the quality of life. The concept of the character armour, which is formed by fixing muscle tension, which was introduced by an outstanding Austrian psychologist Wilhelm Reich, is relevant in the practice of body psychotherapy. The character armour is a bodily, psychological as well as spatial and motor phenomenon at the same time. In the character armour, the peculiarities of a human's interaction between himself/herself and the outside world are reflected to a significant degree. Therefore, we consider the said problem from the standpoint of the need to harmonise a human with himself/herself, terrestrial landscapes and other people. Accordingly, the practices and technologies of intellectualised, ecologised, and psychologised physical culture can be ways of harmonisation. Motor activity in this case is considered to be recreation, self-therapy and reflection, which are implemented through "spatial, bodily and motor" practices. Physical culture becomes a way of understanding and cognition of oneself, and a way of restoration of harmony with oneself, the Terrestrial world and social environment.

Question № 2 – "In a person, his inner space and world, which in motor activity is represented by pendulum-like, repetitive, balancing movements that create a spatial effect of "mixing" and close interaction of the inner human and outer earthly space, represented by the level of synergistic movements according to N. Bernstein, determines the relevant for health preservation ... aspect" – reveals important vital and motor features of synergistic movements (level B) according to N. Bernstein. These movements are economical, "pulsating", rhythmic. These characteristics determine their ability for recreation, which is one of the important aspects of physical culture. At the same time, synergistic movements can be "easy", rhythmic and have the "natural potential" of spontaneity. In turn, a person who is tired or who has certain life and psychological problems that "lock" him in the armor of his character partially loses lightness, fluidity, rhythmicity and spontaneity. The rhythmicity of synergistic movements integratively reflects the metaregularities of the human macrocosm and microcosm, which exist and develop as megasystems of synchronized, harmonized rhythms. In this pedagogical system, special attention is paid to the ability of the Physical Education teacher to use the vital, recreational and motor potential of synergistic movements, as those that harmonize a person with himself and the world through motor activity. An example of effective movement for a person in which a synergistic component is prominent is gait. Accordingly, walking has powerful recreational and intellectual effects.

Question № 3 – "From an ecological and value point of view, the implementation of "level C – Spatial movements" according to N. Bernshtein, which defines the possibility of active movement of a person in space, can be considered as a universal way ... " – reveals ancient ontological and worldview-forming ideas of movement and path (for example, there is the Chinese tradition "Tao Te Ching") as a manifestation and formation of life, as ways of existence. Implementation of "Level C – Spatial movements" a priori requires movement in space. In physical culture, purposeful motor activity within the specified level is one of the main ones. This level C (spatial movements) integratively ensures the development of both the body and sensorimotor intelligence. From the ecological and geopsychological point of view (Mindell, 2007), the actualization of this level is significant in the knowledge of the world and the harmonization of man with the earth's spaces (landscapes). Activity at this level is also a way to oneself, i.e., a way of self-discovery through understanding oneself as a part of the great earthly world, which occurs in the process of moving in space and contemplating landscapes. The main movements in this level are walking and running. Walking and running are also based on synergistic movements (level B according to N. Bernstein).

Question № 4 – "Level D – substantive actions according to N. Bernshtein, which determines the formation of a special anthropogenic space of objects, tools, buildings, which from the standpoint of the concept of sustainable development should be ... to the earthly world and space" – reveals the special space of human activity and its results – objects of material culture and the phenomenon of architecture. Emphasis is placed on the need to implement human activity in an ecologically oriented manner in accordance with the ideology of the Concept of Sustainable Development.

Question № 5 – "The development of "level E – intellectual (speech) movements", according to N. Bernstein, is an anthropogenic and mental prerequisite for the formation of a special shell of the Earth, which V. Vernadsky defined as ..." – reveals deep philosophical and worldview ideas about the special shell of the Earth – the noosphere, which is considered as the highest manifestation of the spiritual-

mental and motor-metal nature of man. We interpret the noosphere as a manifestation of human nature integrated with planet Earth. In this case, man is to some extent derived from her, from Terra Mater (lat.) – Mother Earth. These ideas contribute to the development of intentionality, values, and meanings aimed at preserving the Earth as a planet, as a human environment, and as its "cosmic" homeland. The actualization of the phenomenon of the noosphere contributes to the development of anthropocosmic consciousness and a holistic perception of the Earth as a special and unique anthropoearthly world for humans (Yevtuch et al., 2021a). In such a world, space is interpreted and has a metric as "telus-existential – res extenza".

Thus, each level highlighted in N. Bernstein's theory of movement construction corresponds to its own special "telus-anthropic" and cosmic understanding of space. Each level reflects its specificity of interaction of the motor sphere of a person with space and with itself, and forms a certain systemic multi-level integrity in the perception of oneself and the world. The actualization of different levels of human interaction with the earthly space is also a method of self-reflection and physicality. In his imagination, a person almost always imagines himself not separately, but connected to some fragment of reality in which there is a distinct spatial aspect. That is, a person always reflects a fragment of some artificial or natural landscape in his mental reality. Psychologically, it is essentially inseparable from Terra Mater – Mother Earth.

3 RESULTS AND DISCUSSION

Improving the health-preserving competence of a Physical Education teacher in the conditions of postgraduate education is a defining and system-organizing educational precondition for the effective preservation of the health and life of children in the conditions of the educational process. Guided by the paradigm of competence approach and the ideas of inclusion, creativity, child-centeredness and humanization, we define the *health-preserving competence of a Physical Education teacher* as an integrative professional and personal ability of a teacher aimed at preserving the life and health of students with typical development and special educational needs in the educational process by forming a healthy lifestyle, prevention and correction of disorders; by promoting the formation of children's competence in personal health-preserving, physical activity, corporeality, physical image, personal freedom, as well as the development of socially adapted, harmonious, ecophilic and life-creating personality through the use of physical culture means. A relevant component of improving the health-preserving competence of Physical Education teachers in postgraduate education is the use of virtual and augmented reality technologies to deepen and expand practical knowledge about motor activity as a manifestation of human nature and as a way to his or her health.

Let us consider the ways and peculiarities of using the virtual model ("Virtual Model Illustrating Nikolai Bernstein's Theory of Movement Construction") as a system organizing model within the "Methodology of development of the health preserving competence of a Physical Education teacher on the basis of Nikolai Bernstein's theory of the levels of movement construction" (Yevtuch et al., 2021b). In this methodology, the virtual model is the central and sense-forming element, representing a spatial image-semiotic system. We formed the stated methodology on the basis of methodological idea of cyclic, repetitive, rhythmic, step-by-step development of knowledge and senses as well as on the "panoramic" and holistic perception of reality. Together with knowledge development, we actualize the formation of corresponding senses, values, intentions, reflections, interpretations and professional health preserving attitudes. Cyclicity and repetitiveness, being the determining structural and didactic ideas of knowledge representation and sense shaping, are initially defined by systemic nature and a "multi-dimensional" and diverse specifics of N. Bernstein's theory of movement construction (Bernstein, 1990, 2020; Bongaardt and Meijer, 2000). Within the framework of this theory five levels of movements are defined – A, B, C, D, E. Being interrelated and interdependent, these levels represent a complex hierarchic system. It is relevant that every level of motor activity is relatively autonomous and specific and may be considered as a determining and defining for movements that are characterized by common features. At the same time, a certain level is presented as a necessary component or the basis for the next, "higher" level of movements. According to the above described understanding, movements activity may be presented either by all levels or by one, two (e.g. balancing movements), three (e.g. walking) or more (up to five) levels.

Highlighting the essence of N. Bernstein's theory, we characterize each level of movements in the relation to other levels and thus disclose the phenomenology of movements activity as a whole. At the same time, we highlight one key determining aspect (vector) and a few additional ones. These additional aspects facilitate a deeper, widened and interpretation

oriented disclosure of the key aspect by supplementing its senses. In this pedagogical system the key aspects (vectors) are presented as *problem-conceptual lines*. These lines differ from the aspects (in a narrow sense) as they are clearly directed, aimed at problem setting, interpretation and constructing of new knowledge. The orientation towards knowledge and sense construction, transfer and transformation includes the actualization of an individual problem as well as the formation of complex and general understandings about movement perceiving the peculiarities of all five levels. Thus, the consideration of the issue of movements activity is being actualized through its consideration within the "individual-general" system, which is one of the central correlations in hermeneutics (Dilthey, 1996). The stated "individual-general" correlation is reflected in the concept of a hermeneutic circle. In our pedagogical system of didactic positions, the central and main differences between the problem-conceptual line and aspect lie in the fact that it is primarily viewed and formed as a certain epistemiological, hermeneutic, value-conceptual and practically and technologically oriented subsystem with the corresponding orientations. The consideration of a certain problem-conceptual line (aspect) discloses the nature of all five levels of movement as a complex system and accentuates each of these levels as a particular "movement ontology". By actualizing each next aspect as the previous one we "take it through" all A, B, C, D, E levels (Yevtuch et al., 2021b).

For instance, while disclosing the nature of movement through the representation of "Key manifestations of movement" and "Movement characteristics", we analyze and illustrate it with the help of a virtual model. The movement is structured into subsystems represented by a certain level: A (tonic movements) – ensures muscle tonus, mimic movements, trembling from cold and stress, etc. (figure 1); B (synergistic movements) – synergistic, economic, balancing, reciprocal (movements in which antagonist muscles contract and relax in turn), smooth, "round" movements etc. (e.g. body movements when a person stands, balances or does physical exercises without lifting the legs from the surface or changing his or her position) (figure 2); C (level of spatial movements) – movements that ensure active spatial movements: jumps, walking, running, thrusts (figure 3); D (level of concrete actions) – movements that ensure an effective and targeted work with objects, tools – praxis (figure 4); E – intellectual movements: language movements and dances and "motion scenarios", which have a complicated structure (figure 5) (Yevtuch et al., 2021b).

We briefly represent another important problem-conceptual line, which is a group of interrelated aspects – "Movement as a manifestation of existence, movement as a body scheme, movement as a spatial and orientation phenomenon" (Yevtuch et al., 2021b). Level A – level of tone – is a manifestation of existence as a given; is "discloses" the space of the body as a self-sufficient, self-referential and self-reflective system; the level of tone (A) essentially "forms" the "vital body" as a self-referential phenomenon both in the consciousness and in reality; this level ensures the formation of a "primary" scheme of the body; discloses the corporal "self" as the one that is in the body in general, actualizes it; existential of corporality; forms a certain orientation within one's body, which is relatively independent from the environment. Level B – level of synergy – swaying, synergistic movements form: movement as such, which is characteristic of a body and the movement of body parts relatively to the body as well as swaying shifts (sways, bends etc.) of a body in space; discloses the corporal "self" as such exists in the body through synergistic movements; actualized the existential of space (Besoli, 2017), the existential of corporality as the existential of movement (Klochko and Fedorets, 2022) by shifting parts of the body (limbs and the body itself) relatively to it; discloses the existential of temporality through movements, which are repetitive and periodical, forming a "temporal-biochemical-swaying" process, which facititates the perception of time; forms orientation within one's body with regard to and depending on the movement of parts of the body (arms, legs) relatively to it and while making swaying movements, also taking gravitation into consideration; balancing movements give the realization of gravitation and thus form a close connection with the Earth as a planet and the foundation of life; these movements are a precondition for forming spatial metaphors, which represent the basis of the sensor-motoric thinking. Level of spatial movements – C: represents and "unveils" the space, landscape and the Earth with the existing objects and perspectives; presents movement as a "spatial" existence through spatial movement; discloses the existential of spatiality and temporality; actualizes the existential of corporality and the existential of locomotion (Klochko and Fedorets, 2022) through movement of the body in space; forms an orientation and goal setting in space; is a precondition of forming spatial metaphors as the basis of thinking and values (Lakoff and Johnson, 1980). Level of concrete actions – D; "forms" a "world of things" in the consciousness (the object domain); discloses the orientation within the objects and actions; "creates" praxis as an ability for

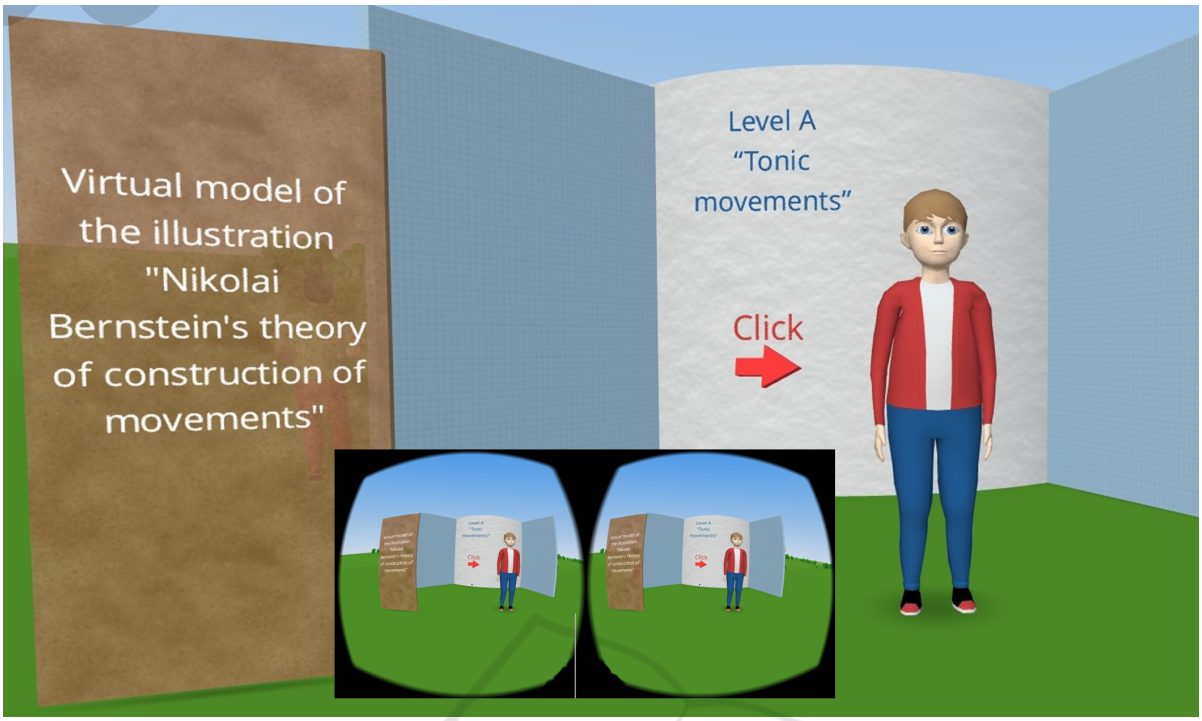


Figure 1: Level A – Tonic movements (Fedorets & Klochko, 2022). The figure shows a man standing. This is provided by the tonic level (A). A person can jump sharply. This is an example of changes in the tonic level – ballism. Movement: muscle tone, statotonic, coordination-tonic, facial expressions, trembling in the cold, grouping when falling. Level basis (is the "background level") – B, C, D, E. Characteristic of movement: unconscious (automatic), the involvement of all muscles of the body, basic and background for all levels, associated with the subconscious. Attitude to space and orientation: own body (Yevtuch et al., 2021b).

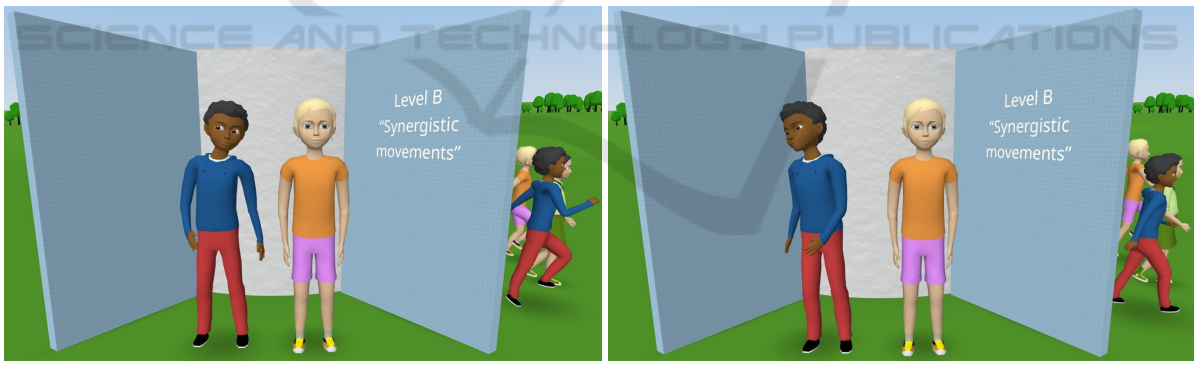


Figure 2: Level B – Synergistic movements (Fedorets & Klochko, 2022). Movement: base walking and dancing (rhythmic), maintaining balance and balancing, facial expressions. Level basis (is the "background level") – C, D, E; rhythm of speech and intonation. Characteristic of movement: movements without taking into account the spatial structure of the environment, economical, balancing, stereotic, equilibrium, "pulsating", rhythmic, repetitive, smooth and precise, partially automatic, the basis of walking, may be partially automatic and unconscious. Attitude to space and orientation: own body and the immediate surrounding space (Yevtuch et al., 2021b).

targeted, creative and "transformational" work with objects, tools and the environment and to a certain extent as a "specific" interaction with people and animate objects (plants, animanls). Level of intellectual movements – E: forms mental and corporal activity as a semiotic-conceptual and intentionally-targeted, in the formats of language and communication; discloses the language and dialogue as existence and a mental-communicative way of existing in it; determines the spaces and fields of concepts, senses and values; discloses intellectual activity as a human way of being; actualizes the existentials of love and health

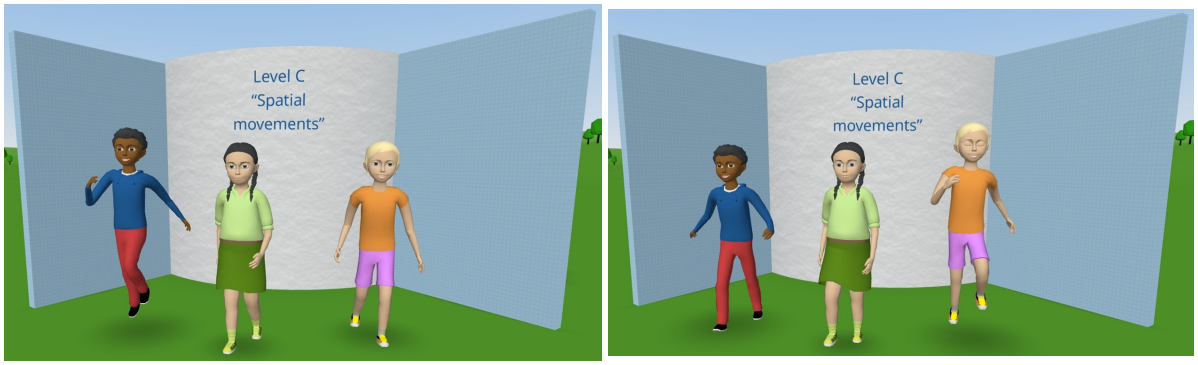


Figure 3: Level C – Spatial movements (Fedorets & Klochko, 2022). Movement: movement based on orientation in space, walking, running, throwing, jumping. Level basis (is the "background level") – level D, E. Characteristic of movement: spatially oriented, differentiated, precise, conscious, conscious movements. Attitude to space and orientation: Three-dimensional Space (Yevtuch et al., 2021b).

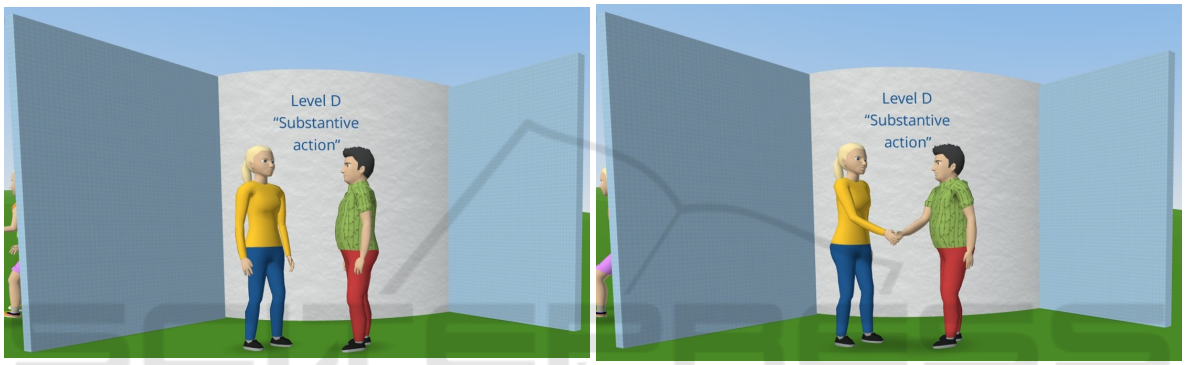


Figure 4: Level D – Substantive action (Fedorets & Klochko, 2022). The figure shows the idea of movement of level D – Substantive action. It is primarily formed through contact in the "man-man" system as a contact. In this case, the participation of level A (tonic movements) is relevant – which forms the possibility of contact with another person, and later (in the process of human development) with the object (tool). Movement: actions and work with objects, praxis. Level basis (is the "background level") – level E. Characteristic of movement: has a complex algorithm, is targeted, subject-manipulative and meaningful, system-forming and meaning-forming factor is the goal and the result is focused on the action with the objects, this level is semantic and objective, conscious movements. Attitude to space and orientation: "space" of objects and tools that are in three-dimensional Space (Yevtuch et al., 2021b).

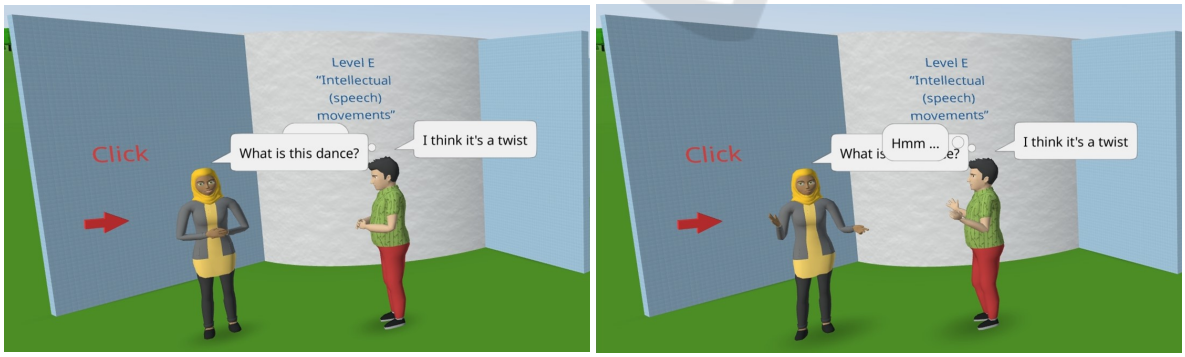


Figure 5: Level E – Intellectual (speech) movements (Fedorets & Klochko, 2022). Movement: intellectualized movements – sign language and partly body language and dance (understood as complex choreographic actions), reading, spoken and written language and reading. Characteristic of movement: characteristics related to speech, physical communication, complex dances and motor scenarios, conscious. Attitude to space and orientation: for language – space of objects and ideas, ideal (virtual) spaces of values, values; for dances and complex motor scenarios – three-dimensional space, space of speech, "space" of tools and objects, space of ideas, values and meanings.

as a manifestation of human nature.

The presented brief overview of the three problem-conceptual lines (aspects) in the learning process discloses with the help of the "Virtual Model Illustrating Nikolai Bernstein's Theory of Movement Construction" the essence of movements activity in a consecutive, "layer-by-layer", cyclic way. In the course of this process the knowledge from various fields (knowledge transfer) is used, which is then naturally integrates into a certain epistemological system. Such a variety of knowledge facilitates the actualization of the hermeneutic potential of N. Bernstein's theory, which accordingly launches the active formation of interpretations, reflections, understandings and senses. From the didactic point of view, the stated methodology of knowledge representation and perception allows to present the knowledge in various ways, not being limited to a fixed hierarchic model. Problem-conceptual lines may be represented in any order and combination. This creates a corresponding learning diversity, facilitates spontaneous manifestations and is a precondition for creativity and active dialogue-based interaction. Physical Education teachers can independently choose the aspect that needs to be analyzed in the context of N. Bernstein's theory. This may further be used for a formal description of the methodology for the improvement this virtual reality model of the stated issue and creation of a corresponding interactive model.

Within this pedagogical system we present the repeated and multi-dimensional highlighting of the nature of movement, together with the actualization of its various aspects and with a corresponding subsequent formation of complex understanding of the movements field and a human being, as a methodology (methodological technique) of cyclic and layer-by-layer shaping of knowledge, values and senses, calling it the "Wheel of problems and senses". The axis idea of this methodology is the cyclic and repetitive knowledge formation, reproduction, transfer and transformation in various aspects, contexts, formats and in correlation with various problems and aims of movements activity and corporality. This, in turn, determines the hermeneutic and sense forming potentials of the methodology as well as the existence of knowledge in the form of a problem. Accordingly, in the course consideration of various aspects and their analysis in correlation with the nature of various levels of motor activity organization, knowledge is being constantly updated. The very existence of knowledge in the form of problematization, as a problem and as interpretations, facilitates its preservation, development, growth and widens the opportunities for a value based and practical orientation of creativity. Using the ideas expressed by Frank (Frank, 2016), we may characterize such knowledge as "living knowledge". Thus, thanks to its multi-dimensional, systemic, representative nature, N. Bernstein's theory allows to disclose the phenomenology of movement using the "Wheel of problems and senses" methodology, which is a practical and targeted application of the idea of a hermeneutic circle and which, speaking metaphorically, forms new knowledge and senses in the course of its "movement" within the "knowledge space".

The "Virtual Model Illustrating Nikolai Bernstein's Theory of Movement Construction" forms the foundation of the above presented practical implementation of the ideas of a layer-by-layer and cyclic shaping of knowledge and senses about movement with the help of the "Wheel of problems and senses" methodology (methodological technique). The stated model contains anthropic images, typical situation (e.g. a person is running – level C, or talking – level E) and "motion spaces" in which the peculiarities of every level of movements is being disclosed. The virtual spaces of the stated model as well as the corresponding anthropic images are used to study the peculiarities of various levels of movements and are also subsequently used as sense-forming contexts to highlight and particularize the relevant issues of the motion sphere, health preservation and disclosure of the human phenomenon as a whole.

Thanks to the use of the "Virtual Model Illustrating Nikolai Bernstein's Theory of Movement Construction", the "Wheel of problems and senses" and the problem-conceptual lines, which form it to a great extent, motor activity is disclosed as a manifestation of the poly-ontological human nature (Nosov, 1999). Accordingly, the motor activity is represented as a particular "existential-vital-movements-activity-intellectual ontology", and is not reduced (simplified) to mechanic movements. Motion is viewed as a continuum of anthropological phenomena – from purely "biological-corporal" ones (levels A, B) and "corporal-spatial" (level C) and "corporal-praxeological" to "gnoseological-linguistic" and spiritual ones (level E).

For a "dialogue-based" "immersion" of course participants into the "biomechanical essence of movement", the initial demonstration of the virtual model includes the actualization of maieutic and interactive practices. The idea of this aspect is to disclose movement as a complex, multi-level anthropic system. In the virtual model, the five levels are demonstrated in the form of anthropic images and are a spatial formation. Such a presentation is essentially a "spatial" as well as "anthropic" metaphorization. It creates the ef-

fects and levels of movements are presented using real examples and in real situations, which are considered with the relation to and together with the use of the virtual model.

While focusing the attention of course participants on the phenomena of complexity and consistency as the determining ones in movement construction, we analyze when the stated complexity is distorted by considering the virtual model. Therefore, the fine interaction between the levels of movements is also distorted. The fact that probable distortions really exist, can be modelled and thus "extracted" from N. Bernstein's level theory poses a special methodological interest (Klochko and Fedorets, 2022; Bernstein, 1990; Devishvili, 2015; Latash and Latash, 1994; Bongaardt and Meijer, 2000). We suggest that the course participants model probable distortions on the basis of knowledge about the nature of movement disclosed with the help of the virtual model. The stated aspect of decomposition with the subsequent "construction" of movement is possible even after the basic familiarization with N. Bernstein's theory.

Using the virtual model and, consequently, the "layer-by-layer and periodic consideration", we present various aspects of movement, each time quickly analyzing the peculiarity of all five levels. In the course of this process, the movements, sport, life and professional experiences of Physical Education teachers are being actualized. As an example, we will consider the problem of sense as a significant component of organizing movements activity by analyzing three levels (A, B, C) of N. Bernstein's theory.

A – "The level of tone" – reflects the sense of corporal existence. In this aspect we focus on the existentiality of corporality, remembering classical ideas of Binswanger (Besoli, 2017). We consider the stated aspect in the spirit of existential pedagogics (Bollnow (Bollnow, 1955)). Thus, it is significant for the humanization of the educational process and the formation of a kind attitude of a teacher towards a child, which corresponds to the child-centric ideas of the "New Ukrainian School". While analyzing the "A" level, we indicate that the main "purpose" of a child is the existential perception of self as a possibility and a reality – "I AM" and "BE".

Senses of the next level B ("Synergistic movements"), which is well represented in the virtual model, is also characterized by human corporality. At the same time, relevant senses of human existence in the environment are added. This level is directly linked with the Earth, namely with gravity. Balancing movements are also included into this level. Thanks to this level, the essential initial contact with the Earth is created. I this aspect, we actualize the ideas of Embodied Cognitive Science within the framework of which the relevant aspect of intellectual activity is the body and human corporality, which are "inscribed" and interact with the environment.

Senses of level C ("Spatial movements") are primarily disclosed through a possibility to shift the position in space, which is effectively presented in the model. Thus, through the realization of this level, the orientation and search activity, which is one of the preconditions of the intellect and a manifestation of the vitality and spatial nature of a person, is manifested and developed.

The main reason for actualizing the idea of senses of motor activity is for the teacher to understand the ways and possibilities for motivating the pupils to work out and lead a healthy lifestyle. For instance, at level A (tonic movements) the educator works with the senses of corporal being and being as such. This includes beauty, health, the sense of life (Klochko and Fedorets, 2022; Besoli, 2017). This is the "source" of motivation and not the fact that a child "must" workout.

Level B ("Synergistic movements"), just as the previous one, allows a person to understand himself in relation with "himself" and the "environment", with the Earth. At this level, in order to form senses and influence a pupil, it is necessary to be congruent. In our opinion, this level is linked with a person's perception of his/her body. To a certain extent, it may be called "corporal reflective". It discloses the corporality dynamically, in synergistic movements and through rhythms (it is the basis of dances).

At level C ("Spatial movements"), it is important to use the informative-value and vital potential of the "Earth space" in order to form senses and motivations for motor activity and healthy lifestyle. A relevant point is the environmentally friendly application of landscape pedagogics, spatial metaphors etc.

In the course of implementation of this virtual model, we consider the issue of inclusion (as one of the central problem-conceptual lines) in order to give the teacher an understanding of the ways of improving pedagogical interaction with as well as teaching the children with special educational needs (Fahr et al., 2020; Safonicheva and Ovchinnikova, 2021), and also to broaden the professional abilities of an educator in terms of correction of sensor-motoric and other disorders with the help of Physical Education tools.

Motor health-preserving strategies are formed on the basis of N. Bernstein's theory of construction of movements. Based on the practical and technological understanding of the features of biomechanics, psychology and neuronal foundations of different levels of movement revealed in N. Bernstein's theory and

through the reception of pedagogical and sports experiences of Physical Education teachers the strategies are developed that are considered as health-preserving and prophylactic ones. The very same strategies are to some extent corrective and developmental. These strategies can be used for health-preserving improvement of existing physical culture and health technologies and practices as well as for the development of new ones. We will briefly present the main aspects of motor health-preserving strategies.

Motor health-preserving strategy "Application of synergistic movements to adaptation to movement activity, and recreation" is developed on the basis of practically oriented understanding of synergistic movements – level B. The feature of these movements is economical, adjusting, pulsating, repetitive, rhythmic, balancing and to some extent "recreational" nature (figure 2). This strategy can be applied to the formation of new motor actions (in the sense of physical exercises), as well as used in the already existing ones with the actualization of the synergistic component. That is, already known exercises can be performed in a "synergistic mode". Such movements are balancing, rhythmic, repetitive and are realized with a sense of ease. The movements can also be performed partially in an automated mode, which creates the effect of rest, comfort of the movement itself, "comfortable" feeling of your body, as well as calming due to the actualization of the rhythmic component. The application of spatial and body-spatial motor metaphors is relevant, in which there is an orientation in the directions up/down, forward/backward, right/left, the movement around own axis. The application of this "synergistic strategy" is necessary for the "soft entry" into motor activity, which corresponds to human nature i.e. for warming-up and getting out of the load – for a hitch. "Entering" and "exiting" motor activity should be delicate and inconspicuously synchronize the work of the cardiovascular and respiratory systems and musculoskeletal system, taking the body to a qualitatively new level of functioning systematically, smoothly, rhythmically, not abruptly, quickly, "avalanche like" and not synergistically. Synergistic movements also play a setting and tuning role for a particular activity or other movements. Let's remember the soft, delicate, oscillating and rhythmic movements when a woman shakes a baby. In the same semantic series there are synergistic (rhythmic, oscillating) combat or "marriage" (expressed in animal dances) movements, both in humans and in animals that have a corresponding reflection in dances.

The motor health-preserving strategy "Application of spatial movements for actualization of orientation-search activity and development of spatial thinking" is formed on the basis of actualization of orientation-search activity which has expressive spatial character (figure 3). In the implementation of this activity, visual and auditory analyzers are activated as the main ones that provide adaptation in space. The development and active functioning of the mentioned analyzers (visual, auditory) is a sensory prerequisite for the formation of spatial thinking, orientation and imagination. To implement this strategy, we recommend using outdoor activities, the potential of landscape pedagogy and tourism, as well as the demonstration of landscapes and spatial objects and their discussion. It is important to use motor games with elements of orientation in space and complex-coordinated movements and movements on various including circular trajectories and their subsequent analysis and discussion. The application of spatial motor metaphors, elements of theatrical pedagogy, which includes reincarnation into various images in which the motor and spatial-motor components are expressive, is relevant.

The motor health-preserving strategy "Application of movements with a complex algorithm for the development of intellect" is formed on the basis of updating the intellectual potential of the level E – intellectual movements) (figure 5). We recommend using relatively complex motor scenarios, including choreographic and those that can be performed both individually and collectively, as well as to teach to work with spatial images, routes and actions, thinking about their trajectory and method of implementation. An example is the performance of combat movements in martial arts combined into a special system (dance) – kata. The combat motor actions are integrated and transformed into a sequence of movements and a sequence of actions (if movements with objects or weapons) in kata. Motor actions are thus interconnected and "intercurrent" successive combat movements that are integrated into a system. They represent "motor-spatial algorithms" and a system of body-movements "tools" of influence and action. The spatial-temporal integration of motor actions is based on: principles and cultural traditions and experiences of combat, ideas about the enemy and the combat situation, modeling and reflexive understanding of the probable problem, concentration and meditation techniques, knowledge of biomechanics and human psychology. Thus, the kata from the standpoint of cognitivistics can be considered as a "body-space-activity" semiotic system defining characteristic, which is cognition. It is interesting to use the representative potential of movements, which includes the ability to communicate through motor activity and demonstrate complex ideas, feelings, which is also considered in

the framework of theater pedagogy. The use of music and the arts in general, including poetry, is important. The use of elements of play, carnival, imitation of life scenarios, as well as narrative and communicative skills of a teacher is important for the actualization of this level.

We recommend using augmented and virtual reality technologies in the implementation of all these motor health-preserving strategies, which will allow implementing them at a new quality level.

One of the significant results of contemporary European centric transformations of the Ukrainian education is the formation of intellectualized, axiologized, "human-centric", psychology driven and "humaniticized" physical culture (Aksonova, 2010; Efimenko, 2011). Such physical culture is considered as a relevant component of movements activity, development and existence of a child and not only as a school subject. Thus, it is represented as a system of personality-oriented and culture-corresponding techniques of the body, which we view in correlation with mental, spiritual and health preserving practices as well as, to a certain extent, their inseparable components. Judging from the anthropological-cultural and humanistic positions, it is important that the teacher perceives the cultural heritage and includes it into the value-conceptual contexts of the educational process, namely, for the organization of motor activity, development of corporality and the corporal image of the pupils.

In the light of such views, physical culture may be viewed not only as a corporal technique and a motion practice of a particular culture, but first and foremost as a culture forming unit. We believe that corporal techniques make up the basis of preserving physical as well as psychological, existential and spiritual health.

N. Bernstein (Klochko and Fedorets, 2022; Bernstein, 1990; Devishvili, 2015; Talis, 2015; Bongaardt and Meijer, 2000; Meijer and Bruijn, 2007) defined a person and his/her locomotor sphere as a set of super complex integratively functioning intentional systems, which have a certain potential for autonomy (in a modern auto-poetic understanding). This made his views radically different from the views of a simple person (lat. Homo simplex) and a reflex person, mechanic person, automated person. N. Bernstein's ideas are disclosed and have undergone value based comprehension with the help of virtual reality and they lead us to an idea that movement is a manifestation of the higher nature of human existence as well as to an understanding of metaphysical and ontological for mans of motor activity.

An experimental study. To analyze the efficiency of using the "Virtual Model Illustrating Nikolai Bernstein's Theory of Movement Construction" within the "Methodology of development of the health preserving competence of a Physical Education teacher on the basis of Nikolai Bernstein's theory of the levels of movement construction" in the Communal Higher Educational Institution "Vinnytsia Academy of Continuous Education" and study was conducted in 2019 among 165 Physical Education teachers, who were taking the professional growth training course. The experimental group was made up of 85 people.

Let us prove the statistical confidentiality of the obtained results. The number of tasks that had to be completed by the Physical Education teachers before and after the using the methodology of development of health-preserving competence of a Physical Education teacher in the conditions of postgraduate education on the basis of N. Bernstein's theory of construction of movements with the use of virtual reality technologies. The results showing the number of correct answers of Physical Education teachers to questions before and after using this methodology are considered at $n_1 = 10$ and $n_2 = 10$ (figure 6) (Yevtuch et al., 2021b).

Let us confirm the statistical significance of exceeding the values of the indicators of the results of solving control problems by Physical Education teachers after the experiment over the values of the corresponding indicators before the experiment using the Wilcoxon's rank sum test (Wilcoxon, 1945; Wilcoxon et al., 1963).

We find the difference between the values of the corresponding indicators of the results of solving control tasks by Physical Education teachers before and after the experiment (table 1) (Yevtuch et al., 2021b).

We arrange the obtained absolute values of the differences in the indicators of the studied trait before and after the experiment in ascending order. Rank them in ascending order of absolute differences with using average ranks (because there are related ranks) from 1 to 10 (table 1) (Yevtuch et al., 2021b).

Analysis of the table data showed that there are no "atypical" shifts. So, calculated by formula (1)

$$T_{emp} = \sum_{i=1}^{k} r_i = 0.$$

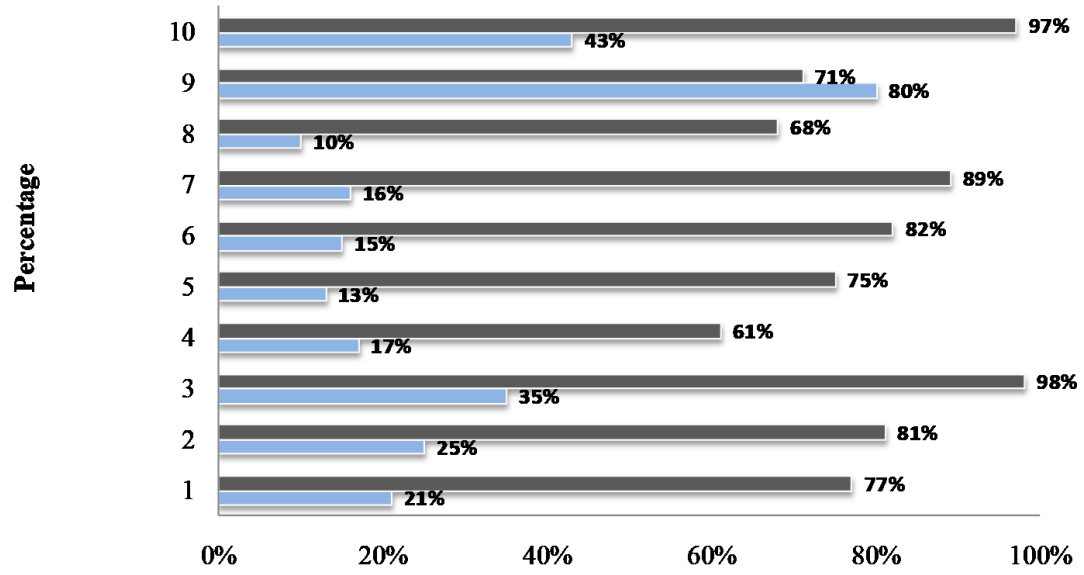
Find the critical value for the Wilcoxon's rank sum test for $n = 10$, using the data in table 1:

for $p < 0{,}05$ the $T_{cr} = 10$,

for $p < 0{,}01$ the $T_{cr} = 5$.

The empirical value $T_{emp} = 0 < T_{cr} = 5$ at the significance level $p < 0{,}01$.

Hypothesis H_0 is accepted. The values of the indicators of the results of solving control tasks by Phys-



	1	2	3	4	5	6	7	8	9	10
After the study	77%	81%	98%	61%	75%	82%	89%	68%	71%	97%
Before the study	21%	25%	35%	17%	13%	15%	16%	10%	80%	43%

Figure 6: The results showing the number of correct answers of Physical Education teachers to the question before and after using the methodology of development of health-preserving competence of a Physical Education teacher in the conditions of postgraduate education on the basis of N. Bernstein's theory of construction of movements with the use of virtual reality technologies (Yevtuch et al., 2021b).

Table 1: The value of the corresponding indicators of the results of solving control tasks by Physical Education teachers before and after the experiment, their difference and ranks of absolute values of differences.

Order number of the task, n	Before the experiment, x_{before} (%)	After the experiment, x_{after} (%)	Difference, $x_{after} - x_{before}$ (%)	The absolute value of the difference (%), $\lvert x_{after} - x_{before} \rvert$	Ranks of absolute values of differences, r_i
1	21	77	56	56	3,5
2	25	81	56	56	3,5
3	35	98	63	63	7,5
4	17	61	44	44	1
5	13	75	62	62	6
6	15	82	67	67	9
7	16	89	73	73	10
8	10	68	58	58	5
9	8	71	63	63	7,5
10	43	97	54	54	2
Sum total	-	-	-	-	55

ical Education teachers after the experiment statistically with a high probability exceed the values of the indicators before the experiment at the level of significance $p < 0{,}01$.

We will present the results of research on educational effectiveness "Methodology for the development of the health-preserving competence of the Physical Education teacher based on N. Bernstein's theory of the level construction of movements" using a spatial approach (figure 7). The specified spatial approach was aimed at the ecological-value and spatial-value understanding of human motor activity based on N. Bernshtein's theory of movement construction. The study was conducted at the Communal Institution

of Higher Education "Vinnytsia Academy of Continuing Education" in 2022. The studied sample consisted of 32 Physical Education teachers.

Let us prove the statistical confidentiality of the obtained results. The number of questions that had to be completed by the Physical Education teacher before and after the introduction of the "Methodology for the development of the health-preserving competence of the Physical Education teacher based on N. Bernstein's theory of the level construction of movements" with the use of the "Fedorets Questionnaire for the definition of ecological value and health-preserving reflection of the earth's space and human motor activity based on the spatial interpretations of N. Bernstein's theory of movement construction" is $n = 5$ (figure 7).

We find the difference between the values of the corresponding indicators of the results of solving control questions by Physical Education teachers before and after the experiment in table 2.

Analysis of the table 2 data showed that there are no "atypical" shifts. So, calculated by formula (1)

$$T_{emp} = \sum_{i=1}^{k} r_i = 0.$$

Find the critical value for the Wilcoxon's rank sum test for $n = 5$, using the data in table 1:

for $p < 0{,}05$ the $T_{cr} = 0$,

The empirical value $T_{emp} = 0 \leq T_{cr} = 0$ at the significance level $p < 0{,}05$.

Hypothesis H_0 is accepted. The values of the indicators of the results of solving control tasks by Physical Education teachers after the experiment statistically with a high probability exceed the values of the indicators before the experiment at the level of significance $p < 0{,}05$.

Theoretical and conceptual understanding of the use of the spatial approach. The "Concept of tellus-existential – res extenza" was developed (V. Fedorets, O. Klochko). In this space-value understanding of man, the consideration of space and spatiality not only as the "res extenza" (lat.) of Descartes or the ideal space of physicists, in which, or against the background of which motor activity is realized, is a relevant direction. Understanding space as a special earthly spatial reality and as a cultural space with which people interact becomes significant. Accordingly, a person is presented as a "bodily-motor-spatial being". Space is considered not only as physical, but above all as earthly and as human and cultural space. With such an "anthropo-telus" (in the sense of "human-terrestrial") representation of space, in addition to its 3 physical dimensions, additional "dimensions" – earthly and human – are also actualized. The specified humanitarian-aesthetic, ecological and anthropocultural understanding of space translates it into the category of living objects. Accordingly, the physical space is transformed into the world or cosmos, as it was imagined by the ancient Greek philosophers, namely, into a harmonious, balanced, aestheticized, stable, anthropologically oriented. We present the above methodologically oriented interpretations of physical space as the "tellus-existential" (res extenza, lat.) educational concept. To clarify, let's note that the word "telus" is used in the "tellus-existential" (res extenza, lat.) concept, which comes from the name of the ancient Roman goddess Mother Earth – Tellus (lat.). The educational meaning of the specified methodological metamorphoses is the disclosure to man of high meanings and significance, ontological meanings and the beauty of space, as a harmonized anthropo-earthly world. This is the basis for determining the ways of preservation and harmonious existence in the Earthly world. The "tellus-existential" (res extenza, lat.) concept reveals the deep existential meanings of the existential of spatiality and the existential of corporeality (according to L. Binswanger) (Binswanger, 1942). This concept also at the level of methodology represents the deep meanings and perspectives of the anthropological and valuable understanding and reception of the concept of sustainable development.

4 CONCLUSION

The application of virtual reality technologies for health and practically oriented perception of the phenomenology of movement activity, the essence of which is disclosed in Nikolai Bernstein's theory of movement construction, is an important innovative tool for improvement of the health preserving competence of a Physical Education teacher in conditions of post-graduate education. Based on the use of AR/VR technologies a software application "Virtual Model Illustrating Nikolai Bernstein's Theory of Movement Construction" was developed. This virtual model is an effective tool for the development of the stated competence.

The results of the analysis of the research aimed at the study of the efficiency of the virtual model within the "Methodology of development of the health-preserving competence of a Physical Education teacher on the basis of Nikolai Bernstein's theory of the levels of movement construction" using the Wilcoxon's rank sum test prove the statistical significance of the efficiency of application of the given methodology, namely, a statistically viable positive

Table 2: The value of the corresponding indicators of the results of solving control tasks by Physical Education teachers before and after the experiment with the use of the "Fedorets Questionnaire for the definition of ecological value and health-preserving reflection of the earth's space and human motor activity based on the spatial interpretations of N. Bernstein's theory of movement construction", their difference and ranks of absolute values of differences.

Order number of the task, n	Before the experiment, x_{before} (%)	After the experiment, x_{after} (%)	Difference, $x_{after} - x_{before}$ (%)	The absolute value of the difference (%), $\lvert x_{after} - x_{before} \rvert$	Ranks of absolute values of differences, r_i
1	7	95	88	88	5
2	11	71	60	60	3
3	32	81	49	49	2
4	13	88	75	75	4
5	76	98	22	22	1
Sum total	-	-	-	-	15

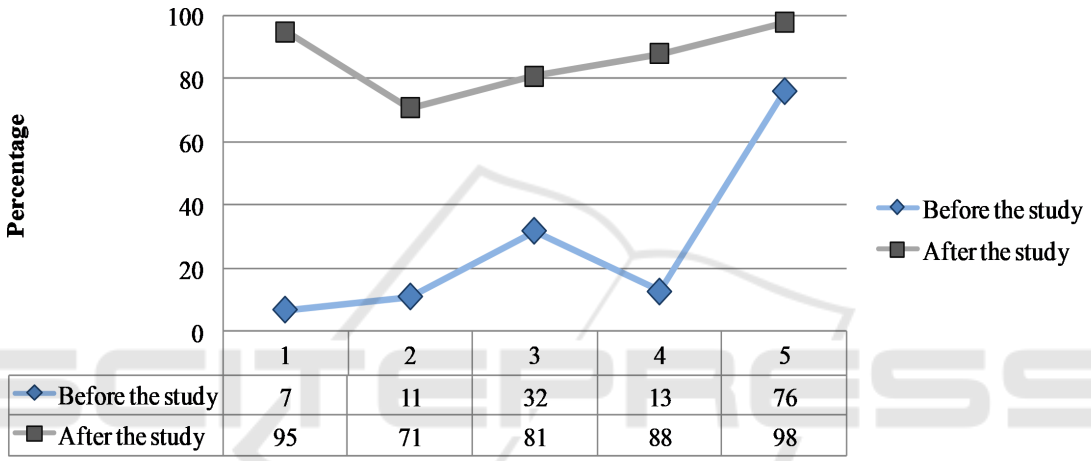


Figure 7: The results showing the number of correct answers of Physical Education teachers to the questions of the "Fedorets Questionnaire for the definition of ecological value and health-preserving reflection of the earth's space and human motor activity based on the spatial interpretations of N. Bernstein's theory of movement construction" before and after the introduction of the "Methodology for the development of the health-preserving competence of the Physical Education teacher based on N. Bernstein's theory of the level construction of movements".

dynamics of the educational achievements of Physical Education teachers have been determined. With the help of the virtual model the health-preserving, intellectual, gnoseological, hermeneutic, representative, axiological, praxeological, technological and sense forming potentials of Nikolai Bernstein's theory are being disclosed. This facilitates the formation in a teacher of systemic views and structural-functional, holistic and value-conceptual understandings of movement as the basis of life and health as well as the "existential-vital-movement-activity-intellectual ontology".

Disclosing the theory of movement construction through the application of the virtual model and other tools as viewed as a gnoseological precondition of fundamentalization of the health-preserving knowledge and the corresponding competence and it is also a cognitive factor of the health-preserving oriented professionalization and axiologization of the work of a Physical Education teacher. The use of a virtual model for the representation of Nikolai Bernstein's theory in the methodology of the health-preserving competence of Physical Education teachers is a necessary condition for the development of the stated competence both in the context of its integration with the professional competence as well as to raise the scientific, fundamental and technological level. This also facilitates the effective practically oriented application of the state theory by a Physical Education teacher for the analysis and improvement of physical and recreational technologies as well as of concrete physical exercises and movement modes.

Nikolai Bernstein's theory of movement construction, virtual reality technology, and spatial and ecological approaches were used integratively for ecologization, anthropologization, and for the health-care-oriented disclosure of human bodily-motor-spatial phenomenology.

"Methodology for the development of the health-preserving competence of the Physical Education teacher based on N. Bernstein's theory of the level construction of movements" includes the representation of environmental and health-preserving issues using a spatial approach. The "Virtual Model of the Illustration of N. Bernstein's Theory of Movement Construction" and photographs, diagrams and pictures of people and natural and anthropogenic landscapes, objects, and architectural structures were used to implement the indicated methodology. As a result of studies of the educational effectiveness of the specified methodology, the positive dynamics of educational results were determined using the "Fedorets Questionnaire for the definition of ecological value and health-preserving reflection of the earth's space and human motor activity based on the spatial interpretations of N. Bernstein's theory of movement construction".

Accordingly, a Physical Education teacher gains professional opportunities for the application of Nikolai Bernstein's theory in the health preserving and correction-development work with children with special educational needs as well as in inclusive education practices. On the basis of the health-preservation oriented disclosure of the nature of movement, health-preserving, preventative, corrective and developmental strategies are being formed among which the significant ones are: "Application of synergistic movements to adaptation to movement activity, and recreation", "Application of spatial movements for actualization of the orientation and search activities and development of spatial thinking", "Use of movements with a complicated algorithm for intellect development".

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