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Neuropsychological Bases of Self-Improvement of Own Physical Health of Future Teachers in the Course of University Education

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Abstract: *The article says that despite the decline in health as a professional value and self-realization, future teachers have neurobiological inclinations for self-improvement and reflection. In this regard, new pedagogical conditions and stages of the formation of students 'readiness for physical self-improvement are proposed, namely: students' awareness of the importance of health as a necessary prerequisite for personal and professional self-realization; their mastery of diagnostic techniques, reflective analysis and practical skills to improve their own physical condition; providing pedagogical support for students in physical self-improvement. The experimental stage used a set of methods and techniques: step ergometry, Rufier's and Cooper's tests, watching movies, photos, test tasks, observations, interviews, questionnaires, expert assessments and etc. The number of students being at the local reflexive level increased from 12.2% to 22.2% and at the adaptive algorithmic level – from 28.1% to 41.3%. The percentage of students at the directive empirical level of competency in physical self-improvement decreased from 52.4% to 21.4%. The effectiveness of the designed methodology for developing students' competency in physical self-improvement was verified by the formative experiment. The hypothesis of the study, which was the subjective neurobiological basis of motivation to improve and reflect on future teachers, was also confirmed, which contributed to the choice of the appropriate profession in order to implement and transmit these personal values.*

Keywords: *pedagogical conditions, training stages, physical self-improvement, self-improvement program, pedagogical support, self-control.*

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Introduction

Researchers show that most teachers do not consider health as one of their core values of life. There are some cases when teachers tend to develop bad habits or do not take sick leave when necessary. As a result, the teaching profession is characterized by extremely low physical health indicators. Indeed, young teachers often suffer from cardiovascular diseases, gastrointestinal diseases, neurogenic diseases (nervous exhaustion, neurosis). There is a tendency towards the deterioration of teachers' health indicators along with increasing work experience.

According to Faresjio (1992), definitions of health can be divided into the three main groups: 1) biological definitions, which consider health as a category of the body's functional state; 2) social definitions, which characterizes health as a prerequisite for participation in public life; 3) mixed or biosocial definitions, which consider health as general well-being. According to such definitions, the regulation and self-regulation of physical health should take place with the actualization of psychological, social and biological factors (resources) of the individual.

This article hypothetically assumes that the motivation and reflection of teachers is the neurobiological basis of their subjectivity, which contributed to the choice of the appropriate profession (to promote the development and improvement of the younger generation).

In this regard, the idea of the development of the motivational sphere of G. Allport's (1950) personality deserves attention. His concept of motives' functional autonomy considers a person in the activity aspect. The researcher explains the origination of new motives by transforming the means of activity into its goals and motives. An object or activity that once acted only as a means to achieve a certain goal begins to arouse certain interest and helps one find one's motivating force. Allport (1950) developed this concept in a polemic with psychoanalysis, refuting their basic tenets: the instinctive and irrational nature of human motivation, the invariability of personal motives, the lack of dynamic force in self and, finally, the fatal conditionality of childhood experiences in adult personality.

According to Allport (1950), physical self-improvement is characterized by the emergence of motives that become completely independent of childhood motivation. The motives of adults should be considered "as infinitely diverse and self-sustaining modern systems, growing from previous systems but functionally independent of them" (Allport, 1950). Such autonomous motives create an important part of the

self. It follows that self has its strong energy and does not draw it only from the irrational libidinous "it".

Changing meanings of actions in physical self-improvement leads to changes in a person's behaviour and actions. One can obtain a new meaning either by changing what already exists or by creating additional meanings. Besides, revaluating the significance of a motive or need can bring certain changes in the meaning of actions. In his works, Bandura (1977) highlights such a possibility.

As evidenced by the analysis of psychological and pedagogical literature, the problem of developing future teachers' competency in physical self-improvement during physical training has not been properly studied yet. Traditionally, physical education of students predominantly focuses on the standard model, since teachers somewhat force students to engage in standard physical activities. As a result, most students are physically inactive and unmotivated to strengthen their health. Thus, there appears to be the need to enhance students' internal motivation to participate in physical activities and develop their physical skills. Besides, it is imperative to discover novel ways and methods to prepare future teachers for physical self-improvement based on the principles of humanism and democratism.

Neuropsychological studies of the need for self-improvement reveal a link between self-improvement and self-regulation, which raises the issue of the neuropsychological nature of subjectivity. The latter is influenced by negative and positive incentives that are fixed. Thus, J. Karman studied the self-improvement of students in the knowledge of exact subjects in different educational conditions in the laboratory and natural conditions, Kurman (2003). The latter showed more valid results: participants' efforts to improve themselves were not related to the need to change, but were manifested in stages of behavior stimulated by a negative emotional response to failure and improved productivity through such a reaction (negative stimulus). That is, an immature person can self-improve in order to avoid failures and appropriate changed behavior.

Thus, in neuroscience excessive attention is paid to the so-called "routine self-improvement", which requires negative stimulation, and therefore excessive time, mental resources and one-dimensional motivation. The way out of the situation is the introduction of a holistic approach aimed at changing the way of life, Schmeichel (2006). This requires a departure from the academic perception of regulatory information and the actualization of individual multimodal motivations.

Barkley (2001) proposes to paint a long-term evolutionary perspective for the subjects of the educational process: "This model

considers the executive functions of a person as a form of behavior to himself, transforming from open (public) to hidden (private) reactions as a means of self-regulation." At the same time, praise or other short-term stimulation cannot be strategically important, and interpersonal competition as a form of motivation must be transferred from the direct context to "self-regulation by internal ideas about a hypothetical social future." Of course, the problem of self-improvement can be considered in terms of biological adaptation, but in the human dimension it is more complex and requires interdisciplinary study of social exchange, altruism, imitation, mimesis, cooperation, preservation of private sovereignty and protection.

Recently, there have been pilot neuroscience studies of innovative methods of health care and valeological self-improvement. Quasi-experimental studies by interviewing students for their knowledge, behavior and their beliefs after listening to a course on the neurology. Intervention teams found improved knowledge of neuroscience, but applied little to self-regulation: "The data suggest that information on the relationship between health behavior and brain function can be successfully integrated into medical education, although the implications for beliefs and behaviors of students' health were not observed. Additional development work should focus on elucidating the theoretical mechanisms of change, integrating the content of neuroscience with self-regulation and thinking of growth, and providing additional professional development for teachers" (Babinsky et al., 2018). These data indicate the need to develop interdisciplinary neuropedagogical mechanisms to stimulate motivation for health and improvement.

The most promising for self-improvement of their own physical health of future teachers in the process of university education is the direction of "Exercise Neurology" (Portugal et al., 2013). The key point of such research is: "Exercise can improve both the mood and adherence to an exercise program in healthy people and can modulate both performance and mental health of athletes. Exercise is associated with increased synthesis and release of both neurotransmitters and neurotrophic factors, and this increase may be associated with neurogenesis, angiogenesis and neuroplasticity" (Portugal et al., 2013). To implement such a program, three areas of work are decisive: a) the neurophysiological effects of exercise on mental disorders; b) the impact of exercise on mood and mental health; c) elucidation of neurobiological mechanisms of consequences of physical exercises and physical improvement. It is clear that positive reactions (improvement of self-esteem, well-being, functional autonomy) are possible

only after a certain period of time, which requires personal motivation, initially of a humanitarian (psychological, value) nature.

After studying the construction of personality-oriented health systems and the formation of professional competencies of future physical education teachers, Russian scientists believe that it is difficult to achieve significant results in a short-term experiment (Kudryavtsev et al., 2016). This is determined by the specifics of the discipline "Physical Culture". According to them, there are symptom complexes and patterns that are difficult to correct, but within one school year you can form the simplest needs and skills of adaptation to the socio-cultural environment, self-organization and motivation for self-improvement.

Thus, pedagogical support of students in developing their competency in physical self-improvement should be systemic and take into account the following factors: the need to optimize students' communication and increase their level of personal and physical development; the ability to prove oneself during individual communication, the striving for self-development; the opportunity to master diagnostic assessment methods, reflexive analysis and practical skills to improve one's physical health; flexibility and creative approach to solving the problems in educational interaction. The main principles of providing pedagogical support while preparing students for physical self-improvement are the following: orientation towards positive traits of the individuals, their potential opportunities; the combination of pedagogical leadership with the development of students' ability to act independently; partnership; tolerance and tactfulness.

The favourability of emotional background within the educational environment directly depends on physical education teachers' personality, their style of communication with students and attitude towards their health. As facilitators of the education process, they should be able to solve the following tasks: to enhance students' awareness of the importance of health and the need to improve their physical competency as an essential prerequisite for professional self-realization; to acquaint students with diagnostic assessment methods, reflexive analysis and practical skills to improve their physical health; to provide students with relevant pedagogical support.

Therefore, the current research follows the idea that future teachers' competency in physical self-improvement can be effectively developed based on the fulfilment of the conditions mentioned above. The **purpose of the study** is to theoretically substantiate and experimentally test the pedagogical conditions for the formation of future teachers' competence for physical

self-improvement, taking into account the neurobiological patterns of motivation, whole set, activity and self-analysis (reflection).

Materials & methods

The formative experiment required 8 experimental groups (EG) and 8 control groups (CG), which involved 246 and 249 students respectively. The experiment (2015-2019) was conducted at Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University, Communal Higher Educational Institution "Vinnytsia Academy of Continuing Education", Lesia Ukrainka Eastern European National University, Vasyl Stus Donetsk National University, Municipal Establishment "Kharkiv Humanitarian Pedagogical Academy" of Kharkiv Regional Council, Vinnytsia National Technical University, State Higher Educational Institution "Vasyl Stefanyk Precarpathian National University", Khmelnytskyi Humanitarian-Pedagogical Academy, T. H. Shevchenko National University "Chernihiv Colehium".

The following stages of developing students' competency in physical self-improvement were distinguished: the motivation stage, the goal-setting stage, the organization and implementation stage, the supervision stage. *The motivation stage* aims to enhance students' striving for self-cognition, to determine strong and weak sides of their personality, to actualize the need for physical self-improvement. These concepts shape the inner strength, which is necessary for achieving success. At *the goal-setting stage*, it is necessary to assist every student in identifying the main aim and develop an individual programme for physical self-improvement. Such a programme provides for a system of certain actions aimed at achieving the main aim and performing specific objectives, which imply constant self-improvement. Without this programme, self-education becomes rather situational and reduces to occasional and ineffective actions. *The organization and implementation stage* aims to assist students in realizing their intentions. This process is rather complicated since it always involves a volitional act. Making or approving a decision is important in self-education, namely, it is a reliable means of developing volition, determination, faith in oneself; it is an incentive for further action, the trigger mechanism of activity; finally, it is an indicator of the individual's maturity. As life and history show, many intentions are not realized due to the inability to make decisions. During this stage, the teacher acquaints students with the methods of self-control, self-analysis (written form), self-report (oral form). *The supervision stage* encourages students to analyze their results, achievements and failures.

At the first stage of developing the need for physical self-improvement, many students demonstrated indifferent or negative attitudes towards physical education and their physical health. Therefore, they were provided with a variety of interesting information, as well as pictures, photographs, drawings, films on sports topics. As a result of such actions, students became interested in the information they received. The success stories of outstanding athletes, their current position in society and the beauty of their spiritual world effectively motivated students towards self-improvement. The teachers' narrative skills, their ability to use speech and live this experience with their students and appreciate their success played a decisive role in this process (Maksymchuk et al., 2018). Practice shows that the teachers' language under such circumstances should be: 1) bright, expressive, emotionally rich, that is, thought-provoking; 2) figurative; 3) optimal in terms of tempo, clear and precise; 4) varied in content.

Discussions on physical education and sports and consideration of every student's activity level are rather important in the process of developing students' competency in physical self-improvement. Such discussions were prepared and conducted by students themselves under the supervision of the teacher. Those students who were rather physically active prepared discussions of the scientific and cognitive nature and shared their own experience of self-improvement. Those students who were less physically active discussed rather simple topics. As the physical activity of students increased, the topics of discussions became more complicated. Many efforts were made to enhance students' interest in these topics, encourage them to express their points of view, share their thoughts, learn more about the individual's ability to strengthen his/her health. As a result, such discussions contributed to transforming students' knowledge of the role of self-education into their intention to engage in physical activities. Those students who were involved in the discussions not only consolidated their knowledge but also acquired some useful experience in communicating with their groupmates and improved their ability to relay the received information to others.

At this stage of the experiment, **persuasion** was mostly used. There were two ways of persuasion, namely a word and a personal example. The first one includes such techniques as clarification, refutation, discussion. The main requirements for using these techniques involved eliminating excessive moralization and ensuring a close connection of theoretical material with practice. The teacher's role mostly implied assisting students in making the right decision.

In the process of verbal persuasion, some internal contradictions were revealed. They formed the basis of the problem and the ways of solving it with the use of specific positive and negative examples and facts.

At this stage, particular attention was paid to acquainting students with **diagnostic assessment methods**, reflexive analysis and practical skills to improve their physical health. This is since most young people consider their physical health to be quite sufficient and do not attempt to improve it. To dismantle such an illusion, students were taught how to identify the level of their physical health with the help of the indicator of **maximum oxygen consumption** (VO_2 max), which can be characterized by the functional state of cardiovascular and respiratory systems. To a certain extent, physical health can serve as an integral indicator of physical development and human health. It is determined by various methods such as stepergometry, the Ruffier test, the Cooper test, etc.

During the experiment, these methods were briefly described. Also, students were taught how to use them to identify the level of their physical health.

While identifying the level of their physical health, students relied on the relative indicator of VO_2 max with the help of **stepergometry**.

The suggested method is quite accurate, informative and accessible. To conduct the survey, one needs a metronome, a stopwatch and a step platform of 0.3-0.4 m in height.

Students were offered such physical activities, which involved climbing a step platform in fours in the following order: left leg – on the step, right leg – on the step, left leg – on the floor, right leg – on the floor.

The work performed by the trainee for one minute can be presented by the following formula:

$$W = 1{,}33 \times P \times h \times n, \quad (1)$$

where W – the performed work in kgm; P – body weight in kg; h – step platform height in m; n – the number of climbs per minute; 1.33 – the coefficient taking into account the work performed during descending.

Since W amounts to the work performed per minute, it corresponds to physical workload (N) and is measured in kgm/min.

The trainee performed two loads. The physical workload was easily adjusted by the frequency of climbing the step platform. The first load was performed with a frequency of 15-20 climbs per minute, the second one – 25-30 climbs per minute. The work was assessed with the help of metronome. Given that each climb required 4 steps, the number of climbs (n) was multiplied by 4 and the obtained figure was set on the metronome.

The duration of the first and second loads amounted to 5 minutes, the duration of rest between loads – approximately 3 minutes.

At the end of the first and second loads, the heart rate was calculated (f_1 i f_2). It is important to keep the heart rate at 100-120 beats at the end of the first load, 140-160 beats – at the end of the second load. The difference between the first and second loads should be no less than 40 beats per minute. Provided that one adheres to these conditions, the error will be minimal.

This formula was also used to calculate the level of physical workload while performing the first and second loads (N_1 and N_2).

The PWC 170 indicator was calculated using the following formula:

$$PWC_{170} = N_1 + (N_2 - N_1) \times \frac{170 - f_1}{f_2 - f_1}, \text{ where}$$

PWC_{170} – the level of physical workload measured in kgm/min at heart rate 170 beats per minute;

N_1 and N_2 – the level of the first and second loads measured in kgm/min; f_1 and f_2 – heart rate at the end of the first and second loads in beats per minute.

There is a high correlation between PWC170 and VO_2 max, which can be shown by the following formula:

$$VO_2 \text{ max} = 1{,}7 \times PWC_{170} + 1240, \text{ where}$$

VO_2 max is measured in ml/min, PWC_{170} – kgm/min.

Once the absolute index of VO_2 max was determined, its relative index was calculated. This required that the absolute value of VO_2 max be divided by the trainee's body weight. The obtained result was measured in ml/min kg^{-1}. The physical health level of people of different age based on the relative index of VO_2 max was determined by Pyarnat's criterion.

Determining the level of physical health based on the Ruffier test. After a five-minute rest, the trainee's heart rate in 15 seconds (f_1) was calculated. Then the trainee performed 30 sit-ups in 30 seconds (f_2). After a one-minute rest, the trainee's heart rate in 15 seconds was recalculated in the sitting position (f_3). The value of the Ruffier's index was determined by the following formula:

$$J = \frac{4(f_1 + f_2 + f_3) - 200}{10}$$

The level of physical health is considered to be excellent if J<0, good – if J=0-5, sufficient – if J=5-10, insufficient – if J=10-15, poor – if J=16 and more.

Determining the level of physical health based on the Cooper test. The trainee performed a 12-minute running load. The running distance and the heart

rate in the first 30 seconds of the second, third and fourth minutes of the rest period were taken into account. Physical readiness was assessed based on Cooper's index determined by the following formula:

$$Y = \frac{Q \times 100}{2(f_1 + f_2 + f_3)}, \text{ where}$$

Y – the Cooper's index,

Q – the result of the 12-minute running load measured in metres,

f_1, f_2, f_3 – heart rate in the first 30 seconds of the second, third and fourth minutes of the rest period.

After students identified and reflexively analyzed their level of physical health (which turned out to be rather low in most cases), they changed their views on their physical skills. This rather positively influenced their attitude towards physical education.

So, at this stage of developing students' need for physical self-improvement, the content and methods were aimed at the following: to make them believe in their abilities; to help them find personal meaning in physical self-improvement and develop a positive attitude towards physical education.

Using these forms, methods and means, it was possible to develop a positive attitude towards physical education lessons in EG students, as well as to enhance their responsibility, activity, autonomy and initiative. The developed interest in physical education and sports encouraged students to deepen and broaden special methodological knowledge, changed their attitude to self-study, a healthy lifestyle.

As a result of such actions, students started to subconsciously compare innate abilities and external demands. When the actions of this assessment mechanism "gave a positive signal", there appeared, as indicated by A. Maslow, "the need for self-actualization" and, subsequently, motivation for physical self-improvement: the individual is always more interested in the activities he/she feels able to do.

At *the goal-setting stage*, it was important to assist every student in **identifying the main training aim and develop an individual programme for physical self-improvement**. It is rather a complicated task and an extremely important stage in the individual's self-education. Also, it was essential to take into account the results on the identification of one's physical health level and analyze the causes, which might negatively affect its indicators, and clearly define further actions aimed at self-improvement.

The programme for physical self-improvement provided for a system of certain actions targeted at achieving the main aim and specific

objectives of self-improvement. Without this programme, self-education becomes rather situational and reduces to occasional and ineffective actions.

Within the current research, the programme for physical self-improvement mostly was viewed as a brief or detailed description of the aim and the content of a particular activity. It served as a system or plan realized in space and time. This is an important long-term document of activity, which, however, is being revised and clarified in the process of its implementation. Such a programme implied its "decoding", that is, drawing up a plan of action, identifying specific objectives and actions aimed at achieving the goal, such as adopting a confident posture, developing certain physical skills, as well as the ability to control and improve one's physical health, sporting achievements.

Students were offered to draw up a clear plan of physical self-improvement. Specific attention was paid to developing a positive attitude towards the plan since it might directly influence its effectiveness. When the plan takes into account students' physical and psychological characteristics, their employment, interests and tastes, its effectiveness greatly increases.

The research considered the fact that even an effective programme of physical self-improvement and its specific plan did not necessarily result in success. They serve only as a means. However, they formed the basis for relevant short recommendations and rules of self-education.

The third stage of the experiment was targeted at providing students with relevant pedagogical support.

This process is rather complicated and significant since it always involves a volitional act. Making or approving a decision is important in self-education, namely, it is a reliable means of developing volition, determination, faith in oneself; it is an incentive for further action, the trigger mechanism of activity; finally, it is an indicator of the individual's maturity. As life and history show, many intentions are not realized due to the inability to make decisions. It is precisely this idea that lies at the heart of the well-known proverb "the road to hell is paved with good intentions".

Therefore, the organization of the experiment took into account the causes identified during the ascertaining experiment, which might impede the development of a positive attitude towards physical exercises. Based on this, the main ways to improve the programme of the experiment were determined. Particular attention was paid to the methodical provision of extracurricular physical and recreational and mass sporting activities of students; professional training of the core staff, who supervised these activities; participation of students in the organization and implementation of sporting and other events.

The third stage aimed at providing students with specific tasks on physical self-improvement. The main forms and means that contributed to involving students in physical education and increasing their level of competency in physical self-improvement involved interest-based lessons, individual tasks, participation in a variety of physical and recreational and mass sporting events.

The dynamics of the motives behind physical self-improvement was systematically studied. The causes interfering with students' active actions regarding physical self-improvement were timely detected and eliminated. As students developed the personal meaning of physical self-improvement, external stimulation gradually declined.

To enhance students' cognitive activity regarding physical self-improvement and increase the amount of information about physical education within self-study, the list of recommended methodical and reference sources was provided, as well as technical teaching means intensifying the education process were widely used. In particular, such means of transmitting the information as tables, drawings, slides and films were used. Thus, every student could assess the level of his/her physical health using the tables, which represented different options for assessing the level of the physical workload with VO_2 max. Also, students were required to prepare reports on the given topics as part of the programme's theoretical course. Based on the results, teachers assessed students' level of the acquired knowledge of the course and defined whether they passed/failed it.

The process of assessing students' knowledge involved ongoing monitoring (after mastering a certain topic), final monitoring (at the end of the school year) in oral, written and online forms, as well as through group and individual activities, etc. For instance, students answered teachers' questions, performed specific tasks, explained the rules of an exercise, etc. Didactic tests assessed students' knowledge more in detail. Students were offered to do multiple-choice tests, where each question was allocated 1-2 minutes. This allowed teachers to conduct a quick assessment of their knowledge during the rest between exercises.

Professional orientation of practical lessons provided for acquiring the necessary skills and abilities of physical self-improvement. During practical lessons, specific attention was paid to preventing negative emotions and the feeling of physical inferiority. To this end, students were offered some physical loads adequate to their abilities, excluding unreasonable pauses, which were filled with relevant educational content and individual tasks.

While developing motivation towards physical education, the following basic rules were employed: 1) the process of developing motivation towards physical education should be based on a steady interest in all sports included in the comprehensive programme of physical education; 2) the process of involving students in systematic physical exercises facilitates consolidation of self-study skills in physical education at the level of habit; 3) only consciously acquired habits are stable; 4) the process of developing one habit creates the necessary preconditions for developing other ones related to it; 5) systematic and standard conditions for motor activity greatly increase the speed of acquiring and strengthening habits.

At the fourth stage of students' physical self-improvement, particular attention was paid to acquainting students with diagnostic assessment methods, reflexive analysis and practical skills to improve their physical health. Besides, they were taught to analyze their achievements and set further goals.

Practice shows that students' progress in physical self-improvement and their increased emotionality while being assessed are important means of compensating for certain deficiencies, which serve as an incentive for further self-improvement.

The final stage aimed to transform external actions into internal ones, shift from teacher's requirements to internal self-organization of physical and sporting activities.

It is found that the following pedagogical conditions can contribute to maintaining and developing in students a steady interest in physical education:

1) employing various means, methods and forms while organizing physical education lessons: monotonous physical activities lead to developing adverse psychological phenomena such as monotony and mental overload;

2) implementing gaming and competitive methods into the organization of physical education lessons at the stage of improving the studied movements;

3) providing students with the knowledge they need to set specific and achievable physical self-improvement goals;

4) motivating students toward extracurricular physical activities. This includes awarding a prize or certificate of appreciation for outstanding achievements in the form of a ceremony, which can positively affect not only those students who have already achieved success in physical self-improvement but also those who are still on their way to do it;

5) providing the necessary facilities. This problem can be solved by introducing non-standard tools for group and individual use into physical education lessons;

6) incorporating musical accompaniment into physical education lessons. Musical accompaniment evokes positive emotions, enhances the working ability and increases interest in physical exercises. It is in particular effective in the first part of the lesson during walking, jogging and performing general physical exercises.

The research shows that a steady interest in a particular type of motor activity is developed gradually, with the increase in the number of repetitions transformed into a habit. The following pattern was discovered: the deeper interest in engaging in physical education, the steadier need for physical self-improvement.

So, future teachers are more motivated towards physical self-improvement if they comprehend its role in professional and personal development, are interested in the very process and their results. Therefore, one can distinguish the following stages of this process: the motivation stage, the goal-setting stage, the organization and implementation stage, the supervision stage, which realized the determined pedagogical conditions:

- enhancing students' awareness of the importance of health and the need to improve their physical competency as an essential prerequisite for professional self-realization;
- acquainting students with diagnostic assessment methods, reflexive analysis and practical skills to improve their physical health;
- providing students with relevant pedagogical support.

Results

The effectiveness of both pedagogical conditions and methodology for developing students' competency in physical self-improvement was verified with the use of assessment tests before and after the experiment. The obtained results prove that the formative experiment has resulted in statistically significant changes in the main components of EG students' competency in physical self-improvement, namely motivation and values, cognition and information, activities and results. In general, there was observed a statistically significant positive dynamics in the general levels of development of students' competency in physical self-improvement (see Table 1). A significant number of students (15.1%) reached the systemic reflexive level of this competency. The number of students being at the local reflexive level increased from 12.2% to 22.2% and at the adaptive algorithmic level – from 28.1% to 41.3%. The percentage of students at the

directive empirical level of competency in physical self-improvement decreased from 52.4% to 21.4%.

Table 1. *Dynamics in the levels of EG and CG students' competency in physical self-improvement (in %)*

Source: Authors' own conception

№	The levels of competency	EG (n=246)						CG (n=249)					
		Male students		Female students		Total		Male students		Female students		Total	
		1st test	2nd test	1st test	2nd test	1st test	2nd test	1st test	2nd test	1st test	2nd test	1st test	2nd test
1.	The systemic reflexive level	6,7	14,2	7,9	15,9	7,3	15,1	8,2	7,4	4,0	4,8	6,1	6,1
2.	The local reflexive level	13,3	21,7	11,1	22,7	12,2	22,2	13,9	15,6	12,1	11,3	13,0	13,5
3.	The adaptive algorithmic level	27,5	41,7	28,6	40,9	28,1	41,3	27,9	33,6	29,8	35,5	28,9	34,5
4.	The directive empirical level	52,5	22,4	52,4	20,5	52,4	21,4	50,0	43,4	54,1	48,4	52,0	45,9

In contrast to EGs, the levels of CG students' competency in physical self-improvement did not significantly change. Some positive changes can still be observed, although they are rather local and do not reach the level of statistical significance.

Thus, the obtained results testify to the effectiveness of reasonable pedagogical conditions for the formation of the competence of future teachers to physical self-improvement and confirm the truth of the formulated hypothesis.

Discussion

The scientific novelty and theoretical significance of the study is that for *the first time* the pedagogical conditions for the formation of future teachers 'readiness for physical self-improvement are substantiated, taking into account neuropsychological and neuropedagogical patterns: students' awareness of the importance of health as a necessary prerequisite for personal and professional self-realization; mastering their methods of diagnosis, reflexive analysis and practical skills to improve their own physical condition; providing pedagogical support to students in physical self-improvement

- the essence and structural components of readiness for physical self-improvement have been *specified*;

- the content, forms and methods for ensuring pedagogical support for students in physical self-improvement have been *further developed*.

The practical value of the research lies in developing a complex of diagnostic techniques for identifying the levels of students' readiness for physical self-improvement; preparing and implementing methodical recommendations on how to motivate future teachers for physical exercise in practice; developing methodical recommendations for developing students' readiness for physical self-improvement.

The current research confirms that it is imperative to consolidate students' training for physical self-improvement with the creation of an appropriate educational environment, which can contribute to students' understanding of physical health as a personal and social value and promote sustainable development of the necessary practical skills. Taking into account the researches on the environmental education approach (Manuilov, 1997), it can be proved that future teachers' readiness for physical self-improvement can be developed provided that a favourable psychological atmosphere and appropriate ecological niches, that is the opportunities for students to study and change themselves under certain ideals and values orientations, have been developed. □

Considering the specifics of self-improvement as an internally determined activity of the individual, pedagogical support can be defined as an important condition for developing students' competency in physical self-improvement.

The research findings also prove that pedagogical support as a requirement for personality development is considered in the context of various psychological and pedagogical areas, namely existential psychology and pedagogy (Rogers & Freiberg's, 2002) concept of helping relations (Petrovsky's, 1987) concept of personalization, Rubinstein's (1959) idea of "strengthening the existence of other individuals" (Gazman's, 2002) concept of individualization. The specificity of pedagogical support as a factor in education consists in the fact that it ensures the utmost consideration of the individual's needs and interests, stimulates his/her activities aimed at self-organization and self-improvement.

The ideas of Maksymchuk et al. (2018) that the implementation of the model for developing competency in physical self-development consists of several interconnected stages and the basis of the model is rooted in the determined pedagogical conditions were confirmed. This opinion is shared by other researchers (Soltyk et al., 2017). They indicate that "the positive

dynamics of developing future physical education teachers' professional competency during professional training is achieved by the implemented organizational and pedagogical conditions for these specialists' professional development during professional training".

The conducted research does not disclose all aspects of the problem of developing students' competency in physical self-improvement. Further researches should deal with such aspects as the theoretical justification of faculty's activities aimed at motivating students towards a healthy lifestyle.

This research follows certain ethical rules. First, all ethical requirements were considered before conducting it. Next, the authors of the research obtained the consent of ethics committees of educational institutions. Then, the participants were informed about the goals and objectives of the research. They were also informed that their participation in the research was voluntary and they could withdraw from it at any time.

Conclusions

Teachers' success, professional and personal self-realization depend not only on professional competency and methodological skills but also on physical condition and functional readiness to perform professional duties. However, certain studies show that teaching as a professional group is characterized by extremely low levels of physical health, as well as insufficient readiness and focus on physical self-improvement. The physical condition of teachers directly or indirectly affects pupils' health and results of educational activities in general. Therefore, there appears to be a need to improve the system of physical education in higher education institutions and justify pedagogical conditions for developing their readiness for physical self-improvement.

The analysis of researchers views on physical health and features of self-education has made it possible to determine whether future teachers are ready for physical self-improvement as an important component of their general professional culture and a complex personal quality, which is manifested in productive independent physical and sports activities aimed at improving their moral and psychological condition.

The readiness of future teachers for physical self-improvement consists of three components, namely motivation and values, which characterize the motivational aspect of competency and includes steady motives behind physical self-improvement, comprehension of its importance for one's life and professional activity, a system of value orientations and mental sets that motivate the individual to systematically

engage in physical and recreational activities; cognition and information, which reflect the cognitive aspect of competency in physical self-improvement and provide for the knowledge of the basics of physical culture, healthy lifestyle, patterns in physical functioning and body development, criteria for health assessment and physical self-improvement methods; activities and outcomes, which characterize the practical aspect of this competency and contains the skills necessary for effective physical self-improvement (the ability to assess one's physical health, plan, organize and control their actions).

The effectiveness of the designed methodology for developing students' competency in physical self-improvement was verified by the formative experiment. The obtained results prove that the formative experiment aimed at implementing the justified pedagogical conditions has resulted in statistically significant changes in the main components of EG students' competency in physical self-improvement, namely motivation and values, cognition and information, activities and results. A significant number of students (15.1%) reached the systemic reflexive level of this competency. The number of students being at the local reflexive level increased from 12.2% to 22.2% and at the adaptive algorithmic level – from 28.1% to 41.3%. The percentage of students at the directive empirical level of competency in physical self-improvement decreased from 52.4% to 21.4%.

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Such a number of authors is related to a large number of participants in the experiment, as well as a large number of control and experimental groups in different regions of the country. It has ensured high representativeness of the research sample. Each author created a control and / or experimental group in his / her educational institution. The article contains information about it: "The formative experiment required 8 experimental groups (EG) and 8 control groups (CG), which involved 246 and 249 students respectively. The experiment was conducted at Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University, Communal Higher Educational Institution "Vinnytsia Academy of Continuing Education", Lesia Ukrainka Eastern European National University, Luhansk National Agrarian University, Municipal Establishment "Kharkiv Humanitarian Pedagogical Academy" of Kharkiv Regional Council, Vinnytsia National Technical University, State Higher Educational Institution "Vasyl Stefanyk Precarpathian National University", Khmelnytskyi Humanitarian-Pedagogical Academy, T. H. Shevchenko National University "Chernihiv Colehium".

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