

## ORIGINAL SCIENTIFIC PAPER

# Methodological Aspects of Health Formation for the Practice of Adaptive Physical Education in School-Children Taking into Account the Endoecological Factors

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## Abstract

Purpose of the research to define and characterize the projection theory of scientific knowledge prerequisites on the concept of health-forming technologies development in the process of adaptive physical education for school-age children with hearing impairment. The study involved 236 pupils. Depending on age, gender and degree of hearing impairment, pupils were divided into 8 groups. Studied physical development, physical work capability, physical preparedness, morbidity, level of health and peculiarities of children with hearing impairments attitude's to their own health for substantiation of methodical provisions to concept of health formation for children with hearing impairments. According to the Kettle index, none of the groups of surveyed pupils met the norm. Data showed that almost 60.00% of children were below the average for the vital index, and 40.00% are at the low level. In the morbidity structure of hard-hearing and deaf pupils, regardless of age and gender, the first place was occupied by infectious and parasitic diseases (86.97%), followed by diseases of the nervous system (76.54%) and musculoskeletal system (81.78%). Children with hearing impairments had below average of recovery rate of the cardiovascular system after a standard exercise (57.80%). Only 15.70% of boys and 28.40% of girls considered themselves as practically healthy. All data determine the urgent need for focusing attention on the children with hearing impairments health.

**Keywords:** health formation, adaptive physical education, school-children with hearing impairments, technology, endoecological factors

## Introduction

The current state of health in Ukrainian population in general and children and youth in particular is a significant challenge to society and the state and without exaggeration poses a real threat to humanitarian security (Futorny, 2014). Nowadays, views and worldview of young people are influenced and deepened by many factors: environmental, economic, as well as so-

cial and demographic crisis, which together create an extremely dangerous environment for the formation of the adolescent's personality, and possibility for socialization (Head, 2010).

Particular social and educational importance of this subject gets towards the representatives of today's youth with limited opportunities for building and maintaining their own health, for the qualitative and quantitative characteristics which was



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often used indicator of disability, most realistic illustrates the sharp decline on functional capacity of the body, its adaptive and protective reactions (Ignatov, 2011).

Current results of scientific research in the field of environmental protection, medicine, toxicology in particular, rightly indicate that the health of children and youth, both directly and indirectly depends on the pathogenetic action mechanisms for three groups of factors: physical (radiant energy, ultraviolet irradiation, geomagnetic factors, atmospheric pressure), chemical (xenobiotics, food allergens), biological (viral infection, bacterial infection, fungal infection, plants, insects, animals) (Maslova, Savchenko, Bohdanovych, Holub, & Shumiyshuk, 2018).

Since physiological systems and psychoemotional processes determine the direct and feedback with the outside world, the scientists found that endoecology with the above factors is manifested by the parameters of the body that determine the nature and outcome for interaction of external factors with the subject of perception (Tam, 2006; Sutton, 2013).

In pedagogical research of the last decade the complex approach to the decision for problem of physical, mental and social well-being maintenance of pupils with the functional infringements on activity of sensory systems, in particular with hearing defects is incompletely used. If such work is carried out, it is often episodic events of physical culture and sports-mass orientation (Kashuba, Goncharova, & Butenko, 2018).

This one-sided approach cannot ensure the usefulness and effectiveness of the preservation and strengthening for pupil's health as special education and school-age children who study in schools of education provided and based on updating requires organization (Futoryni et al., 2020).

Purpose of the research to define and characterize the projection theory of scientific knowledge prerequisites on concept of health-forming technologies development in the process of adaptive physical education for school-age children with hearing impairment.

## Methods

The study involved 236 pupils 13-17 years old with various congenital or acquired hearing from specialized boarding schools for children with hearing impairments of Kyiv (No. 6, 9, 18) and Bila Tserkva. Depending on age, gender and degree of hearing impairment, pupils were divided into 8 groups: hard-hearing boys 1315 years (n=35); hard-hearing girls 1315 years (n=37); hard-hearing boys 1619 years (n=27); hard-hearing girls 1619 years (n=29); deaf boys 1315 years (n=28); deaf girls 1315 years (n=33); deaf boys 1619 years (n=24); deaf girls 1619 years (n=22). The research was approved by the Institutional Ethics Committee (number 2/2014) and was carried out in compliance with the international principles of the Helsinki Declaration of the World Medical Association (World Medical Association, 2013), and in accordance with the Law of Ukraine "Fundamentals of Ukrainian Legislation on Healthcare" (Law of Ukraine, 1992) on ethical norms and rules for conducting medical research involving human.

Studied were the variables of physical development (body mass; body length; values calculation of the Kettle's index, Robinson's index, Vital index and Power's index, with the subsequent comparison of the received values with the established values of norm), physical work capability (index of Harvard step-test; Rufier's index; the rate of recovery of the cardiovascular system after standard exercise), morbidity (types of morbidity; morbidity structure; temporary disability), level of

health and peculiarities of children with hearing impairments attitude's to their own health (lifestyle characteristics; analysis of living and learning conditions; medical awareness and activity; subjective self-assessment of health) (Kashuba, Maslova, & Rychok, 2018).

All statistical analyses were conducted using software packages MS Excel XP, Statistica 10 (for indicators descriptive statistics: calculation of a sample mean –  $\bar{M}$ , standard deviation SD; representativeness errors  $m$ ; to determine the reliability of differences in statistical estimates of sample indicators of students with congenital and acquired hearing impairments, which were normally distributed, the Student's t-criterion was used). During the implementation of mathematical analysis of data was taken statistical reliability  $P=95\%$  (probability of error 5%, i.e., the level of significance  $p \leq 0.05$ ).

## Results

We found that the largest number of children with normal body length was observed among a group of deaf boys 1316 and 1719 years (69.40 and 74.30%, respectively). In other groups of subjects, the number of pupils with a body length that corresponds to the norm was in the range of 45.0058.00%, and in the group of deaf girls aged 13 to 16 years, their number was 40.40%.

The results of the study of the lungs vital capacity and the leading hand wrist dynamometry concluded that regardless of age, gender and degree of hearing impairment, the examined pupils have significantly lower average values compared to the established norms. The lungs vital capacity: hard-hearing boys 1315 years ( $2280.80 \pm 113.4$  ml per norm 2600 ml); hard-hearing girls 1315 years ( $1750.40 \pm 250.6$  ml per norm 2530 ml); hard-hearing boys 1619 years ( $2770.40 \pm 344.7$  ml per norm 3520 ml); hard-hearing girls 1619 years ( $2160.50 \pm 248.8$  ml per norm 2750 ml); deaf boys 1315 years ( $2150.40 \pm 183.4$  ml per norm 2600 ml); deaf girls 1315 years ( $1930.80 \pm 296.7$  ml per norm 2530 ml); deaf boys 1619 years ( $2820.20 \pm 341.5$  ml per norm 3520 ml); deaf girls 1619 years ( $2580.40 \pm 284.6$  ml per norm 2750 ml). The leading hand wrist dynamometry: hard-hearing boys 1315 years ( $16.30 \pm 4.4$  kg per norm 21.637.6 kg); hard-hearing girls 1315 years ( $11.90 \pm 2.1$  kg per norm 19.928.3 kg); hard-hearing boys 1619 years ( $35.70 \pm 5.6$  kg per norm 45.951.0 kg); hard-hearing girls 1619 years ( $20.40 \pm 6.7$  kg per norm 31.333.8 kg); deaf boys 1315 years ( $12.1 \pm 5.2$  kg per norm 21.637.6 kg); deaf girls 1315 years ( $10.70 \pm 3.3$  kg per norm 19.928.3 kg); deaf boys 1619 years ( $29.50 \pm 7.0$  kg per norm 45.951.0 kg); deaf girls 1619 years ( $19.80 \pm 4.8$  kg per norm 31.333.8 kg).

None of the surveyed pupils groups does not meet the norm of the Kettle index: hard-hearing boys 1315 years ( $384.50 \pm 0.04$  c.u. per norm 265.10315.00 c.u.); hard-hearing girls 1315 years ( $382.90 \pm 0.08$  c.u. per norm 265.10315.00 c.u.); hard-hearing boys 1619 years ( $398.70 \pm 0.07$  c.u. per norm 350.10375.00 c.u.); hard-hearing girls 1619 years ( $423.40 \pm 0.06$  kg per norm 350.10375.00 c.u.); deaf boys 1315 years ( $322.60 \pm 0.04$  c.u. per norm 265.10315.00 c.u.); deaf girls 1315 years ( $358.60 \pm 0.07$  c.u. per norm 265.10315.00 c.u.); deaf boys 1619 years ( $396.20 \pm 0.05$  c.u. per norm 350.10375.00 c.u.); deaf girls 1619 years ( $372.70 \pm 0.06$  c.u. per norm 350.10375.00 c.u.).

In the groups of hard-hearing girls and deaf boys 1619 years of age, the average values of the Robinson index approached the upper limit of the norm and indicate the presence of negative tendencies to exceed it ( $94.20 \pm 6.8$  c.u. per norm 9469 c.u.). Statistical processing of the obtained data showed significant dif-

ferences between the established age norms of Vital index and Power index, and showed a significant lag in the average values for each group of surveyed pupils, regardless of the established nosology and age differentiation.

Data of the pupil's physical preparedness with hearing impairments showed a clear trend towards its deterioration among high school pupils compared to the results of middle school children. A comparative analysis of the data showed that the level of pupil's physical work capacity with hearing impairments according to the Harvard step-test in almost all groups was below average, except for groups of hard-hearing girls 1619 years old ( $60.80 \pm 9.10$  c.u.) and deaf boys 1315 ( $69.90 \pm 11.80$  c.u.) and 1619 years old ( $61.10 \pm 14.60$  c.u.), who have a level of physical work capacity was at an average level. The study of the cardiovascular system functional state on the indicator of cardiac activity in accordance with the results of the Ruffier test showed that none of the groups did not meet the norm and received an assessment of the indicator as "satisfactory".

The results of the research showed a negative tendency to increase the number of requests for medical care among deaf children compared to hard-hearing children. Thus, according to the indicator of primary morbidity, the number of requests for medical care among deaf children was almost 2 times higher than among hard-hearing children. Similar data were obtained for indicators of general and infectious morbidity, as well as dispensary morbidity at the ratio of the number of chronic diseases to the total number of diseases registered during the year.

In the structure of morbidity of hard-hearing pupils, regardless of age and gender, the first were infectious and parasitic diseases (87.95%), then diseases of the nervous system (81.45%) and musculoskeletal system (76.07%), severe eye dis-

eases (70.85%) and mental disorders (33.45%). Among deaf pupils, also irrespective of age and gender, at one level infectious and parasitic diseases (86.33%) and diseases of musculoskeletal system (87.48%), further - diseases of an eye (74.23%), diseases of a nervous system (73.10%) and mental frustration (64.38%). It should be noted that our analysis of the students with various hearing impairments structure of morbidity, revealed the presence of associated pathologies - an average of four chronic diseases and two acute conditions in one pupil.

Total numbers of closed sick leaves of hard-hearing pupils were 87 completed forms (on average more than every second pupil issued a sick leave at least once a year), while the number of closed sick leaves among deaf pupils was 101 completed forms (almost every pupil draws up a sick note at least once a year). According to the number of days missed due to illness, 694 days were recorded among deaf pupils (each pupil who drew up a sick leave did not attend classes for 8 full working days). In hard-hearing children, the number of days missed due to illness was 743 days (on average, each pupil who drew up a sick leave did not attend classes for 7 full working days).

## Discussion

According to the basics of the scientific knowledge theory and according to the forms of the scientific knowledge functioning we have defined our research idea on how true the knowledge of reality from the subjective point of view to possible conversion and fixation not only exists, but also proper approval, and became the basis for systematizing the process of identifying prerequisites for the concept of health-promoting technologies in the process of adaptive physical education for school-age children with hearing impairments (Figure 1).

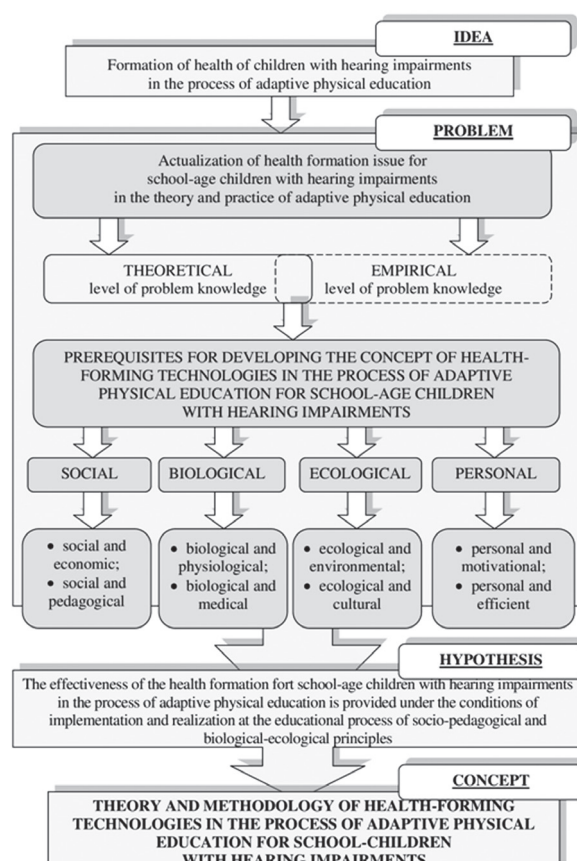


FIGURE 1. The structure of scientific knowledge of the preconditions of the concept of health-forming technologies in the process of adaptive physical education of school-age children with hearing impairments

The proposed scientific knowledge structure of the prerequisites on the concept of health-forming technologies in the process of adaptive physical education for school-age children with hearing impairments included four categories: social, biological, ecological and personal (Maslova, 2020).

The category of social preconditions was the urgent need of modern society for a harmonious physically and mentally developed personality, the ability for successfully integrated as a social member and self-realize in the social environment (Maslova, 2020).

We found that only 20.60% of hard hearing boys and 23.70% of hard hearing girls and 9.50% of deaf boys and 11.60% of deaf girls aged 13 to 15 years are completely satisfied with living and learning conditions. Among schoolchildren aged 16-17, only 11.00% of hard hearing boys and 2.30% of hard hearing girls and 9.50% of deaf boys and 5.00% of deaf girls consider their own living and learning conditions like excellent ( $p < 0.05$ ).

Analysis of parents' responses showed compatibility of views with children. Only 2.20% of parents of hard hearing

pupils and 8.30% of parents of deaf pupils aged 13 to 15 years noted that the living and learning conditions of their children are excellent and completely satisfactory. Among parents of schoolchildren aged 16-17, a similar opinion was expressed by 7.40% of parents of hard hearing pupils and 6.50% of parents of deaf youth ( $p < 0.05$ ).

To the biological preconditions on the concept of health-forming technologies in the process of adaptive physical education for school-age children with hearing impairments, we have included provisions that correspond to the concept of norm and pathology of individual body systems functions, taking into account the impact of healthy lifestyles. Based on the results of the study for the level of morphofunctional development of children with hearing impairments, we calculated the indicators of the Kettle index, Robinson index, Life Index and Power Index, which allowed determining the level of their somatic health according to the method of Apanasenko (Table 1).

A high level of somatic health was found in only two groups of surveyed contingent, a high level was typical for 13.00% of

**Table 1.** Comparative characteristics of indexes children with hearing impairments and age norms

| Index/<br>Norm                         | Contingent researched       |                  |                  |                  |                     |                  |                  |                  |
|--|-----------------------------|------------------|------------------|------------------|---------------------|------------------|------------------|------------------|
|  | Hard hearing pupils (n=129) |                  |                  |                  | Deaf pupils (n=107) |                  |                  |                  |
|  | 13 - 15 aged                |                  | 16 - 17 aged     |                  | 13 - 15 aged        |                  | 16 - 17 aged     |                  |
|  | Boys<br>(n=35)              | Girls<br>(n=37)  | Boys<br>(n=27)   | Girls<br>(n=29)  | Boys<br>(n=28)      | Girls<br>(n=33)  | Boys<br>(n=24)   | Girls<br>(n=22)  |
| <b>Kettle Index, g·cm<sup>-1</sup></b> |                             |                  |                  |                  |                     |                  |                  |                  |
| Norm                                   | 265.10<br>315.00            | 265.10<br>315.00 | 350.10<br>375.00 | 350.10<br>375.00 | 265.10<br>315.00    | 265.10<br>315.00 | 350.10<br>375.00 | 350.10<br>375.00 |
| Results<br>(M±SD)                      | 384.50±<br>0.04             | 382.90±<br>0.08  | 398.70±<br>0.07  | 423.40±<br>0.06  | 322.60±<br>0.04     | 358.60±<br>0.07  | 396.20±<br>0.05  | 372.70±<br>0.06  |
| t value                                | 1.88                        | 1.87             | 1.65             | 1.96             | 0.85                | 1.73             | 1.62             | 0.85             |
| p value                                | 0.08                        | 0.08             | 0.11             | 0.06             | 0.42                | 0.09             | 0.11             | 0.42             |
| <b>Robinson Index, conv. units</b>     |                             |                  |                  |                  |                     |                  |                  |                  |
| Norm                                   | 94.00<br>69.00              | 94.00<br>69.00   | 94.00<br>69.00   | 94.00<br>69.00   | 94.00<br>69.00      | 94.00<br>69.00   | 94.00<br>69.00   | 94.00<br>69.00   |
| Results<br>(M±SD)                      | 89.30±<br>8.40              | 87.60±<br>7.30   | 94.10±<br>9.70   | 81.80±<br>7.20   | 92.90±<br>5.70      | 89.10±<br>8.80   | 87.60±<br>7.20   | 94.20±<br>6.80   |
| t value                                | 0.80                        | 0.81             | 0.63             | 0.97             | 0.60                | 0.79             | 0.81             | 0.63             |
| p value                                | 0.42                        | 0.42             | 0.51             | 0.47             | 0.52                | 0.42             | 0.42             | 0.51             |
| <b>Life Index, ml·kg<sup>-1</sup></b>  |                             |                  |                  |                  |                     |                  |                  |                  |
| Norm                                   | 56.00<br>66.00              | 47.00<br>57.00   | 56.00<br>66.00   | 47.00<br>57.00   | 56.00<br>66.00      | 47.00<br>57.00   | 56.00<br>66.00   | 47.00<br>57.00   |
| Results<br>(M±SD)                      | 39.60±<br>8.40              | 28.90±<br>6.10   | 40.80±<br>9.10   | 30.30±<br>10.40  | 39.90±<br>11.80     | 31.40±<br>9.80   | 41.10±<br>14.60  | 39.50±<br>8.40   |
| t value                                | 2.44                        | 2.72             | 2.42             | 2.63             | 2.44                | 2.66             | 2.35             | 2.12             |
| p value                                | 0.02*                       | 0.02*            | 0.02*            | 0.02*            | 0.02*               | 0.02*            | 0.03*            | 0.04*            |
| <b>Power Index, %</b>                  |                             |                  |                  |                  |                     |                  |                  |                  |
| Norm                                   | 66.00<br>81.00              | 51.00<br>61.00   | 66.00<br>81.00   | 51.00<br>61.00   | 66.00<br>81.00      | 51.00<br>61.00   | 66.00<br>81.00   | 51.00<br>61.00   |
| Results<br>(M±SD)                      | 28.30±<br>8.40*             | 19.70±<br>9.10*  | 52.60±<br>15.20* | 28.60±<br>9.70*  | 22.40±<br>5.20*     | 17.40±<br>5.70*  | 42.90±<br>13.10  | 30.30±<br>11.90* |
| t value                                | 4.01                        | 4.26             | 3.48             | 4.01             | 4.78                | 4.65             | 2.77             | 3.96             |
| p value                                | 0.001*                      | 0.001*           | 0.002*           | 0.001*           | 0.001*              | 0.001*           | 0.01*            | 0.001*           |

Legend: M – mean; SD – standard deviation; \*  $p \leq 0.05$



children in each group, the average level was 33.00%, and the rest almost 54.00% on average below low level and low level ( $p < 0.05$ ).

In the category of environmental prerequisites for the introduction of health technologies in the process of adaptive physical education for school-age children with hearing impairments, we considered current trends in the formation of ecological culture in the context of balanced development:

- ecological and environmental - reducing the negative impact of the environment and its individual components on the organism through the application of a certain regime and conditions of exercise; understanding the concept of environmental cleanliness and environmental safety in the educational process; implementation of natural environmental conditions in the educational process for its promotion; use of the forces of nature in the system of strengthening the body and improving the quality of life;

- ecological and cultural - the expansion of ecological worldview and consciousness through physical education; instilling ecological behavior and activities to create a system of moral, material and spiritual ecological and cultural values; integration into the education system on optimal norms and ways of society interaction with the environment; formation the system of ecological knowledge and its combination with the system of subject knowledge (Imas, Futorny, Tsyganenko, & Maslova, 2018).

Characterization of personal preconditions on the concept of health-forming technologies in the process of adaptive physical education for school-age children with hearing impairments made it possible to distinguish:

- personal and motivational lack of awareness of the value of health and the desire to follow all the rules and norms of a healthy lifestyle; failure to form a responsible attitude to one's own health and the health of others, an active worldview regarding healthy living; underestimation of own needs and desires to optimize the level of health, increase the level of physical fitness both in the process of physical education and during the independent organization of physical activity; priority of passive lifestyle and distorted perception of new types of addictions (gambling, drug addiction, gadget addiction, internet addiction);

- personal and efficient the formation of behavior indi-

vidual system for aimed at achieving full physical, psychological and social well-being, based on the categories: "lifestyle", "work and rest", "culture of interpersonal communication", "prevention of bad habits"; low level of theoretical knowledge and practical skills in health care; lack of experience in shaping one's own health and positive emotional support of health development activities (Maslova, & Hopey, 2017).

The studying of self-assessment for the level of formation the practical skills and abilities of children with hearing impairments showed that more than 67.00% of pupils, regardless of age and degree of hearing impairment, are at an uncertain (indifferent) level. Almost 27.00% of children and adolescents assess their practical skills at the elementary level, and only 6.00% of pupils believe that their level of practical skills and skills to carry out health-building activities corresponds to a sufficient level ( $p < 0.05$ ).

Analysis of the responses allowed to outline the range of the most difficult skills for children with hearing impairments, among which they noted those related to the organization of optimal motor mode (83.50%), with independent drawing up of a program of physical training and health classes (91.30%), with the application of knowledge about the specifics of the certain types of impact of exercise on the body (84.90%), with the control of physical activity in the classroom (95.50%) ( $p < 0.05$ ).

The obtained results of pedagogical observation showed ignorance of almost 77.00% of children with hearing impairments in the issues of drawing up individual programs for physical culture and health classes; development of complexes of morning hygienic gymnastics; diets substantiation ( $p < 0.05$ ).

The results of research and studying of pedagogical foundations to create conditions for physical, mental and social well-being of children with hearing impairments allowed us to develop the basic provisions on the concept of health-forming technologies in the process of adaptive physical education of school-children with hearing impairments.

The development of the theoretical basis on the concept of health-forming technologies in the process of adaptive physical education of school-age children with hearing impairments directed us to determine the synthesized provisions of the author's concept based on a review of existing principles of modern pedagogy, education and health (Kashuba, & Goncharova, 2018).

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## Conflict of Interest

The authors declare that there are no conflicts of interest.

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