

Differentiated approach for improving the physical condition of children with visual impairment during physical education

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Abstract

The article justifies the use of a differentiated approach in the physical education of 10-year-old children with visual impairments and postural impairment to improve their physical condition. The differentiated approach in our study meant the division of children with visual impairments into relatively homogeneous subgroups according to similar secondary abnormalities in health. The purpose of the study is to develop and experimentally test a differentiated program of improving the physical condition of 10-year-old children with visual impairments in the process of physical education. The transformation experiment involved 28 children both with visual impairments (14 boys and 14 girls) and with scoliotic posture or round back. Research methods: theoretical analysis, systematization and generalization of scientific literature, Internet resources, pedagogical experiment, pedagogical testing, methods of mathematical statistics. The disharmony in the development of primary school aged children with visual impairments has a reflection in a lower level of their physical condition ($p < 0.05$). Postural impairment negatively affects the development of physical characteristics of 10-year-old children with visual impairments. As a result of the implementation of the differentiated program for enhancing the level of physical condition of 10-year-old children with visual impairments and either scoliotic posture or round back, there were positive changes in the indicators of physical qualities such as endurance, flexibility at the level of significance $p < 0,05$ and vertical stability of the body at significance levels of $p < 0.05$ and $p < 0.01$. The data obtained before and after the transformative experiment indicate that the use of the differentiated program of increasing the level of physical condition in the process of physical education of 10-year-old children with visual impairments and different types of impaired posture contributed to ensuring the positive dynamics in the average figures growth in all the studied parameters of children of both groups. The differentiated program is developed, implemented, and successfully tested during the transformation experiment: its effectiveness is proved by quantitative changes at the level of $p < 0.05$ and $p < 0.01$ of the studied fitness indicators.

Key words: children, impairments, vision, posture, differentiation, approach, physical education.

Introduction

According to the World Health Organization, today 180 million people worldwide are suffering from visual deprivation, nearly 40-45 million of them are completely blind (in the last twenty years this amount has increased by 12 million people) (Winnik J., 2004; Evseev S., 2014; Rostomashvili L., 2014). The attitude towards people with disabilities is an indicator of the maturity of social consciousness.

The attention of leading experts in the field of physical education is directed towards updating the content and technology of education, which implies a shift of emphasis on deeper differentiation and individualization of the learning process, the development of life competence and creative abilities, social adaptation and integration of children with visual impairments.

Recent studies indicate a low level of physical condition of children with visual impairments (Winnik J., 2004; Evseev S., 2014; Rostomashvili L., 2014) and prove the need to implement a differentiated approach that will improve both the efficiency of an educational process, improvement of motor skills, and the level of physical capacity (taking into account individual characteristics of students) (Begidova T., 2007; Rostomashvili L., 2014; Kashuba V., Yurchenko V., 2017; Mykhaylova N., Grygus I., 2013-2014; Savliuk S., 2017; Nesterchuk N., 2019).

Material and methods

In the theory and practice of physical education, the concept of "differentiated approach" is considered in the context of improving the effectiveness of educational and sports activities, in particular, improving the effectiveness of lessons of physical education (Ishmukhametov M., 1992). A differentiated approach to the education of children with visual impairments is a didactic provision that involves the division of the class into groups by different criteria: interests, physical development, health status, major defect and secondary deviation, physical condition and success (Vavilova E., 1983). The differentiated approach in our study meant grouping children with vision impairments into relatively identical subgroups with similar secondary health abnormalities.

The aim of the study was to develop, scientifically justify and experimentally test a differentiated program to improve the physical condition of 10-year-old children with vision impairments with different types of posture in the process of physical education.

Research Methods: Theoretical analysis, synthesis and generalization of scientific literature, Internet resources, pedagogical experiment (involves determination of the level of physical condition of 10-year-old children with visual impairments with different types of postural impairment to obtain initial data of further study. The pedagogical testing was performed to determine the level of physical condition of children with visual impairments and with scoliotic posture or round back who were studied for their ability to exhibit coordination abilities (static body balance), endurance of abdominal muscles and spine flexibility; methods of mathematical statistics (descriptive statistics, parametric Student test, nonparametric Mann-Whitney criterion, Kruskal-Wallis one-way analysis of variance).

Procedure: 28 ten-year old children with visual impairments (14 boys and 14 girls) and with either scoliotic posture or round back participated in the transformative pedagogical experiment.

Results

The state of physical condition is determined by testing individual motor capabilities. Testing in the dynamics of the physical education process helps to solve a number of complex pedagogical problems: to identify the level of development of motor abilities, which closely correlates with the functional capacity; and, in our case, to determine the level of development of certain physical qualities of children with visual impairments with different types of postural impairment and the effectiveness of exercise to improve their level of fitness. It is found out that thus far, the criterion of differentiation of workloads in practical training in physical education in special needs schools is to divide children into main and special groups by the results of their medical examination and by gender. All this criterion confirm the necessity and expediency of the studied problem, development and introduction in the educational process of a differentiated program of raising the level of physical condition of children, which would contribute to the optimization of the specified process in the environment of a special needs boarding school. We developed differentiated physical education classes by taking into account the provisions of the "Programs for correction and developmental work of therapeutic physical training (TPT) of 1-4 grades children with reduced vision" (Sheremet M., Nachynova O., Arnautova L., Kolomiichenko O., 2014).

During the study, 10-year-children with visual impairments showed the greatest number of musculoskeletal disorders (MSDs) that were recorded and detected. Considering the prevalence of such disorders of the posture as scoliotic posture and round back, we developed for them a differentiated program of physical condition enhancement, covering the following components: purpose, tasks, conditions, principles, forms and means of preventive-corrective children activity, stages and methods of teaching the ability to form the correct posture during exercising. Organizational preconditions for implementing a differentiated program to improve the physical condition of young school children with visual impairments include: analysis of the motives, interests and needs of children for individual and differentiated approaches to coverage their preventive and corrective activities; conducting mini-conversations to inform students about improving their own health, preventing and forming the right posture, using the knowledge they have gained in everyday life.

The preconditions for the implementation of a differentiated program to increase the level of physical condition of 10-year old children with visual impairments by optimizing their physical activity are based on the formation of motivation to exercise; needs of children with visual impairments in physical education; personality-oriented approach; diagnostics of physical fitness indicators; use of a complex of traditional, unconventional and modern means of physical education; application of game training technology aimed at improving and increasing the level of fitness, ensuring the harmonious development, social adaptation and integration of children with visual impairments in the society of healthy peers.

The implementation of the differentiated program took place in afterschool, extracurricular and daytime classes: in particular during differentiated TPT lessons, individual lessons. The choice of teaching methods envisaged an individual approach with taking into account the characteristics of children with visual impairments, such as the severity of the basic defect, the presence or absence of concomitant and secondary abnormalities, age, physical development, preservation or damage of sensory systems, medical indications and contraindications, type of postural impairment.

The main ways of implementation of the differentiated approach are the achievement of the optimal level of motor readiness of children and its maintenance within the limits that ensure successful implementation of future educational tasks; planning of fitness-and-wellness and correctional-and-developmental means in different group forms of classes; differentiation of normative requirements for physical condition of children with visual impairments at different stages of the adaptive physical education process;

In the differentiated program of increasing the level of physical condition, it is proposed to differentiate physical activity according to age, sex, type of postural impairment (scoliotic posture and round back) of children, taking into account the power capacity and judicious mix of means for the development of motor qualities. The differentiated program is effective in compliance with the following provisions: the optimal number of extracurricular activities – twice a week, with the total amount from 50 to 56 hours per academic year, and with the optimal number of children in the group (3-4 persons); individualization of capacity taking into account the main visual pathology, accounting for the presence of concomitant somatic diseases and available secondary abnormalities in physical development, optimal power capacity of the conducted classes – medium (HR 120-130 beats / min), use of methods of formation of vital skills and habits, accounting parents and children interests when choosing the means of physical education, integrated use of methods of pedagogical control.

The differentiated program of improving of physical condition included *two parts*: “*Physical exercises*” and “*Game training*”.

The 1st Part “Physical exercises” contained two complexes:

1. The complex of physical exercises for preventing and correcting visual impairments, such as Bates – [Corbett](#) corrective exercises for eye muscles called “Palming”; Bates - [Corbett](#) method of vision correction; complexes of exercises with the ball for the treatment of myopia.

2. The complex of physical exercises for prevention and correction of postural disorders, such as yoga-fit; fitball gymnastics; stretching; complex of Pilates system exercises; breathing exercises.

Exercise complexes for the prevention and correction of postural impairment for children with visual impairments and with roundback or scoliotic posture were used in differentiated classes in 2 subgroups. The aim of differentiated classes was the prevention and correction of postural and visual defects of pupils with visual impairments. Differentiated classes with TPT were aimed at activating the body's functionality, restoring impaired functions, general health promotion and correcting secondary abnormalities of students with visual deficiency. To overcome secondary deviations in the physical development of children, the corrective work was performed on differentiated exercises with TPT, which were conducted twice a week within 40-45 minutes, with the experimental group of children divided into two subgroups.

The first subgroup consisted of children with secondary abnormalities in respiratory (bronchitis, pneumonia) and cardiovascular (cardiac arrhythmia, vascular failure) systems. The second subgroup consisted of students with musculoskeletal system (MSS) diseases (posture violation, flat feet). One differentiated training session with TPT was conducted, if possible, outdoors, the other one – indoors. To achieve this goal, the following individual tasks were set for the first subgroup: to strengthen the heart muscle; normalize blood and lymph circulation and thus eliminate congestion in the lungs; to teach children the correct rhythm of breathing. The tasks that have been solved in this subgroup are to promote harmonious physical development; to form and consolidate the skills of correct posture; to strengthen the so called “muscle corset”.

The content of the educational material of differentiated classes for 10-year-old children with visual deficiency and with either scoliotic posture or with round back was differentiated into 4 sections: prevention and correction of postural disorders; development of physical qualities; formation of motor skills; improving the work of sense organs.

In *the second subgroup* (MSS diseases) we divided the means for prevention and correction of postural disorders into 2 groups: for 10-year-old children with vision deficiency and round back, and for children with scoliotic posture:

- corrective exercises aimed at correcting and normalizing the posture. Proper posture provides the most functionally complete location and functioning of internal organs and systems. The corrective exercises included gymnastic exercises for the muscles of the back, abdominal press and shoulder girdle, performed in various starting positions, as a rule, lying (on the back, abdomen), sitting and standing (near the gymnastic wall, wall, touching them with the shoulder blades); exercises with a gymnastics stick, balls. When having the spinal deformity, the Pilates corrective exercises were combined with the developmental exercises and fitballs;

- exercises on the prevention, correction and unloading of the spine, strengthening the muscles of the foot, strengthening the muscles of the abdominal press and lower extremities;

- relaxation exercises were used to relieve fatigue and to reduce muscle tone (breathing exercises, fitball-gymnastics);

- exercises aimed at improving the vertical stability of the body – that improve the ability to balance the body when shifting the centre of gravity. Keeping balance when performing different movements is a vital skill. Special exercises and equilibrium games contributed to the restoration of stability, orientation in space, adaptation to different positions of the body (physical exercises with yoga-fit, Pilates);

- stretching exercises were used as various joint bending, followed by fixation of the joint in a bent position; used in the fatigue relief.

The main component of the 2nd subgroup of physical exercises was a special correction (active corrective exercises) that provided the solution of the main tasks: correction of postural disorders; strengthening the muscular corset, mainly the back muscles; prevention of functional foot failure; strengthening the muscles of the abdominal press; prevention of individual secondary deviations. It is recommended to perform corrective exercises from a certain starting position, which causes a strictly local influence. Much attention was paid to the combination of force tension and stretching.

For children with visual impairments with different types of posture we developed complexes of corrective exercises. The duration of each complex is at least 1–1.5 months, depending on the severity of posture violation and correction tasks, as well as the neglect of this condition and deformity of the musculoskeletal system, which requires long and systematic treatment to correct it. At the same time it is necessary to keep in mind the necessity of gentle learning of movements, ensuring careful control over the physical activity of children and the system of adapted possibilities of educational forms and methods of teaching, providing the basic requirements for improving the physical abilities of school children with visual impairments.

The 2nd part of the differentiated program included game training. Software and methodological support of the content of game training in physical education of children with visual impairments contained: theoretical and practical material, game exercises and motion games; the method of using motion games depending on the solution of educational, disciplinary, wellness, corrective and social tasks during the school year; testing of physical fitness, general condition of health of children with visual impairments; differentiated blocks of motion games and exercises for solving a wide range of educational and socializing tasks; complex method of controlling and correcting the dynamics of physical condition during the academic year.

The structure of the technology of implementation of game training in physical education of 10-year-old children with visual impairments included a stepwise algorithm of actions:

1. Preparatory-adaptive stage. It provided an increase in the general physical condition, adaptation of functional systems to physical activity, familiarization with the rules of motion games that will be applied in the academic year, etc.

2. Basic-developmental stage, where we continued to enhance the general physical condition, used story games aimed at solving various motor tasks, games aimed at the prevention and correction of posture; and widely used different paraphernalia and sports devices.

3. Competitive-fixing stage (the first part of the second semester). Here we widely used complex games, relay games, games with a non-standard solution of motor tasks, games to form some motor experience, games to correct posture, games with the identification of the most active and creative students.

4. The result-summary stage. It contained integrative games, through which further improvement of the intellectual and physical indicators of children takes place, and where the diagnostics of the physical condition of children with visual impairments on the basis of game training is carried out.

According to the results of tests by the indicators of physical condition of 10-year-old children with visual impairments we rated a qualitative assessment of physical condition into 5 levels, each of which met the following criteria: low – poor, lower than average – unsatisfactory, average – satisfactory, higher than average – good, high – excellent (Sheremet M., 2014). The criteria for evaluating the effectiveness of the differential program were the improving of posture and raising of the level of the physical condition of 10-year-old children with visual impairments.

Previous studies have defined the disharmony of physical development of primary school children with visual impairments, they show a lower level of physical condition ($p < 0.05$) in comparison with their healthy peers (Savliuk S., 2017); we have determined that 6-10-year-old children with visual impairments and with different types of posture, in terms of the development of physical qualities, lag behind not only their practically healthy peers, but also children with visual impairments and normal posture ($p < 0.05$) (Savliuk S., 2017). A statistically significant lag was observed in the development of endurance ($p < 0.01$) and coordination abilities (vertical body stability) ($p < 0.001$). Postural impairment negatively affects the development of physical characteristics of 10-year-old children with visual impairments, as it was confirmed by the results of Kruskal-Wallis one-way analysis of variance at the significance level $p < 0,05$. The results of the study were used to develop the differentiated program to improve the physical condition of young children with visual impairments.

In view of the fact that 10-year-old children with vision defects mostly have scoliotic posture and round back, a comparative analysis of the indicators of physical qualities of this contingent before and after the implementation of the differentiated program is given below. At the end of the transformation experiment, we repeatedly tested the endurance on the indicators of lifting the torso to a sitting position from the supine position and performed a comparative analysis of the results of 10-year-old children with visual deprivation and with scoliotic posture or with a round back before and after the implementation of the differential program to enhance the level of their physical condition (Table 1).

Table 1. Dynamics of endurance of 10-year-old children with visual impairments before and after the experiment (n = 28), times

Type of posture	Statistical indicator	Boys (n = 14)		Girls (n = 14)	
		before the experiment	after the experiment	before the experiment	after the experiment
Scoliotic posture	\bar{x}	18.3	24.7*	17.0	22.5*
	S	3.1	1.5	2.9	2.6
Round back	\bar{x}	20.0	26.8*	16.3	25.5*
	S	2.6	1.3	2.5	0.7

Note: * is the difference between the results of the experiment, which is statistically significant at $p < 0.05$

The comparative analysis of endurance of 10-year-old children with visual impairments and with scoliotic posture or round back before and after implementation of the differentiated program showed positive dynamics of results at the significance level $p < 0.05$. 10-year-old boys with visual impairments and with scoliotic posture or round back have improved their endurance levels from the initial to average one during the transformation experiment (Sheremet M., 2014). Girls with visual impairments and scoliotic posture improved their endurance levels from the initial to intermediate level; girls with visual impairments and round back – from the initial to sufficient level of strength endurance (Sheremet M., 2014).

In Table 2. the presented results of the comparative analysis made it possible to evaluate the development of flexibility of primary school students with visual impairments and with either scoliotic posture or round back before and after the introduction of the differentiated program to increase the level of physical condition of 10-year-old children with visual deficiency.

Table 2. Dynamics of flexibility of 10-year-old children with different types of posture before and after the experiment (n = 28), cm

Type of posture	Statistical indicator	Boys (n = 14)		Girls (n = 14)	
		before the experiment	after the experiment	before the experiment	after the experiment
Scoliotic posture	\bar{x}	2.7	8.0*	4.5	9.5*
	S	0.6	1.0	0.8	1.5
Round back	\bar{x}	1.5	7.8*	5.3	10.0*
	S	0.6	1.5	3.1	4.4

Note: * is the difference between the results of the experiment, which is statistically significant at $p < 0.05$

An analysis of the dynamics of indicators of flexibility of 10-year-old children with visual impairments showed an improvement in flexibility indicators at the level of significance $p < 0.05$. Boys with scoliotic posture or round back improved their flexibility score from the average level to the above-average one during the transformative experiment (Sheremet M., 2014). Girls with visual impairments and scoliotic posture improved their flexibility score from the average to above-average level; girls with round back improved their flexibility score from the medium to high level during a transformative experiment (Sheremet M., 2014).

The presented results of the comparative analysis of static equilibrium indicators by testing the ability to balance on one leg with open eyes allowed us to determine the dynamics of development of coordination abilities of 10-year-old children with visual deficiency and with either scoliotic posture or round back before and after the experiment (Table 3).

Table 3. Dynamics of static equilibrium indicators by testing the ability to balance on one leg with open eyes by 10-year-old children with visual impairments before and after the experiment (n = 28), s

Type of posture	Statistical indicator	Static equilibrium indicators by testing the ability to balance on one leg with open eyes by 10-year-old children with visual impairments before and after the experiment (n = 28), s			
		Boys (n = 14)		Girls (n = 14)	
		before the experiment	after the experiment	before the experiment	after the experiment
Scoliotic posture	\bar{x}	5.7	17.0*	6.3	18.8*
	S	1.5	1.7	2.2	1.7
Round back	\bar{x}	5.5	18.3*	6.0	17.3*
	S	1.3	3.0	1.0	2.1

Note: * is the difference between the results of the experiment, which is statistically significant at $p < 0.05$

Analysing the static equilibrium indicators by testing the ability to balance on one leg with open eyes by 10-year-old children with visual impairments with different types of posture after the implementation of the experimental program, we found a statistically significant difference ($p < 0.01$). 10-year-old boys with visual impairments and scoliotic posture and 10-year-old boys with visual impairments and with round back during the pedagogical experiment improved their static body balance from the initial level to the average one. Girls with visual deficiency and scoliotic posture and girls with visual impairments and with round back improved their results from the low level to the above average one (Sheremet M., 2014).

Presented in Table 4 results of a comparative analysis of static equilibrium indicators by testing the ability to balance on one leg with closed eyes made it possible to follow the dynamics of coordination abilities of 10-year-old children with visual impairments and with either scoliotic posture or with a round back before and after the experiment.

Table4. Dynamics of static equilibrium indicators by testing the ability to balance on one leg with closed eyes of 10-year-old children with visual impairment before and after the experiment ($n = 28$), s

Type of posture	Statistical indicator	Boys (n = 14)		Girls (n = 14)	
		before the experiment	after the experiment	before the experiment	after the experiment
Scoliotic posture	\bar{x}	1.5	10.3*	1.3	11.0*
	S	0.5	2.1	0.4	0.8
Round back	\bar{x}	1.4	12.0*	1.1	10.3*
	S	0.4	2.6	0.2	2.1

Note: * is the difference between the results of the experiment, which is statistically significant at $p < 0.05$

Dynamics of static equilibrium indicators by testing the ability to balance on one leg with closed eyes of 10-year-old children with visual impairments and with either scoliotic posture or round back after implementation of the experimental program showed an improvement of results at the level of significance $p < 0.05$. 10-year-old children with visual impairments during the transformation experiment increased their static equilibrium values to the level of results of children with visual impairments with normal posture. It is important to note that, despite the positive dynamics of the presented indicators. these parameters still remained at a low level relative to the average norm.

Thus, according to the analysis of the development of coordination abilities of 10-year-old children with visual impairments during the transformative experiment, their static equilibrium indicators have improved from the *low level* to *average* and *higher than average* ones, but did not reach the average norm in testing the vertical stand with closed eyes. The low level of development of children with visual impairments coordination abilities can be explained by the fact that the violations in their motor skills are stable and therefore difficult to correct. A major negative factor limiting the development of such children is also the fact that the existent motor disorders of schoolchildren with visual impairment are of compensatory, i.e. adaptive character (Rostomashvili L., 2014). The educational process breaks the comfort zone and therefore causes some resistance and negativity of students.

Discussion

Analysis of the results of pedagogical testing made it possible to establish that, taking into account the indicators of development of physical qualities of 10-year-old children with visual impairments and with scoliotic posture or round back, there are positive changes in their endurance and flexibility at the level of significance $p < 0.05$ and vertical stability of the body at the level of significance $p < 0.05$ and $p < 0.01$.

As a result of the impact of the developed differentiated program, the level of physical condition of 10-year-old children with visual impairments improved significantly in the course of the transformative experiment. The endurance indicators of 10-year-old boys and girls with visual impairments and with scoliotic posture increased from the *initial* level to the *average* one. The endurance indicators of 10-year-old boys and girls with visual impairments and with round back improved from the *initial* to *sufficient* level of motor condition (Sheremet M., 2014)

The results in flexibility of 10-year-old boys and girls with visual impairments and with scoliotic posture increased from the *average* to *above average* level. The results of flexibility of boys with a round back increased from the *average* to *above average* level during the transformative experiment; girls with round back - from *average* to *high* level (Sheremet M., 2014). 10-year-old boys with visual impairments and with scoliotic posture or a round back during the pedagogical experiment have improved their static equilibrium indicators from the *initial* level to the *average* one; girls with visual impairments and either scoliotic posture or round back improved their fitness results from the *low* to *higher than average* level (Sheremet M., 2014).

Conclusions

The data obtained before and after the transformation experiment indicate that the use of a differentiated program of improving the level of fitness in the process of physical education of children with visual impairments and with different types of impaired posture contributed to ensuring a positive dynamics of the average values for all studied parameters for children of both groups. Thus, the effectiveness of the use of the implemented differentiated program of improving the level of physical condition of primary school children with visual impairments is confirmed.

In our opinion, the data obtained as a result of the transformative experiment prove the fact that, talking about children with vision impairment, the positive effects of the preventive-corrective influence of the performed measures manifest themselves relatively quickly after the start of the implementation of the differentiated program for improving the level of physical condition of primary school students with visual impairment as they continue to be used (Rostomashvili L., 2014; Kashuba V., Yurchenko V., 2017; Savliuk S., 2017). Obviously, this phenomenon reflects the presence of the preserved restorative potential of the organism of children with visual impairments, stimulation of which does not require a long period of time and is manifested in a uniform increase of physical condition indicators of children with visual impairments (Rostomashvili L., 2014; Kashuba V., Yurchenko V., 2017; Savliuk S., 2017)

However, it should be noted that some of the studied parameters of physical condition at the end of the pedagogical experiment still remained at a low level of development. This demonstrates the persistence of existing disorders of children with visual impairments which have a specifically personal character. There is also an obvious interrelation between the negative impact of secondary abnormalities on the condition of children and, as a consequence, the increase in individual developmental disorders of children with visual impairments and different types of posture (Kashuba V., Savliuk S., 2017).

Conflict of Interest

The authors declare that there are no conflicts of interest.

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