



Development of the General Coordination Abilities of School Students Taking their Nervous System into Account

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ABSTRACT

Background: The general coordination abilities of children of 7-8 years will develop more effectively if in classes on physical culture to use the differentiated approach which is based on strength of the nervous system. **Aim of the study:** To define the influence of strength of the nervous system on the development of coordination abilities of school students. **Subjects and methods:** Total 60 school students from the usual comprehensive school participated in a pedagogical experiment. The age of children was 7-8 years. All school students have been differentiated in 3 groups. The level of development of the general coordination abilities was determined by the "shuttle run 3 × 10" test. In the third group children have been differentiated on subgroups taking into account strength of nervous system by a technique of "tapping-test". **Results:** In 7 months of a research on indicators of school students there were changes. In KG, indicators of coordination abilities have slightly worsened from 10.3 ± 0.6 seconds to 10.4 ± 0.6 seconds ($p > 0.05$). In EG-1 in which school students carried out physical exercises for development of coordination abilities indicators have slightly improved from 10.3 ± 0.6 seconds to 10.1 ± 0.5 seconds ($p > 0.05$). **Conclusion and recommendations:** The new research has shown that if on classes in the physical culture at school, 2 times a week within 12-15 minutes to develop the general coordination abilities of children of 7-8 years, then their indicators considerably will grow. Especially at those school students who are engaged, it is differentiated, taking into account the strength of the nervous system.

Keywords: Strength of nervous system, Differentiated approach, School students, Coordination abilities

INTRODUCTION

Among all abilities of the person, there is dexterity, which is one of the most difficult mechanisms. The concept of dexterity is not studied enough and instead of this term, experts use coordination abilities. Such abilities are complex in quality. Coordination abilities are abilities of the person to quickly, precisely and economically solve the motive problems especially difficult and arising suddenly [1,2]. One of the major tasks on classes in the physical culture at school with younger school students is the development of motive function and ability to operate the movements. It should be noted that for successful assimilation of physical exercises the large role is played by the high level of development of coordination of the movement. Coordination abilities allow to carry out effectively motive tasks in the course of work, they provide economical expenditure of energy resources of children [1-3]. Therefore, besides physical qualities, at school age development of coordination abilities of children is important.

Despite a big variety of coordination abilities, there are several classifications which allow systematizing them. Today the general, special and specific coordination abilities are defined [4]. General coordination of movements is the base for the development of special and specific coordination abilities. The sensitive period for the development of the general coordination abilities is the younger school age, namely, 7-8 years [5].

An individual approach is one of the major both in the general and in special pedagogics. His essence consists of the accounting of specific features of pupils for the aim of active development of their intellectual and physical indicators. The individual approach assumes a comprehensive study of children and the development of the appropriate measures of pedagogical influence taking into account the revealed features. An individual approach is of particular importance on classes in physical culture as physically, technically and intellectually for all children. With children of younger

school age, the differentiated approach which assumes association of children in groups on any sign is used more often [6,7].

When performing physical exercises in classes on physical culture, school children can be differentiated by different criteria, for example, on growth, age, technical training and other indicators [8,9].

One of the effective and perspective approaches is the typological criterion. The typology represents features of manifestation of properties of the nervous system. There are several typological signs, for example, the strength of the nervous system on excitement process, its liability, the mobility of processes and some other. The most effective criterion of differentiation of children on groups, in our opinion, is the strength of the nervous system, a number of authors hold the same opinion [10,11].

Thus, the value of coordination abilities for younger school students and use of the differentiated approach in classes on physical culture is not doubtful; however, not clear as the differentiated development of coordination abilities of children taking into account, the strength of their nervous system can affect indicators of development of these abilities.

Therefore the research aims the definition of the influence of strength of the nervous system on the development of coordination abilities of school students.

Research Hypothesis

If in classes on physical culture within 12-15 minutes purposefully to develop coordination abilities of children of 7-8 years, and taking the strength of their nervous system into account, the indicators of coordination of the movement will considerably be improved.

MATERIALS AND METHODS

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or National Research Committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Children of 7-8 years who studied at the usual school participated in a pedagogical experiment. In total 60 people participated in a research. All school students have been healthy and allowed to classes in physical culture. All children have been differentiated into 3 groups, and school students from the third group have been differentiated on the basis of the strength of the nervous system on excitement process [12].

The first group (KG) was children who were engaged in physical culture according to the standard program for school students of the first class [13].

The second group (EG-1) was school students who were also engaged according to the standard program, but, at the same time within 12-15 minutes they carried out physical exercises on the development of coordination abilities. Various exercises, for example, jump with turns, somersaults forward and back, accelerations and many others were carried out. Also exercises with objects, for example, with a ball, a jump rope, a hoop, a gymnastic stick, and others were used. The complexity of performance of physical exercises increased due to the introduction of additional elements, an increase in the speed of performance of exercise, change of the direction and some other receptions [14].

The third group (EG-2) was children who were also engaged according to the standard program and carried out coordination training within 12-15 minutes. But, when performing exercises the school students have been differentiated on subgroups taking into account the strength of the nervous system. For school students with the strong nervous system, loading was intensive and for weak-volume. The volume of loading increased due to an increase in a number of repetitions and time of rest. The intensity of loading increased due to an increase in a number of exercises and a reduction of time of rest [15,16].

During a pedagogical experiment, 59 classes have been given in physical culture in each group, all classes took place 2 times a week, each for 45 minutes. Prior to the research and after his termination, all school students took the control test which shows the level of development of the general coordination abilities (Shuttle run 3×10) [13]. In EG-2 children have been differentiated on subgroups taking into account strength of the nervous system by "tapping-test" [17].

Shuttle Run

In the sports gym, the distance between the 2 lines was represented by 10 meters. The school student's task was to reach as soon as possible from first to the second line (to touch the line by a hand), to return back (again to touch the line by a hand), and to finish by reaching the second line. On the sheet of paper 6 identical squares were represented. On a signal, during 5 seconds children have to put quickly dots in the first square, then in the second and so on. After the 13th second (after the 6th square) the exercise comes to an end. By quantity of dots, the schedule is under construction and strength of the nervous system was defined.

Mathematical and statistical processing of results of a research was carried out by means of parametrical criterion T-student; the programs Excel-2016, Biostatistica-2009 were used. The result was significant at $p > 0.05$ [18,19].

RESULTS

Before the pedagogical experiment, all school students have been differentiated in 3 groups in such a way that indicators in groups on coordination abilities were approximately identical. However, after the pedagogical experiment, there were changes of indicators of coordination abilities in all groups (Table 1).

Table 1 Change of indicators the coordination abilities school students 7-8 years (M ± m)

Indicators	Group	Before	After	p-value
Shuttle run 3 × 10 (sec)	KG	10.3 ± 0.6	10.4 ± 0.6	>0.05
	EG-1	10.3 ± 0.6	10.1 ± 0.5	>0.05
	EG-2	10.3 ± 0.6	9.7 ± 0.5	<0.05

The analysis of Table 1 allows speaking about some new results. In KG in which children were engaged by a standard technique on classes in physical culture for first graders indicators of coordination, abilities have slightly worsened from 10.3 ± 0.6 seconds to 10.4 ± 0.6 seconds ($p > 0.05$). Such indicators can speak about the need for a revision of the program of development of first graders in classes on the physical culture at the school.

In EG-1 in which school students were engaged according to the standard program, but, at the same time within 12-15 minutes carried out physical exercises for development of coordination abilities, indicators have slightly improved from 10.3 ± 0.6 seconds to 10.1 ± 0.5 seconds ($p > 0.05$). Such a result allows speaking about the efficiency of use of coordination training in classes with younger school students.

In EG-2 in which children were engaged according to the standard program, but carried out coordination exercises taking into account the differentiated approach which is based on strength of the nervous system, have considerably improved the indicators from 10.3 ± 0.6 seconds to 9.7 ± 0.5 seconds ($p < 0.05$). The result approves efficiency of the offered differentiated technique.

Thus, results of a research allow speaking about the efficiency of application of a coordination training on classes in the physical culture at school, especially in those groups in which the differentiated approach which is taken into account for the strengthening of the nervous system.

DISCUSSION

The value of coordination abilities in human life is very high. Such abilities are prerequisites for the development of other physical qualities. A basis of development of special and specific abilities are the general coordination abilities [1,2]. The opinion of authors that it is more effective to develop the general coordination abilities at a younger school age is confirmed by results of a research [20]. As school students who used classes on physical culture, the physical exercises which aimed at the development of coordination abilities have improved the indicators, unlike those children who didn't develop these abilities.

The efficiency of use of the differentiated approach in classes on physical culture with children of 7-8 years is also confirmed by results of the real research by Santos, et al., Solomatina, et al., Bakulev, et al., [6,7,21]. Children who were engaged in such type of activities have considerably improved indicators of coordination abilities.

Despite a variety of criteria on which children can be differentiated on groups, the efficiency of use of typological criterion, namely strength of the nervous system on excitement process was once again proved [10,11,22]. Children

who were engaged in taking into account strength of nervous system have surpassed in indicators of school compared students who didn't use the differentiated approach during the coordination training. At the same time, it is important to remember that for school students with different nervous system loading has to be different. For children with a strong nervous system, intensive loading will be involved [15,16].

It should be noted that children with the weak nervous system aren't weak in principle. School students with strong and weak nervous system have different qualities and go towards the aim in different ways. Children with weak nervous system worked in quicker, are capable to perform a long time monotonous work. Children with a strong nervous system can support the high level of working capacity for a long time.

Thus, the purposeful coordination training on classes in the physical culture at school has been used for the first time. It was carried out within 12-15 minutes after short warm-up. The efficiency of use of the differentiated approach for the development of coordination abilities in children of 7-8 years which is based on strength of nervous system was proved. The aim of the research was achieved, and the hypothesis was solved.

CONCLUSION

In conclusion, it should be noted that in classes on the physical culture at school it is necessary to use exercises which aims at fully developed coordination abilities. Also, during the coordination training, it is necessary to use the differentiated approach which is based on strength of nervous system of the pupils. Such approach allows to open internal reserves of an organism of school students and to considerably improve indicators of coordination abilities. At the same time, loading for children with strong and with system weak nervous system has to be different.

Results of a pedagogical experiment can be useful to teachers, trainers, and athletes. The research is new, relevant and perspective for studying of typological features of manifestation of properties of nervous system and indicators of coordination abilities.

DECLARATIONS

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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