

# The Influence of Speed and Strength Indicators on the Coordination Abilities of 13-14-Year-Olds with Different Typologies

Georgiy Georgievich Polevoy<sup>1,2\*</sup>, Andrew Borisovich Sablin<sup>1</sup>

<sup>1</sup>Department of Physical Education, Moscow Technical University of Communications and Informatics, Moscow, Russia. <sup>2</sup>Department of Physical Education, Moscow Polytechnic University, Moscow, Russia.

## Abstract

The children's health is one of the significant issues of the families, schools and governments all over the world. Considering the importance of their health, the aim of this research is to designate the emergence of speed and power abilities in children aged 13–14 years on their coordination abilities. By using a tapping test, the strength of the nervous system is diagnosed, and Speed-strength abilities were determined by arm strength, torso strength, leg strength. Furthermore, coordination abilities were determined by using a test called the "shuttle run 3x10" test. The results of the tests and research indicate that the control group improved by 2-6% and there were more significant changes in the experimental group. Indicators enhanced by 11-17%. The study concluded that if you perform exercises to develop the speed and strength qualities of children aged 13-14 during physical education lessons at school, these indicators will improve coordination abilities.

**Keywords:** Health, Children, School, Physical education, Nervous system, Differentiated approach

## INTRODUCTION

In recent studies, the children's health in preschool and age causes quite a big concern [1, 2]. During the period of study from 1st to 11th grade, children manage to master a sufficient set of motor skills and abilities. From simple to complex, they go from year to year. Consistently, the physical education material is presented in the standard work program [3]. The program is focused on the comprehensive development of all physical abilities, endurance, speed, strength and flexibility, coordination abilities. Some authors provide evidence that the development of one physical quality affects the performance of another [4-6].

Some studies have determined a fairly rigid framework if we talk about favorable periods for developing a particular physical quality. So, for example, motor qualities or dexterity are formed at primary school age, and speed-strength abilities should be accentuated in the middle link, it is better to work on strength in the senior school link when the child's body is physiologically ready for this [7, 8].

An individualized (often allergic approach for children) effectively develops each child's physical abilities. He reveals his full potential. At the same time, for the distribution of children into groups, there may be a level of different training, physical, theoretical, technical, etc [9-11]. One of the quite effective directions in the differentiation field of children into subgroups is the typology of the nervous system [12].

In our new study, we had to determine the influence of speed-strength abilities on the coordination abilities of schoolchildren in physical education lessons, taking into account different loads for children with other nervous systems; this was the purpose of our study.

## MATERIALS AND METHODS

### Participants

Children aged 13-14 engage in the pedagogical experiment. Schoolchildren in the 20 people from class 7a were – control group (CG), another 20 from class 7b – experimental group (EG). All children were from the leading medical group and could participate in physical education lessons.

**Address for correspondence:** Georgiy Georgievich Polevoy, Department of Physical Education, Moscow Technical University of Communication and Informatics, Moscow, Russia. [g.g.polevoy@gmail.com](mailto:g.g.polevoy@gmail.com)

This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 License, which allows others to remix, tweak, and build upon the work non commercially, as long as the author is credited and the new creations are licensed under the identical terms.

**How to cite this article:** Polevoy GG, Sablin AB. The Influence of Speed and Strength Indicators on the Coordination Abilities of 13-14-Year-Olds with Different Typologies. Arch Pharm Pract. 2022;13(2):17-20. <https://doi.org/10.51847/08Fe7xmvx4>

### Procedure

The study was conducted at 60 Kirov (Russia) schools from January 12 - March 20 in 2020. For the entire period, 20 lessons of 40 minutes were held in each class.

The children were engaged in physical education on a stable schedule simultaneously on Tuesdays and Fridays.

Children from CG were pitched in the physical education program for secondary school students grades 1-11 [3].

After a short running warm-up, the EG children also conducted physical exercises to develop speed and strong point capabilities at each physical education lesson. The components of the load for children were different. Schoolchildren with a robust nervous system executed the complex with greater intensity in the process of arousal. Namely, they changed exercises more often and performed fewer series, and for schoolchildren, there was a volume load, opposite to a load of children using a sturdy nervous system [12].

Before the beginning of the pedagogical experiment, children from CG and EG passed a tapping test, which differentiated

them into subgroups taking into account the strength of the nervous system [6].

### Tests Determined Speed-Strength Abilities

Flexion and extension of the arms whereas lying on the floor at the stop (arm strength) [13], long jump from a place with a push with two legs (leg strength) [14], lifting the torso from the prone position (torso strength) [15].

The development level of coordination abilities was determined by the test "shuttle run 3x10m" [6].

The results of the pedagogical experiment (percentage, mean value, and standard deviation) were processed using the Excel program. The percentage increase in indicators is calculated at the end of the experiment.

## RESULTS AND DISCUSSION

After the tapping test procedure, children from grades 7a and 7b were differentiated according to typological characteristics, 10 people with strong and weak nervous systems in each subgroup. At the same time, all children in CG were engaged in a common group. During the study period, the values in the CG changed, the data in **Table 1**.

**Table 1.** Indicators of speed-strength abilities and coordination abilities in CG

Test	Strong nervous system			Weak nervous system		
	Before	After	%	Before	After	%
leg strength (cm)	185,1±4,7	190,7±4,8	+3%	189,6±4,5	197,2±4,7	+4%
torso strength (20 sec)	12,8±1,1	13,1±1,2	+2%	12,3±1,1	12,8±1,1	+4%
arm strength (20 sec)	7,8±0,8	8,0±0,8	+3%	8,2±0,8	8,4±0,8	+2%
Shuttle run 3x10m (sec)	8,1±0,2	7,8±0,2	+3%	8,4±0,3	7,8±0,2	+6%

**Table 1** shows that the indicators in CG in schoolchildren with a resilient nervous system in the test "leg strength" improved by 3%, and in children with a weak nervous system became 4% higher. The indicators in the test "torso strength" in children with a strong nervous system became 2% higher, and in children with a weak one – 4%. In the "arm strength" test, schoolchildren with a strong nervous system succeeded by 3%, and children with a weak nervous system only 2%. The indicators of coordination abilities of children with a

strong nervous system improved by 3%, as well as in children with a weak nervous system by 6%.

Thus, according to the results of tests in CG, it can be assumed that the program for students of grades 1-11 in physical education does not significantly impact the indicators of speed, strength, and coordination abilities in children 13-14 years old. **Table 2** shows the results in the EG.

**Table 2.** Indicators of speed-strength abilities and coordination abilities in EG

Test	Strong nervous system			Weak nervous system		
	Before	After	%	Before	After	%
leg strength (cm)	197,0±6,8	224,6±7,8	+14%	188,0±4,9	218,1±5,7	+16%
torso strength (20 sec)	12,7±1,1	14,4±1,2	+13%	13,0±0,8	14,4±0,9	+11%
arm strength (20 sec)	8,0±0,8	9,1±0,9	+14%	8,5±0,5	9,5±0,6	+12%
Shuttle run 3x10m (sec)	8,7±0,2	7,2±0,2	+17%	8,2±0,2	7,0±0,2	+14%

**Table 2** showed us that schoolchildren in the EG improved their physical qualities significantly. In the "leg strength" test,

schoolchildren with a strong nervous system enhanced by 14%, and weak ones by 16%. In the "torso strength" test, the

indicators were higher in children with a resilient nervous system by 13% and a weak one by 11% nervous system. In the "arm strength" test, the indicators in children with a strong nervous system were 14% higher, and in children with a weak nervous system, the indicators improved by 12%. The indicators of coordination abilities in the "Shuttle run 3x10m" test in children with a strong nervous system enhanced by 17%, and in children with a weak nervous system by 14%.

According to the results of the study in the EG, it can be said that the results of training for speed-strength diseases are manifested, while children perform exercises individually, train - they perform more exercises, and the load is performed constantly. At the same time, there was a positive effect on coordination in general.

According to the results of the study, several points should be noted:

1. The ordinary physical education program for students in grades 1-11 has a negligible effect on the indicators of speed and strength abilities. The results shown in CG prove the existence of a sensitive period for the development of speed-strength skills. Hence, their natural and insignificant increase in a fairly short time interval seems logical. The age of 13-14 years is favorable for developing speed and strength capabilities; such a statement is confirmed by the data obtained in previous studies [7, 8].
2. A distinguished approach in lessons in working with children is effective. In previous studies, its effectiveness in working with children of diverse ages as well as genders has been proven [9-11]. This is confirmed by our results obtained in the EG, in which the children were engaged in a differentiated way. The strength of the nervous system to the load. A stout nervous system is children who perform large doses in the same amount of time. Weak nervous system - can perform more substances more efficiently [12].
3. There was no work on the purposeful improvement of synchronization capabilities in the EG, but these indicators increased significantly following speed and strength abilities indicators. Therefore, it can be concluded that the purposeful development of speed-strength abilities entails the simultaneous development of coordination abilities. Such studies can be confirmed by the interconnection of some physical abilities of other authors [4, 5].

The article is promising, since the topic of public health in different countries is relevant [16-20].

## CONCLUSION

Thus, the results of the study allow us to draw some conclusions. As a result of a new study, the influence of speed-strength abilities on the indicators of coordination abilities of children aged 13-14 years has been established. In physical education classes at school, it is important to use an

individual approach in which the main thing is the type of nervous system. The complex of speed and strength abilities should be used as an addition to the standard program at school at the age of 13-14 since this age is sensitive for developing these abilities. Summarizing the above, we can say that the purpose of the study has been achieved, and the data obtained during the experiment are promising for further study of the interrelationships of physical abilities of schoolchildren of different ages.

**ACKNOWLEDGMENTS:** Authors would like to thank all participants of the study.

**CONFLICT OF INTEREST:** None

**FINANCIAL SUPPORT:** None

**ETHICS STATEMENT:** All procedures met the ethical standards of the 1964 Declaration of Helsinki. Informed consent was obtained from all parents of the children included in the study.

## REFERENCES

1. Shuba LV. Modern approach to implementation of health-related technology for primary school children. *Pedagog, Psychol, Med-Biol Probl Phys Train Sports*. 2016;20(2):66-71. doi:10.15561/18189172.2016.0210
2. De Giorgio A, Kuvacic G, Milic M, Padulo J. The Brain and Movement: How Physical Activity Affects the Brain. *Monten J Sports Sci Med*. 2018;7(2):63-8. doi:10.26773/mjssm.180910
3. Kainov AN, Kuryerova GI. Working programs. *Physical Culture. Grades 1-11. Comprehensive program of physical education of schoolchildren*. Teacher; 2019. p. 169.
4. Bozdoğan TK, Kızılet A. The effect of coordination and plyometric exercises on agility, jumping, and endurance ability in badminton players. *Int J Sports Exerc Train Sci*. 2017;3(4):178-87. doi:10.18826/useeabd.345236
5. Jekauc D, Wagner MO, Herrmann C, Hegazy K, Woll A. Does Physical Self-Concept Mediate the Relationship between Motor Abilities and Physical Activity in Adolescents and Young Adults? *PLoS One*. 2017;12(1):1-18. doi:10.1371/journal.pone.0168539
6. Georgiy P. The development of speed-power qualities of schoolchildren with different typologies applying coordination training. *Pedagog, psychol, med-biol probl phys train sports*. 2019;23(1):43-6. doi:10.15561/18189172.2019.0107
7. Bas H, Mark DSC. Sensitive Periods to Train General Motor Abilities in Children and Adolescents: Do They Exist? A Critical Appraisal. *Strength Cond J*. 2020;42(6):7-14. doi:10.1519/SSC.0000000000000545
8. Solum M, Lorås H, Pedersen AV. A Golden Age for Motor Skill Learning? Learning of an Unfamiliar Motor Task in 10-Year-Olds, Young Adults, and Adults, When Starting from Similar Baselines. *Front Psychol*. 2020;11:538. doi:10.3389/fpsyg.2020.00538
9. Gavin C, Tony P, Christine J, Starla MC. Differentiating Instruction in Physical Education: Personalization of Learning. *J Phys Educ Recreat Dance*. 2017;88(7):44-50. doi:10.1080/07303084.2017.1340205
10. Van Munster M, Lauren L, Michelle G. Universal Design for Learning and Differentiated Instruction in Physical Education. *Adapt Phys Activ Q*. 2019;36(3):1-19. doi:10.1123/apaq.2018-0145
11. Jarvis JM, Pill SA, Noble AG. Differentiated Pedagogy to Address Learner Diversity in Secondary Physical Education. *J Phys Educ Recreat Dance*. 2017;88(8):46-54. doi:10.1080/07303084.2017.1356771
12. Polevoy GG. Development of the Speed of Movement and Coordination Abilities of Pupils with Use of Exercise Classics. *Int J Educ Sci*. 2019;26(1-3):9-13. doi:10.31901/24566322.2019/26.1-3.1083
13. El-Ashker S, Hassan A, Taiar R, Tilp M. Long jump training emphasizing plyometric exercises are more effective than traditional

- long jump training: A randomized controlled trial. *J Hum Sport Exerc.* 2019;14(1):215-24. doi:10.14198/jhse.2019.141.18
14. Kota T, Sumiaki M, Seiji U, Naokazu M, Hiroaki K. Effect of abdominal bracing training on strength and power of trunk and lower limb muscles. *Eur J Appl Physiol.* 2016;116(9):1703-13. doi:10.1007/s00421-016-3424-9
  15. Dhahbi W, Chaabene H, Chaouachi A, Padulo J, Behm DG, Cochrane J, et al. Kinetic analysis of push-up exercises: a systematic review with practical recommendations. *Sports Biomech.* 2018;21(2). doi:10.1080/14763141.2018.1512149
  16. Lanting Zh, Rong He, Yuanwei L, Fei Sh, Ying X, Ping Zh. Report of a patient with refractory atrial tachycardia whose heart rate was controlled using ivabradine. *J Int Med Res.* 2022;50(3):03000605221081727. doi:10.1177/03000605221081727
  17. Ghaderpour S, Ghiasi R, Hamidian G, Heydari H, Keyhanmanesh R. Voluntary exercise improves spermatogenesis and testicular apoptosis in type 2 diabetic rats through alteration in oxidative stress and mir-34a/SIRT1/p53 pathway. *Iran J Basic Med Sci.* 2021;24(1):58-65. doi:10.22038/ijbms.2020.49498.11314
  18. Gholamian S, Attarzadeh Hosseini S, Rashidlamir A, Aghaalinjad H. The effects of interval aerobic training on mesenchymal biomarker gene expression, the rate of tumor volume, and cachexia in mice with breast cancer. *Iran J Basic Med Sci.* 2020;23(2):244-50. doi:10.22038/ijbms.2019.39535.9375
  19. Koelen JA, Mansueto AC, Finnemann A, deKoning L, vander Heijde CM, Vonk P, et al. COVID-19 and mental health among at - risk university students: A prospective study into risk and protective factors. *Int J Methods Psychiatr Res.* 2022;31(1):e1901. doi:10.1002/mpr.1901KOELENET AL.-9 of 9
  20. Passavanti G, Paoli A, Rizzato A, Ceccarelli I, Fiorenzani P, Casini I, et al. Age and training intensity differently affect male runners' endocrine and sexual parameters. *Chin J Physiol.* 2022;65(1):37-45.