



Enhancing the effectiveness of strength training methods in the context of physical education for high school students

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PhD, Associate Professor V.S. Astafyev¹

PhD, Associate Professor V.K. Gebert¹

I.V. Rudyakova²

¹Transbaikal State University, Chita

²Chita Institute (branch) of Baikal State University, Chita

Corresponding author: miss.rudyakova@mail.ru

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Abstract

Objective of the study was to theoretical, methodological, and experimental validation of the approach to enhancing the strength capabilities of high school students through the application of fitness technologies.

Methods and structure of the study. Twenty-two young men from the eleventh grade of Secondary School No. 26 in Chita, Transbaikal Territory, participated in a pedagogical experiment. The experiment, which consisted of three stages – ascertaining, forming, and control – was conducted from September 2023 to May 2024. During this time, medical and biological research was conducted, control tests were administered, and experimental methods were implemented. The boys in the control group (KG) and the experimental group (EG) engaged in the experiment for nine months, which were divided into three-week periods (mesocycles). Each mesocycle consisted of three weekly sessions (microcycles), each lasting 60 minutes outside of school hours. On average, 12 practical sessions were conducted in each mesocycle, resulting in a total of approximately 108 sessions. The sessions followed a structured format, with a warm-up (functional and joint warm-up), pre-stretch (dynamic stretching exercises) lasting 10 minutes, a cardio-power section (aerobic exercises for 25 minutes and strength training for 15 minutes), and a cool-down (static stretching exercises) lasting 10 minutes.

Results and conclusions. The unique aspect of the experimental approach was the alteration of the content of the main lesson section by adjusting the level of physical exertion, employing the circuit method, alternating between aerobic and anaerobic activities, incorporating dynamic and static strength exercises, and integrating various types of strength training technologies with a gymnastic focus. The findings of the educational experiment confirmed the efficacy of the implemented approach. Based on the experimental outcomes, conclusions were drawn regarding the successful implementation of the method.

Keywords: *strength, schoolchildren, high school students, improvement, physical exercises, training, abilities, anaerobic.*

Introduction. Recently, there has been a tendency towards a decrease in the general level of health and physical fitness of schoolchildren in Russia [1; 2]. The increasing intensity of the educational process in educational institutions leads to the fact that high school students are forced to spend more and more time at the computer, which contributes to a significant decrease in physical activity [3]. These factors negatively affect physical fitness, the level of strength abilities and have an unfavorable effect on the interest in physical education among the younger generation [4].

As noted by A.A. Gusev, A.A. Zhuravlev, N.I. Zayarnov, A.D. Tuboltseva, E.A. Smirnova, strength training is the main component in the physical education pro-

gram for senior school boys, ensuring the harmony of motor activity.

A number of authors I.V. Chernov, R.V. Revunov notes that traditional approaches to organizing strength-oriented classes currently do not have the proper impact on the strength training of schoolchildren, their desire for systematic physical exercise, self-improvement, and increased muscle strength, and do not take into account in sufficient volume the health and training significance of strength training [5]. Therefore, the situation that has developed in modern educational institutions requires new, non-standard approaches and technologies to solving the problem of developing strength abilities in the learning process, which must correspond to individual characteristics and contribute to the most ef-



fective implementation of the interests of high school students [4, 5].

Objective of the study was to theoretical, methodological, and experimental validation of the approach to enhancing the strength capabilities of high school students through the application of fitness technologies.

Methods and structure of the study. The pedagogical experiment was conducted at Secondary School No. 26 in Chita, Transbaikal Territory, Russian Federation, from February 2023 to July 2024 in three stages. The pedagogical experiment involved 22 11th-grade boys who were divided into two groups: control (CG) and experimental (EG), each consisting of 11 people.

At the beginning and at the end of the pedagogical experiment, medical and biological studies and control tests were conducted in the control (CG) and experimental (EG) groups. All studies were conducted in the afternoon. The results of each study were recorded in consolidated electronic protocols. Medical and biological studies made it possible to identify the body types of high school students according to the theory of M.V. Chernorutsky. Control tests were carried out to study the level of dynamic and static strength abilities. The young men of the control (CG) and experimental (EG) groups were engaged in training for nine months (mesocycles), three times a week (microcycles), for 60 minutes after school hours. In one mesocycle, on average, 12 practical classes were held, with a total of about 108 classes.

A distinctive feature of the experimental methodology was the modification of the content of the main part of the lesson by changing the intensity of physical activity; using the circuit method; alternating aerobic and anaerobic work; using dynamic and static strength exercises; including various strength types of gymnastic fitness technologies. The duration of the power part (Power) remained unchanged throughout the pedagogical experiment. During the first mesocycle

(September), the young men of the control (CG) and experimental (EG) groups had the same content of practical classes and a moderate-intensity load at a heart rate of 120-130 beats per minute. The strength exercises were performed using the repeated efforts method in an aerobic mode for all muscle groups (shoulder girdle, upper limbs, trunk, buttocks, lower limbs). The complex included strength dynamic exercises with the weight of one's own body to develop strength abilities. Starting from the second mesocycle (October), the subjects of the control and experimental groups were divided into several subgroups taking into account their body types.

In the control group, the repeated efforts method was used with the frontal method of organizing the participants. The complex included strength dynamic exercises with their own weight for all muscle groups (shoulder girdle, upper limbs, trunk, buttocks, lower limbs). Young men with a normosthenic body type performed exercises taking into account the principle of achieving an individual maximum in a combination of aerobic and anaerobic modes at a heart rate of 150-160 beats per minute. Young men with a hypersthenic body type performed exercises up to the maximum number of times in aerobic mode at a heart rate of 130-140 beats per minute. Young men with an asthenic body type performed exercises until fatigue at a heart rate of 150-160 beats per minute. In subsequent mesocycles, the combinations and types of strength dynamic exercises in the complex changed.

In the experimental group, in October and November, a circular method was used, which is an organizational and methodological form of performing physical exercises. In training sessions, the following were used: Body Sculpt direction (strength exercises for all muscle groups based on the use of special equipment: fitball, medicine ball). In total, two sets of strength exercises of a dynamic and static nature were developed in combination with aerobic

Results of strength abilities indicators of senior schoolchildren of the control and experimental groups during the control experiment

Control exercises (units of measurement)	CG (n=11)	EG (n=11)	Reliability	
	X±m m	X±m m	t	p
Bending and unbending arms in a prone position (number of times)	26,20±0,16	32,50±0,10	t=3,41	p<0,01
Flexion and extension of the trunk from a supine position for 1 min (number of times)	42,17±0,18	52,10±0,24	t=3,24	p<0,01
Long jump from a place with a push from two legs (cm)	205,04±5,61	225,00±7,00	t=4,12	p<0,01
Hanging Legs at 90° (sec)	11,05±0,04	13,50±0,03	t=3,61	p<0,01
Hanging on bent arms on the horizontal bar (sec)	30,27±0,20	35,00±0,21	t=4,27	p<0,01



and anaerobic muscle work modes. One set was used in October, the other set - in November. The sets of strength exercises were aimed at developing strength abilities, dynamic and static strength endurance. In December, January and February, several strength types of fitness technologies were introduced: Body Pump, ABS, ABL, Upper Body. At each lesson, regional and global exercises were used depending on the volume of active muscle mass. The Body Pump direction was used as a global effect at a heart rate of 150-160 beats / min, for regional effects, the following directions were used - ABS, ABL, Upper Body at a heart rate of 130-140 beats / min. In March, April and May, the Hot Iron direction was used as a global impact with a heart rate of 160-170 bpm, while the regional impact was achieved with ABS, ABL, and Upper Body with a heart rate of 130-140 bpm. Strength exercise complexes were performed taking into account the increase in the intensity of physical activity.

Body Pump and Hot Iron classes were conducted using the frontal method simultaneously with subgroups of young men of all body types in the same intensity mode. The selection of ABS, ABL, and Upper Body exercises and their dosage were carried out taking into account body types and were performed using the repeated method. Young men with normosthenic and asthenic body types performed the exercises taking into account the principle of achieving an individual maximum. Young men with a hypersthenic body type performed the exercises up to the maximum number of times. In addition, the following sequence was observed in one weekly microcycle: during the first lesson, a set of exercises was performed to develop strength abilities themselves; during the second lesson, a set of exercises was performed to develop dynamic strength endurance; During the third session, a set of exercises was performed to develop static strength endurance.

Results of the study and discussion. At the ascertaining stage of the pedagogical experiment, the use of M.V. Chernorutsky's methodology made it possible to identify body types in young men in the control and experimental groups. In the control group, 1 (9%) student was identified with an asthenic body type, while in the experimental group there were 2 (18%) students; with a normosthenic type, 4 (36%) students were found in the control group, while in the experimental group there were 4 (36%) students; with a hypersthenic type, 6 (55%) students were found in the control group, while in the experimental group there were 5 (46%) students. At the beginning of the study, no reliability was found in the control and experimental groups of high school students (for the 5% significance level). At the ascertain-

ing stage of the pedagogical experiment, the strength abilities of schoolchildren in the control and experimental groups corresponded to a low level compared to the normative ones. Analysis of the strength abilities results during the control stage will reveal statistically significant differences in all the studied indicators in the experimental group of young men (see the table).

The analysis of the strength training indicators of the young men obtained at the end of the experiment when compared with the normative ones revealed an average level and demonstrates higher growth rates in the experimental group compared with the control group.

Conclusions. The results of the pedagogical experiment demonstrated the effectiveness of the applied methodology and indicate positive dynamics of the experimental group's indicators. Thus, the growth rate in arm flexion and extension in a prone position was: in the experimental group – 15%; in the control group – 1,40%; the growth rate of torso flexion and extension from a supine position in 1 minute was: in the experimental group – 17%; in the control group – 3%; the growth rate in long jump from a place with a push with two legs was: in the experimental group – 14%; in the control group – 0,98%; the growth rate when holding the legs at an angle of 90° while hanging on a horizontal bar was: in the experimental group – 20%; in the control group – 1,27%; The growth rates in hanging with bent arms on a horizontal bar were: in the experimental group – 18%; in the control group – 1,33%.

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