

## Studying the Effectiveness of Physical Education in the Secondary School (by the Example of Kazakhstan)

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### ABSTRACT

The purpose of this study was to determine the effectiveness of the existing model of teaching physical training in secondary schools and the analysis of a game like method introduced to improve physical fitness of students. The authors substantiated the use of a game like method during physical training classes, which implementation should create prerequisites required for the optimization of physical development, physical preparedness and functional state of the student organism. Empirical research was based on the obtained difference in the level of physical training in the control and experimental groups. Students of the control group were trained according to the existing school curriculum. The experimental group was trained according to a modified program, which implied using the game like method and the increased number of training hours. The pedagogical experiment was carried out in three stages. Quantitative indicators were processed using two-factor variance analysis. The experiment was carried out among 1350 high school students. The application of two-factor variance analysis gave the possibility to determine that the curriculum-based physical training was favorable for the development of endurance, whereas the game like method was more suitable for the development of speed-strength and strength. Practical significance of the study lies in the fact that statistical data processing used by the authors of this research, will be helpful for coaches to verify the effectiveness of the existing curriculum in real time and to improve student sports achievements.

### KEYWORDS

Child development, physical education, student physical fitness level, teaching models of physical education, methods aimed at increasing physical activity

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### Introduction

Physical education is a very important component in child development (Maher, 2016; Darst, 2014; Balsevich, 2006). Physical activity directly affects the cognitive processes – excitation and increased secretion of neuropeptides increase the child's self-esteem and affect his/her mental activity at school (Trudeau & Shephard, 2010). The child should be able to organize his/her independent physical activity in order to take responsibility for his/her own learning (Gavrilov, Komkov & Malinin, 2005). In order to implement this approach, the school should provide an expansive version of physical education (Atencio et al., 2014).

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In recent years, sports, fitness and recreation are becoming more and more popular among secondary school pupils. Physical education becomes devalued since schoolchildren lose confidence and motivation to attend these classes (Siedentop, 1992). The majority physical education curricula in secondary schools are ineffective and cannot ensure the achievement of educational goals. A large number of students say that attending physical education classes cause strong negative feelings. Teachers report that the pedagogical conditions do not provide the possibility to achieve the goal of physical education. This problem cannot be solved by improving or upgrading the existing school programs: this requires complete replacement of the existing physical education model in the secondary school (Locke, 1992).

The resulting crisis of physical education in the secondary school is manifested in the loss of learning motivation in schoolchildren. The curriculum does not encourage youngsters to attend physical education lessons, both within the training sessions, and during extracurricular activities (Gavrilov, Komkov & Malinin, 2005). Designing the new curriculum should be based on the special needs of postmodern students. This entails rethinking the nature of physical education in the secondary school (Tinning & Fitzclarence, 1992).

The traditional class-lesson form of physical education, based on the standard, normative approach, no longer provides adequate compliance of pedagogical influences with the regularities related to physical development of students; PE teachers working within the system adequately organize theoretical and practical activities of students, demonstrating ineffective teaching activities (Bogdanov, 2007).

Physical education of schoolchildren in Kazakhstan is characterized by the following problems:

1. Being part of the traditional physical education system, implementation of educational objectives based on traditional class-lesson forms does not allow physical education teachers to provide motor action learning in accordance with the development of student motor skills and abilities. This is determined by the fact that implementation of the physical education curriculum provides only 25 minutes to solve one educational problem. In turn, this does not allow forming coordination abilities and motor skills, providing advanced culture of movements, their relaxedness and reliability (Vishnevskiy, 2003).

2. The traditional physical education system, based on the class-lesson form and standard-normative approach to the organization of PE lessons, virtually ignores individuality of each student and does not provide stimulated development of motor activity in schoolchildren. This approach creates a visible effect of good organization, it is self-sufficient, but it cannot provide effective pedagogical influence, with relevant educational and training effect of physical exercises and, consequently, in cannot implement the main task of physical education (Lubysheva, 2003).

3. Hence, there is another problem: if PE teachers are unable or cannot provide a PE class in accordance with the regularities of stimulated development of motor qualities (two or even three mandatory physical education lessons a week, along with a large number of annual vacation days do not provide continuity of training effects), they will not be able to teach the students to understand, and to continue using the said patterns in the organization of independent extracurricular PE classes. This results in the low

level of positive motivation to regular physical exercises, sports, and to healthy lifestyle in secondary school students (Sinelnikov, Hastie & Sychev, 2000).

4. Student PE system includes control actions that imply physical fitness tests as an important element.

However, one should keep in mind that physical exercise should have a stimulating effect not only on human motor skills, but also on the development of the basic systems and the entire body (Gavrilov, Komkov & Malinin, 2005). Physical activities that are not correlated with individual and typological characteristics of students may lead to overstrain, reduction of adaptive capacity and functional reserve mechanisms of autonomic regulation of the circulatory system (Khromin, 2005).

The above arguments necessitate replacement of control and regulatory student assessment system in the physical education process at school. Therefore, one can conclude that traditional class-lesson form of physical education, based on the standard, normative approach, no longer provides adequate compliance of pedagogical influences with the regularities related to physical development of students; PE teachers working within the system adequately organize theoretical and practical activities of students, thus demonstrating ineffective teaching (Dolzhikova, 2001).

This vision of the problem provides the possibility to consider a systematic, purposefully organized physical education in educational institutions as an effective means of correcting various deviations in health status of students and the need to improve its scientific and methodological foundations is regarded as an important factor in improving the quality of physical education.

The school should focus on the existing state curricula in the development and implementation of PE programs. Expertise in the field of physical education and training based on competencies can provide relevant methodology in the development of PE curricula (Sollogub, 2003).

Physical education in secondary schools should focus mainly on physical activity of students, which is aimed at preventing obesity and enhancing physical capacity. This objective can be realized by changing the professional education of teachers, which will focus on the interaction between the latest pedagogical approaches and the institutional and social conditions in which they work (McEvoy, Heikinaro-Johansson & MacPhail, 2015).

In addition, PE curriculum modeling should take into account the grade point system and the possibility of student satisfaction with PE classes. Curriculum development implies master approach that ensures predicting the possibility of take pleasure in doing physical exercises (Baena-Extremera & Granero-Gallegos, 2015).

### ***Background Paper***

Looking for ways to increase the effectiveness of physical education in secondary schools, some authors prefer sports-oriented physical education (Lubysheva 2002; Gråstén, 2015; Ulstad, 2016.). Conversion-like penetration of sports culture elements into the physical education promotes physical training of children and adolescents. This transformation in the school physical education methodology results in the improvement of physical fitness indicators, which is commensurate with the sports training level (Capel, 2010; Gordiyash, 2009).

This position became the basis for the creation of the new improved direction of mass physical training of children, adolescents and young people, which significantly improves the quality and effectiveness of educational technology in the field of cultural, physical, spiritual and moral education of the younger generation (Balsevich, 2006). This trend can be called sports-oriented, physical education. The school training sessions should be based on a training system. This concept creates preconditions for the involvement of students in the world of sports, their future sports achievements, allows considering the training process at the new level of personal enhancement of schoolchildren, which leads to a gradual transformation of physical education classes into the sports education classes.

Other innovative approaches to PE modernization are also interesting in terms of improving its culturological efficiency. These include "Spartan movement" aimed at humanization of physical education and sports (Stolyarov, 1997); the movement "Presidential competitions", created with a view to promote self-esteem culture of physical fitness in children and adolescents (Misharov, 1993; Goranko et al., 2006); "Olympic education", aimed at the development of Olympic values in students (Chedov, 2004); valeological vector of physical education, ensuring the development of healthy life style of the younger generation (Lubysheva, 2002); physical education, with emphasis on its historical-cultural content (Jakimovich, 2002) and other new or updated elements related to the organization and methodology of physical education (Salov, 2001; Romanovich & Svetovets, 2006; Gritskov, 2006).

Physical education, especially in primary and secondary school should be focused mainly on physical training. Its content implies teaching the basics of motor actions, sports, recreational motor activity, the psychophysical self-rehabilitation, increasing the proportion of intelligence in motor activity (Matveev, 2005).

The authors of this study adhere to a different position: increasing the effectiveness of physical education at school implies the shift from physical fitness, and bodily development to the development of health culture, healthy lifestyle by using means and methods of physical training (Kim, 2006; Peterson, Baker & McGaw, 2010).

The authors of this paper believe that modernization of sports education should start with rethinking of physical culture in the socio-cultural aspect. The unity of biological and social in a person is crucial for understanding the essence of sports education: physical and spiritual harmony presents the methodological basis of learning physical training values (Nikolaev, 2005).

Under the current socio-economic conditions, one should strengthen the system socio-cultural integration mechanisms of subject-content and organizational framework of sports education, taking into account regional

peculiarities of education activities, which provide holistic, harmonious development of young people (Bikmukhametov, 2004; Rafalovich, 2009)

Improving the efficiency of physical education at school is directly related to the compliance of human physical training conditions with the geographical environment, according to which physical education planning of different population groups should be based on a number of factors. These factors imply the following:

1. At preschool age, one should focus on cognitive methods; the game like method of physical training should be the most effective in this age group.

2. At primary school age, physical training should be focused on the development of functional physical abilities of schoolchildren, at the secondary school age – on the development of physical abilities and at the senior school age – on the development of physical qualities.

3. As regards students enrolled in secondary vocational and higher educational institutions, physical training should be aimed primarily at the improvement of qualities required by their professional profile (Nesterov, 1999).

Studies confirm that consideration of regional differences in living conditions as well as in individual needs and interests of children in many ways ensures the success of sports events in the physical training system of secondary school (Manor, 1996; Ponomarev, 2002).

The concept of school education (Zaitsev, 1998) considers physical education as the process aimed at the development and satisfaction of student dominant basic needs. Reform of physical education based on need-motivational sphere of students is aimed at the development of a certain hierarchy of needs that are most favorable to their health, physical self-development and self-improvement.

Development of physical culture and sports environment of educational institutions and its pedagogical potential, aimed at maintaining sports life style of students should be paramount in the modernization of sports education (Manzheley, 2005).

Four types of sports and sports lifestyle of the personality were determined (Gordiyash, 2009):

1. Operant-algorithmic – the bearer;
2. Vicar-reconstructive – the consumer;
3. Local-heuristic – the creator;
4. System– search – the screenwriter.

This concept aims at complementing the theory of physical training with culture the idea of physical education, based on a particular understanding of education as the interaction between a person and sports and physical training

environment, the individual as the subject of the environment, whose creative activity results in the transformation of this environment and his/her individuality (Khromin, 2005).

There are other approaches, suggesting the concept of personality-oriented physical education (Myzan, 1996; Sollogub, 2003). The key feature of this concept is personal enhancement, development of character, discipline, fortitude, as well as social and aesthetic education.

Improving the efficiency of physical education at school has been widely discussed in the studies, which consider issues about the need to increase the time required for physical activity and sports, providing conditions for the daily training exercises, student engagement in specialized sports clubs and their participation in various inter-school sports events (Luke, 2000). National health objectives will be achieved only provided the efforts of schools, society and political leaders made to give the young people opportunities to be engaged in physical activity (Ming, 2006). Strategies aimed at the development of physical activity in schoolchildren should be integrated within the family, at home, at the level of public organizations, keeping in mind important gender differences as factors associated with physical inactivity of youth (Boyle, Jones & Walters, 2008).

The expediency of extracurricular programs aimed at increasing the quantity and quality of physical activity in schoolchildren was substantiated (Moore et al., 2010). Researchers developed standards with a view to meet physical activity needs of schoolchildren in North Carolina. The programs reflect the following categories: program volume, time and intensity, opportunities, evaluation, training schedule, qualified staff and coaches, equipment. These programs are used for children with a high risk of insufficient physical activity, including ethnic minority children, poor areas, and children with physical disabilities or those who live in areas with limited physical activity (Maher, 2016).

Thus, we can conclude that modern system of physical education of children and adolescents needs radical transformation; optimal and purposeful physical activity has a positive effect on the student organism. Systematic, purposefully organized physical education process provides continuity in various educational institutions and has a significant impact on physical fitness improvement, physical development and functional state of the human organism. Proceeding from the conceptual provisions that contribute to a clear statement of goals and objectives, the authors of this paper opted for a game like method that can be used regardless of age, gender and physical fitness of students.

### ***Research purpose***

The purpose of this study is to identify the effectiveness of the existing model of teaching physical education in secondary schools, to analyze the introduction results of a game like method aimed at the improvement of student physical fitness, as well as the development of methods with the view of improving results of reaching school qualifying standards and the Presidential physical fitness tests.

### ***Research questions***

Research objectives include:

1. Development of the program with a view to process results of the Presidential physical fitness tests and the school qualifying standards on the subject "Physical Training".
2. Study of the physical education management in secondary schools in Aktobe.
3. Study of interconnection features of reaching PE school qualifying standards and results of the Presidential physical fitness tests.
4. Development of methodology aiming at the preparation of the 9th grade schoolchildren in Aktobe for reaching school qualifying standards and the Presidential physical fitness tests.

### Methods

The authors grouped research methods according to the objectives.

Solution of the first research problem required application of several methods. The "Control test" method was used to assess student results of reaching school qualifying standards and the Presidential physical fitness tests.

The method of "mathematical statistics" was used to calculate the following indicators:

"Arithmetic mean value"  $\bar{X} = \frac{\sum xi}{n}$ , where  $\sum$  – the summation sign;  $xi$  – sampling options;  $n$  – sampling volume,  $i$  – serial number (possesses values between 1 and  $n_i$ ).

$$\sigma = \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n-1}}, \text{ where } \sigma - \text{standard deviation,}$$

$V$  – variation coefficient

$$V = \frac{\sigma}{x} \cdot 100\%$$

The software (Frolov, 2009) was developed to process results of reaching school qualifying standards on the subject of "Physical Education" and the Presidential physical fitness tests. Before software development, the authors designated the tasks related to processing of the obtained data:

- 1) To determine the value of the arithmetic mean, standard deviation and variation coefficient;
- 2) To identify the difference between the results of the Presidential physical fitness tests and the national preparedness level;

3) To analyze the results of student physical fitness using the selected sample;

4) To determine the frequency of results in a given interval.

Solution of the second problem required the following methods. Pedagogical observation was used to identify usage of the planned material by the teacher. The analysis of documents gave the possibility to study planning: the annual schedule, lesson plans, notes (Teleugaliyev, Kulnazarov & Tayzhanov, 2002).

Solution of the third problem implied application of the following methods. Mathematical statistics was used to determine statistical indicators. Percentile scale graphics were used to identify differences between the Presidential physical fitness tests and school qualifying standards. The sequence of calculations was as follows.

The author compared the results of the school tests and the presidential physical fitness tests with regard to relevant ranks. For example, the best result was taken as 100%, i.e. the student who showed this result was ahead of all the rest. Other results were ranked pursuant to the following proportions:

$$\frac{n - 100\%}{z_i - x_i} \quad x_i = \frac{z_i \cdot 100\%}{n}$$

where

$n$  – the total number of all results;

$z_i$  – each result of each subsequent rank is decreased by 1 unit; for instance, given 48 results reached,  $z_i = 48 - 1 = 47$ ,

$x_i$  – percentage-wise evaluation of other results, besides the first one.

$$x_i = \frac{47 \cdot 100\%}{48} = 97,9\%$$

Development of the methodology aimed at the preparation of students for reaching school qualifying standards and the Presidential physical fitness tests and its experimental validation required the following methods: pedagogical experiment and two-factor variance analysis.

The study involved 1350 students of the 9<sup>th</sup> grade of secondary schools in Aktobe. The study was carried out in three stages:

The first stage (2013-2014) implied formation of scholarly apparatus.

In the second stage (2014-2015), the authors developed a software to process the results of reaching school qualifying standards on the subject "Physical Training" and the Presidential physical fitness tests. This stage also implied definition of specific features related to academic planning, and the relationship between the school results and results of the Presidential physical fitness tests.

In the third stage (2015-2016), the authors elaborated the methodology aimed at preparation of schoolchildren for reaching school qualifying standards and the Presidential physical fitness tests. This methodology was tested through the pedagogical experiment.



## Data, Analysis, and Results

The computer program intended for processing results of physical fitness tests (to be used by schoolteachers of physical training) provides tools to determine the individual and group characteristics of schoolchildren as well as to draw methodical conclusions related to the correction of physical qualities of schoolchildren.

Before the development of the program, the following tasks were identified:

- 1) to determine the arithmetic mean values, standard deviation, variation coefficient;
- 2) to determine the difference between the results obtained at the national and at the presidential level;
- 3) to analyze results obtained within the selected sample

Each school is provided with a database, containing such options as the value of standards, statistical parameters, and individual card of each student reflecting his/her results, etc. The program provides a graphic distribution of results in intervals with a view to determine frequency of occurrence of these results. Analysis of results showed that the highest frequency of results occurrence was within the range of improper national preparedness for the Presidential level.

The analysis of school results and the Presidential tests gave the possibility to identify the following regularities.

The first regularity consisted in the fact that the results of the school tests differed from the results of the Presidential tests. For example, the students of school No. 19 who took the test "pulling up on the bar" with a score of "10 times", were in the third place, and after taking the Presidential test with a score of 8.3 they were in 23rd place. The author considers the "psychological factor" effect relevant in this regard, that is, the Presidential test standards demand the students' full inner potential in the competition with their peers. One can also conclude that the required qualities of the schoolchildren were not brought up properly.

The second regularity was found during the study of interconnection between the percentage of students who took physical fitness tests at school getting the "excellent", "good" and "satisfactory" grades and the results of the Presidential tests. For example, as regards the test "Pulling up on the bar," the percentage of students from school No. 17, who got "excellent" and "good" grades, was rather high (79.1% and 10.4%, i.e. 89.5% of students got "good" and "excellent" grades). The students from school No. 22 also showed good results (42.5% and 36.1%, i.e. the total amount of "excellent" and "good" grades made 78.6%). Therefore, the author considers that high percentage of students who

got the "excellent" and "good" grades indicates the effective results of the Presidential tests.

The authors tried to identify the differences between the Presidential tests and the school qualifying standards by using percentile scale graphics. Following the recommended (by the school curriculum) standards for "pulling up on the bar," the "excellent" grade requires pulling 10 times, "good" grade – 8 times, "satisfactory" – 7 times. According to this evaluation, "excellent" results are within the range of 88-100% efficiency, "good" grades – 71-85%, and "satisfactory" – 65-75%.

According to the National Standards for Physical Education, the Presidential tests are compulsory for all students of secondary schools. Firstly, they should reach the national level. According to the Presidential test, national standard on the "pulling up on the bar" exercise makes 12 times the standard on "throwing the ball" – 50 meters. According to the percentile scale, the value of "pulling up on the bar" exercise corresponding to the national level set by the Presidential test (12 times and higher) and represents 100%. According to the curriculum, high value of this qualifying standard (higher than 10 times, which stands for the "excellent" grade) is within the range of 88-100% in the percentile scale graph.

Thus, percentagewise, the number of students who reached this qualifying standard with the "excellent" grade made 12% according to the percentile scale graph. If the strongest performance of students passing the Presidential test is considered through the prism of values corresponding to the "excellent" grade (i.e., 10 times), these results will be within the range of 80-100%, i.e., equal to 20%. Therefore, the authors of this research believe that the students need to make full use of their internal reserves when passing the Presidential tests; therefore, they need to train more frequently during their PE classes.

The impact of different teaching methods and ways of organizing the learning process on the development of physical training was studied through the pedagogical experiment, which involved the 9th grade students (boys) of secondary schools in Aktobe. Based upon the two-factor plan presented in Table 1, the author performed randomization sampling, which included 30 schools. Randomization was based on the use of random numbers. The number of the 9th grade students selected from one school made 15 persons; they were also selected by random numbers.

**Table 1.** Distribution of schools with regard to methods and study load

<i>Teaching methods</i>	<i>Study load</i>		
	3 classes per week	2 classes per week and 2 sectional classes	3 classes per week, 2 sectional classes
Traditional	5 schools (75 people)	5 schools (75 people)	5 schools (75 people)
Game like method	5 schools (75 people)	5 schools (75 people)	5 schools (75 people)

Thus, 15 schools used the traditional teaching method, which was based on the school curriculum. The student's study load was distributed as follows. 5 schools held 3 classes per week, 5 more schools held 2 classes and 2 sectional classes, and the other 5 schools held 3 classes and two sectional classes. Sectional classes were also held pursuant to the curriculum.

The other 15 schools used the gaming method of teaching. As shown by the table, the distribution of study load was the same as in schools, where traditional methods of learning were used. The game like method was also used during the sectional lessons.

The experiment was conducted during the 2015-2016 academic year. At the end of the school year, the students took several fitness tests: the stamina test – long-distance running (2000 meters); the speed-strength test – tennis ball throwing and the strength test – pulling up on the bar. The two-factor variance analysis based on the obtained indicators is shown in Table 2.

The results of the two-factor variance analysis of the teaching methods and study load impact on stamina, speed-strength qualities and strength, are shown in Tables 3, 4, 5.

In each of the three variance complexes the adjustable factor "A" had two gradations:  $a_1$ – the traditional method of teaching;  $a_2$  -gaming method of teaching, and the adjustable factor "B" had 3 gradations:  $b_1$  – 3 classes per week;  $b_2$  – 2 classes per week and two sectional classes;  $b_3$  -3 classes per week and 2 sectional classes.

**Table 2.** The average physical qualities in the two-factor variance complex

Teaching method			"B" factor gradation (study load)								
			b <sub>1</sub> - 3 classes per week		b <sub>2</sub> - 2 classes per week and 2 sectional classes		b <sub>3</sub> - 3 classes per week and 2 sectional classes				
Factor gradation	$a_1$ - traditional	Long-distance running (2000 meters), min	9,7	9,8	8,9	9,1	9,0	9,0	8,4	8,0	8,4
	$a_2$ - game like		9,8	9,3	9,1	8,6	8,5	8,6			
Factor gradation	$a_1$ - traditional	Tennis ball throwing, meters	10,3	12,0	10,3	10,0	9,9	10,0	9,6	9,3	9,3
	$a_2$ - game like		10,4	10,1	10,0	10,1	9,5	9,7			
Factor gradation	$a_1$ - traditional	Pulling up on the bar, times	32,5	32,4	20,7	32,5	32,4	20,7	39,5	37,4	36,0
	$a_2$ - game like		33,4	32,3	33,4	32,3	36,2	36,8			
Factor gradation	$a_1$ - traditional	Pulling up on the bar, times	41,2	40,9	40,7	43,8	42,2	45,0	45,5	41,9	46,7
	$a_2$ - game like		40,8	41,3	46,6	42,9	41,3	47,1			
Factor gradation	$a_1$ - traditional	Pulling up on the bar, times	7,1	7,8	7,0	8,3	8,2	8,4	9,0	8,7	9,1
	$a_2$ - game like		7,8	7,2	7,9	8,3	9,0	9,6			
Factor gradation	$a_1$ - traditional	Pulling up on the bar, times	8,5	8,0	8,0	11,5	9,5	9,8	11,7	9,5	11,8
	$a_2$ - game like		8,1	8,1	9,6	10,0	10,3	9,5			

Table 3 shows that stamina is largely determined by both factors. The increased stamina of the 9th grade students was largely determined both by the method of teaching ( $F_f = 11,36 > F_{0,01} = 7,82$ ), and by different study load ( $F_f = 4,1 > F_{0,05} = 3,4$ ). Moreover, the impact of factor "A" (teaching methods) is more meaningful. Assessing the impact of factors and methods shows that the impact

of factor "A" makes 34.5%, while the impact of factor "B" makes 15.5%. The share of non-regulated (unreported in the experiment) factors makes 60%. Comparison of teaching methods shows that the traditional methods had greater impact on stamina improvement. The average indicators of the long-distance running (2000 m., in minutes) given the traditional training method were significantly lower than during the use of the gaming method ( $F_{a1/a2} = 5,85 > F_{0,05} = 2,04$ ).

**Table 3.** Results of the two-factor variance analysis of the impact of different teaching methods and study load on the stamina development

Sources of variation	Degrees of freedom, <i>df</i>	Sums of squares, <i>SS</i>	Middle squares, <i>MS</i>	$F_f$	$F_{st}$	
					0,05	0,01
Factor A	1	8,86	8,86	11,36	4,26	7,82
Factor B	2	6,39	3,2	4,1	3,4	5,61
A-B interaction	2	0	0	0	3,4	5,61
Inside the cells	24	18,83	0,78	-	-	-

Considering the effect of different amounts of study load, one should note that the highest degree of stamina was achieved in schools where 3 classes and two sectional classes were held (graduation  $b_3$ ). These schools significantly surpassed schools, which held only 3 classes ( $F_{b1/b3} = 3,25 > F_{0,05} = 2,58$ ). There were no differences between schools where 3 classes (graduation  $b_1$ ) and schools where 2 classes and 2 sectional classes (graduation  $b_2$ ) were held ( $F_{b1/b2} = 1,68 < F_{0,05} = 2,58$ ). Also, there were no differences between schools, which held sectional classes, i.e. gradations between  $b_2$  and  $b_3$  ( $F_{b2/b3} = 1,56 < F_{0,05} = 2,58$ ). Other schools showed no differences as regards stamina level. No interaction between the teaching methods and study load was detected ( $F_f = 0 < F_{0,05} = 3,4$ ).

The variance analysis presented in Table 4, shows that only teaching methods had an impact on the development of speed-strength qualities ( $F_f = 14,57 > F_{0,01} = 7,82$ ). This impact makes 47,5% ( $h^2_A = \hat{S}^2_A : S^2_y = 34,55 : 72,74 = 0,475 \times 100\%$ ). The share of non-regulated factors is 52.5%. Significant difference in indicators between the gradations of factor "A" ( $F_{a1/a2} = 6,68 > F_{0,05} = 2,04$ ) demonstrates that the gaming method is more favorable for the development of speed-strength qualities than the traditional one.

The difference in the number of traditional classes and sectional classes had no significant effect on the level of speed-strength qualities ( $F_f = 2,1 < F_{0,05} = 3,4$ ). The combined effect of teaching methods and study load was also insignificant ( $F_f = 0,25 < F_{0,05} = 3,4$ ).

**Table 4.** Results of two-factor variance analysis of the impact of different teaching methods and study load on the development of speed-strength qualities

Sources of variation	Degrees of freedom, <i>df</i>	Sums of squares, <i>SS</i>	Middle squares, <i>MS</i>	$F_f$	$F_{st}$	
					0,05	0,01
Factor A	1	556,42	556,42	14,57	4,26	7,82
Factor B	2	160,22	80,11	2,1	3,4	5,61
AB Interaction	2	18,82	9,41	0,25	3,4	5,61
Inside the cells	24	916,67	38,19	-	-	-

Considering the impact of adjustable factors "A" and "B" on the strength increase (number of pull-ups on the bar), Table 5 shows significant influence of both teaching methods and study load. The accuracy of the impact related to the traditional and gaming methods reaches 95%. ( $F_f = 7,18 > F_{0,05} = 4,26$ ). The impact of the study load amount reaches 99%. ( $F_f = 5,67 > F_{0,01} = 5,61$ ). The significance of these factors makes 21.9% for teaching methods and 24.8% for the study load. The impact of unregulated factors makes 53.3%.

**Table 5.** Results of two-factor variance analysis on the effect of different teaching methods and study load for the development of strength qualities

Sources of variation	Degrees of freedom <i>df</i>	Sums of squares <i>SS</i>	Middle squares <i>MS</i>	$F_f$	$F_{st}$	
					0,05	0,01
Factor A	1	14,01	14,01	7,18	4,26	7,82
Factor B	2	22,09	11,05	5,67	3,4	5,61
Interaction AB	2	1,55	0,78	0,40	3,4	5,61
Inside the cells	24	46,83	1,95	-	-	-

Considering the impact of traditional and game like methods on the strength increase, it should be noted that in this case the playing method has more advantages. The sum of the average number of pull-ups in schools where the gaming method was used makes 28.78 times, while in schools where traditional methods were used, this sum made 24.78 times. The significance of differences made 95% ( $F_{a1/a2} = 4,52 > F_{0,05} = 2,04$ ).

Analyzing the effect of different training load amounts, it should be noted that schools, which held three physical education classes and two sectional classes demonstrated the most substantial progress in increasing strength qualities. However, as in the case of stamina, significant superiority was displayed only with regard to the schools, which held only traditional classes. ( $F_{b1/b3} = 3,81 > F_{0,05} = 2,58$ ). In other cases no significant difference was shown ( $F_{b1/b2} = 2,56 < F_{0,05} = 2,58$ ;  $F_{b2/b3} = 1,25 < F_{0,05} = 2,58$ ).

Summarizing the results of the variance analysis one can note the following. Various teaching methods differently affect the development of various physical qualities. Physical exercises, based on the school curriculum (the traditional method of teaching) are more favorable for the development of stamina, while the gaming method is more suitable for the development of speed and speed – strength qualities. In addition, the improvement in physical characteristics affect the number of organized activities. Greater effect in the development of physical qualities could be achieved through holding more classes. Even holding three classes per week is insufficient to hit the qualifying standards of the Presidential tests.

Based upon the detected regularities, the authors developed the methodology aimed at preparing students for reaching school qualifying standards and taking the Presidential physical fitness tests. In this regard, one should consider the following: a) the use of game like method as the main one in terms of student motivation development; b) improvement of the students' independent work; c) rationalization of the sequence content of planning documents and providing cumulative effect as regards the implementation of the program material; g) effective use of different forms of physical training (in this case, three PE classes per week + two section classes per week + independent physical exercises); e) the use of student achievement cards.

### Discussion and Conclusion

A similar study aimed at the analysis of relationship between the effective content of PE classes and the level of regular physical / sporting activity in schoolchildren from the region of Murcia (Spain) (Rodriguez et al., 2013). The method of random sampling was used to study 1120 schoolchildren aged between 10 and 12 years. The results showed that both for boys and girls, effective content of PE classes is a variable, which is largely associated with the increase in the overall level of regular physical activity in schoolchildren.

H. Little, and N. Sweller (2015) surveyed 245 centers across Australia with the view of determining motor abilities and physical activity. The factors that limit the opportunities for challenging, physically active games included regulatory restrictions on the recommended height limits, on the climbing equipment and the lack of space for games. Open spaces and support of teachers were identified as important factors in the prevention of injuries.

Scientists from Belgium investigated the changes in the objective evaluation of weight and optimal weight values for student health and behavior during transition from high school to college (university), as well as the impact of changes in student behavior or health on weight change (Deforche et al., 2015). Physical activity and participation in sports activities decreased. It was found that some types of passive motor actions (watching TV, computer games) were reduced, while the other (using the Internet, the study) were increased.

A. Arriscado, et al. (2015) analyzed the impact of a healthy environment in primary schools in Logroño (La Rioja, Spain) on student habits. Physical activity was higher among boys – due to extracurricular activities, training of teachers, as well as access to sports grounds. The authors believe that the introduction of adjustments to the PE planning at school can greatly affect the habits of students at the fundamental stage in their development.

The use of two-factor variance analysis, which was used in this study, gave the possibility to study the effect of strength training on the spontaneous motor activity of children in Switzerland (Meinhardt et al., 2013). The study involved 102 students, aged 10-14. The authors concluded that the target strength training might be a promising strategy in schools to counteract the decrease in physical activity.

J. Mantjes et al. (2012) using the sample of 839 British children aged 9-10 years investigated the impact of school activity factors on their physical activity. According to these researchers, safe movement in the morning while walking or cycling to school can play an important role in the implementation of physical activity of children.

One should also note that the present research findings are relevant to the findings obtained by S. Mandic et al. (2012) as regards the connection between social and demographic conditions and the biological characteristics of the 1837 secondary school students from 23 schools in the region of Otago (New Zealand) and the time spent by them on sports activities. Analysis of the results showed that the highest participation in sporting events had been observed in schools with a high level of physical activity of schoolchildren.

The level of physical fitness of students in relation to their level of physical development was also studied by the Brazilian scientists (Pelegriani et al., 2012). Analysis of results showed low physical fitness, especially in terms of flexibility, muscular strength and cardiorespiratory system.

The authors of this research believe that the Republic of Kazakhstan can use the following patterns of foreign experience:

1) Physical fitness presents not only the integrated background of the functional state of the human body, but also an important indicator for health promotion;

2) Effective content of PE classes is a variable, which is largely associated with the increase in the overall level of regular physical activity at school;

3) Target strength training significantly increases spontaneous daily physical activity in boys;

4) High performance in terms of participation in sports competitions are marked in schools with a high level of physical activity of schoolchildren.

Improvement of training standards aimed at preparing students for taking physical fitness tests at school and the Presidential physical fitness tests require understanding the scientific and theoretical background of their interrelation. Among them, one should note the following:

– On the one hand, over the last 20 years one might notice an increase in quantitative indicators of training standards in physical education curricula, however on the other hand their content was not subject to qualitative changes as regards the increase in the number of lessons;

– To date, the interrelation between the Presidential tests and the school tests is poorly substantiated as compared with the previous practice related to the metrological substantiation of the school physical fitness standards and the GTO complex standards;

– In the Republic of Kazakhstan, not all students meet the national readiness standards of the Presidential tests. One of the problems here is a relatively weak methodology related to training aiming at the preparation for taking the Presidential physical fitness tests.

Development of the program aimed at processing the results of both tests require knowledge of the following basic rules related to its development and further interpretation of the obtained data:

- The data to be processed is interrelated with the processing tasks;
- Technical skills are required to interpret the results in accordance with the tasks;
- The developed program allows getting timely information on each student, class, and the school related to their preparedness for taking physical fitness tests at school and the Presidential physical fitness tests;
- Graphical display of the students' results through using the histogram gives the possibility for specialists to determine physical abilities of schoolchildren and to correct deficiencies, if any.

The analysis of test results at school and the Presidential tests gave the possibility to identify the following regularities.

- The results of the school tests differed from the results of the Presidential tests.
- There is a distinct interconnection between the percentage of students who took physical fitness tests at school getting the "excellent", "good" and "satisfactory" grades and the results of the Presidential tests.
- High percentage of those schoolchildren who got the "excellent" and "good" grades is one of the factors of effective taking the Presidential physical fitness tests.

The use of two-factor variance analysis gave the possibility to determine that physical exercises, based on the school curriculum (the traditional method of teaching) are more favorable for the stamina development, while the gaming method is more suitable for the development of strength and speed-strength qualities. Greater effect in the development of physical qualities could be achieved through holding 3 traditional and 2 sectional classes per week.

The methodology of preparing students for reaching school qualifying standards and taking the Presidential physical fitness tests should be based on the following:

- 1) Use of a game like method;
- 2) Improvement of student independent work;
- 3) Rationalization of content consistency in the planning documents along with cumulative effect as regards implementation of the material during each lesson and a quarter;
- 4) Effective use of PE planning forms.

Reliability of the obtained results is determined by the use of several theoretical and empirical methods that correspond to the research subject, as well as by experiment using a representative sample.

### **Implications and Recommendations**

The authors of this study identified specific features of relationship between the student results related to reaching qualifying standards at school and the Presidential physical fitness tests and provided universal guidelines for the implementation of the above results.



In addition, based on the experimental results, the authors developed and justified the methodology aiming at student preparation for reaching qualifying standards at school that can be used in modern teaching practice.

This study does not cover all aspects of the problem. Further studies might focus on the development of universal techniques with a view to monitor physical activity of schoolchildren, as well as on the application of innovative student-centered learning principles with a view to increase the level of student physical activity.

### Disclosure statement

No potential conflict of interest was reported by the authors.

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