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



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

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




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

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




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


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

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# The Relationship between Leisure Satisfaction and Hopelessness

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## Abstract

The study aims to determine whether there is a significant difference between the satisfaction and hopelessness levels of individuals in leisure activities by certain variables. The study sample consisted of 250 volunteer students, 143 (% 62.4) males, and 107 (% 37.6) females, studying at Istanbul University-Cerrahpaşa Faculty of Sport Sciences. The participants were selected by random sampling method. Data collection instrument of the study involved a personal information form, the "Leisure Satisfaction Scale (LSS)" developed by Beard and Raghep (29) and adapted into Turkish by Gökçe and Orhan (30), and "Beck Hopelessness Scale (BHS)" that was developed by Beck et al. (31) and adapted into Turkish by Seber et al. (32). Since the Kolmogorov-Smirnov test results revealed that the study data did not show a normal distribution, it was analyzed using T-Test, ANOVA, and Pearson Correlation Test. Significant differences were found between the LSS sub-dimensions by gender and department of the participants. Similar differences were also seen between the BHS sub-dimensions by gender. Besides, there was a significant negative relationship between LSS and BHS. It was concluded that leisure satisfaction and hopelessness levels vary by certain variables, and as satisfaction in leisure time increases, hopelessness decreases.

**Keywords:** Leisure, Leisure Satisfaction, Hopelessness.

## 1. Introduction

Recent developments in technology and changes in the modern lifestyle have influenced agents' social environments and habits (1), which leads to a particular interest in leisure activities. (2). The research revealed that leisure contributes to protecting physical, cognitive, social, and emotional health and prevents the emergence of adverse outcomes. Leisure is not the only period when a person acts productively. However, the sense of freedom accompanying leisure is also a factor that a person subjectively makes the best sense of that period (3). Leisure activities allow people to voluntarily participate during the remaining time except for their work (4).

Yang (5) indicated that leisure activities help agents improve mental and physical health, increase participation in teamwork, develop creativity and productivity in daily life. Although leisure goals are diverse, the common goal is to be satisfied and gratified during leisure activities (6). Amestoy et al. (7) stated that leisure satisfaction is a complex human need met by the production and consumption of enjoyable experiences. In other words, it is closely related to the perceptions about leisure quality. In general, it refers to the pleasure and contentment with leisure activities (8). According to Chick et al. (9), leisure satisfaction is a function of the difference between conditions individuals think they deserve, expect or desire and the actual experiences.

Hope refers to the minimum expectations in achieving a future goal (10). Hopelessness can be explained as the absence of expectations for a specific outcome (11). A pessimistic point of view characterizes hopelessness and negative expectations for the future and generally involves the generalization of such an unfavorable perspective (12). Hopelessness and despair generally occur due to the interrelations between specific cognitive processes (13). According to the American Psychological Association (1997), the causes of hopelessness involve the followings:

- The loneliness that stems from the restriction of the activities,
- A health problem,
- Stress,
- Loss of faith in God (13).

In the literature, there have been several studies on leisure satisfaction (14-15-16-17-18-19-20-21-22-23) and hopelessness (24-10-25-26-27). However, there are very few studies addressing the relationship between leisure satisfaction and hopelessness. Hence, the current study aimed to clarify the relationships between leisure satisfaction and hopelessness.



## 2. Method

### 2.1. Research Model

The quantitative method is an objective research approach based on observation or measurement that can be repeated (28). A quantitative research method- a scanning model- was used in the study.

### 2.2. Research Group

The group consisted of 250 students, 143 (57.2%) males and 107 (42.8%) females, studying at Istanbul University-Cerrahpaşa Faculty of Sport Sciences. The participants were chosen by the random sampling method.

### 2.3. Data Collection Tools

Personal Information Form consists of four items to collect information about the gender, department, and welfare.

Leisure Satisfaction Scale (LSS) was developed by Beard and Raghep (29) to assess leisure satisfaction and adapted into Turkish by Gökçe and Orhan (30). The 5-point Likert type scale includes 24 items and six sub-scales (Psychological, Educational, Social, Relaxation, Physical, Aesthetics). The Cronbach alpha coefficient of the scale was .90.

Beck Hopelessness Scale (BHS) was developed by Beck et al. (31) and adapted to Turkish by Seber et al. (32). The tool assesses negative expectations for the future. It includes 20 items and three sub-scales (Feelings about the Future, Loss of Motivation, Future Expectations). The minimum score in the inventory is 0; the highest point is 20. High scores indicate a high level of hopelessness. The Cronbach alpha coefficient was .85 for the total scale; .78 for the "Feelings about the Future"; .72 for the "Loss of Motivation," and .72 for the "Future Expectations" sub-scales.

### 2.4. Data Analysis

The analysis was carried out with SPSS 20.0 package program. The percentage and frequency methods were used to describe the distribution of personal information. A Kolmogorov-Smirnov normality test was conducted to determine whether the data collected via an online Google Form had a normal distribution, and the test results indicated the unavailability of a normal distribution. After the normal distribution of the data was ensured, T-test and ANOVA tests were performed. Pearson Correlation test was also used for correlation analysis.

## 3. Results

*Table 1. Demographic Information of Participants*

		f	%
<b>Gender</b>	Male	143	57.2
	Female	107	42.8
	<b>Total</b>	250	100.0
<b>Department</b>	Physical Education and Sports	92	36.8
	Coaching	75	30.0
	Sport management	83	33.2
	<b>Total</b>	250	100.0
<b>Welfare Status</b>	High	33	13.2
	Medium	167	66.8
	Low	50	20.0
	<b>Total</b>	250	100.0

Table 1 shows the demographic information about the participants. According to the table, 57.2% were "male", and 42.8% were "female". Among them, 36.8% studied at the department of "Physical Education and Sports Teaching," 30% at "Coaching," and 33.2% at "Sports Management." 13.2% had a "high," 66.8% had "normal," and 20% had "low" level of welfare.

*Table 2. T-Test Results between LSS-BHS Sub-Dimensions by Gender*

		N	Ort.	Ss.	Sd.	t	p
<b>LEISURE SATISFACTION SCALE (LSS)</b>	Male	143	3.65	0.69	248	2.449	<b>.000*</b>
	Female	107	3.80	0.66			
<b>Psychological</b>	Male	143	3.37	0.88	248	.352	.851
	Female	107	3.64	0.87			
<b>Educational</b>	Male	143	3.62	0.89	248	1.988	<b>.003*</b>
	Female	107	3.80	0.81			
<b>Social</b>	Male	143	3.58	0.85	248	2.205	<b>.004*</b>
	Female	107	3.85	0.79			
<b>Relaxation</b>	Male	143	3.86	0.79	248	2.485	<b>.000*</b>
	Female	107	3.97	0.80			
<b>Physical</b>	Male	143	3.43	0.87	248	2.374	<b>.010*</b>
	Female	107	3.68	0.85			
<b>Aesthetic</b>	Male	143	3.67	0.78	248	1.115	<b>.000*</b>
	Female	107	3.88	0.75			
<b>BECK HOPELESSNESS SCALE (BHS)</b>	Male	143	5.45	3.91	248	4.385	<b>.000*</b>
	Female	107	7.38	3.17			
<b>Feelings about the Future</b>	Male	143	2.35	1.31	248	-.135	.894
	Female	107	2.22	1.43			
<b>Loss of Motivation</b>	Male	143	3.87	2.30	248	-2.815	<b>.010*</b>
	Female	107	4.81	2.89			
<b>Future Expectations</b>	Male	143	2.87	1.38	248	5.684	<b>.000*</b>
	Female	107	1.83	1.45			

Table 2 presents the T-test analysis results between LSS and BHS sub-dimensions by gender. As seen in the table above, there was no statistically significant difference between the "psychological" sub-dimension ( $t_{(248)} = .352$ ,  $p > 0.05$ ) by gender; but meaningful differences were found in "educational" ( $t_{(248)} = 1.988$ ,  $p < 0.05$ ), "social" ( $t_{(248)} = 2.205$ ,  $p < 0.05$ ), "relaxation" ( $t_{(248)} = 2.485$ ,  $p < 0.05$ ), "physical" ( $t_{(248)} = 2.374$ ,  $p < 0.05$ ), and "aesthetics" ( $t_{(248)} = 1.115$ ,  $p < 0.05$ ) sub-dimensions.

Besides, no statistically significant difference was found between the "feelings about the future" sub-dimension ( $t_{(248)} = -.135$ ,  $p > 0.05$ ) by gender, but a statistically significant difference was seen in "loss of motivation" ( $t_{(248)} = -2.815$ ,  $p < 0.05$ ) and "future expectations" sub-dimensions ( $t_{(248)} = 5.684$ ,  $p < 0.05$ ).

*Table 3. Relationships between Leisure Time Satisfaction and Hopelessness*

		Leisure Satisfaction
<b>Hopelessness</b>	r	-.205
	p	<b>.000*</b>



Table 3 describes the relationships between the participants' leisure satisfaction and hopelessness levels. According to the analysis, there was a negative and low-level correlation between leisure satisfaction and hopelessness ( $p < 0.05$ ) ( $r = -0.20$ ).

## 5. Discussion and Conclusion

This study aimed to describe leisure satisfaction and hopelessness levels by certain variables and clarify the relationship between leisure satisfaction and hopelessness.

According to the analysis, there was a statistically meaningful difference between leisure satisfaction by gender. In terms of the sub-dimensions, a significant difference was found between all sub-dimensions except the "psychological." It was observed that the mean scores of the female participants were higher than the male participants in those sub-dimensions. In other words, women got higher satisfaction during leisure activities than men. The studies in the literature also revealed that the participants achieved satisfaction during leisure activities in at least one sub-dimension, which is in parallel with the current findings (15-14-23-16-33-34).

A statistically significant difference was also seen in "loss of motivation" and "future expectations" sub-dimensions, except for "feelings about the future" by gender. Besides, a significant difference was measured in the total hopelessness scores by gender. It was determined that females' hopelessness scores were higher than males, so it can be inferred that women were more hopeless about the future than men. Özben and Argun (25) and Gençay (24) also emphasized a significant difference in the "loss of motivation" sub-dimension by gender, which shows similarity with the current findings. However, some studies found no significant difference (10-35).

There was a significant difference in the "social" sub-dimension by the departments of the participants. The students at the "coaching" department had a higher average than the students at other departments, which refers to a high level of leisure satisfaction. Kayabaşı et al. (36) also revealed a significant difference by department variable. Those results were parallel with the current findings. On the other hand, no significant difference was measured in hopelessness levels by the department. Kırımoglu (26) also found no significant difference by the department variable.

The primary purpose of the study was to determine whether the leisure satisfaction levels of individuals affected their future expectations. The analysis results highlighted a negative and low-level relationship between leisure satisfaction and hopelessness scores of the participants. It was concluded that a high level of leisure satisfaction leads to less hopelessness. In this sense, previous studies have shown that leisure satisfaction enhanced the well-being of people (37), job satisfaction (38), life quality (39), motivation (40), and relieving depression (41) and loneliness (23). Thus, it can be stated that leisure satisfaction reduces hopelessness about the future.

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## From Myth to Reality: Resistance Training in Children

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### Abstract

Children have been participating in sports with the increasing numbers day by day. With the increasing rivalry, they are trying to find the ways to improve their performance to the best possible. As a result, the number of children who are adding resistance training to their training routines is also increasing. This raises myths about the harmful and risky nature of resistance training on children with many questions about its safety and effectiveness. Recent studies can remove doubts about the risk of injury, uselessness and ineffectiveness. With the proves from many studies for some decades, it is now accepted that properly controlled and supervised resistance training during childhood is not only safe and effective but also recommended by the world's leading healthcare and sports organizations for improving health and athletic performance. In the light of the scientific data, possible benefits, risks and application areas of resistance training for child athletes are discussed in this review.

**Keywords:** Resistance training; athletic performance; child athlete; adolescent.

### Introduction

Resistance training refers to the type of exercise that requires the muscles to contract against the opposite force created by some type of resistance. The resistance can be created by body weight, free weights, weight machines, hydraulic machines, elastic tubes, bands etc. If resistance is created through weights or specific machines, the term 'weight training' can also be used in the same sense. Strength training, on the other hand, is used in a broader sense and refers to any type of training used to increase physical strength.<sup>1</sup> Resistance training is one of the most popular and effective methods of increasing sportive performance and is widely practiced by high school, university and professional athletes.<sup>2</sup> Resistance training is known to increase the strength of adults and this improvement has been shown to arise from muscle hypertrophy, structural changes in muscle fibers, and neuromuscular and metabolic adaptations.<sup>3-5</sup> However, resistance training in children is a controversial topic. In early studies on the effects of resistance training on children, it was reported that these adaptations could not be seen, mainly due to insufficient androgen in the circulation.<sup>6,7</sup> Furthermore, resistance training hasn't been recommended for children and adolescents for a long time for its possibility of causing injuries.<sup>8</sup>

Clinicians once considered open growth plates in children as a definite contraindication for resistance training due to the risk of injury to the growing sensitive bones. In fact, the American Academy of Pediatrics reported that it would be impossible to increase strength or muscle mass in prepuberty due to the lack of circulating androgen hormones, making weight lifting an unnecessary risk for children.<sup>9</sup>

The fear that resistance training will damage the growth plate is not supported by scientific studies; on the contrary, the mechanical stress on the growth plate caused by resistance training or high-intensity sports such as weightlifting has been shown to be beneficial in bone formation and development.<sup>10-16</sup> In addition, there is no scientific evidence that resistance training can adversely affect the linear development of the bone or cause short stature in adulthood.<sup>17,18</sup>

In light of all these studies, the traditional fears and false concerns that resistance training will damage the developing skeleton have been replaced by reports stating that childhood may be an opportunity to create bone mass and improve bone structure through physical activities that contain weights.<sup>19,20</sup>

Children must have sufficient muscle strength to be competent in basic movement skills.<sup>21</sup> Insufficient muscle strength leads to difficulties in basic movement skills at an early age and as a result, physical and psychosocial problems may develop in participating in physical activities in adolescence and adulthood.<sup>22</sup>

### Effects on Athletic Performance

Besides the arguments that resistance training will increase the risk of injury in children, there is also debate about the effectiveness of resistance training. It has long been known that resistance training can



increase strength and hypertrophy in adults. Despite increasing evidence that resistance training in children can lead to enhance performance by improving strength, speed, power, and other related features, the degree of hypertrophy due to androgen hormone deficiency especially in prepubertal children has been a matter of debate among researchers.<sup>23-26</sup>

Recent studies clearly show that appropriate resistance training improves strength and strength-related features at all ages.<sup>1,27</sup> It has been clearly demonstrated that well-designed and well-supervised resistance training can make significant improvements in muscular fitness even in 5-year-olds.<sup>28,29</sup>

The strength increase seen in prepubertal children seems to be related to the development of the central nervous system rather than hypertrophy.<sup>30</sup> Especially the increase in motor unit participation, firing frequency, synchronization and improvement in neural myelination increase the neuromuscular performance.<sup>31,32</sup> For this reason, trainers working with prepubertal children should avoid training methods aimed at increasing muscle mass, and focus on strength development and movement ability.<sup>33</sup> In adolescence, in addition to neural development, structural changes due to testosterone, growth hormone and insulin-like growth factor 1 (IGF-1) increase are also of great importance.<sup>30</sup> Accordingly, while the gender effect is observed to be minimal in absolute and relative strength gains with resistance training in prepubertal children, the gender effect and gender-related strength difference are more pronounced as the age progresses.<sup>33,34</sup>

Strength training in adolescent soccer players has been shown to improve maximal strength and muscular endurance and provide better body composition, and different types of resistance training (daily wavy, linear) have similar effects on maximal strength in adolescents.<sup>36,37</sup>

In the literature, gains in maximum strength vary between 10 to 70% depending on different factors such as training program type, duration, and exercise type used for strength measurement. Usually, sedentary children typically have 30-40% expectation of strength gain with the beginner's program.<sup>38</sup>

In addition, fundamental motor skills like jumping, running, hopping etc. as main locomotor skills and object control skills like kicking, catching, throwing etc. must be gained by the end of adolescence.<sup>39</sup> Recent studies have shown that resistance training improved power generation, jumping, sprinting and agility performances in pre and post-pubertal children.<sup>1,22,40-43</sup>

### Effects on the General Health

In addition to its positive effects on the athletic performance, studies have shown many other benefits of resistance training in terms of protecting and improving health. Results of studies conducted with resistance training in obese children are promising in terms of combating childhood obesity. In these studies, positive effects on the general body composition<sup>44</sup> in obese children, abdominal and body fat decrease<sup>45</sup>, insulin<sup>46</sup> and leptin<sup>47</sup> sensitivity increase in overweight adolescents, improvements in cardiac functions<sup>48</sup> and improvement in self-perception in obese children were shown.<sup>49</sup> It has also been reported that the participation of overweight and obese children in resistance training can increase their muscle strength, motor coordination and self-confidence in the physical activity.<sup>44</sup>

In addition, it has also shown positive effects in the development of body composition<sup>50</sup>, preventing and treating sports-related injuries<sup>22,51</sup>, long-term protection of the health, cardiovascular fitness and blood lipid profiles in healthy children and child athletes.<sup>22,51-52</sup> Besides its benefits on the physical health, different studies have shown that resistance training improves children's self-confidence and has positive effects on their psychological health.<sup>50,53,54</sup> It has also been reported that resistance training in the form of CrossFit training can improve mental health in adolescents with risks of psychological disorders.<sup>55</sup>

As the positive effects of resistance training on strength and physical performance emerged, private patient groups were also started to be studied. There have been many studies recently on the effects of resistance training on children with cerebral palsy. As a result of these studies, although its effects on mobility are controversial, positive effects on muscle strength, general functions and mood were reported.<sup>56-58</sup>

Contrary to the historical belief that resistance training in children will increase the risk of injury, recent studies have revealed that resistance training can prevent sports-related injuries in child athletes.<sup>59-62</sup> It has been reported that focusing on risk factors for sports-related injuries (such as low fitness levels, muscle imbalances, training errors) resistance training can reduce overuse injuries by up to 50%.<sup>63,64</sup>

In addition to all these, studies conducted in different countries show that strength parameters in

children tend to decrease gradually in time.<sup>65-67</sup> Well-designed and properly followed resistance exercises can be applied as an effective method to prevent this undesirable tendency.<sup>38</sup> Resistance training is especially important as it can be taken up by all children regardless of their individual abilities and body composition.<sup>37,68</sup> Physical education teachers, child fitness specialists, healthcare professionals and trainers working with child athletes should know the basic principles of child development and plan their exercise prescriptions to meet the individual needs of the child and independent of the chronological age due to the individual nature of growth and development.<sup>38</sup>

Despite all these positive effects, it is vital to ensure that children can safely coordinate and be aware of how they move with weights before resistance training.<sup>69</sup> For this purpose, 'Resistance training skills battery for children' was developed<sup>53</sup> to evaluate children's individual and general resistance training skills and it was emphasized in later studies<sup>69</sup> that this battery can be used by anyone to determine the competence and readiness of children before resistance training is planned.

With the increasing number of scientific evidences many meta-analyses<sup>70-72</sup> and reviews<sup>73</sup> have been conducted for resistance training in children most recently They all unveiled the benefits and the effectiveness of the resistance training on children and adolescents.

## Conclusion

Correctly planned and properly supervised resistance training is very safe also for children. Contrary to historical misconceptions, it has been clearly shown that the injury rates during resistance training are not higher than other training and sports activities, and that they do not have a negative effect on children's growth and development. In addition, it appears to be effective and safe in terms of preventing sports-related injuries and improving the overall health.

Today, when resistance training is applied under the right technical instructions and supervision, it is recognized and recommended as safe and effective by the world's leading medical and sporting communities such as American Academy of Family Physicians (AAFP), American Academy of Orthopaedic Surgeons (AAOS), American Academy of Pediatrics (AAP), Australian Strength and Conditioning Association (ASCA), American College of Sports Medicine (ACSM), American Medical Society for Sports Medicine (AMSSM), American Orthopaedic Society for Sports Medicine (AOSSM), American Osteopathic Academy of Sports Medicine (AOASM), The National Strength and Conditioning Association (NSCA), and The President's Council on Physical Fitness and Sports, United Kingdom Strength and Conditioning Association (UKSCA), Canadian Society for Exercise Physiology (CSEP).<sup>38,67,68</sup>

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## Tolerance in the Communicative Culture of Modern Educational Manager

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### Abstract

Cultural, racial, social, religious, ethnic heterogeneity of educational groups is a problem of modern education in the context of integration and globalization. This often becomes a reason for misunderstandings, sometimes aggression in the interaction of representatives of opposing worldviews, preferences or traditions. Tolerance in the communicative culture of the educational manager, activated at the level of management structures and broadcast vertically and horizontally through the education system through pedagogical teams to all categories of consumers of educational services, will be able to prevent this.

**The aim** of the article is to outline the role of tolerance in the communicative culture of the modern education manager. According to the purpose the following tasks of research have been defined:

- to analyze sources of various branches of science and to find out meanings of basic concepts;
- to outline the features of management in education in communication area;
- to define its structure, establish relationships between components and develop a structural and semantic model of tolerance in the communicative culture of the education manager.

The following research methods have been used to study the backgrounds of the problem: information, terminology, analysis, synthesis, methods of scientific research. The comparative-typological method has been used to compare, identify signs of similarities and differences between phenomena and facts. Methods of forecasting and theoretical modeling have been used in the development of structural and semantic model. Systematization, classification and use of structural-functional analysis have been contributed to the generalization of the research results.

Interdisciplinary approaches (sociocultural and multicultural) to the study of management, along with axiological, holistic, systemic, activity and synergetic are the methodological basis of the study. Methodological principles (synergetic, complementarity, activity (action and creative), interaction between the subjects of the educational process, convergence from the abstract to the concrete) have been applied.

#### **The scientific novelty of the research:**

- for the first time the meaning and value-semantic nature of tolerance in the communicative culture of an educational manager have been determined;
- the determinants of educational management in the projection on communication have been clarified;
- the interrelations between the components have been established and the possibilities for realization of tolerance in different directions of communicative culture have been revealed;
- a structural and semantic model of tolerance in the communicative culture of the education manager has been developed.

**The main results of the study** are the analysis of the source base from the standpoint of scientific approaches to various fields of knowledge (economics, sociology, psychology, pedagogy, management, culturology, etc.), which made it possible to identify a modern interpretation of "education management".

The determinants of educational management as a component of social in the context of intangible, spiritual resource of education have been revealed. The similar and different characteristics of the managerial activity of the education manager and the pedagogical worker have been outlined. The essence, origin, structure, types and directions of functioning of communicative culture of the manager of education have been determined.

**Keywords:** education, management in the field of education, education manager, tolerance, communicative culture.

### Problem Statement in General

Under the influence of modern civilizational challenges, values and social systems are changing. The education system as the basis of socio-cultural reproduction of society is adapting to today's requirements. The cultural, racial, social, religious, ethnic homogeneity of educational collectives is leveled in terms of integration and globalization. Often heterogeneity becomes a reason for misunderstandings, sometimes aggression in the interaction of representatives of opposing worldviews, preferences or traditions. The managerial personnel is an important resource for educational reform. However, its subject characteristics are both the result and the driving force of educational transformations. The goals determined by the management structures are transformed in the minds of the subjects of activity depending on their professional and social attitudes, criteria, norms, values, competencies, etc. The problem of updating the culture of communication of managers in the context of changing subjectivity is important for our research.

Communicative culture as a complex social phenomenon is part of the general culture of the individual, includes the achievements of social and individual life. In management, aimed at transforming external norms into internal assets, communicative culture is one of the most important professionally significant characteristics of the educator, and the manifestation of tolerance in communicative culture is a priority. Management in the education system is considered simultaneously in two aspects: as an organizational structure of education from the Ministry of Education to the teacher, and as a certain socio-psychological structure, i.e. the subjective basis of the industry. It reflects the ratio of subjective and objective qualities and functions that are personified in the job hierarchy at each level of the education system.

**The aim of the study** is to investigate the role of tolerance in the communicative culture of a modern education manager. According to the aim the following tasks of research have been defined:

- to analyze sources of various branches of science and to find out essence of basic concepts, to cover features of management in education;
- to outline the structure, establish relationships between components and develop a structural and semantic model of tolerance in the communicative culture of the education manager.

### Research Methods

General scientific and mathematical methods have been used during the research process. Among them are methods of analysis and synthesis, methods of system approach, methods of modeling, etc. The research is based on interdisciplinary approaches to the study of educational processes and phenomena that determine the causes and motives, allow the interpretation of facts. The system approach and the use of structural-functional analysis contributed to the generalization of the research results.

### The Main Material Research

The problems of management in the field of education crystallize at the intersection of the achievements of various branches of science, such as economics, sociology, psychology, pedagogy, management, culturology, and others. The analysis of researches in the field of economics devoted to the development of management indicates that the terms "government", "administration" are used in scientific circulation (Skibytska, 2010, p. 4), as synonyms for the key concept of "management". From the standpoint of organizations management (government, administration) management is seen as a process aimed at achieving the goals of the organization by streamlining the transformation of raw materials or resources (labor, materials, funds, information, etc.) into the desired results (goods, products, services).

In pedagogical science the concept "education management" (Philosophy of Education, 2009, p. 269) has been interpreted as one of the types of social management. It has been considered that all management

is administration, but not all administration is management, because along with it there is the management of technical systems and management of biological systems.

There are the following aspects of management:

- the activity or product; subject and object;
- the structure and technology;
- the formal or declared authority and informal leadership;
- the natural gift and professional education;
- the science and art.

Social management is the management of people, the science of human being, his interests, behavior and interaction with other people since. A. Shegda (Sheregda, 2004, pp. 12-45) points out that human management always has a direct or indirect impact on human behavior, because a person can act correctly or incorrectly, while the mechanism always acts the same, according to the design or given programs. Therefore, management explains the nature of administrative work, establishes cause-and-effect relationships, and identifies the factors, conditions under which people work together more effectively.

It is important to take into account the universality of management in education. For example, the rigidity of the administrative vertical from the team to the reaction and the report, and with the public - on the principle of the supremacy of private interests. Therefore, in the horizontal dimension there are activities on a partnership basis, i.e. it is universal in nature and applies to any educational processes and systems.

It has been emphasized that the manager-administrator manages the activities of adults, who are mainly able to independently determine priorities and act based on acquired competencies and life experience. At the same time, the influence on the educational (training) team is indirect. While the teacher provides team management, communicates with participants in the educational process directly. It is noteworthy, that the educational process is not one-sided; its integral component is the interaction with parents and various social institutions. Communication is considered in terms of the interaction of individuals and groups of people who exchange knowledge, skills, abilities and performance. Communication in management is a way to meet various human needs: material or spiritual, but in educational management, material interests are not taken into account. Thus, educational management is a component of social in the context of intangible, spiritual resources to meet the social, cultural, cognitive needs of consumers of educational services.

According to the research (Rozlutska, Kostak, Sharkadi, 2019, p. 408) the basis of effective activity is provided by the axiologists of partnership, i.e.:

- respect for the individual;
- friendliness and positive attitude;
- trust in relationships;
- dialogue - interaction - mutual respect; distributed leadership (proactivity, the right to choose and responsibility for it, the horizontality of ties);
- social partnership (equality of the parties, voluntary commitment, binding agreements).

Thus, the difference in the perception of the classical manager and teacher-manager is manifested in the fact that the main characteristic of a professional manager is the identification of his interests with the interests of the organization in which he works, through an incentive system as a service mechanism. However, the pedagogical activities of the manager-administrator should not be excluded, for example, during the teaching of training courses, educational activities, etc.

In addition to the concept of "management in education / educational management", the terms "pedagogical management" and "didactic management" are used in scientific circulation. It has been noted that the historical concept of "pedagogical management" because of development has evolved into "educational management" (Sokol, Tsaryk, Rozlutska, 2020, p. 43). Based on the limits of action, the didactic management has been considered as part of the educational one which is functioning within the educational process.

Common to the teacher and the manager are the general requirements due to the need to effectively communicate, interact, dynamism, psychological stability, responsibility, etc. I. Zyazyun (Zyazyun, 2004, p. 48) defined a set of professional values and personal qualities of a teacher through the prism of pedagogical skills. Pedagogical skill has been considered as the highest, creative activity of the teacher that is shown in expedient use of methods and means of pedagogical interaction in each pedagogical situation. This

expediency depends on two variables, namely: the quality of training and the development of individual characteristics of the teacher. The basic qualities of a teacher that allow you to manage the development of personality in the educational process: observation, empathy, dynamism, emotional stability.

Today's integration tendencies have been reflected in multicultural education, which has exacerbated the problem of identity at different levels: national, religious, linguistic. The stabilizing factor of confrontations in education was the implementation of multiculturalism principle, which is considered as the basis for the interaction of speakers of different cultures or culturally appropriate environments. Tolerance has been considered as an essential element of communicative culture. The study outlines tolerance as a component of the value basis of the communicative culture of the education manager. However, the need for a friendly or restrained attitude of the manager to differences between people in the broadest sense, the avoidance of intolerance in interaction can cause the extrapolation of previously formed social and personal values. Given the effectiveness of positive motivation as a psychological mechanism, which by force determines the reassessment of the acquired value system through self-education and self-education, the opinion of modern researchers (Barchiy, Voronova, 2020, p. 253) can assume a variety of forms and manifestations of tolerance in the communicative culture of the education manager. In addition, this allows the interpretation of tolerance as a value, practice and principle of interaction of participants in the educational process.

In world scientific community, tolerance from the first religious treatises was considered in the context of recognizing the need or possibility of working together with others to achieve the common wealth. I. Vegesh rightly remarks (Vegesh, 2019, p. 23) that tolerance has been interpreted differently at different times and in different communities, but throughout the history of human civilization it remained an important human virtue that required effort to work on.

The paradigm of tolerance concept has been characterized by a variety of manifestations, such as: ethnic, religious, racial, social, age, gender, physical and others. The most common tokens are: impartiality, liberalism, resolution, variation, generosity, mercy, obedience, endurance, patience, moderation, long-suffering, tolerance, indulgence, pardon, indulgence, gentleness, meekness, meekness generosity, generosity, benevolence, affection, compassion, charity, respect, patronage, care. The research study will take the values of multiculturalism, practice and the principle of interaction of participants in the educational process as a basis for understanding tolerance.

Pedagogy, accumulating knowledge of related fields of science, interprets tolerance as: moral value (together with philosophy), personal education, personality quality (together with psychology), human virtue, active life position (together with sociology). It is important to understand tolerance as:

- a value or art of living in a world of different people and ideas, the ability to have rights and freedoms, without violating the rights and freedoms of others;
- an active life position based on the recognition of another;
- an attitude to people - acceptance of otherness, recognition of multidimensionality and identity of any culture, acceptance of norms and rules, refusal to reduce diversity to uniformity or dominance of any one point of view and position, understanding and acceptance of traditions, values and culture of other nationalities and religions;
- a quality of the child's personality that determines its characteristic behavior, activities and thinking (Rozlutka, Sokol, Ivanychko 2020, p. 96).

The above gives us grounds to identify the qualities of tolerance and to establish directions for their implementation in the communicative culture of the modern education manager (see Table 1). Tolerance is evidenced by the following manifestations in communication or the art of speech of the manager - normativeness, accuracy, logic, emotional expressiveness, relevance, content, variability, and others. The qualities that characterize the ethics of behavior include benevolence, a positive attitude of mercy, kindness, gentleness, compassion, and others. Tolerance in professionalism has been determined by the presence of a humanistic worldview, professional dignity and honor, self-criticism, restraint, moderation, impartiality, dynamism, emotional stability and others. The main strategies of the manager's behavior are: partnership, distributed leadership, equality of the parties, mutual respect, guardianship, the right to choose, voluntary obligations, fulfillment of agreements, etc..

**Table 1.** Directions of tolerance qualities realization in communicative culture of the modern education manager

№	Tolerance qualities	Directions of realization
1.	normativeness precision logic relevance content variability positive emotional coloring	the art of speech
2.	goodwill positive attitude mercy kindness empathy mutual respect	ethics of behavior
3.	professional dignity and honor self-criticism humanistic worldview restraint moderation emotional stability dynamism	professionalism
5.	partnership distributed leadership equality of arms dialogization informatization digital transactions	innovative technologies
4.	impartiality the right to choose voluntary commitment fulfillment of agreements	interaction strategies

The defining characteristic of a tolerant communicative culture is the awareness of the differences of the communication partner, as well as the differences of his motivations, intentions, background knowledge, code (language, gestures, symbols, etc.). It is also important to be aware of each other - communication partners as "foreign" on the basis of different historical developments, cultures, main codes or meanings, oppositions and categories through the prism of identity. Tolerance as a desire to establish a positive interaction between people who differ in some respects or do not adhere to generally accepted ideas and norms (Darmoriz 2000, p. 225).

Thus, from a practical point of view, tolerance in the communicative culture of a modern education manager can be defined as:

- a strategy of establishing and developing relationships between people, which involves the exchange of information, certain tactics and strategies of interaction, direction and mutual understanding between communication subjects;

- a behavior regulator, guarantor of respectful attitude of the individual to others, their understanding, patience and mutual respect;

- one of the mechanisms of harmonization of personal and professional interests.

### Conclusions and Prospects for Further Researches

The study has been presented as a basic definition of the communicative culture of the education manager as an integrative personality trait, which is positioned with the interaction of participants in the educational process, the creative potential of the manager, his ability to maintain a friendly attitude to

others. It has been proved that in the conditions of modern integration challenges tolerance testifies to the development level of communicative culture of education manager.

Based on the results, a structural and semantic model of tolerance in the communicative culture of the education manager has been developed. It has been found that tolerance as a part of the value basis of communicative culture is manifested in personal and social values, norms of behavior. This concept has been formed under the influence of external and internal factors, in particular through self-improvement and continuing education. The most important for educational management types of communicative culture, which enable manifestations of tolerance, in particular: the case of communication, system-forming and integrating social factor, sectoral aspect) have been singled out. The education manager structure includes conceptual-target, content, functional, evaluation-performance components of modern teaching process.

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## Features of Teacher's Syncretic Activity in the Conditions of Modern Higher Education

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### Abstract

Effective feedback is an art that every leading teacher must improve. The student, who receives excellent feedback during the lesson, walks out of the door feeling confident and motivated for further improving. A student who receives poor feedback will feel the opposite. The feedback should be defined like "great work" with the meaning not only about how to correct the mistakes of students so that they can study in the future without undermining their confidence but also about the modern teacher's role in educational process.

The article has been raised the issue of the specific features of the teaching activities, the essence of the concept of "syncretic activity of the teacher "is revealed, in particular the concept of "role functions" is clarified, approaches to interpreting the features of the role functions of a teacher are considered. The main instructions of the teacher which provide the identification of teacher's new qualities in the conditions of modern higher school have been highlighted. The teacher is entrusted with such functions as coordination of educational activities, adjustment of the content of education, counseling, etc. The solution of this problem in terms of personal and professional growth of the teacher has been proposed, which allows to improve the teaching process in higher education. The author's understanding of the main roles of the teacher in higher school has been outlined, the attention on urgent tasks, the features of the role functions of a teacher as syncretic multifunctional interaction between the teacher and the student on preparation of experts for information society has been emphasized. The sequence and priority of the teacher's roles in the syncretic activity in the teaching process have been revealed. The psychological structure of the teacher's syncretic activity has been clarified from the point of view of the requirements for teacher's personality with an explanation of the set of skills that the teacher of a higher education institution should have. The professional skills of the teacher in relation to the peculiarities of his or her activity, which are shown in various types of the teacher's role functions in accordance with the situation and professional tasks of teaching have been analyzed. It has been shown that the transformation of educational activities and role functions of a modern teacher of higher education testifies to constant changes in his personal and professional growth, which also affects the development of the personality of a student - a future professional - in the process of his training.

**Keywords:** teacher's personality; syncretic activity; teacher's role functions professional knowledge; socio-professional position.

### Problem Statement in General

The global problems of modern age are a single, dynamic, constantly changing, open-ended system, since it may include new problems of universal importance, and the previous ones may disappear as they are solved. The global nature of these problems lies, in particular, in the evolution of human thinking and behaviour; improving human qualities; imbalance in the development of the natural, technical and human sciences; the avalanche growth of information and the reform of higher education, the functions of a teacher and student in the educational process (Glazko, 2006).

The development and implementation of a personally oriented model for the development of the role functions of teachers of higher education institutions is one of the most important tasks of higher education





in the context of socio-economic reforms. It has been designed to train a highly qualified specialist who can identify sustainable professional knowledge and professionalism in business communication situations and be competitive in the labor market. Well-grounded knowledge in special disciplines contributes to the creative growth of the individual, the formation of a national and professional mentality of a person.

Considering the specifics of modern vocational education in higher education, the latest developments in society and experimental approaches to relevant fields of science have been taken into account. Nevertheless, it is also important that university education should be fundamental and holistic, strong enough ground for a scientific worldview and an active life position. For the last 6-10 years, the higher education system of Ukraine has been in a crisis state, which is associated with the choice of new optimal ways to develop higher education. These crises are due to the demands of the time and market economy, so reform of higher education and the entire education system is inevitable, which indicates irreversible variable phenomena in many social processes.

Among the many factors that determine the success of students in higher education is the personality of the teacher of higher education. Since he is the teacher who forms the future specialist, because it is known that only a person can educate a person. Therefore, a modern teacher should carry out activities that extend the usual translation of knowledge and the formation of the necessary professional skills and skills among students in the learning process, contribute to the formation of professional qualities and the development of the creative personality of the future specialist.

### The Aim of the Study

The following tasks have been defined according to the purposes of research:

1. To analyze and systematize the features of professional-role functions of a high school teacher in accordance with the general requirements of society for the training of a qualified specialist.
2. To find out the role of the teacher's personality and his syncretic activity and to analyze the components of the teacher's role functions in preparing students in order to form a specialty in modern conditions.
3. To summarize research developments and identify prospects for further research into the professional activities of the teacher's personality from the perspective of a role-based approach.

**The methodology of the research.** The theoretical and practical study of the problem allows forming the author's concept of research on continuity, the syncretic nature of the situational application of role actions of teachers during student training. The application of teaching activity role transformations in practice is possible in the process of implementing systemic, cognitive-communicative, competent-activity, professionally and personally oriented approaches to training. This requires substantiation of the latest criteria for the content, methods and forms of organization of practical work on the development of professional training of students for future work in the specialty.

**The main material of the research.** Models of people behavior in communication are the generalized, schematically expressed characteristics of communicative actions. In these models, the teacher finds expression of his socio-professional position. Moreover, in the pedagogical literature there is a wide variety of typologies of the professional roles of the teacher.

Scientists have been revealed and quite thoroughly clarified the specifics of competent qualities and professional roles of a teacher in traditional, sustainable training (S. Vitvitskaya (2006), A. Gura (2008), S. Courland (2007), A. Moskalenko (2016), R. Khmelyuk (2007) and others. In recent years, the classification of pedagogical communication styles according to the typology of professional positions of teachers, proposed by M. Talen (Stolyarenko, 2004), has become widespread. As a result, the teacher is based on his needs, and not on the needs of students. The attention of "Manager", "Coach", "Guide", etc have been outlined among the interesting models of teachers' behavior in pedagogical communication. Such models of behavior have strongly pronounced role characteristics of teachers pedagogical influence on students personal qualities (Stolyarenko (2004), pp. 553 - 554].

However, the role functions of a teacher of a higher school is training as a qualified, competitive specialist in a modern information society. Such notion have just started to be investigated or described about a separate role position of a facilitator teacher, in particular in the works of S. Vasiliev (2015), A. Kudryashova and N. Gorbatov (2015), O. Levchenko (2008), S. Melnik (2011) and others. Actually, all the role functions of teaching have been generalized and reduced to one thing - facilitatively, not taking into account

the richness and branching of certain methods, techniques and means of learning, the level of proficiency of which depends on the level of pedagogical skill of the teacher and the effectiveness of the educational process.

Analysis of the scientific literature allows concluding that there is no single systematic and extended description of the personality of a teacher of higher education; secondly, the role functions of the teacher are so flexible and variable that they can be combined in interconnected, syncretic activities, built because of traditional and latest approaches to training.

Thus, in the context of the transformation of modern society, the challenges and consequences of global problems, in particular socio-economic, environmental and health-saving (due to a planetary pandemic), the problem of determining the role functions of a teacher at a higher school of Ukraine remains extremely urgent. Because it would adequately correspond to the conditions of personal growth and professional functioning of a specialist.

The importance of the teacher as the most important authority and former of the professional qualities of the student, his professional culture and professional competence, the formation of the personality of the future specialist, ideology and even his norms of behavior cannot be overestimated. It is necessary to take into account an important point in the psychology of influence: the most strongly influenced not by the message of the word, but by the communicant himself as a real person, enters the sphere of life of the recipient (Drozdova, 2010). Persuasiveness, erudition, democracy and teacher's tact are favorable factors.

The "product" of the university teacher's activity is a student who, in accordance with the new requirements for the quality of professional training, has become an active subject of the educational process in higher education institutions (Petryk, 2013).

The professional role of a teacher (a set of regulatory approved requirements for the professional behavior of the teacher) has been determined by his leading role as the leader and organizer of the educational process, translator of the cultural and linguistic picture of the world, etc. (Ushatikova 2013, c. 36).

Working with a student – an adult – the teacher considers this and appeals to his ability to decide think, create his own life position, form a worldview. Therefore, the influence on students (contact factor), the improvement of its forms and techniques, accounting and reliance on it, that is, the conditions for intensifying training as a means of forming the personality of a professional is the most important link of the educational process (Dichkivskaya I.M., 2004).

The concept of approximating the content and forms of practical teaching of a foreign language in a higher school to future professional activity takes into account the main provisions of the philosophy of higher education and is based on a systematic approach. The effectiveness of the developing process of the students professional skills depends on the extent to which the methodology and content of practical language education outlines the specifics of the student's future specialty. The complexity and originality of this process lies in professional activity of freelance students and is characterized by versatility, which requires various forms of practical training.

## General Background

The new possibilities of higher education allow each student to work at an individual pace. Experience shows that the use of the full range of various role functions of the teacher increases interest in studying special disciplines as a means of obtaining a chosen profession, since it allows us to adapt the educational process even in poorly trained students. Therefore, much in the teacher's work depends on the teacher's personal abilities, his professional and general training, pedagogical skill and intuition, plays a significant role in intensifying the educational process (S. Courland, R. Khmelyuk, A. Semenova, etc., 2007).

The development of the role functions of teaching is productive implementation of a syncretic approach. It is a specific activity based on principles such as functional and communicative; integration; system organization of training; commitment and consistency; high efficiency of each type of work, finding implementation in the system of practical knowledge; actual general education training and the individual characteristics of students of institutions of higher education etc.

The teacher's syncretic activity involves preliminary psychological and pedagogical training, extensive work experience and high professional, organizational, communicative, managerial and personal qualities.

The effectiveness of training has been ensured by submitting the system of educational tasks as a system of problem situations and achieving maximum involvement of students in their solution. It is achieved by the methodology of conducting classes and fulfilling all the involved role functions of the teacher in his syncretic activities. Given process can be described as multifunctional contact interaction (as opposed to authoritarian style).

Figure 1 illustrates the learning process with the implementation of role functions in the interaction of the teacher and the student.

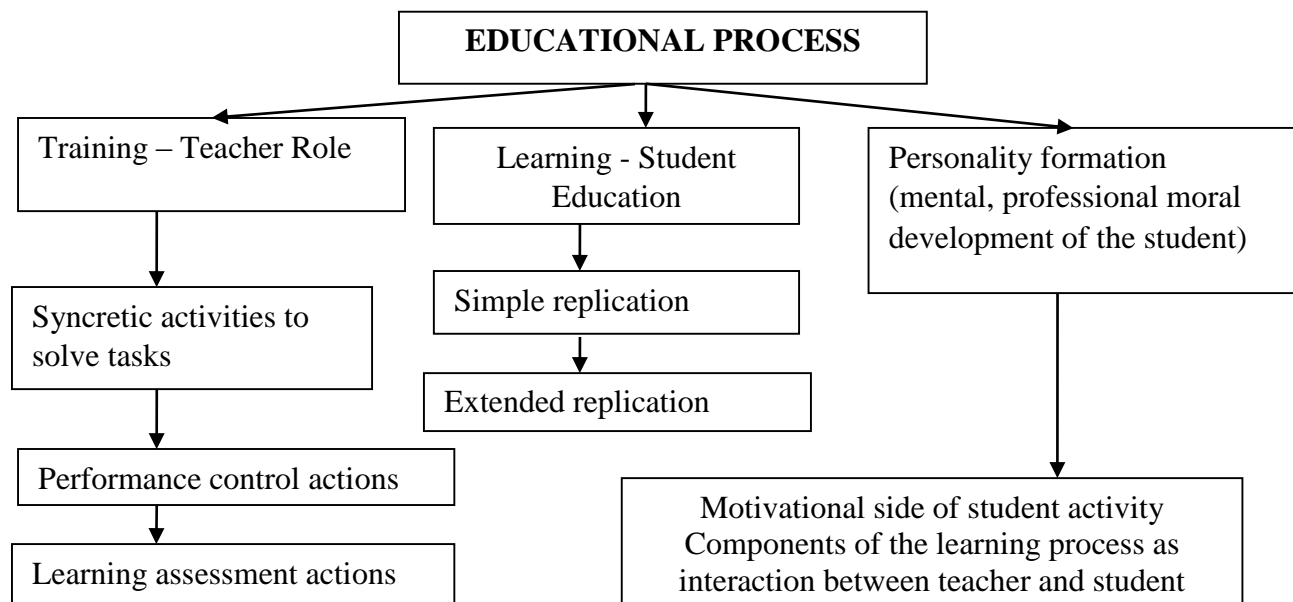


Figure 1.

Therefore, in order to form a creative specialist with a high level of professional development, it is necessary to maximize the involvement and implementation of special role functions of the teacher in the process of training students in the specialty. The motivational side of student activity has been achieved by solving the problem, formed as "I-inclusion" (Ollport G., (1998), p.232) in the educational situation. A properly selected approach to the student, taking into account his personality and a set of educational tasks will help teachers to solve this problem. As noted, the main goal and duty of the teacher is to arm each person in a life struggle for clarity of mind (Moren E., 2007; page 35).

A research of the pedagogical process on the implementation of the role functions of a teacher in the educational process has been carried out during 2019 - 2020 years based on Kharkiv Petro Vasilenko National Technical University of Agriculture, Kharkiv State Academy of Design and Arts, Kharkiv National Automobile and Highway University in several stages of scientific search. The research work has been involved 102 teachers. The results of the experiment (questionnaires, surveys and interviewing teachers) indicate the importance of professional verbal-non-verbal role detection and its informativity.

The method of processing the questionnaires of teachers with the survey has been included deciphering, subsequent classification of factual material, analysis of answers and conclusions on the content.

Thus, teachers identified the main roles of the teacher in the educational process. There are following functions for each of them:

1. Planner. The complex strategic role of the teacher provides planning of classes, the procedural two-way nature of the joint activities of the teacher and the student; identification of the types of interaction between students; a set of techniques and methods; design and organization of the process; availability of comfortable conditions for training (Drozdova, 2010). While preparing for the educational process, the

teacher relies on a careful selection of educational and methodological literature and its provision for students for its correct application in classroom and independent work.

2. Manager / coordinator. The teacher embodies the complex and most important role in learning, organizes and coordinates the learning process on an individual schedule, manages the conduct of individual and group classes; checks students' compliance with control measures (incoming, current and final control), etc. The manager is responsible for the correct beginning and accurate completion of training activities, competent feedback. The teacher cannot force the student to study independently, but he creates the most favorable conditions for organizing and controlling his independent work; increases motivation for high-quality performance of tasks, to identify hidden abilities and creative opportunities of students.

3. The controller is a teacher who is fully responsible for the lessons in the classroom, what students do, what and how they say. The teacher-controller shows the ability to update the necessary professional knowledge in the educational situation; assumes this role, especially important when new educational material is introduced and clear control over the exact reproduction of techniques and its processing is required. In this role, the teacher is the center of attention and the center of the lesson, he may have an outstanding talent for teaching, good knowledge and rich experience, but the role functions of the teacher-controller will be limited and monotonous.

4. Facilitator is a mediator who helps students, supports, encourages effective (corrects ineffective) behavior; finds and activates constructive models of behavior in intragroup interaction; accompanies the process of developing new experiences in students (Volkova, Stepanova, (2018), Levchenko OO, (2008)).

5. The teacher as a resource is a potential center, ready to offer students immediate support or help, which they lack performing communication during training. These role functions of the teacher involve the use of available resources, such as the Internet. However, it is necessary to ensure that students rely on the teacher to work independently.

6. Analyst – the role of a teacher consists of direct work with students, identifying difficulties and problems that arise in teaching. The teacher diagnoses his activities to adjust and monitor the independent work of students, distributed in individualized and distance learning.

7. Evaluator. In this role, the teacher determines the successfulness of students and the quality of their learning outcomes. The teacher provides feedback and corrects the activities of students, evaluates their independent work, performance of various tasks. However, empathic support should be kept in mind so that the student's self-esteem and confidence in acquiring knowledge are not affected, which will greatly affect the learning process. The task of the teacher is to diagnose and evaluate the performance of independent written work with their mandatory commenting, making adjustments to the entire learning process.

8. Expert consultant. This is the usual formalized role in the interaction of teacher and student. The expert-consultant not only assesses the level of students' knowledge with the help of various tasks and tests, but also coordinates the cognitive process of students and conducting group and individual consultations, communicative classes, etc. In this function, the teacher does not teach the material (it is in textbooks, manuals), but gives explanations, consultations on the best mastery of the material, ensuring the correct use of educational and methodological literature in the student's specialty. The consultant may be a mentor in individual work with the student or in groups of 5 to 10 students.

9. Rapport builder. The teacher is always in the process of building relationships with students: both during classes (in the audience) and outside the audience. Without this, it is impossible to build a working atmosphere in learning and create a trusting relationship with students. Rapport builder always takes into account the level of training of students, has an individual approach to each of them. In the process of building a relationship between a teacher and a student, it is impossible to "paternalistic" communication between students during classes, since all students are individuals who deserve respect. The teacher, considering the complex requirements of the information society, not only will not show irritation or annoyance when the student is guilty, but also at the right time will come to the student's aid – he will calm down and cheer up and help to deal with educational material. In particular, in the system of teaching the second foreign language, Rapport builder is the first and main source of correct speech for the student.

10. Prompter. The teacher encourages students to participate in communication and makes suggestions on how they can continue their activities. The teacher should help students only if necessary. The functions of the teacher are correction of errors, hints and help in choosing the right word or

grammatical construction, term, formula, concept, etc. Students can sometimes be confused, lose the thread of answer or be uncertain how to proceed; the teacher will support, guide the course of thoughts in the right direction.

11. Participant and observer. This role contributes to a better atmosphere in the classroom, is an excellent way to interact with students, when the teacher participates in the work of students, without dominating the activities during its implementation. The teacher as a participant and observer now not only monitors the activities of students, but also catches mistakes, corrects them during classes. The teacher helps to perform intensive educational work in the classroom, if he is able to keep pace in the classroom and not become the center of attention, because of his authority.

12. Parent-friend / mentor / advisor. This role of the teacher is very important and complex; the functions in this case will be related to the coordination of support for the educational activities of students during extracurricular independent work. The teacher-advisor should not be the student's best friend. Moreover, such teacher is not obliged to replace his relatives; but also he cannot completely ignore a student as a person. This teacher function assists the student in solving a controversial problem, providing the right advice and support if it is necessary to express sympathy and understanding.

13. Practitioner. This is a very broad function. The teacher not only conducts classes and provides scientific and methodological assistance to students in their studies; but also ensures the correct organization and control of independent work, the effective use of educational and methodological literature. The practitioner is able to respond quickly and adequately to changes in the situation during classes, in closer communication providing the students with the necessary information. During the internship, the teacher has the opportunity to transfer the professional skills to students, to help to apply theoretical knowledge in practice; find and indicate ways to solve specific problems; show a real picture and explain the specifics of work in the chosen specialty, thus preparing the student for the realities of future work.

14. Tutor. The teacher performs coaching functions when students participate in project work or self-study provides advice and recommendations, helps students to find ideas and identify tasks. This role allows the best way to pay individual attention to each individual student to meet his or her specific learning needs and research interests. However, it can also greatly affect the student's independent decisions; he will become too dependent on one teacher or one method or style of communication and teaching. The tutor can sometimes combine the functions of a leader, manager, consultant and he is addressed to as an authoritative source of information, as an expert.

Teachers who has bene participated in the questionnaire and survey distributed the percentages by role function as follows (see Table 1).

*Table 1.*

No	Role of Teacher	%
1.	Planner	19
2.	Manager / coordinator	24
3.	controller	21
4.	<b>Facilitator</b>	6
5.	The teacher as a resource	6
6.	Analyst	7
7.	Evaluator	6
8.	Expert consultant	9
9.	Rapport builder	8
10	Prompter	5
11.	Participant and observer	5
12.	Parent-friend/ mentor / advisor	2
13.	Practitioner	5
14.	Tutor	3

Thus, it becomes clear that the modern approach to teaching involves fundamental changes in the basic functions of the teacher in the educational process. In particular, it provides for an expansion of the

roles of the teacher compared to the traditional approach to learning. However, all teachers in the questionnaires noted the multifunctionality of their activities, and its syncretic nature. All teachers have been noted that the role functions are unlimited; they are constantly changing, depending on the tasks, goals and types of methodological work. The paradigm and their significance has been determined, due to the predominance in their methodological activities depending on many aspects: age and seniority, the peculiarity of the subject taught, the changing types and forms of work in higher school, the requirements of society and so on.

However, the predominant distribution of functional responsibilities of the teacher (64%) has been associated with organizational (planning, management) activities. Only 36% - with corrective, consulting, other functions of teaching in the specialty of the student, and 20% of them - with practical speech activity, only one-fifth is focused on the creative activity of the teacher.

It can be seen that within the framework of innovative technologies, taking into account the modern challenges of time and the tasks of the information society to a qualified, competitive specialist, the main task is precisely the flexible syncretic activity of the teacher. This involves radical changes in the form of cooperation between teachers and students, since there are wide discussions of current results in the group. Training tasks, "brainstorming", reports, speeches take on a different character, which is associated with both the latest changes in higher education and changes in forms of education: individual, remote, other types of computerized training. Therefore, the teacher has high professional and business requirements: he must have not only the skills of scientific, pedagogical, methodological activities; he should have communicative, organizational, managerial skills and qualities and so on.

### Conclusions and Prospects for Further Studying

Therefore, the transformation of educational activities and role functions of a modern teacher of higher education testifies to constant changes in his personal and professional growth, which also affects the development of the student's personality - the future professional - in the process of his training.

The presented research materials of the article have been based on the implementation of the role functions of a teacher in syncretic activities for the formation of future specialists. The examples of their use in higher education correspond to real trends in the development of modern Ukrainian education and are promising. The study has identified a number of issues that require special study. Scientific work on improving the syncretic role of the teacher should be aimed at studying, for example, such problematic issues as:

- the peculiarities of the system of teaching methods of students depending on their further specialization;
- the application of research methods in the process of assisting students to carry out their course and thesis work;
- the use of modern working methods taking into account the distance nature of educational activities and etc.

Taking into consideration a syncretic and open nonequilibrium system in the complex conditions of a globalized world, the prospect of further research is the detailed definition of the role functions of the teacher in the educational process for their necessary correction and constant transformation depending on society and the labor market.

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## The Integrative Nature of Interculturalism in Galicia at the Beginning of the 20th Century

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### Abstract

The article outlines the main aspects of interculturalism in Galicia at the beginning of the 20th century. The interculturalism has been defined as the initial basis of communication, formed by a combination of social and educational environment. In modern society with many political and intercultural problems, the communicative competence and formation of tolerant attitudes towards people play a significant role. Linguistic education is one of the main tasks of educational pedagogy, linguistics, methodology, language rules, principles, and methods of teaching, ways of investigating education. The level of language culture of the personality in the mother tongue and foreign languages is evidence of the development of linguistic competence.

The changes in the cultural sphere of society determine the need to investigate linguistic problems, focusing on improving language culture to achieve efficiency. The language problems have gone beyond the framework of philology and have become the general problems of society to regulate language culture in the process of social communication, social processes, the development of society as a whole system. In the political sphere, the culture of language promotes the emergence of mutual interest and respect between people of different nationalities and the stabilization of interethnic and international relations.

The described innovative approach in the organization of social communication and interculturalism in Galicia space can be creatively and practically adapted in the conditions of any modern multicultural society.

**Keywords:** interculturalism, social communication, education, integration, tolerance.

### Problem Statement in General

The scientific works on the history of the emergence and development of the linguodidactics mainly have been focused on the theoretical foundations of the reform and modernization of the national language training. This question has been investigated by such Ukrainian scientists as O. Savchenko, M. Stelmakhovych, O. Horoshkovska, A. Bilyajev, A. Bogush, M. Vashulenko, T. Donchenko, O. Melnichayko, O. Palamar.

To begin with, it would be necessary to clarify the meaning of the term "interculturalism". This can be problematically confusing as scientific literature does not provide a clear definition. By this term, it should be defined an active contact among different cultures, the confrontation of customs, thinking, and lifestyles that collide in intercultural relations. In society, a phenomenon that goes beyond all involved cultures and affects the actions of people in different situations and areas of life (Lejsková 2006, p.7).





**The aim of the study** is to define the most important aspects of interculturalism in Galicia at the beginning of the 20th century.

Interculturalism also means the encounter of two or more cultures, in which there is mutual influence despite cultural differences. When different cultures meet, their own cultural identity and character can be experienced mutually. Alois Wierlacher emphasized that an intermediate position, the so-called third system, arises in cultural overlapping situations. It does not correspond to any cultures involved nor represent their combination. Rather, it is to be understood as a synergy that is completely novel and unpredictable. This creates a mutual understanding process that enables cultural cooperation (Wierlacher 1999, p.155).

According to the literary subject of Galicia, it should be spoken about the coexistence of different nations in one area. Martin Pollack has been investigated this topic. His work "Galicia. A journey through the vanished world of Eastern Galicia and Bukovina" analysed the literary work of the writers of different nationalities: "Jewish, German, Polish and Ukrainian authors served me as an important guide, who made Galicia and Bukovina unforgettable literary landscapes, in which, beyond all strife and all bloodshed, there was a fruitful interaction of the different peoples and cultures" (Pollack 2001, p.11).

### The Main Material of the Research

One of the most important and informative works for our investigation is the book by Wiefried Trillinberg "Formation and Decay of Multiculturalism in Eastern European Galicia. Mid-18<sup>th</sup> to Mid-20<sup>th</sup> Century". Here Galicia has been analyzed as part of the Austro-Hungarian monarchy with its diverse cultures. The author has been stated that the historical immigration to Galicia led to a multicultural society with 10 official languages, and religious diversity (Trillinberg 2013, p.7).

Moreover, at the beginning of the 20<sup>th</sup> century, Galicia was a multi-ethnic and multicultural area. In addition to the Ukrainians and Poles, the Jews and the Germans also lived here. The problem of living together has been discussed in scientific literature. For example, the Austrian writer Martin Pollack shows in the book "Galicia. A journey through the vanished world of Eastern Galicia and Bukovina" at which levels of social life the coexistence took place and how the borders between the individual nations influenced the everyday life of the inhabitants of Galicia (Bizová 2009, p.23).

From a cultural point of view, there was a huge difference in the various nationalities in Galicia. When assessing the level of illiteracy, 5-7 percent of the Germans and Czechs were illiterate, 16 percent of Italians, and 24 percent of Slovenians. Among the nations living further away from Vienna, the proportion of illiterates was higher: in 1900, 41 percent of Poles and 72 percent of the Romanians in Bukovina were illiterate, the proportion among the Ukrainians (Ruthenians) was even at 76 percent and among the Serbo-Croats in Dalmatia at 74 percent (Alfred Grund 1997, p.95).

The following educational institutions have been existed in Galicia to increase cultural development and solve the problem with the illiteracy:

- 2 universities in Lviv (then called Lemberg) and Cracow (with 900 listeners), Lviv Polytechnic (200 students); Cracow School of Art (125 students);
- 4 theological colleges;
- 17 higher grammar schools, 4 lower grammar schools, and 3 secondary academic schools emphasizing mathematics and science, 5 upper secondary schools and one lower secondary school, 6 educational institutions for 14 030);
- 2 trade schools, a state vocational school, an arts-and-crafts school, and 15 other trade schools, 9 agricultural schools, mountain school, and 3126 primary schools, with 397 of 605 school children (of 709 941 school-age, i.e. 56 percent).
- Academy of Sciences based in Kraków.

Philipp Hofeneder has been focused on some central aspects of the Galician school system, especially the school system from the point of view of the Ukrainian-speaking population. In his opinion, the question of the teaching language is an essential part, and one of the central demands within the development of the school system in Galicia. The legal situation of the language of instruction was subject to major changes during this time. Two petitions (1848) to the emperor called for the introduction of Polish in schools, courts, and all Galician public institutions. In 1848 there was a petition to the emperor also from the Ukrainian side, which demanded that Ukrainian has been introduced as a teaching language in elementary schools. Philipp

Hofeneder has been mentioned that Ukrainian was also required as a language of instruction in the secondary school system in accordance with the population figures (Hofeneder 2009, pp. 34-38).

According to the regulation of the school system (1774, Vienna), the governor of Galicia has been obliged to ensure primary education both in the countryside and in the cities. The school system should have been divided into three types of schools: primary schools, secondary schools, universities. The primary schools in Galicia have been divided into one-class schools with two and three years of schooling, in which the children were to learn to read, write, and calculate in the Ukrainian language. In the cities, mainly the "trivial schools" were widespread, with the instruction in the German language, which had three or four classes. The trivial schools prepared for the lower public service and further school education in secondary schools and grammar schools. At the instigation of the Greek Catholic Church, the Ukrainian language has also been taught in the trivial schools from 1791. Ukrainian schools have been set up especially where there were no Polish or German schools.

Later, after the death of Emperor Joseph II, the extent of school instruction in Ukrainian has been restricted. The Polish influence was further strengthened. Some Ukrainian primary schools have been held for a relatively long period at Greek churches and monasteries. In the small towns, Ukrainian primary schools have been organized by the financing of craftsmen and merchants (Trillinberg 2013, p. 132).

At the beginning of the 19th century, conflicts over the maintenance of the Ukrainian language in schools in eastern Galicia have been increased. From 1817 onwards, the Ukrainian language has been increasingly used in eastern Galicia, according to the rule that children should be taught in their mother tongue. In Eastern Galicia, the Ukrainian people group represented the vast majority in the countryside, but in the cities, the number of Ukrainians reached less than 1/3 of the urban population because the Polish and Jewish ethnic groups have been more represented (Trillenberg 2013, p. 133).

Some statistics on the school system have been presented by Philipp Hofeneder in his dissertation on linguistic concepts and thematic orientations of the Galician-Ruthenian textbooks in the period from 1848 to 1918. Thus, within 30 years from 1847 to 1877, the number of elementary schools in Galicia with the Ukrainian language of instruction has been increased from 741 in 1847, and correspondingly the elementary schools with the Polish language of instruction have been increased from 491 in 1847 to 1213 in 1876. The elementary schools with mixed instruction in both Polish and Ukrainian languages have been decreased from 459 in 1847 to 252 schools (1877). Between 1871 and 1883 there have been almost a doubling of the number of elementary schools with the German language from 61 to 110, while before and after their number remained almost unchanged (Hofeneder 2009, pp. 34-38).

At the beginning of the 20th century, the formation of the Ukrainian intelligentsia has been carried out differently. In Galicia, as a rule, the right to education had the children of the families of the clergy and the wealthy rural population. For the liberal professions a home education or secondary education, or only skills have been sufficient (Kozhukhar 2013, p. 87).

In 1869, at the request of the Ukrainian deputies, general primary education has been proclaimed by the government of the Austro-Hungarian monarchy in Galicia, and in 1874 the Ukrainian language has been allowed as the language of instruction in secondary schools. At this time, the number of students in middle schools has been quite increased. 1894-1895 school year 572 students attended the middle schools of our region, and in 1905-1906 there were 2137 students. For example, in October 1898 a Gymnasium has been opened in Ternopil, in 1905 in Stanislaw, in 1907 in Terebovlia, in 1909 in Gorodenka and Rohatyn. The largest training centre in Galicia was Lviv Academic Gymnasium (Smalyha 2004, p. 18).

From 1851 to 1910, the number of German secondary schools have been decreased, from 9 in 1851, 2 in 1867, and only one high school in 1910. In contrast, there was a rapid growth in the Polish-language high schools. Their number has been increased from 6 in 1851 to 19 in 1867, from 23 in 1890 to 78 in 1910. Ukrainian-speaking grammar schools have been represented with only one Grammar School in 1867 and with 7 grammar schools in 1910. This is probably a clear result of Polonization in Galicia.

*Table 1. Number of secondary schools in Galicia*

	1851	1867	1890	1910
German	9	2	2	1
Mixed lang.	-	-	-	2
Polish	6	19	23	78
Ukrainian	-	1	1	7
Total	15	22	26	88

Source: Otruba, G., The nationality question and language question of the higher education and universities as a problem of integration of the Danubian Monarchy (1863-1910), in: Plaschka, R.G., Mack, K. (ed.), Network of the European spirit. Science centers and intellectual interrelationships between Central and Southeast Europe from the end of the 18th century to the First World War = Series of publications by ÖOSI 8), Vienna 1983: 88-106 [the table was supplemented by data from Sirka (1980: 206)].

Kristýna Bizová has been studied the literary image of Galicia and Bukovina and mentioned the Polish, Ukrainian and German-speaking schools in Galicia. Also, there were also Jewish schools, in which the students mainly got Jewish teaching.

The church was the second area where nations and cultures rarely met (Bizová 2009, p. 24). Through education and religion, the essential values and ideas of culture have been handed over to future generations. The existence of own schools and churches has been necessary for a multicultural city to preserve own culture and language.

The different ethnic groups have been also divided into districts, the separation of cultures also happened at the spatial level. The Ukrainians were mostly farmers and lived in the village, the poles inhabited the city, the Jews lived in the shtetl and the Germans in their colonies (Bizová 2009, p. 25).

Beyond all the differences and boundaries that lay between the individual nations, however, there was a space in which the different cultures met.

The third area is business life. "In the streets and houses of the garrison town, however, the national and linguistic boundaries seemed to blur, and at the diagonally falling tree-lined ring square in the centre of the Old Town, Polish shops were found alongside German and Jewish ones" (Pollack 2001, p.21).

In this quote, Martin Pollack has been used the verb "blur" in connection with the national borders. This word combination indicates that cultural change only took place under certain conditions and was spatially and factually limited. Another place of meeting was the market. On market days, people of different ethnic origins met each other, exchanged and sold their goods. In other cases of cultural contact, cultures exist side by side, but separately (coffee houses, associations, churches, schools). At the market, the inhabitants of the multicultural cities were forced to maintain contact with each other. As a result, there was a real interaction of the cultures (Bizová 2009, p. 25).

The Polish language has been spread not only among the Germans but also among the Jews. A group of Jews has been identified with Polish culture during the Jewish Enlightenment. Martin Pollack's example of Polish-Jewish relations in the city of Ternopil with the impact of Polish culture in the school system was evident.

"One circumstance was remarkable in Ternopil: the local Jews spoke Polish better than in most other eastern Galician cities..." (Pollack 2001, p. 197).

There is an explanation of this phenomenon. The Polish school for Jewish children has been established in Ternopil. The coexistence of the many peoples also caused numerous conflicts and tensions in society.

An interesting feature of Galician life is the figure of mixed culture has been mentioned by Martin Pollack. These people can also be described as intercultural figures, which appeared as a result of the confrontation of many cultures (Bizová 2009, p. 46).

Nahuievychi was a predominantly Ukrainian village. The inhabitants of this place were mostly poor peasants whose lives were difficult. A notable figure of this place was Ivan Franko, an ethnographer, Journalist, and poet. In his notes, he has been described the Galician landscape with its typical features.

Ivan Franko was a journalist and wrote in Polish, Ukrainian, and German. Thanks to this ability, he is called "an exemplary figure of mixed culture".

"Language is a sign of interculturality, of mutual cultural impact. As already indicated, the people in these countries were mostly multilingual" (Pollack 2001, p. 64).

Of primary importance are Franko's critical contributions, including "Theory and Development of the History of Literature", "The Little Russian-Ukrainian Literature", "The Ukrainian (Ruthenian) Literature", "Taras Shevchenko and His Legacy", "Taras Shevchenko", Shakespeare at the Ruthenen", " Maria Konopnicka ", " A Poet of Betrayal ", etc. (Zymomrja 1999, p. 2).

Ivan Franko is not only an intercultural figure because of his multilingualism. The second aspect is also a cultural identity. He was born as a Ukrainian, but the village was in the hands of Polish rule, he studied at Polish schools and wrote in Polish newspapers.

Ivan Franko is proof of the interaction of cultures in Galicia. He connected different cultures in his literary work through language and also in his personal life through contacts with people (Bizová 2009, p. 47).

Ivan Franko also embodied the conflict in this area. On the one hand, he took over a part of Polish culture (the language, cultivated contacts), on the other hand, he criticized the conditions in Galicia under the power of the poles and showed in his writings the Polish arbitrariness.

In Martin Pollack's work "A Journey through the Missing World of Eastern Galicia and Bukovina" one can also find other representatives of mixed culture, e.g. the writers Józef Wittlin, Joseph Roth, and Izydor Berman. These personalities of the cultural literary life in Galicia have been connected by the cooperation and the common time and place.

The fall of the Galician world has been determined by the end of the Austrian monarchy in 1918. But long before that, when the world of yesterday really fell apart, some changes took place in society, which pointed to the end. (Bizová 2009, p. 56).

In this way, it can be concluded that at the beginning of the 20th century Galicia was a multi-ethnic and multicultural area, where on the one hand the peoples have been strictly separated from each other nationally, and on the other hand, the nations and cultures have been met freely and maintained contact with each other. Moreover, in this multinational society there have been strictly nationally separated social spaces and also those in which the nations and cultures met freely and maintained contact with one another. The nationally divided spheres have been included the school system. The boundaries between cultures have been interpreted differently. On the one hand, borders contribute to the preservation of one's national identity, culture, and traditions; on the other hand, nations can be inaccessible to other cultures. Due to national closeness, it can arise an understanding gap that is difficult to overcome.

So, interculturality in Galicia is prominent to an active contact between different cultures, the confrontation of customs, thinking, and ways of life that collide in intercultural relationships. A phenomenon emerged in Galicia that went beyond all cultures has been involved and affected the actions of people in different situations and areas of life.

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## How to Train Physical Education Teacher to Detect Physical and Social Adaptation Criteria and to Use Them in Education Activity

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### Abstract

The problem of primary to secondary school transition is common extremely acute for all teachers. The role of physical education teacher in its solution has several features. One of them is necessity of preserving not only physical health, but also psychological comfort and fixing healthy lifestyle habits. Highly specialized university programs for physical education departments cannot allow preparing young teacher to solve these problems and to evaluate the effectiveness of his activity from the point of his students' health. This educational problem is aggravated by the fact that health cultural criteria are very individual and their set is unique for every child.

The goal of this article is to determine the health culture forming criteria for primary school pupil and to find the most effective methods of teaching physical education students to use them in school educational process.

The main methodological approach in primary school pupils' health culture components' analysis is humanitarian educational approach. It allows to view every changes in physical, psychological and social state of pupils as a priority target of any educational process. Pedagogical modelling provided by educational cases complex is one of the leading method of teaching students to determine criteria for the formation of primary school pupil's health culture.

As a result of research primary school pupil's health culture components and their functions in adaptation to secondary school process were determined. Also a complex of common and special criteria was presented. This one allows to young physical education teachers to draw individual plans for comfortable adaptation of their pupils to new realities of educational process in secondary school. Authors present technological content support for students' preparation to solve this problem.

This article can be useful for students and teachers of pedagogical universities, additional professional education specialists, primary and secondary school teachers, researchers working on primary to secondary school transition problem.

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**Keywords:** Health culture, Health culture components, Health culture functions, Physical education, Teacher's professional education, Health culture forming criteria.

### Introduction

The problem of forming and evaluating of pupils' health culture is usually discussed with respect to teenagers, although the basis of healthy lifestyle and its propaganda in society starts in primary school, the more active the more pupil are included in media field through interactive and virtual environment. Thus the problem of pedagogical support for worldviews foundation as some other social and value orientation became much younger (Berinskaya and Kuzina, 2019, Kalinina, 2019, Gavrilycheva, 2008). According to this, authors try to review forming criteria and ways to determine the mastery of basic health culture by comprehensive school 4 grade pupils. The relevance of this problem in primary school age is also connected with needs in early determining of child's abilities and preferences his mastering different kinds of

productive and creative activity, which is approved by new generation Federal educational standard for common education (FESCE) for secondary school. Particularly FESCE mentions the increasing role of school education in team building, child emotions and feeling development, personality forming detecting and developing his talents and preparation to adulthood according to humanitarian terms (Kurbatova and Skoda, 2015, Savinov, 2012, Kazakova, 2016).

Thus the objective of the research is to detect the abilities and mechanics of basis health culture forming in primary school age and to suggest evaluation and self-evaluation criteria for dynamics of phenomenon and processes building this kind of culture as a component of humanitarian worldview and as healthy lifestyle rules regulator development.

## Materials and Methods

Humanitarian paradigm and humanitarian approach in education authors view the effectiveness of any pedagogical activity according to terminal values of society and human worldview. Most scientists working on pupil's personal culture give to health culture prominent space in human potential development in any age (Parfenova, 2016, Kalinina and Lomakina, 2018, Mammadov, 1996). This kind of personal culture is based on such values as «Health», «Life», «Human», «Nature», «Learning», that is why it includes several important components reflecting its total composition. This approach allows the authors to determine primary school pupil's health culture components, educational transition from primary to secondary school functions.

As a physical education students' preparation for primary school pupils' health culture evaluation process main method a pedagogical modelling was used. It is good both for strategical goals and vectors and for specific situations in physical education process (Xutorskoy, 2004, Dakhin, 2010). For example, students were given tasks, connected with the work of primary and secondary school physical education teacher, sport instructor, rehabilitation teacher and inclusive education teacher. The research experimental base were teachers and students of Minin University physical education department and young physical education teachers from schools of Nizhny Novgorod, 783 people in total.

## Results

During theoretical research (it's results became the foundation of a content for teaching physical education department students the way to solve problems of primary to secondary school transition based on health culture criteria) following postulates were determined:

Health culture, as the most researchers say, «is viewed in worldview aspect, as constantly transforming system of knowledge and motivational and volitional personal experience and practical activity directed on learning, development perfection of individual health needed for long and high-quality life, joyful performing of life duty» (Grigoryeva et al, 2020, Bystritskaya et al, 2020, Bicheva, 2016). In the presented and similar interpretations, the culture of health is realized by a person directly in relation to himself, his current state of health, his goals, determined by N.A. Bernstein in the position of the "required future" and to his activities.

However, practice shows that there is no clear correlation between somatic health state and health culture development level. For example, Paralympics and personal history of several outstanding people (blindness of Homer, deafness of Beethoven etc.), had very high cultural level, including corporeality culture, confirms that personal physical culture can be developed among people with any kind of health state (Vetkov, 2016, Kuzmina, 2019, Krasnopevtseva et al, 2020). That is why we can detect health culture functions not only to their host, but to his attitude to other people, nature and society. These functions are perfectly match with cultural components. In this relationship their role in worldview and management of child's life is more obvious.

1. Health culture cognitive component – level and dynamic indicator which includes not only knowledge about healthy lifestyle organization rules according to age and social group, but also a motivation to use this knowledge in individual and collective mode (Karaseva et al, 2018). This component is expressed in pursuit of propaganda of received knowledge and creed in healthy lifestyle social projects and their exchange during routine communication, in pursuit to their renewal. In this aspect we should consider it as an information and enlightenment function of health culture of individual person. We can understand from description of this component that almost all of its forming criteria can manifest if not in the start of

school education then no later than in third or fourth grade. We should note that this health culture component is not limited by healthy lifestyle knowledge, but allows a child to be a part of incredibly important forms of social communication and pro-social activities thanks to them. Thus, the common criteria of primary school pupils' health culture forming on this component are: knowing the rules of healthy lifestyle and knowing about his own standard in his age and for the closest future. There are also special criteria for cognitive component: knowing the potential of family environment in subject's health support, understanding individual needs and propensity to movement activity and very accurate understanding of sport giftedness.

2. Health culture communicative component can be described from the perspective of multipositioning and communication receiver. It can be expressed as self-communication, as verbalized self-analysis, self-control, targeting, self-regulation and self-correction in goal achieving (Petrova, 2014). In communication with education environment subjects it is presented as a reflection of child's goals and interests, his examples, landmarks and propensities in understanding of health, in conviction of mutability of healthy lifestyle. Then pupil not only says about his attraction to sport, but also motivates his classmates to join the same sport section, to health camp participation, to self-discipline and rejecting bad habits. In family communication this component manifests as child's requests for purchasing sport equipment, books about human's nature and physiology, cooperative attending of events directed on organization of a dialogue of a man with himself, with others, with nature.

According to ideas of L.S. Vygotsky, written in his Psychic functions compensating theory, «the presence of illness does not qualify the defectiveness of human, but his social realization does»... «sooner or later the humanity will overcome blindness, deafness and imbecility, but at first it will be made not in medical or biological fields, but in social and pedagogical fields». In other words, the communication, specially organized for healthy environment, personal realization for people with different abilities and possibilities, which is high-level health culture interaction, is fully wellness. Primary school pupils also can be part of this communication. The word can heal and bring hope.

In point of nature primary school pupil acts, accordingly with his actual health culture level. He acts in borders of ecological rules: «Human is a part of a nature, not its master»; «Everything is interconnected», «Everything must go somewhere», «Nothing is granted» and «Nature knows best» («Closing Circle» Barry Commoner). These are imperatives which create behavioral patterns for primary school student in natural environment. According to these, a child will communicate with nature not detached, but carefully, based on useful interaction, both for nature and human. Verbalization of these relationship of child with nature and himself leads to acquiring socially approved status of "fizkulturnik" (amateur sportsman in Russian), ecologist, junnat (junior naturalist) and so on. This status can correct his role and place in children collective and allows to take higher social position. That is why we can say about recovery and corrective function of health culture.

According to the data of health culture forming objective criteria on this component contain: understanding the core principles of communication with different categories of people working on pupil's health (parents, coaches, teachers, medics etc.); wide and accurate lexicon which reflects needs and possibilities of health culture forming, propensity to communication on forming and developing health culture. The main subjective criteria are communication style, extroversion or introversion, individual communication experience on health and recovery.

3. Health culture action component is a complex of quality indicators and level of success in health preserving activity, correction and rehabilitation. This component, as it was shown earlier, views health as a construct consisted of three levels - internal (biological), intermediate (psycho-emotional) and external (personal-social) (Treshcheva et al, 2014). Because of this fact it is vital to choose health-preserving forms of activity in such a way that they could reflect in health culture of the subject as full as it can. During the harmonic health forming activity child can get his own interests, propensity, uncover abilities to certain activity. This activity will always be creative and personal. Creative function of health culture uncovers in such a way. According to patterns of educational process and Skinner's laws of learning, the most strongly remembered and most often manifested in a person is an activity that, on the one hand, is mastered with the maximum cost of labor, on the other hand, it includes the maximum possibility of realizing the various abilities of the child, and therefore has the potential for the development of his giftedness. Thus health culture manifests as a complex energy consuming and creative activity, e.g. sport.



Objective criteria of health culture forming are collective sport and creative experience analyzed by teacher, using sport infrastructure in school educational process and sport and recreation events intensity in educational organization. Subjective criteria are individual reflected sport activity experience of a pupil, family and individual state of three-component health and its correction.

4. Health culture reflective and motivational component is child's evaluation of the situations and facts, processes and phenomena from position of harmonious health as a target of self-perfection (Rushakova, 2015). This component forming criteria are knowledge and systematic using of diagnostic procedures on tracking dynamics of well-being and mood, determining reasons of health improvement and deterioration; expanding diagnostic instruments arsenal, which is used in health procedure using processes and results evaluation; self-stimulation and self-motivation to achieving these goals and analysis of actions leading to positive and negative tendencies in human health dynamics; pursuing of forming steady healthy habits and in strong position on actions breaking health harmony. This component manifests in diagnostic and control health culture function, which is deliberate conduct of healthy lifestyle and its adaptation to different life situation. The example of such changing can be transition from primary to secondary school. It aggravates several problems. Their decision depends on child's health culture forming level. The objective criteria are external motivation to healthy lifestyle from educational facility; using diagnostic methods for three-component health analysis in educational facility; using technology of developmental education by educational facility. Subjective criteria are regularity of self-diagnostic and mutual diagnostic of three-component health in pupils' families; subjective perception in wellness activity; including pupil in healthy leisure traditions.

As a technological justification of preparation of physical education department students to primary school pupil health culture criteria analysis solving inventive tasks technology (SITT) mutual learning technique SWOT analysis and other forms of project education analysis were used [13]. Also educational cases were built. They reflect needs, determined by future physical education teachers, in using separate components of health culture forming criteria for primary school pupils for educational process. These educational technologies were used by physical culture department of Minin university during three semesters.

As a result more than 70% of students started to use objective criteria of primary school students health culture analysis in complex, 62% of students realizes the necessity of using primary school pupils' health culture subjective criteria for the first time, 34% of students were ready to interact with teachers in primary school pupils' health culture forming again, 42.5% of students realized the necessity of preparation pupils for primary to secondary school transition and for new pedagogical conditions of educational processes. Moreover, the experiment allowed to learn that experimental group students during the experimental activity realized the necessity of special training for pupils' health culture evaluation and not only for physical condition and sport features evaluation for the first time. According to this we can ascertain that the experiment confirmed researchers' theory and gave an opportunity to teach students the target criteria evaluation for primary school pupils health culture, especially in the moment of secondary school transition.

## Discussions

Based on research it became apparent that work on criteria analysis and correction of primary school pupils' health culture during their primary to secondary school transition allows to solve large number of significant problems mentioned by other researchers, such as:

1. Decreasing quality of knowledge and competence due to structural and logical distortion of the content and technical support and unformed ability and propensity to self-educating. Such tendency can be overcome with sufficient level of cognitive and reflective components of health culture, when a child organizes his learning process and controls it according to orientation on positive result with positive attitude to his health. These children do not start making their home task in bad mood or being exhausted, they are able to match the periods of their work and rest by themselves and, as a rule, are totally independent in their learning. They are gladly taught and widen their horizon. However, such success in transition are not given free. For that the mechanic of «study sustainability» must be fully practiced.

2. Losing interest in study, in learning process and activity during the entering the fifth grade, when at the primary school last study period teachers, in order to perform the transition, are making accent on

preparation of children to graduating procedures. The volume of tasks in educational process grows rapidly, information preparation increasing through repeating, memorizing and other kinds of reproductive activity. In this extremely sensitive and creative period for children the developing of their talents “stalls”. To form health culture action component, which prevents aggravation of the problem, you should turn on selection activity mechanics.

3. Secondary (acute) infantilism among the modern primary school pupils and signs of false maturity due to weak health culture communicative component forming was found earlier. Unwillingness for teenage, where communication and interaction with the peers is the dominant activity, becomes more and more actual problem for teachers. The contradiction between scientific periodization of aged feats of pupils and educational structure, unacceptable exploitation of still not formed psychic and personal structures of children in “mature” activity lead to increasing these tendencies. Educational level transition is broken in this case. In order to secure the basis of non-conflict and productive communication and forming the atmosphere of successful transition in fifth grade it is necessary to use health culture communicative component, which can be realized in project activity in different social groups through “aged teeterboard” mechanics.

To prove effectiveness of content-technological support of primary school pupils’ health culture criteria evaluation a survey was conducted among the parents, whose children attended class where the students participated in experimental group had their pedagogical and research practice.

To determine the level of health culture component development among primary school pupils (3th and 4th grade) the questionnaire was created and the survey was performed among kids and their parents. Also teachers gave their expert opinion on the preparation process. The «Health culture» questionnaire included these questions and tasks:

1. Who in your opinion is health culture distributor in our society?

2. Which qualities the health culture distributor should have? Choose them from the list and give them number according to their importance. (There is a list of characteristics and values of health culture, like humanism, self-discipline, will, love to beauty and so on).

3. From which sources do you prefer to get an information about wellness, disease prevention and healing, recreation and healthy lifestyle? (There is a list of the most well-known health portals, printed and interactive)

4. Which health information do you want to use with your family?

a). Knowledge of physiotherapy.

b). Knowledge of massage and self-massage.

c). Knowledge of fitness system.

d). Communicating on health and wellness topic experience.

e). Knowledge of day-night rhythm (diet, dream etc.)

f). Healthy lifestyle personal experience.

The result of survey and expert evaluation showed that control group students use their knowledge and competence connected only with the task of primary school students’ physical perfection. At the same time the members of experimental group used the total complex of primary school students’ health culture criteria evaluation got necessary and reliable data and, cooperating with parents, formed training vector for their pupils, got gratitude from the administration of educational facilities due to high level and speed of adaptation of their pupils to secondary school.

## Conclusion

The goal of the article is to determine primary school pupils’ health culture forming criteria, the most important among these are knowledge of healthy lifestyle organization rules, according to age and social group, motivation on using this knowledge not only on individual but also on collective level, self-communication and communication with other subjects of educational environment, reflecting the information about goals, tasks, standards, landmarks and talents, according to their health, health of their folks and healthy lifestyle rules, a set of quality indicators and the level of success of activities for health preservation, correction and rehabilitation of health; the child’s assessment of situations and facts, processes and phenomena from the position of harmonious health, as a target guideline for self-improvement.

Authors determined cultural health functions targeted on secondary infantilism overcome and prevention. Among them are information and enlightenment, corrective and recovery, creative, diagnostic and control.

Also authors determined the most effective ways of teaching of pedagogical universities students to primary school pupils' health culture in interests of 1<sup>st</sup>-4<sup>th</sup> grade students' adaptation to secondary school transition. These are pedagogical modelling, case technology and social-educational projects.

### Recommendations

This article can be useful for students and teachers of pedagogical universities, additional professional education specialists, primary and secondary school teachers, researchers working on primary to secondary school transition problem. It is especially vital that these materials could be learned by students of non-physical education departments of pedagogical universities to harmonize primary school pupils' health culture pedagogical impact.

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## Development of Research and Writing Activities in the Field of Sports Science Publishing in Montenegro

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### Abstract

The aim of this research was to analyze the trend of publication within Montenegrin journals, as well as the scientific research activities of Montenegrin researchers in the field of sports science. The investigation subject included the scientific papers published in the period from 2002 until 2020, within the field of sports science. The electronic databases (Google Scholar, Scopus and Web of Science) were searched for research articles available until 22nd September 2020. The findings of this study were summarized in accordance with the PRISMA guidelines, presenting the values of citations, h-index, i10-index, as well as the number of scientific papers of the best authors. The results of this study indicated that researchers in the field of sports science increased the number of publications from 2002 to 2020. The number of citations span from 502 and 10677 within ten most cited researchers in Google Scholar database, while the same researchers were cited quite less in Scopus and Web of Science databases. On the other hand, in Google Scholar database, there are three registered Montenegrin journals and the Sport Mont journal is the most cited one. The Montenegrin Journal of Sports Science and Medicine is the best ranked Montenegrin journal according to the bibliometric data that can be found in the Scopus and Web of Science databases, while the Journal of Anthropology of Sport and Physical Education is the lowest ranked in Scopus and Web of Science databases, but middle ranked in Google Scholar database, and with significant progress in the last year. Hence, the further deployment is expected in upcoming period.

**Keywords:** Development, Ranking, Journal, Researcher, Sports Science, Montenegro.

### Introduction

We are witnessing that attention is increasingly being paid to bibliography research in which the main focus is sports science, as one of the youngest but the most popular sciences today [1]. Considering the fact that knowledge from various scientific fields is expanding day by day and increasing amount of information is available, the purpose of bibliographic research is exactly reflected in that all important information is systemized in one place and could be easily accessed. Research conducted by Popovic [1] and Vukasevic at al. [2], clearly indicate the significance of sports sciences. Popovic [1] states that sports sciences are equal to both natural and technical sciences, according to the number of papers published on an annual basis. All this clearly express that sports sciences are rapidly developing, building a stable scientific field. Even though Montenegro is a territorially small country, it is the region in which grow up a lot of excellent athletes, both in individual and collective sports. Many achievements of Montenegrin athletes are remembered. While we are talking about this topic, it should not be omitted to mention a golden medal at the European Championship won by water polo players of the national team of Montenegro in Malaga in 2008, as well as a silver medal at the World Championship in Barcelona, in 2013. A notable result was also achieved by women's handball national team, winning a gold medal on European Championship held in Serbia in 2012, as well as a silver medal on summer Olympic Games in London, held in the same year. Also, a silver medal won by Mario Hodzic and a bronze medal won by Nikola Malovic at the senior European Championship in karate, held in Guadalajara, are a confirmation of hard work and potential of Montenegrin athletes. Considering that Montenegro gained its independence in 2006, and has been trying to prove itself through a large number of activities for many years, among others with achieved sports results, it should be point out that without sports science, professional sport and its progress is inconceivable. That is an unbreakable bond which leads to success if it is done diligently and with dedication on its firming. In Montenegro, sports sciences are linked to the Faculty for Sport and Physical Education of the University of Montenegro, as a renowned institution operating in this field. Faculty for Sport and Physical Education was founded in 2008,



and since then has been working as an individual university unit, within which the greatest experts in the field of sports science in Montenegro work, and improve their competences. Furthermore, as a confirmation of quality, the Faculty for Sport and Physical Education standing behind the international conference of sports science that is organized once a year, and which gathers a large number of experts from around the world, within the latest achievements in this field are presented. In addition, the Faculty for Sport and Physical Education has three journals in which papers from the field of sports sciences are published, namely: "Montenegrin Journal of Sports Science and Medicine", "Sport Mont" and "Journal of Anthropology of Sport and Physical Education". Accordingly, the purpose of this paper is to present and analyze the scientific activity of researchers, as well as the trend of publishing in the mentioned Montenegrin journals in the field of sports science.

## Method

### *Subjects and Sample Characteristics*

The subject of research in this study were scientific papers in the field of sports science, published in the period from 2002 until 2020, and the research included journals that cover the mentioned field in Montenegro, and those are: "Montenegrin Journal of Sports Science and Medicine", "Sport Mont" and "Journal of Anthropology of Sport and Physical Education". Also, the scientific research activities of all researchers in the field of sports sciences has been processed.

### *Instruments*

For research articles available until 22 September 2020 were searched three electronic databases (Google Scholar, Scopus, and Web of Science). Mentioned scientific databases have all the aspects necessary to conduct an adequate and reliable analysis. Namely, "Google Scholar" is the most visible, open database that collects all bibliographic material, even one that has not been reviewed and thus does not ensure quality as is the case with the other two. "Scopus" is a widely accepted database and it is very important. All journals that are within the scope of "Scopus" database are reviewed every year, in order to maintain a high standard of quality. At the very end, the "Web of Science" is the most prestigious scientific citation database that has grown into the most reliable instrument for evaluating the journals and scientific production of the author, and being part of the elite is also a prerequisite for adequate academic progress.

### *Measurement Procedure and Data Analysis*

In this research were used "Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)" guidelines [3]. For the purposes of this research, into consideration were taken the number of citations, h-index, i10-index, as well as scientific papers of researchers, which are ranked as the most successful in the field of sports science and who presented their scientific activities in the form of published scientific papers in the mentioned journals.

## Results

Table 1 shows the data obtained by analyzing the "Google Scholar" database. Based on the obtained results, it can be concluded that the highest values of citations, h-index, and i10-index has "Sport Mont" journal. Surely, there is constant progress from year to year, which is clearly visible if a comparison is made with the previous research [1, 2]. Mentioned research progress of "Sport Mont" journal is supported by the facts that it dates back to 2003, and there are published over 1500 scientific papers. That is why it is not surprising that "Sport Mont" journal is at the top of this list. Right after it, with a less number of citations, is the "Journal of Anthropology of Sport and Physical Education". It is very important to mention that a change is registered by comparison with the previous research [2], in which this journal was in the last place in terms of citations, while it is now ahead of the "Montenegrin Journal of Sports Science and Medicine" journal, which is the last on this list. Thus, even though it is a young journal, created in 2017, it records rapid progress and an increase in the number of citations within the "Google Scholar" database.

**Table 1.** Bibliometric analyses of Montenegrin journals in "Google Scholar" database on 22nd September 2020

Journal	Number of Citations	h-index	i10-index
SMJ	5171	39	112
JASPE	1804	25	55
MJSSM	1526	18	53

Note: SMJ – "Sport Mont" journal, MJSSM- "Montenegrin Journal of Sports Science and Medicine", JASPE – "Journal of Anthropology of Sport and Physical Education", h-index - is an author-level metric that attempts to measure both the productivity and citation impact of the publications of a scientist or scholar, i10-index - the number of publications with at least 10 citations; this very simple measure is only used by "Google Scholar", and is another way to help gauge the productivity of a scholar

In table 2 are processed and presented results obtained by analyzing the "Scopus" database. What is evident, as in the previous research that had Montenegrin journals in the field of sports science as the subject of research, the analysis included only indexed journals, and accordingly the "Journal of Anthropology of Sport and Physical education" was not taken into consideration. The better ranked journal within this database is the "Montenegrin Journal of Sports Science and Medicine", but there is also an evident decrease compared to 2018 when CiteScore was 3.30, while the journal "Sport Mont" recorded growth within CiteScore compared to the previous year, when it was 0.83.

**Table 2.** Bibliometric analyses of Montenegrin journals in "Scopus" database on 22nd September 2020

Journal	CiteScore 2019	SJR 2019	SNIP 2019
MJSSM	2.8	0.309	0.453
SMJ	1.9	0.529	0.624
JASPE	Not calculated	Not calculated	Not calculated

Note: CiteScore -measures average citations received per document published in the serial, SJR - SCImago Journal Rank that measures weighted citations received by the serial, citation weighting depends on subject field and prestige (SJR) of the citing serial, SNIP - Source Normalized Impact per Paper measures actual citations received relative to citations expected for the serial's subject field

In table 3 are presented results by analyzing the "Web of Science" database. The difference compared to the "Scopus" database is that citation data can be recorded for journals that are not indexed in this database. After the conducted analysis, it can be stated that the "Montenegrin Journal of Sports Science and Medicine" has the largest citation. In addition, the h-index and the average number of citations per published scientific work have increased compared to previous years. "Sport Mont" also has an enviable number of citations, although it is not indexed in this database yet. It is important to note that the youngest journal, in the field of sports science in Montenegro, "Journal of Anthropology of Sport and Physical Education" also records citations in the most prestigious database.

**Table 3.** Bibliometric analyses of Montenegrin journals in "Web of Science" database on 22nd September 2020

Journal	Number of Citations	h-index	Average citations per item
MJSSM	324	7	2.55
SMJ	296	Not calculated	Not calculated
JASPE	23	Not calculated	Not calculated

The activities of researchers in the field of sports science within the scientific database "Google Scholar" are shown in table 4, who actively publish scientific papers in the analyzed journals. It is important to emphasize that the analysis included the top ten researchers with affiliation in the mentioned field. There is a remarkable increase in citations of individual authors comparing to 2018 and 2019. If we take into consideration the number of citations made by these researchers, it is important to note that 6 researchers in the field of sports sciences, included in this analysis, are among the top 30 researchers at the University of Montenegro, and all 10 researchers is among the top 40 researchers at the University of Montenegro, taking into account all scientific fields. Furthermore, all 10 researchers have over 500 citations. Based on the

mentioned, it can be certainly stated that researchers from the field of sports science are diligently working on the affirmation of this scientific field and that they are leaders at the mentioned institution.

**Table 4.** Bibliometric analyses of top ten Montenegrin researchers in "Google Scholar" database on 22<sup>nd</sup> September 2020

Researcher	Number of Citations	h-index	i10-index
Dusko Bjelica	10677	50	184
Stevo Popovic	9068	50	133
Jovan Gardasevic	3661	37	89
Bojan Masanovic	2476	31	64
Ivan Vasiljevic	1454	25	36
Rajko Milasinovic	1051	19	20
Rasid Hadzic	571	14	16
Dragan Krivokapic	548	11	11
Marina Vukotic	515	12	17
Miroslav Kezunovic	502	8	8

In table 5 is shown the scientific activity of the top 10 researchers in the field of sports science from the University of Montenegro, within the "Scopus" database. It is noticeable that the number of citations is significantly lower compared to the "Google Scholar" database. This can be explained by the more narrowly, and more quality scientific research content of the database itself. It is evident that in this table there are 8 out of 10 same names as in table 4, and all 10 were on this list in 2019, only with a slightly different formation.

**Table 5.** Bibliometric analyses of top ten Montenegrin researchers in "Scopus" database on 22<sup>nd</sup> September 2020

Researcher	Number of Citations	h-index	Documents by author
Stevo Popovic	1922	12	49
Dusko Bjelica	1860	10	53
Jovan Gardasevic	193	8	38
Kemal Idrizovic	137	7	23
Bojan Masanovic	98	6	25
Miroslav Kezunovic	84	3	10
Jovica Petkovic	57	2	5
Dragan Krivokapic	52	3	10
Ivan Vasiljevic	39	4	18
Rasid Hadzic	25	1	7

Table 6 shows the scientific research activity of authors in the field of sports science in the most prestigious database "Web of Science". As indicated above, the "Web of Science" is database with the highest quality and in many countries is the basis for assessing the quality of both institutions and journals and authors. Accordingly, it can be stated that there is an evident decrease in the number of citations in relation to the previous two analyzed databases, although there is an exceptional number of citations of the first two authors in this one. It can be seen from the attached that Montenegrin authors have a large number of papers in the most prestigious database and they have significantly improved compared to the previous two years. It is important to note that one author has over 50 published works, the other in this table is very close to that number, and even six authors have over 10 published papers in this database, which is also a significant improvement compared to 2019, and the number of citations of all authors exceeds the double-digit number.



**Table 6.** Bibliometric analyses of top ten Montenegrin researchers in "Web of Science" database on 22<sup>nd</sup> September 2020

Researcher	Number of Citations	h-index	Documents by author
Stevo Popovic	1715	10	53
Dusko Bjelica	1658	10	49
Kemal Idrizovic	120	7	16
Miroslav Kezunovic	91	5	20
Jovica Petkovic	49	2	4
Jovan Gardasevic	36	3	19
Rasid Hadzic	22	2	10
Bojan Masanovic	17	2	20
Rajko Milasinovic	16	1	3
Dragan Krivokapic	12	1	5

### Discussion and Conclusion

After the analysis of the presented results, it is very important to emphasize that the researchers from the Faculty for Sport and Physical Education have made remarkable progress for the mentioned period and have published a large number of scientific papers, which are recorded in the mentioned electronic scientific databases, and special attention is paid to the most prestigious ones, such as "Web of Science" (SCI, SSCI, SCIE & ESCI) and "Scopus". It is interesting to note that the first scientific paper of a researchers in the field of sports science was published in the "Web of Science" scientific database in 2013, while in the "Scopus" database in 2008 [1]. If we take into account previous research [1, 2], it could be seen a clear progress from year to year. Namely, based on the data in this study, and compared to the research from 2018 [1], the researchers published 108 more scientific papers, while they published 89 more scientific papers compared to 2019 [2] in the "Web of Science" database. Regarding to the "Scopus" scientific database, 88 more scientific papers were published compared to 2018 and 49 more compared to 2019. Also, the progressive progress of Montenegrin researchers in the field of sports science is evident, not only in the mentioned databases, but also in the "Google Scholar" database. Dusko Bjelica records an impressive 10,677 citations within the mentioned database, which puts him in the second place by number of citations at the University of Montenegro, but there is a tendency for him to take the lead in a relatively short period of time. It is important to note that changes are recorded within this database compared to the previous year, and they relate to the top 10 Montenegrin researchers in the field of sports science. Namely, Ivan Vasiljevic advanced from the sixth place to the fifth, while Marina Vukotic found her place in the top 10 researchers. Regarding the "Scopus" electronic database, it is important to point out that the first author in terms of the number of citations is Stevo Popovic, with 1922 citations. The progress, which made Jovan Gardasevic, Bojan Masanovic, as well as Ivan Vasiljevic compared to 2019, is evident.

As for the "Web of Science" database, one of the important facts is that two researchers who were not in the top 10 researchers last year found their place among them, compared to the research conducted by Vukasevic et al. [2]. These are Bojan Masanovic, who has published 10 papers in journals indexed in SCI, SSCI or SCIE databases in the last two years [4, 5, 6, 7, 8, 9, 10, 11, 12, 13] and Ivan Vasiljevic, who published three papers in the same period in the journals that are indexed in the mentioned databases [14, 15, 16]. Along with them, Jovan Gardasevic is making extremely visible progress, having published nine papers in the last two years in journals indexed in SCI, SSCI or SCIE databases [11, 12, 13, 14, 15, 17, 18, 19, 20]. Montenegrin researchers in the field of sports sciences are one of the few in the entire scientific community of Montenegro who have managed to publish scientific papers in even the most prestigious journals of today. Therefore, Dusko Bjelica and Stevo Popovic, with their competencies and expertise, deserved the attention of the public when they published scientific papers in journals that belong into the Q1 category. The first scientific paper was published in the journal "Lancet" [21], which had an impact factor of 53.254 at that time, while the second was published in the journal "Nature" [22], which had an impact factor of 41.577 in that period. Also, another scientific paper is already available to the public in the "Lancet" journal [23], which currently has an impact factor of 60.392. It was the publication of scientific papers in high-ranking journals that resulted in the great number of citations and popularity of the mentioned researchers. It is

important to state that researchers in the field of sports science (all mentioned researchers belong to one institution, i.e. the Faculty for Sport and Physical Education of the University of Montenegro) based on data provided by "Google Scholar" database (Table 1) are among the best in the University of Montenegro. Namely, six authors are in the top 30, and all 10 authors are in the top 40 researchers at the University of Montenegro, according to the number of citations.

The journals included in the analysis in this work made a constant progress. The "Sport Mont" journal, which is the most cited journal in the "Google Scholar" electronic database, records a progressive increase from year to year. As stated in previous research [2], the key for the development of this journal is 2017, when the journal was indexed in the "Scopus" database, since when the citation has been on the rise. A good indicator of the progressive growth of this journal are the scientific papers of eminent researchers published during 2019 [24, 25, 26, 27, 28, 29, 30, 31, 32, 33]. It is important to emphasize that the journal has maintained constant growth, which is confirmed by the findings of this study and there is a real possibility that it will enter the most prestigious database "Web of Science". When it comes to the "Montenegrin Journal of Sports Science and Medicine", it can be said that it is the best in Montenegro in the field of sports science, included in the prestigious "Web of Science" database, i.e. in the "Emerging Source Citation Index". Regarding to above mentioned, this journal still has no impact factor. If we take into account the dynamics of its growth, we can say with certainty that it will soon be included in one of the three most prestigious categories within the "Web of Science" database (SCI, SSCI or SCIE) and will receive an impact factor. Very high quality scientific papers by eminent authors, which were published in the first [34, 35, 36, 37, 38, 39, 40, 41, 42, 43, ] and the second edition of the eight volume [44, 45, 46, 47, 48, 49, 50, 51, 52, 53], and also in the first edition of the ninth volume [54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64] are guarantee that it will happen. At the very end, the youngest, but still a journal that has made notable progress is the "Journal of Anthropology of Sport and Physical Education". The mentioned journal has been making constant progress since its founding in 2017, so it has been indexed in world scientific databases such as: DOAJ, Index Copernicus, Crossref, ROAD, in addition to "Google Scholar". Accordingly, the editorial team of this journal consists of scientists from Brazil, Turkey, Malaysia, Serbia, Croatia, Kosovo, Bosnia and Herzegovina, as well as the fact that this journal recognizes a growing number of eminent authors from the region, and the world [65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75] it is not surprising why it is recorded much larger citations compared to previous years, as well as to record the citations of this journal in the "Web of Science" database. Of course, it is expected that it will soon be indexed in one of the prestigious electronic citation databases.

The limitation of this study is reflected in the incomplete data within the "Scopus" database, namely, the "Journal of Anthropology of Sport and Physical Education" has not yet been indexed in the mentioned database. Despite the mentioned disadvantages, the significance of this study is great. Namely, the analysis of the remaining databases gave a clear picture of the progress of both journals and authors who have sports science in the focus of their interest. Certainly, the recommendation for further research would be to follow the progress of the "Journal of Anthropology of Sport and Physical Education" and that after its entering the "Scopus" database, make a detailed and precise insight into the dynamics of the development of publishing in the mentioned journals and make a quality comparison with research from previous years.

It is interesting to point out that Vukasevic et al. [2] gave the assumption that the progress of Montenegrin researchers in the coming period will be recorded, and this was confirmed by this study.

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## Management Model of Energy Enterprises Innovative Development Within Physiological Working Conditions

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### Abstract

This paper takes into account scientific approaches to mathematical modeling usage of interval data analysis to develop and improve the innovation management system due to effective innovative solutions related to the sale of energy resources and services including physiological working conditions of employees. The research outlines the tools for implementing the strategy of energy companies' innovative development based on dynamic interval management models of enterprises innovative development, which substantiate management decisions and correlates physiological working conditions of employees. As a result, all these factors make it possible to predict the impact of a system of innovative development factors on the enterprise financial condition. Construction methods of an integrated indicator level combined with workers physiological conditions of energy enterprises innovative development have been used and provided on the optimization of the factor space that creates the company's innovation policy and takes into account its causal links, human factor, physical level of readiness. The article results allowed its usage for modeling the impact of innovation level on the financial performance of energy companies as well as a study of the state of innovative development of energy enterprises in the region.

The mathematical modeling has been used to build such a tool for managing the innovative development of energy market enterprises. One of the most effective approaches to modeling the dynamics of economic processes is the set-theoretic approach accompanied with physical level of employee. Within this approach, the models contain parameters and variables represented as sets of guaranteed or acceptable values, or as fuzzy sets with known matching functions.

The paper determines that the advantage of this approach is that it does not require large samples of data (time series) to obtain adequate models, and preliminary study of statistical characteristics of data, such as the law of data distribution and others. The interval models, which describe indicators of economic processes in intervals of possible values or functional corridors, have been chosen as one type of models. It has been proposed to choose gross income as an indicator of the financial condition of energy market enterprises, because the activities of energy companies are essentially the sale of energy resources and services. Accordingly, innovative solutions aimed at improving sales should receive a response to gross sales revenue. The management mathematical dynamic models proposed in the work scientifically substantiate the decisions made and allow predicting the influence of the system of innovative development factors and physiological working conditions of employees on the financial condition of the enterprise.

**Keywords:** physiological conditions, management model, innovative development, physical level.

### Problem Statement in General

The system of innovation management is the basis of the management mechanism of all processes of direct or indirect influence of the innovation system at the micro or macro level in the field of energy service, as well as the main tool for achieving the goal and achieving all. It can be considered both as a separate management mechanism and as a subsystem of the innovation system, as well as an element of the overall management system of the company, organization or institution.

The managerial mathematical dynamic models are one of the tools of the innovation management system. They scientifically substantiate management decisions and allow predicting the impact of the system of innovative development factors on the financial condition of the enterprise.

A mathematical modeling has been used to build such a tool for managing the innovative development of energy within enterprises physiological working conditions of employees. The set-theoretic approach is one of the most effective approaches to modeling the dynamics of economic processes. Due to such conditions the models contain parameters and variables represented as sets of guaranteed or acceptable values, or as fuzzy sets with known matching functions (Brych V., Manzhula V. others, 2020, pp. 670-673).

The advantage of this approach is that it does not require large samples of data (time series) to obtain adequate models, and preliminary study of statistical characteristics of data, such as the law of data distribution and others.

**The aim of the study** is to propose a management model of energy enterprises innovative development within physiological working conditions.

### The Methodology of the Research

The interval model of the dynamics of the financial condition index (gross profit) of energy companies within physiological working conditions in the western region of Ukraine is built in the form of a solution of discrete difference equations. The solution of equations system has been found by using methods of interval data analysis, which are based on two-way optimization practice of linear programming methods.

### The Main Material of the Research

It has been proposed to choose gross income as an indicator of the financial condition of energy enterprises within physiological working conditions, as the activities of energy companies are essentially sales of energy resources and services. Accordingly, innovative solutions aimed at improving sales should receive a response by gross income of sales. The interval representation of the values of the indicator of the financial condition of the company (gross income) will be:

$$[GP] = \begin{pmatrix} [GP_1^-; GP_1^+] \\ \square \\ [GP_i^-; GP_i^+] \\ \square \\ [GP_N^-; GP_N^+] \end{pmatrix} \quad (3.1)$$

where  $GP_i^- = GP_i - \Delta$ ,  $GP_i^+ = GP_i + \Delta$ ,  $\Delta$  a limited error with a known range of possible values, or a functional corridor of such kind:

$$GP() = GP(-); GP(+). \quad (3.2)$$

The dynamic interval models have been used. They describe discrete difference equations as follows:



$$GP_{n+1} = \alpha_0 + \alpha_1 \cdot GP_n + \sum_{i=1}^M \beta_i \cdot f(u_{in+1}) \quad (3.3)$$

where  $n$  - time discretion,  $n = 0, \dots, N - 1$ ,  $N$  - number of dynamic series;

$GP_{n+1}$  - the value of the simulated index of the enterprise financial condition (gross profit) in  $(n + 1)$  - discrete;

$GP_n$  - the value of the financial index of the enterprise condition (gross profit) in  $n$  - discrete moment of time;

$\vec{u}_n = (u_{1n}, \dots, u_{Mn})^T$  - vector of factors (management) including physiological working conditions of employees on the index of financial condition of the enterprise (gross profit) in  $n$  - discrete moment of time  $i = 1, \dots, M$ , where  $M$  - the number of factors taken into account;

$f(u_{in+1})$  - basic functions in the form of polynomials;

$\alpha_0, \alpha_1$  - model coefficients;

$\beta_i$  - unknown coefficients of factors of enterprise in financial condition management (gross profit).

Estimation of the model coefficients, given the opportunity to obtain interval calculation estimates of the studied indicators in the following form:

$$GP_{n+1} = \alpha_0 + \alpha_1 GP_n + f(u_{n+1}), \quad (3.4)$$

where  $GP_{n+1}, GP_n$  - interval calculations of modeling indices of the financial condition of the enterprise;  $\alpha_0, \alpha_1, \beta_i$  - estimates of model coefficients and factors influencing the index of financial condition of the enterprise.

Statistical data for 2016-2020 has been used for modeling. The value of 3% has been taken for the interval error and it corresponds to the error in the formation of statistical reference books.

As a factor in managing the financial condition of the enterprise, the indicators that reflect the main innovation cost have been taken:

$u_n$  - the general coefficient of innovative development, which summarizes the investment in innovative solutions, where,  $n=0, \dots, 4$  - period corresponding to 2016-2020.

An interval model of the dynamics of the index of financial condition (gross profit) of energy companies in the western region of Ukraine has been built and written in the form of discrete difference equations:

$$GP_{n+1} = \alpha_0 + \alpha_1 \cdot GP_n + \beta \cdot f(u_{n+1}), \quad n = 0, \dots, 4, \quad (3.5)$$

where  $GP_{n+1}$  - the value of the simulated index of financial condition (gross profit) in  $(n + 1)$  - series of dynamics and  $GP_n$  - the value of the index of financial condition (gross profit) in  $n$  - series of dynamics,  $u_{n+1}$  - factors of influence (management) on the index of financial condition (gross profit),

$\alpha_0, \alpha_1$  – model coefficients,  $\beta$  – vector of unknown coefficients of basic functions of the management factor of the enterprise financial condition index.

The model of dynamics is the following:

$$\begin{cases} [GP_1] = \alpha_0 + \alpha_1 \cdot GP_0 + \beta \cdot f(u_1) \\ [GP_2] = \alpha_0 + \alpha_1 \cdot GP_1 + \beta \cdot f(u_2) \\ [GP_3] = \alpha_0 + \alpha_1 \cdot GP_2 + \beta \cdot f(u_3) \\ [GP_4] = \alpha_0 + \alpha_1 \cdot GP_3 + \beta \cdot f(u_4) \end{cases} \quad (3.6)$$

The solution of equations system has been carried out by using the methods of interval data analysis. They are based on a bilateral optimization using linear programming methods, under the following conditions:

$$\begin{cases} GP_1^- \leq \alpha_0 + \alpha_1 \cdot GP_0 + \beta \cdot f(u_1) \leq GP_1^+ \\ GP_2^- \leq \alpha_0 + \alpha_1 \cdot GP_1 + \beta \cdot f(u_2) \leq GP_2^+ \\ GP_3^- \leq \alpha_0 + \alpha_1 \cdot GP_2 + \beta \cdot f(u_3) \leq GP_3^+ \\ GP_4^- \leq \alpha_0 + \alpha_1 \cdot GP_3 + \beta \cdot f(u_4) \leq GP_4^+ \end{cases} \quad (3.7)$$

$$GP_n \in [GP_n^-; GP_n^+], \quad n = 0, \dots, 4$$

where  $GP_i^- = GP_i - \Delta$ ,  $GP_i^+ = GP_i + \Delta$ , – lower and upper limits of the interval values of living standard and taking into account the statistical error.

Tables 3.1 show the original file of the factor of managing the financial condition of the enterprise, taking into account physiological working conditions of employees and index of financial condition of energy company PJSC "Lvivoblenergo". It has been reduced to an interval view with the aim to build a dynamic interval model.

**Table 3.1.** Initial data for building a dynamic interval model for PJSC "Lvivoblenergo"

Year	n	Management factor including physiological working conditions of employees	Interval limits of indicator financial condition		
		$u_n$	$GP_{0n}$	$GP_n^-$	$GP_n^+$
2016	0	0,74	-62,71	-62,09	-63,34
2017	1	0,49	-126,58	-125,32	-127,85
2018	2	0,45	-51,03	-50,52	-51,54
2019	3	0,48	64,30	63,65	64,94
2020	4	0,90	159,94	158,34	161,54

The interval system of linear algebraic equations has been written. The coefficients of the model are its solution. To obtain a model of dynamics, it is sufficient to get a solution in the form of a point in the solution area of this system. It is as following:

$$\begin{cases} -125,32 \leq \alpha_0 - \alpha_1 \cdot 62,71 + \beta \cdot 0,49 \leq -127,85 \\ -50,52 \leq \alpha_0 - \alpha_1 \cdot 126,58 + \beta \cdot 0,45 \leq -51,54 \\ 63,65 \leq \alpha_0 - \alpha_1 \cdot 51,03 + \beta \cdot 0,48 \leq 64,94 \\ 158,34 \leq \alpha_0 + \alpha_1 \cdot 64,30 + \beta \cdot 0,9 \leq 161,54 \end{cases} \quad (3.9)$$

This system is an interval system of interval equations. In practice, this problem has been traditionally reduced to a nonlinear optimization problem. Its solution has been sought by linear programming methods and random search methods (Dyvak M., Porplytsya N., Brych V. others, 2019, pp. 354-357).

After estimating the coefficients of the interval model of gross profit dynamics for the enterprise PJSC "Lvivoblenergo", the following results in the form of a point model have been obtained:

$$GP_{n+1} = 381,75 + 1,06 \cdot GP_n - 595,76 \cdot u_{n+1}, \quad (3.10)$$

In fig. 3.1. graphs of gross profit dynamics have been given on the basis of statistical data and on the basis of the dynamic model (3.10) during 2016-2020 for PJSC "Lvivoblenergo". The projected gross profit for 2020 is UAH 140.24 million.

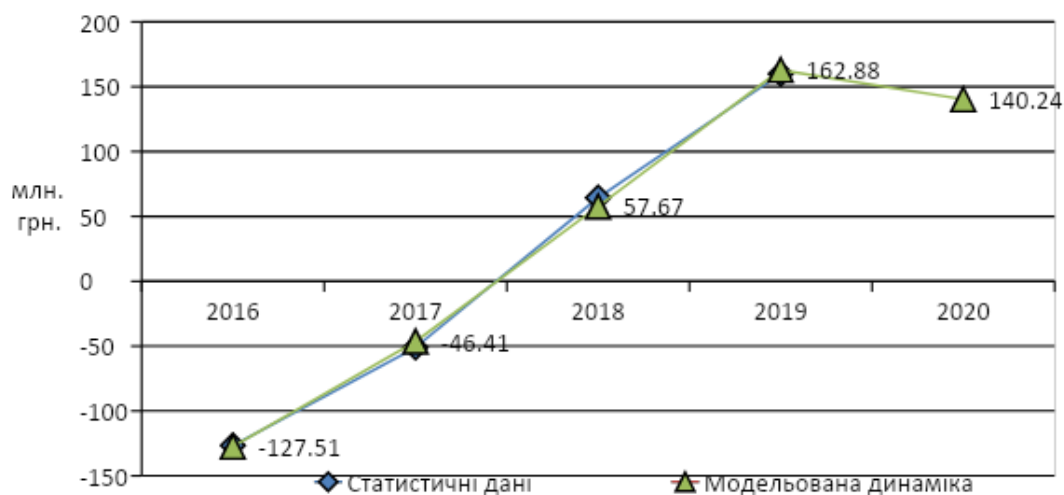


Fig. 3.1. graphs of gross profit dynamics on the basis of statistical data and on the basis of the dynamic model (3.10) during 2016-2020 for PJSC "Lvivoblenergo".

Table 3.2 shows the initial data of management factor including physiological working conditions of the financial condition of the enterprise and the index of the financial condition of the energy company JSC "Ternopiloblenergo". It has been reduced to an interval view with the aim to build a dynamic interval model.

Table 3.2. Initial data for building a dynamic interval model for JSC "Ternopiloblenergo"

Year	n	Management factor including physiological working conditions of employees	Interval limits of indicator financial condition		
		$u_n$	$GP_{0n}$	$GP_n^-$	$GP_n^+$
2016	0	0,85	82,10	81,28	82,93
2017	1	0,64	78,85	78,06	79,64

2018	2	0,81	158,67	157,08	160,25
2019	3	0,93	141,10	139,69	142,51
2020	4	0,87	116,18	115,02	117,35

The interval system of linear algebraic equations has been written. The coefficients of the model are its solution. To get a model of dynamics, it is sufficient to find out a solution in the form of a point in the solution area of given system. It is as following:

$$\begin{cases} 78,06 \leq \alpha_0 + \alpha_1 \cdot 82,1 + \beta \cdot 0,72 \leq 79,64 \\ 157,08 \leq \alpha_0 + \alpha_1 \cdot 78,85 + \beta \cdot 0,4 \leq 160,25 \\ 139,69 \leq \alpha_0 + \alpha_1 \cdot 158,67 + \beta \cdot 0,66 \leq 142,51 \\ 115,02 \leq \alpha_0 + \alpha_1 \cdot 141,1 + \beta \cdot 0,86 \leq 117,35 \end{cases} \quad (3.11)$$

Coefficients estimation of the interval model of the dynamics of gross profit for the company JSC "Ternopiloblenergo", gave the following results in the form of a point model:

$$GP_{n+1} = 176,7 + 0,63 \cdot GP_n - 189,33 \cdot u_{n+1}^2 \quad (3.12)$$

In fig. 3.1. graphs of gross profit dynamics have been given on the basis of statistical data and on the basis of the dynamic model (3.12) during 2016-2020 for JSC "Ternopiloblenergo". The projected gross profit for 2020 is UAH 109.44 million.

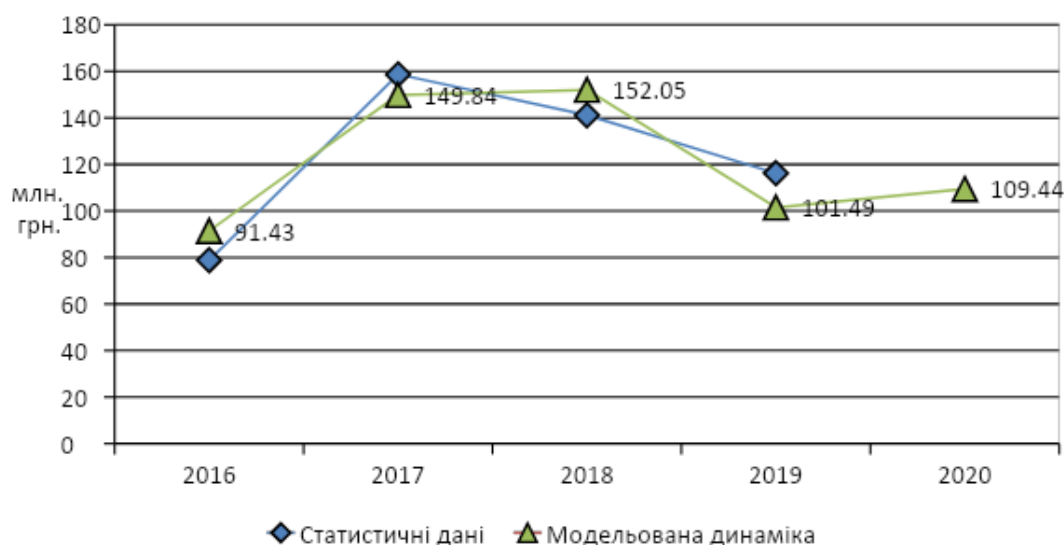


Fig. 3.2. graphs of gross profit dynamics on the basis of statistical data and on the basis of the dynamic model (3.12) during 2016-2020 for JSC "Ternopiloblenergo"

The calculations for the energy company JSC "Chernivtsioblenergo" have been done. Table 3.3. shows the initial data of management factor including physiological working conditions of the financial condition of the enterprise and the index of the financial condition of the energy company JSC "Chernivtsioblenergo". It has been reduced to an interval view with the aim to build a dynamic interval model.

**Table 3.3.** Initial data for building a dynamic interval model for JSC "Chernivtsioblenergo"

Year	n	Management factor including physiological working conditions of employees	Interval limits of indicator financial condition		
		$u_n$	$GP_{0n}$	$GP_n^-$	$GP_n^+$
2016	0	0,82	51,93	51,41	52,45
2017	1	0,88	13,44	13,31	13,58
2018	2	0,97	89,76	88,87	90,66
2019	3	0,54	-36,90	-36,53	-37,27
2020	4	0,88	-252,92	-250,39	-255,44

The interval system of linear algebraic equations has been written. The coefficients of the model are its solution. To obtain a model of dynamics, it is sufficient to get a solution in the form of a point in the solution area of this system. It is as following:

$$\begin{cases} 13,31 \leq \alpha_0 + \alpha_1 \cdot 51,93 + \beta \cdot 0,88 \leq 13,58 \\ 88,87 \leq \alpha_0 + \alpha_1 \cdot 13,44 + \beta \cdot 0,97 \leq 90,66 \\ -36,53 \leq \alpha_0 + \alpha_1 \cdot 89,76 + \beta \cdot 0,54 \leq -37,27 \\ -250,39 \leq \alpha_0 - \alpha_1 \cdot 36,90 + \beta \cdot 0,88 \leq -255,44 \end{cases} \quad (3.13)$$

Coefficients estimation of the interval model of the dynamics of gross profit for the company JSC "Chernivtsioblenergo", gave the following results in the form of a point model:

$$GP_{n+1} = -938,85 - 2,07 \cdot GP_n + 1188,14 \cdot u_{n+1} . \quad (3.14)$$

In fig. 3.3. graphs of gross profit dynamics have been given on the basis of statistical data and on the basis of the dynamic model (3.14) during 2016-2020 for JSC "Chernivtsioblenergo". The projected gross profit for 2020 is UAH 34.67 million.



**Fig. 3.3.** graphs of gross profit dynamics on the basis of statistical data and on the basis of the dynamic model (3.14) during 2016-2020 for JSC "Chernivtsioblenergo"

To build a dynamic interval model for the energy company PJSC "Rivneoblenergo" has been summarized in table 3.4. It shows the initial data of management factor including physiological working conditions of employees and the index of financial condition that is reduced to the interval form.

**Table 3.4.** Initial data for building a dynamic interval model for PJSC "Rivneoblenergo"

Year	n	Management factor including physiological working conditions of employees	Interval limits of indicator financial condition		
		$u_n$	$GP_{0n}$	$GP_n^-$	$GP_n^+$
2016	0	0,57	39,69	39,30	40,09
2017	1	0,90	32,22	31,89	32,54
2018	2	0,80	147,48	146,01	148,96
2019	3	0,80	109,66	108,56	110,76
2020	4	0,96	199,50	197,51	201,50

The interval system of linear algebraic equations has been written. The coefficients of the model are its solution. To obtain a model of dynamics, it is sufficient to get a solution in the form of a point in the solution area of this system. It is as following:

$$\begin{cases} 31,89 \leq \alpha_0 + \alpha_1 \cdot 39,69 + \beta_1 \cdot 0,72 + \beta_2 \cdot 0,72 \leq 32,54 \\ 146,01 \leq \alpha_0 + \alpha_1 \cdot 32,22 + \beta_1 \cdot 0,72 + \beta_2 \cdot 0,4 \leq 148,96 \\ 108,56 \leq \alpha_0 + \alpha_1 \cdot 147,48 + \beta_1 \cdot 0,72 + \beta_2 \cdot 0,66 \leq 110,76 \\ 197,51 \leq \alpha_0 + \alpha_1 \cdot 109,66 + \beta_1 \cdot 0,72 + \beta_2 \cdot 0,86 \leq 201,50 \end{cases} \quad (3.15)$$

Coefficients estimation of the interval model of the dynamics of gross profit for the company PJSC "Rivneoblenergo", gave the following results in the form of a point model:

$$GP_{n+1} = -6356,45 - 2,67 \cdot GP_n + 18398,91 \cdot u_{n+1} - 12288,76 \cdot u_{n+1}^2 \quad (3.16)$$

In fig. 3.4. graphs of gross profit dynamics have been given on the basis of statistical data and on the basis of the dynamic model (3.14) during 2016-2020 for PJSC "Rivneoblenergo". The projected gross profit for 2020 is UAH 176.45 million.



Fig. 3.4. graphs of gross profit dynamics on the basis of statistical data and on the basis of the dynamic model (3.16) during 2016-2020 for PJSC "Rivneoblenergo"

The calculations for the energy company PJSC "Volynoblenergo" have been provided. Table 3.5. outlines the initial data of management factor including physiological working conditions of the financial condition of the enterprise and the index of the financial condition of the energy company PJSC "Volynoblenergo". It has been reduced to an interval view with the aim to build a dynamic interval model

Table 3.5. Initial data for building a dynamic interval model for PJSC "Volynoblenergo"

Year	$n$	Management factor including physiological working conditions of employees	Interval limits of indicator financial condition		
		$u_n$	$GP_{0n}$	$GP_n^-$	$GP_n^+$
2016	0	0,89	-5,673	-5,61627	-5,72973
2017	1	0,61	17,594	17,41806	17,76994
2018	2	0,511	37,344	36,97056	37,71744
2019	3	0,82	85,359	84,50541	86,21259
2020	4	0,92	71,597	70,88103	72,31297

The interval system of linear algebraic equations has been written. The coefficients of the model are its solution. To obtain a model of dynamics, it is sufficient to get a solution in the form of a point in the solution area of this system. It is as following:

$$\begin{cases} 17,42 \leq \alpha_0 - \alpha_1 \cdot 5,67 + \beta \cdot 0,61 \leq 17,77 \\ 36,97 \leq \alpha_0 + \alpha_1 \cdot 17,59 + \beta \cdot 0,51 \leq 37,72 \\ 84,5 \leq \alpha_0 + \alpha_1 \cdot 37,34 + \beta \cdot 0,82 \leq 86,21 \\ 70,88 \leq \alpha_0 + \alpha_1 \cdot 85,36 + \beta \cdot 0,92 \leq 72,31 \end{cases} \quad (3.17)$$

Coefficients estimation of the interval model of the dynamics of gross profit for the company PJSC "Volynoblenergo", gave the following results in the form of a point model with linear component:

$$GP_{n+1} = 99,82 + 0,6 \cdot GP_n - 94,51 \cdot u_{n+1} \cdot \quad (3.18)$$

In fig. 3.5. graphs of gross profit dynamics have been given on the basis of statistical data and on the basis of the dynamic model (3.18) during 2016-2020 for PJSC "Volynoblenergo". The projected gross profit for 2020 is UAH 55.52 million.

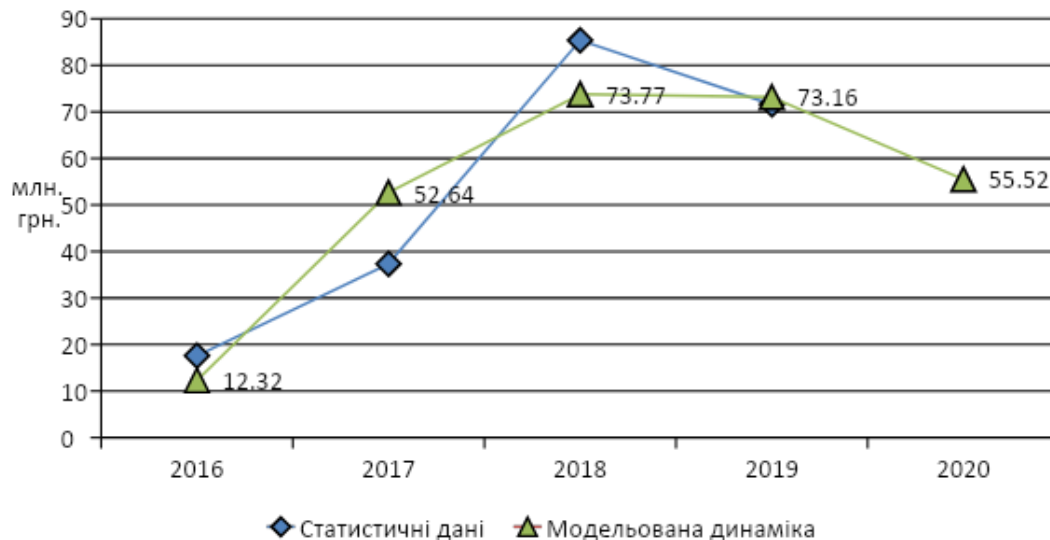


Fig. 3.5. graphs of gross profit dynamics on the basis of statistical data and on the basis of the dynamic model (3.18) during 2016-2020 for PJSC "Volynoblenergo"

### Conclusions and Prospects for Further Studying

The dynamic management model of innovative development of energy enterprises is aimed primarily at employees and their physiological working conditions. Mainly this aspect provides production processes in the power industry and improve the technical equipment of labor, the most efficient use of technological equipment and rational organization of the workplace. The management of enterprises should focus efforts on not only passing special training and testing of knowledge (certification) in accordance with the law. Therefore, it should include regulations of the ministry branches; ensure the implementation of the legal framework for the formation of state policy in the electricity sector, other central executive bodies that provide the formation of state policy in relevant areas.

Thus, mathematical models of the dynamics of the indicator of the financial condition of energy enterprises within physiological working conditions of Ukraine western region have been studied.

It has been proposed to choose gross income as an indicator of the financial condition of energy enterprises. Since the activities of energy market companies are essentially the sale of energy resources and services. Accordingly, innovative solutions aimed at improving sales should receive a response to gross sales revenue.

Mathematical modeling has been used to build the tools of the management system of innovative development of energy enterprises within physiological working conditions. In particular, one of the most effective approaches, the theoretical-multiple (interval) approach, within which the models contain parameters and variables, presented in the form of intervals of guaranteed or acceptable values.

Dynamic models for managing the innovative development of energy market enterprises in the western region of Ukraine, namely: PJSC "Ternopiloblenergo", PJSC "Lvivoblenergo", JSC "Chernivtsioblenergo", PJSC "Rivneoblenergo" and PJSC "Volynoblenergo" have been obtained. The use of models makes it possible to predict the financial condition of the enterprise based on management decisions on innovation expenditures. In future researches it is planned to discover the innovation management



system as a separate management mechanism in the system of innovation management, taking into account the physiological working conditions of European regions.

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# Modeling of the System of Professional Training of Physical Education Specialists in Pedagogical Universities

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## Abstract

The pedagogical system of professional training of future specialists in physical education in the process of university education belongs to the type of complex systems. The article presents a theoretical analysis of modeling the system of professional training of physical education specialists in pedagogical universities. The authors set out in detail various interpretations of the modeling of pedagogical systems. Implementation of modern models of immersive pedagogical technologies for training future specialists in physical education.

The scientific method for determining the characteristics of objects is the modeling method as one of the design methods. The authors believe that using the advantages of the modeling method requires understanding the essence of the prerequisites underlying this method and its content.

Further improvement of the research on the parameters of the pedagogical system of professional development of future specialists in physical education in the learning process is based mainly on the study of the following types of relationships between elements and subsystems: correlation (between random events and variables); functional (between subsystems, which are determined by the quantitative influence of changes in the characteristics of one subsystem on changes in the characteristics of another); causal (between events).

From this point of view, a pedagogical system is characterized by purposefulness. When modeling the system of professional training of future specialists, purposefulness requires researchers to pay attention to the goals and tasks that the specified pedagogical system should solve to achieve the necessary correspondence between them.

**Keywords:** Pedagogical systems, Training of specialists in physical education, Functioning of a pedagogical system, Modeling method, Construction method, Immersive pedagogical technologies.

## 1. Introduction

The study of scientific sources (1-5) indicates that the method of modeling at the present stage of development of science has become widespread in research works, taking into account its epistemological functions, namely: theoretical (a specific image of reality (model), practical (a means of the scientific experiment), and formative (a prototype of the future state).

It should be noted that the concept of "modeling" combines the content of the terms "imitation" (from Latin imitation) – imitation of someone and something and "model" (modulus – measure, sample) – a substitute object, which in certain conditions can replace the original object, reproducing the properties and characteristics of the original (2, 6).

Analyzing the modern theory and methodology of teaching management at a university, it can be argued that at the moment, the modeling of various specific operations in sports activity has not been sufficiently studied and developed, which is a very important and complex problem.

To solve the problem of effective implementation of immersive pedagogical technologies for training future specialists in physical education in higher education institutions, it is necessary to carry out modeling of the process under study and specify the essence of the concepts "model" and "modeling". Considering the concept of immersiveness, it is usually defined as immersion in certain artificially formed conditions. The phenomenon of immersion is widely studied in various sources. The main focus in the context of this problem is on the technological factors of modeling consciousness through visualization of the artificial environment.

Modeling various specific operations in sports activities is a very important and complex problem. It is particularly challenging to model mental operations since it can be extremely difficult to establish the hidden period of the perception process before the response begins.

Modeling is characterized as a method of scientific research; a basis for developing a new theory; a mechanism for determining the development prospects (18). The following functions of models are distinguished: normative, which allows comparing the phenomenon (process) with other, more studied ones; systematizing, which allows considering reality in the totality of all its manifestations; concretizing, which makes it possible to develop and justify a theory; cognitive, aimed at considering scientific and applied problems (2, 6).

There are different definitions of "model" and "modeling" in the scientific literature following the tasks that are solved by certain studies. A model is an artificially created object in the form of a diagram, table, etc., which, being similar to the object under study, displays and reproduces in a simpler, reduced form the structure, properties, interrelations, and relationships between the elements of the object under study (7).

From the standpoint of pedagogical sciences, modeling is a material or mental imitation of a really existing pedagogical system by creating special analogs (modules), in which the principles of organization and functioning of this system are reproduced (8).

Scholars, adapting the essence of this concept to a specific branch of a pedagogical science, define a model as a schematized image of a phenomenon, process, or object in nature or society that replaces the subject of pedagogical reality or as a prediction and means of implementing an original idea, a means of achieving the goals and objectives of the program since it answers the question of what to do and how to do it.

According to the authors (9, 10), a model acts as an analogy and is an intermediate link between the proposed theoretical propositions and their verification in the real pedagogical process.

We agree with the statement that creating a model in the study of pedagogical processes is the best method that provides certain information about the processes occurring in the so-called "living systems". It reflects not only the relationships of its elements but also helps to predict their development. Considering that pedagogical processes are constantly updated and adjusted following the needs of users and society, a model makes it possible to see prospects and take into account risks. Its dynamics consist in the ability to reflect changes that characterize the socio-cultural dynamics.

## 2. Methods

In our research, modeling was understood as an activity that creates a model for the effective implementation of pedagogical technologies for training future specialists in physical education. This model was considered as a simplified visual-graphic image of a certain system of education – an interrelated aggregate of organizational and methodological activities to ensure the effectiveness of the introduction of pedagogical technologies of training of future specialists in physical education, as well as didactic conditions that enhance the effectiveness of this process and are implemented sequentially and step by step in the educational process.

The expediency of modeling was determined by the need for a clear definition of the ways and logic of the use of pedagogical technologies for the professional training of future physical education specialists in a pedagogical university.

Indicators of their functional ability should be taken into account in the process of creating a model, namely (10): inherency, simplicity, and adequacy. Inherency allows establishing a measure of the consistency of the created model with the environment in which it will function and the specified adaptation of the environment to it through interfaces. Simplicity, as a mandatory quality of the model, will ensure its clarity, bring it closer to the modeling reality, and make it easy to use. Adequacy indicates sufficient completeness of a certain phenomenon to the extent that it allows achieving the goal and is accurate and real. Thus, the identified requirements ensure the establishment of relationships between the environment, which expresses a measure of consistency with the subject creating the model and the object of modeling (11).

## 3. Results

Research of scientific sources showed that the construction of models takes place according to a certain algorithm, but different sources offer a different number of stages, although their content is approximately the same.

For example, in studies (11, 12), the authors defined the structure of the modeling process using the following algorithm: a) problem statement; b) creating or selecting a model; c) model research; d) transferring knowledge from the model to the original. This method is based on a synthetic approach that allows identifying complete systems and investigating their functioning. Researchers consider its main advantage to be the integrity of information.

We take into account the results of research conducted by a group of researchers (2, 13) who believe that effective pedagogical modeling provides five main stages: studying the problem of constructing a model and defining the functions of the object under study, its place and role in the education system; setting tasks to clarify the components of the model, its effective functioning and diagnostics; highlighting the necessary components of the model and determining the criteria for their diagnosis; establishment of relationships (logical, functional, semantic, technological, etc.) between the previously defined components of the model; developing the model and predicting its dynamics.

We agree with the statement of researchers (14, 15) that none of the proposed models gives a complete picture of the object under study and cannot accurately predict its development. Therefore, a complex of models should be built that describes various factors of the object under study.

Models have been used and continue to be widely used as a means of professional preparation and training (16). Pedagogical science has long recognized the importance of training a future specialist in professional skills in a higher education institution using the modeling method (17, 18).

The use of the simulation method makes it possible to conduct controlled experiments in situations where experimentation on real objects would be almost impossible (16). Immediate experimentation with the pedagogical system of professional training of future specialists in physical education in the process of studying at a university usually consists in varying some of its parameters while maintaining all other parameters unchanged, observing the results of the pedagogical experiment.

Therefore, the model can contribute to the interpretation of one of two main goals: either to describe, if the model serves to explain and better understand the object, or to reproduce the characteristics of the object, which determines its behavior (17, 19).

Pedagogical models help to organize unclear or contradictory concepts and inconsistencies in scientific research (17, 20). Therefore, a model of the pedagogical system of professional training of future specialists in physical education helps us to identify interdependencies, time relationships, necessary measures, and resources. A well-constructed model forces one to organize their ideas and evaluate and verify their validity.

A model of the pedagogical system of professional training of future specialists in physical education will help us eliminate inaccuracies, offering us the best and reasonable ways to coordinate the development of professional competence of future specialists. A model makes the overall structure of the training process more clear and reveals important cause-and-effect relationships. We generalize scientific materials obtained as a result of research and combine them into a single database to model such a system.

Pedagogical modeling is a very broad concept that is of great importance for the design and functioning of pedagogical systems. Pedagogical modeling is the process of constructing a model of a pedagogical system and setting up experiments on this model to either understand the behavior of the system or evaluate the functioning of this system (21, 22). Thus, the process of pedagogical modeling includes both the construction of a model of the pedagogical system and its implementation to study the problem of scientific and methodological support for the process of professional training of future specialists in physical education. A model of the pedagogical system of professional training of future physical education specialists in the process of university education is a tool used for prediction and comparison, which allows predicting the consequences of alternative actions in a logical way and confidently indicating which one to give preference to.

Pedagogical modeling is mainly based on pedagogical processes. In the context of our research, this refers to the fact that modeling professional activity in the process of professional training of future specialists in physical education provided the development of professional competence, which was an indicator of the corresponding professional development (23).

Pedagogical modeling is a very broad and well-defined concept that is important for those responsible for the design and operation of educational systems. In our opinion, pedagogical modeling is the process of constructing a model of a pedagogical system and setting up experiments on this model to either understand

the behavior of the system or evaluate (within the limits imposed by a certain criterion or set of criteria) various strategies that ensure the functioning of this system.

Thus, we understand the process of pedagogical modeling as a process that includes both the construction of a pedagogical model and its analytical application to study a particular problem.

Aiming to describe the behavior of the pedagogical system, build theories and hypotheses that can explain the pedagogical processes that are being investigated, and use these theories to predict future professional activity, that is, those influences that can be caused by changes in the system or changes in the way it functions, pedagogical modeling can be considered an experimental and applied methodology (24).

#### 4. Discussion

One of the main directions necessary for the effective solution of complex professional tasks is the construction and use of a model of the pedagogical system of professional training, taking into account the dynamics of the development of professional competence of future specialists in physical education (14, 25).

The main directions of building a model of the pedagogical system of professional training of future specialists in physical education in the process of university training will be the integrity of subsystems, unidirectional functions, and the adequacy of pedagogical actions (15, 26).

The integrity of the subsystems of the pedagogical system is a set of components (elements), the interaction of which is aimed at preserving and developing the entire pedagogical system in the required direction and, in the context of our research, at the formation of professional competence of future physical education specialists in the process of professional training.

Each subsystem performs a specific function, and the pedagogical system is aimed at achieving a specific goal. Therefore, it is fair to assume that the pedagogical system of professional training of future specialists in physical education in the process of studying at a university will be such a pedagogical system, the subsystems of which perform functions for achieving, preserving, and developing the highest results. However, the share of subsystems' participation in achieving the goal will vary. Also, the interrelation of elements of subsystems should be differentiated by the strength and direction of action. These indicators depend on the degree of the determinism of the function of subsystem elements in achieving final or intermediate results (27, 28).

The use of models is important, but it does not in any way exhaust the goals of modeling. Building a functional model can also be an effective means of understanding the regularities of the process of professional training of future specialists in physical education. When modeling the proposed pedagogical system, we used a combination of several models from the varieties mentioned above (a functional model of professional training of future trainers, a model for the development of professional competence of future specialists). A pedagogical system or subsystem can be represented in different ways, which differ significantly in complexity and detail. In our case, as a result of research, several different models of the same pedagogical system were used. In a specific case, in the process of professional training of future wrestling coaches, we used the modeling method as an indirect approach to the study of an object by replacing it with another object. Therewith, we assumed that the model represents a complex system that includes simpler systems with properties similar to those that make up the subject of research in the original complex system (29). At the same time, the research used conceptual modeling, which is the development and use of models formed by pedagogical observation in the learning process and observation of objects in the form of an image endowed with certain structural properties and reflecting the mechanism of image functioning (30). The use of conceptual modeling allowed building algorithmic conflict structures of tactical and technical complexes of freestyle wrestling, including game modeling based on the performance standards of tactical and technical complexes, modeling of conflict interaction in combinations, and game modeling of wrestling complexes.

#### 5. Conclusion

Experimental verification of the effectiveness of game modeling of tactical and technical complexes of freestyle wrestling allowed convincingly showing the effectiveness of the proposed method in intra-group comparison in the experimental group and inter-group comparison with the control group. The main increase in professional modeling skills was formed due to the formation of students' skills to identify the conflict interaction of wrestlers.

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# An Analysis of Psychological Resilience and Goal Commitment Levels of Students of the Faculty of Sport Sciences and Education

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## Abstract

In this study, it is aimed to analyze psychological resilience and goal commitment levels of the students that are studying in sports sciences and education faculties. The study group consists of 304 (159 males, 145 females) students from Uşak University Faculty of Sport Sciences and Education, included in the study per the convenience sampling method from the non-probabilistic sampling. We employed the relational screening method in this study, which is designed per the quantitative research model. As a data collection tool in the research, The "Psychological Resilience Scale" developed by Liebenberg et al. [1], adapted to Turkish by Arslan [2] and of which validity-reliability study was conducted, the "Goal Commitment Scale" developed by Klein et al. [3] and rearranged by Hollenbeck et al. [4] and adapted into Turkish by Şenel and Yıldız [5] was employed. In the analysis of data; frequency, percentage, t-test, One-Way ANOVA, and Post Hoc (LSD) test statistics test were utilized. Per the research findings, no significant difference was found between the students' goal commitment and psychological resilience levels with the variables of gender, family income level, and father's educational status. However, a significant difference was identified between the students' psychological resilience levels and the faculties they studied, whether they received psychological support or not, and the mother's education level. We observe that the students' psychological resilience levels studying at the faculty of sports sciences and doing sports a lifestyle are higher than the students studying at the faculties of education. As a result, we analyze that the students' psychological resilience levels were high, and their goal commitment levels were medium. In this context, we observe that students who do regular sports are more psychologically resistant to their difficulties and are more resistant to stress.

**Keywords:** Sports, Psychological Support, Goal Commitment, Stress, Education.

## 1. Introduction

In today's world, psychological resilience is one of the frequently emphasized concepts. The concept that has gained such importance is the risky situations experienced at the global level and in our society, great crises, and the effects of these risky situations and crises on individuals. Psychological resilience is a concept related to individuals' ability to remain strong in challenging situations and crisis periods in their lives and to adapt quickly to the new situation [6]. Besides the joy of being admitted to the university, students who get an opportunity to study at the university; experience many problems such as separation from the family, making new friends, fear of being alone, economic difficulties, getting used to the dormitory life, anxiety about their future profession and business life. Students are exposed to stress and strain from various sources to overcome such problems [7, 8]. If students do not have sufficient equipment to protect themselves against such stress and strain, they may feel weak and face psychological and physical disorders [9]. The concept of psychological resilience aims to rely on these stress factors that individuals experience and to reveal the nature of their reactions to problems [10]. These social life reactions can be positive or adverse [11]. Students who experience emotional exhaustion, depersonalization and decline in success should be provided with information, psychological, and social support [12]. We observe that social support can affect psychological resilience when it comes to stressful living conditions [13]. Some researchers note that students are motivated to improve their commitment to the goals they set for their academic achievements via the strategies they implement (such as study groups, daily study programs, repeating the educational content, and taking important notes) [14]. Therefore, it is not sufficient for students to set a goal and display their commitment to such goals students to achieve. As the more robust and more committed students are in their struggle to achieve their goals, the more they can adapt to the challenges and changes they experience. Besides, students that are less committed to their goals may abandon their goals more easily



if they face substantial problems [15]. In this perspective, goal setting theory [16], which is among the most valid and useful theories in the literature, requires a commitment to the goal [17]. There is a relationship between goal setting and performance [18], and goal commitment plays the most critical role in comprehending the relationship between performance and goal [19]. In general, goal commitment is a persistent, commitment, and determined behavior by exhibiting high performance to achieve a particular goal [5]. In this perspective, goal commitment can be defined as the individual's commitment to achieving his goals [20]. Considering such definitions, we observe that psychological resilience cannot be gathered under a single definition due to its different dimensions, yet there are common points in all of them [21]. In such definitions, psychological resilience is explained by characteristics such as adapting to stressful situations, not being sick despite negativities, coping with stress and difficulties, and recovery and healing following stressful experiences [22, 23]. The concept of psychological resilience is derived from the Latin word "resiliens" and refers to a substance having elasticity and can easily return to its former state [24]. Two critical situations arise per the concept of psychological resilience; the first is to experience a vital threat to the individual, and the second is to survive and adapt despite such threat and difficulty [25]. Thanks to the personality characteristics in individuals, psychological resilience is a factor that reduces the adverse effects of stress as well as the tension that may arise from stress [26]. While high-level social skills, problem-solving skills, and self-efficacy are some of the individual characteristics that contribute to psychological resilience, positive family and peer relationships are among the environmental traits which support psychological resilience [27]. Literature analysis demonstrates that psychological resilience [2, 10, 28-34] and goal commitment [5, 35-41] related studies have been observed. However, we see very few studies that address psychological resilience and goal commitment [37, 42].

In this perspective, the research was conducted to identify the students' psychological resilience and goal commitment levels studying in sports sciences and education faculties. This study considers that psychological resilience and goal commitment will contribute to the limited literature on the subject. Adopting sports as a lifestyle required for individuals to improve their psychological resilience and goal commitment will shed light on studies to improve their psychological health. The following questions will be answered according to this goal:

H1. Is there a significant difference between the students' psychological resilience and goal commitment levels by the gender variable?

H2. Is there a statistically significant difference in psychological resilience and goal commitment levels by students' faculty variable?

H3. Is there a statistically significant difference in psychological resilience and goal commitment levels by the variable of whether the students do sports or not?

H4. Is there a statistically significant difference in psychological resilience and goal commitment levels by students' parents' income and educational status?

H5. Is there a statistically significant difference in psychological resilience and goal commitment levels by whether students receive psychological support?

## 2. Method

The model of the research, study group, data collection tool, and analysis employed by the research has been provided concerning the research method in this section.

### 2.1. Research Model

The research utilizes a relational scanning design, one of the quantitative models. The relational screening model aims to identify the presence and/or degree of mutual exchange between two or more variables [43].

### 2.2. Study Group

Study participants were 304 university students, 159 (52.3%) women and 145 (47.7%) men studying in the second and third grades of Uşak University, Faculty of Sport Sciences and Education in the fall semester 2019-2020 academic year. Of the students selected by convenience sampling method, one of the non-probabilistic sampling methods, 124 students stated that they study in sports sciences and 180 in education faculty.

### 2.3. Data Collection Tools

This study employs "Personal Information Form," "Psychological Resilience Scale," and "Goal Commitment Scale."

**Personal Information Form:** The researchers created it to obtain demographic information from participants such as gender, faculty, sports or not, their parents' income and education, and whether students receive psychological support.

**Psychological Resilience Scale:** The scale developed by Liebenberg et al. [44] from a socio-ecological perspective includes 28 items. The short form study of the scale was conducted by Liebenberg et al. [1], and a 12-item form was developed. Arslan [2] adapted the scale into Turkish. It has a five-point Likert structure and is rated between "fully identifying me (5)" and "never identifying (1)". The internal consistency coefficient of the Turkish form of the scale is  $\alpha = .91$ . Per the research, the Cronbach Alpha internal consistency coefficient of the scale is  $\alpha = .74$ .

**Goal Commitment Scale:** It is developed by Hollenbeck et al. [4] in 9 items, and rearranged in 5 items by Klein et al. [3], is adapted to Turkish by and validity-reliability studies are conducted by Şenel and Yıldız [5]. It is a 5-point Likert-type scale consisting of five questions with the answers "(1) strongly disagree, (2) disagree, (3) indecisive, (4) agree, (5) strongly agree". Cronbach's alpha internal consistency coefficient of the scale was found to be  $\alpha = .74$ . For the research sample, the Cronbach Alpha internal consistency coefficient is  $\alpha = .71$ .

### 2.4. Data Collection

The data were collected via a questionnaire by the students' voluntary participation at the Uşak University Faculty of Sport Sciences and Education. In this perspective, the volunteer participants were informed about the questionnaires, and their answers would only be used for scientific research.

### 2.5. Data Analysis

SPSS 22 statistical package program was employed to assess the participant data. Per the normality test, parametric tests were applied to regularly distribution data. Accordingly, data analysis utilizes t-test and one-way analysis of variance (ANOVA) and Post Hoc test statistics (LSD) in independent groups. The study takes the error level as 0.05.

## 4. Results

This section includes the research findings. Findings are described in detail with tables and descriptive information under the table.

**Table 1.** Psychological Resilience Scale and Goal Commitment Scale levels of the participants

Scales	$\bar{x}$	ss
Goal Commitment Scale	14.69	2.96
Psychological Resilience Scale	48.73	6.31

As observed in Table 1, analysis of the students' average values from the scale shows that the students' goal commitment levels are at a medium level and ( $\bar{x} = 14.69$ ) psychological resilience levels ( $\bar{x} = 48.73$ ) are high.

**Table 2.** Descriptive statistics regarding participants

Independent Variables	Groups	f	%
Gender	Female	159	52,3
	Male	145	47,7
Faculties	Sports sciences	124	40,8
	Faculty of education	180	59,2
Doing exercise	Yes	187	61,5
	Not doing exercise	No	117
Family income level	2020-3020	142	46,7
	3020-4020	93	30,6

	Over 4020	69	22.7
Mother's educational status	Elementary school	168	55.3
	Middle school	60	19,7
	High school	53	17.4
	University	23	7.6
Father's educational status	Elementary school	90	29.6
	Middle school	82	27
	High school	87	28.6
	University	45	14.8
Receiving psychological support	Yes	42	13.8
Not receiving psychological support	No	262	86.2

n = 304

Table 2 illustrates that 52.3% of the participants are women, 59.2% are students studying at the education faculty, 61.5% are students doing sports, 46.7% have their families with an income between 2020-3020 TL, 55.3% of whose mothers have elementary education, 29.6% of whose father are primary school graduates, and 86.2% were students who did not receive psychological support.

**Table 3.** Analysis of differences of students' goal commitment and psychological resilience levels by independent variables

Independent Variables	Scales	Groups	n	$\bar{x}$	ss	Levene Test		t	p
						F	p		
Gender	Goal Commitment	Female	159	14,45	3,21	1,987	0,160	-1,488	0,138
		Male	145	14,95	2,66				
	Psychological Resilience	Female	159	48,23	6,16	0,003	0,959	-1,433	0,153
		Male	145	49,27	6,44				
Faculty Variable	Goal Commitment	Sport Science	124	14,48	2,45	8,516	0,004	-1,089	0,277
		Faculty of Education	180	14,83	3,27				
	Psychological Resilience	Sport Science	124	49,95	5,96	0,978	0,324	2,843	<b>0,005*</b>
		Faculty of Education	180	47,88	6,41				
Doing Sports or Not Variable	Goal Commitment	Yes	187	14,71	2,64	7,952	0,005	0,129	0,898
		No	117	14,66	3,43				
	Psychological Resilience	Yes	187	49,47	6,41	0,557	0,456	2,624	<b>0,009*</b>
		No	117	47,54	5,98				
Did You Get Psychological Support	Goal Commitment	Yes	42	14,33	3,07	0,002	0,964	-0,834	0,405
		No	262	14,74	2,95				
	Psychological Resilience	No	42	46,31	5,94	0,166	0,684	-2,704	<b>0,007*</b>
		Yes	262	49,11	6,29				

\*P&lt;0,05

Table 3 illustrates that no statistically significant difference was found between the students' goal commitment and psychological resilience levels concerning the faculty variable of their gender and goal commitment levels ( $p > 0.05$ ). However, a statistically significant difference was found between psychological resilience levels and faculty variable ( $t(302) = 2.843$ ;  $p = 0.005$ ;  $p < 0.05$ ). It demonstrates that the psychological resilience levels of the students studying at the sports science faculty ( $\bar{x} = 49.95$ ) are higher than those studying at the faculty of education ( $\bar{x} = 47.88$ ). While there was no statistically significant difference between the students' doing sports or not and their goal commitment levels ( $p = 0.898$ ;  $p > 0.05$ ), a statistically significant difference was found between the psychological resilience levels and the variable of doing sports or not ( $t(302) = 2.624$ ;  $p = 0.009$ ;  $p < 0.05$ ). It demonstrates that the psychological resilience levels of the students doing sports ( $\bar{x} = 47.49$ ) are higher than those who do not do sports ( $\bar{x} = 47.54$ ). While

no statistically significant difference was determined between the students' psychological support variable and their goal commitment ( $p = 0.405$ ;  $p > 0.05$ ), a statistically significant difference was found between the psychological resilience levels and the variable of receiving psychological support ( $t(302) = -2.704$ ;  $p = 0.007$ ;  $p < 0.05$ ). The analysis results observe that the psychological resilience levels of students who do not receive psychological support ( $\bar{x} = 49.11$ ) are higher than those receiving psychological support ( $\bar{x} = 46.31$ ).

**Table 4.** Analysis of Differences of Students' Goal Commitment and Psychological Resilience Levels by Independent Variables

Independent variables	Scales	Groups	n	$\bar{x}$	ss	df	F	p	Difference LSD
Family income level	Goal Commitment	2020-3020	142	14.71	3.08	2 301	0.079	0.924	
		3020-4020	93	14.59	3.19				
		4020	69	14.77	2.38				
	Psychological Resilience	2020-3020	142	48.70	6.56		0.391	0.677	
		3020-4020	93	48.38	6.18				
		4020	69	49.26	5.99				
Mother education level	Goal Commitment	Elementary school	168	14.38	2.86	3 300	3.564	<b>0.015*</b>	<b>1-3 2-3</b>
		Middle school	60	14.40	3.25				
		High school	53	15.79	2.94				
		University	23	15.17	2.41				
	Psychological Resilience	Elementary school	168	48.68	6.52		0.030	0.993	
		Middle school	60	48.63	5.83				
		High school	53	48.94	6.71				
		University	23	48.83	5.28				
Father education level	Goal Commitment	Elementary school	90	14.66	3.10	3 300	1.734	0.160	
		Middle school	82	14.56	3.10				
		High school	87	14.38	2.47				
		University	45	15.58	3.22				
	Psychological Resilience	Elementary school	90	47.96	6.80		0.824	0.481	
		Middle school	82	48.84	6.16				
		High school	87	49.44	5.87				
		University	45	48.69	6.41				

\*  $p < 0.05$ ; 1 = Primary school; 2 = Secondary school; 3 = High school; 4 = University

Table 4 illustrates that a statistically significant difference was found between the students' goal commitment and psychological resilience levels and the income level of the family ( $p = 0.924$ ;  $p > 0.05$ ;  $p = 0.677$ ;  $p > 0.05$ ). >> A statistically significant difference was found between the goal commitment levels of the students and the education level of the mother ( $F(3-300) = 3.564$ ;  $p = 0.015$ ;  $p < 0.05$ ). It demonstrates that the goal commitment levels of students whose mothers are high school graduates ( $\bar{x} = 15.79$ ) than those whose mothers are primary school graduates ( $\bar{x} = 14.38$ ) and secondary school ( $\bar{x} = 14.40$ ). There was no statistically significant difference between psychological resilience and mother education level ( $p = 0.993$ ;  $p > 0.05$ ). > No statistically significant difference was found between the goal commitment and psychological resilience levels of the students per the educational status of the father ( $p = 0.160$ ;  $p > 0.05$ ;  $p = 0.481$ ;  $p > 0.05$ ).

## 5. Discussion and Conclusion

Aiming to analyze students' psychological resilience and goal commitment levels studying in sports

sciences and faculties of education, this study demonstrates that no significant difference was found between the students' goal commitment and psychological resilience levels and their gender. The literature review demonstrates that there are studies that comply with the research results for the gender variable [26, 42, 45-51]. However, unlike the research results, some literature studies show that detect a significant difference between gender [52, 53]. Fountain [54] also observes that men have higher levels of psychological resilience than women. Liu and Li [55] found a significant relationship between the leaders' goal commitment levels and their gender in their study. We consider that different research results arise from different sampling groups.

We observe that the psychological resilience levels of individuals studying at the faculty of sports sciences were higher than those studying at education faculties. We can say that students studying at the faculty of sports sciences do sports regularly and adopting sports a lifestyle; they are more resistant to the difficulties they face. However, there was no significant difference between goal commitment and the faculty variable. We observe similar research in the literature review in some aspects [48, 56-57]. Accordingly, we can note that individuals who do sports have higher psychological resilience than those who do not.

Analyzing psychological resilience per whether students do sports or not variable; we observe that the psychological resilience levels of students who do sports regularly are higher than those who do not do sports. Analysis of the research found that individuals who do sports regularly have the effect of reducing their stress levels, and they are psychologically more resilient and stronger than those who do not do sports [58-60]. Some research demonstrates similar results that individuals doing sports had a positive effect on their sportive success and psychological resilience [61-62]. However, unlike our findings, some studies in the literature do not show a significant difference between the psychological resilience levels of individuals and their sports experience [63-65]. No significant difference was found between the students' goal commitment levels and the variable of doing sports or not. However, unlike our study, in their study on students studying in the faculty of sports sciences, Bingöl and Bingöl [66] found that some studies suggest that the students' goal commitment levels may improve by encouraging active sports. A similar study identified that goal commitment was significant and effective on individuals' increasing levels of physical activity [18].

Our study also finds that the psychological resilience levels of the students who did not receive psychological support were higher than the students who received psychological help. Similar to our study, in their study, Souri and Hasanirad [67] found a significant relationship between resilience and psychological well-being. Burton et al. [68] showed that interventions, improving resilience, positively affect psychological well-being, positive emotions, and well-being in individuals. However, we found no significant difference between students' goal commitment and whether they received psychological support. Analysis of the related-study results observes that the most important sources of support for students are their families and that the psychological resilience levels of university students are good [69].

No significant difference was found between their families' income level and the students' goal commitment and psychological resilience. In the study conducted by McCrae and Costa [70], no significant difference was found between the earned income and psychological resilience. Such research result supports our findings. Bhana and Bachoo [71] concluded that the level of psychological resilience changes with the income level, and the income level predicts the psychological resilience level. We consider that such a difference arises from the use of the qualitative method as a research design. A significant difference was found between the mother's education level and the students' goal commitment levels. Per this finding, we observe that the goal commitment levels of the students whose mothers were high school graduates were higher than those whose mothers were primary and secondary school graduates. As the mother's education level increases, the students' level of goal commitment increases. No significant difference was found between the students' psychological resilience levels and the mother's education level. No significant difference was found between the fathers' educational status and goal commitment and the students' psychological resilience levels. Literature does not demonstrate any similar or different studies with our research.

Our study, in which the psychological resilience and goal commitment levels of students studying in sports sciences and faculties of education were analyzed, observe that the students who participated in our study generally had a moderate level of goal commitment and that they had a high level of psychological resilience towards the difficulties they face in their lives. We observed that the psychological resilience levels of the students who study at the faculty of sports sciences and make sports a lifestyle are higher. In this

context, we observe that students who do regular sports are more psychologically resistant to their difficulties and are more resistant to stress. Besides, we found that the psychological resilience levels of the athletes who did not receive psychological help were higher than those who received psychological help. Possible outcomes of the study demonstrate that the active participation of students studying in sports sciences faculties and their adoption of sports as a lifestyle will have positive results on their psychological health and goal commitment; therefore, we observe that sports activities may help to spread among the students studying in education faculties.

We have compared the sports sciences and education faculties in our study. Comparing faculties and sports branches in future studies may help identify sports branches' psychological resilience and goal commitment levels.

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## 3d Corrective Space in the Physical Rehabilitation of Children with Musculoskeletal System Disorders

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### Abstract

In the article, the capability of the space category is considered as one of the main conditions of the matter's existence. We are referring to the length, width and height in their 3D unity. In order to increase the effectiveness of children's physical rehabilitation from a methodological point of view, we proposed to consider physical space as a conditional four-dimensional substance, including the subjective aspect of a specific motoric play situation perception of a child and a rehabilitation teacher.

During the physical rehabilitation classes for children with musculoskeletal system disorders, after many years of practice, it was noticed that spatial parameters can be purposefully controlled to improve the correction efficiency of various motoric disorders. The authors propose to consider as a special phenomenon the corrective modelling of the internal hall architecture to solve the necessary pedagogical problems. The authors named this phenomenon corrective 3D space. In the process of empirical studies of this phenomenon, the authors came up with the following options for its use in the physical rehabilitation of the specified children contingent: an artificial decrease of the spatial parameters of the motoric play zone, an artificial increase of the spatial parameters of the motoric play zone, an artificial violation of the harmonious relationships of the spatial parameters of the motoric play zone (length, width and height), and an artificial complication of the spatial parameters of the motoric play zone for physical rehabilitation of the child.

It turned out that the above options for purposeful changes in spatial parameters have a positive effect of increasing the effectiveness of the correctional process of physical rehabilitation of children with musculoskeletal system disorders. The usual passive physical space of the hall is transformed into a corrective 3D space that actively influences the rehabilitation process.

**Keywords:** corrective 3D-space, physical rehabilitation, children, musculoskeletal system disorders.

### Introduction

In the process of world evolution, three main conditions determine the existence of matter: space, time and motion. Based on this, we can assume the enormous potential of each of these conditions (in particular, space) and its impact on the environment and the person (child) in this environment. Unfortunately, the modern technological boom leads us to an increase in the number of various objects, training constructors, which begin to limit the space, reducing the effectiveness of its influence on the environment. In our opinion, we need to "release the space" (make it free), let it be realized in its original power, and then learn to manage its components to solve the assigned rehabilitation tasks.

### Problem Statement

We have been engaged in physical rehabilitation of children of early and preschool age for about 40 years now. This article will focus on this age group of children with musculoskeletal system disorders. Firstly, we will talk about children with neuro-orthopaedic pathology, i.e. suffering from cerebral palsy, as well as having various variants of spinal paresis of the torso and limbs. A sufficient number of studies have recently been carried out with respect to this children contingent (Efimenko, 2014, 2019; Mastukova, 1991; Moga, 2019, 2020; Kozevnikova, 2013; Glew, 2010; Gulati, Sondhi, 2018; Graham, Rosenbaum, 2016; Lee, Jin., Kang, Gaebler-Spira. & Zhang, 2019; Lieber, Roberts & Blemker, 2017; Mahmood, Habibullah & Babur, 2019; Nieuwenhuys, Papageorgiou, Schless, De Laet, Molenaers & Desloovere, 2017; Novak, McIntyre & Morgan, 2013; Pavão, Rocha, 2017 and others). However, they practically did not pay attention to the methodological substantiation and practical use of the possibilities of space (its three components) to increase the effectiveness of physical rehabilitation of children with musculoskeletal system disorder.

In this regard, we see it as relevant to preliminary investigate the theoretical possibilities of space as one of the fundamental conditions of the matter's existence in the context of their practical use to increase the effectiveness of physical rehabilitation of specified children.

### Research Questions

1. From the position of philosophy, formulate a methodology for the universal use of space to increase the effectiveness of physical rehabilitation of specified children.

2. From a practical point of view – to develop a methodological basis for the practical use of the possibilities of corrective 3D space in the physical rehabilitation of children of early and preschool age with neuro-orthopaedic pathology.

### Purpose of the Study

The purpose of this study is to form the preliminary foundations of the methodology of space usage to increase the effectiveness of physical rehabilitation of children with musculoskeletal system disorders and to develop methods (methodological techniques) for the practical use of corrective 3D space for overcoming children tonic disorders such as muscle hypertension, muscle hypotension, muscle dystonia and related disorders (stiffness in the joints, looseness in the joints, instability in the joints, etc.).

### Research Methods

Theoretical methods:

– historical method of analysis and systematization of domestic and foreign experience was used to study the degree of scientific research and determine the possibilities of practical use of the philosophical basis in developing the physical rehabilitation system of children with musculoskeletal system disorders.

Practical methods:

– method of practical approbation of various variants of spatial parameters application in physical rehabilitation of children with musculoskeletal system disorders.

### Findings

Let's take a look at the category of space. There is an opinion (Aleksandrov) that deeper, more complete knowledge of space and time properties proves their objective reality, just as the variability of scientific knowledge about the structure and forms of matter, motion proves the objective reality of the external world. Real space is **three-dimensional**. The three-dimensionality of space is expressed in the fact that only three mutually perpendicular straight lines can be drawn through each point of space. Any material objects exist in three-dimensional space. No matter how big or small the objects of the world are, their movement can take place only in real space, which has three dimensions (Fig. 1).

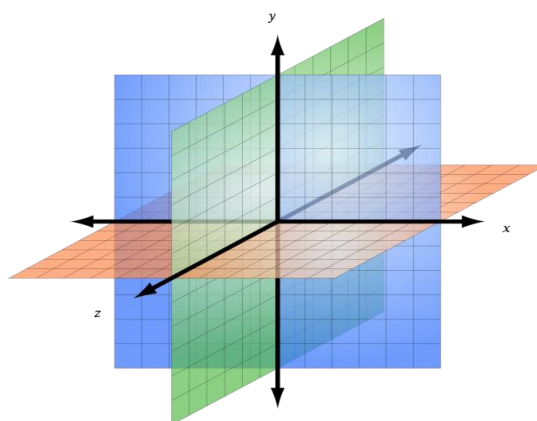


Figure 1. 3D Space

By analogy with real three-dimensional space, mathematics creates abstractions of four-dimensional, five-dimensional, etc., "spaces". It goes without saying that the so-called "multidimensional spaces" cannot be identified with real space, which is the root form of the matter existence and has only three dimensions. These abstractions of the so-called "multidimensional spaces" reflect the patterns of certain sets of things and their properties. In physics, for example, there is an idea of the so-called "phase space" with a very large number of dimensions, which, in addition to three spatial coordinates that characterize the position of every particle of any material system, also include quantities that express the momentum of these particles.

We find interesting the idea of the *multidimensional nature of space*. Of course, we recognize the radical three-dimensionality of space as the main condition of the matter's existence. However, if *situationality* is also added to three-dimensionality at each specific moment of time, then some conditional four-dimensionality may appear, due to both the objective characteristics of the physical rehabilitation process of the child and the subjective experience of this process by the teacher-rehabilitologist and the child. For example, in one situation, a child will perform squats at the gymnastic ladder and feel some discomfort. The objective spatial component will be called 3D. The subjective background that fills this 3D shape, we will call S (Subjective). In this situation, the conditional four-dimensionality can be expressed by the formula  $3D + S_1$ . If the same child performs hang on the same ladder, then this situational option can be expressed by the formula  $3D + S_2$ . The objective spatial characteristics remained the same (the same ladder, the same length, width and height) but the child's emotional experiences changed in the different direction.

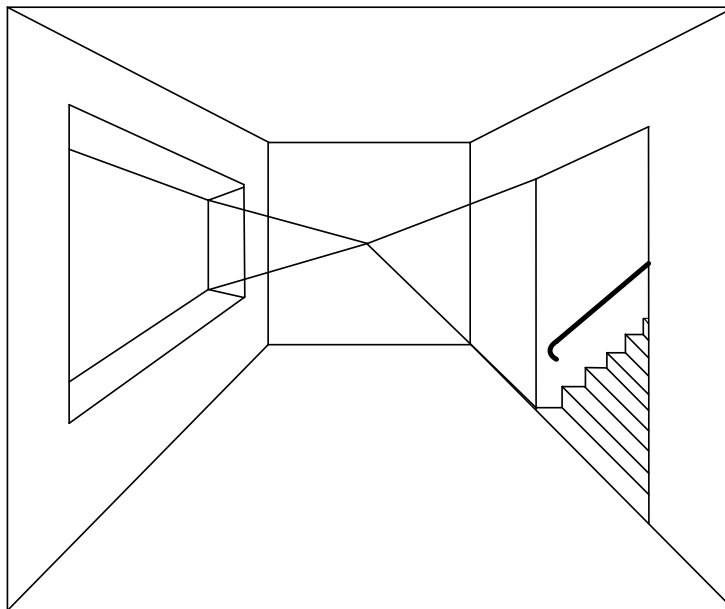


Figure 2. Objective three-dimensionality of the room

Summarizing the above example, we propose to attach an additional situational component to the objective three-dimensional representation of space, which can change (depending on the subjective perception of the given situation) by two actors: a rehabilitologist and a child. This can also include not only the emotional experiences of the participants in each specific situation, but also the planning by the teacher-rehabilitologist P (Plan), and the final correction result R (Result) obtained as a result of its implementation. Taking this into account, the spatial characteristics of a specific motoric game situation can now be expressed by the following formula:  $3D_1 + S_1(P_1 + R_1)$  (Fig. 3).

We propose to call this new component «*Corrective 3D-space*». In its final form, our proposed formula will look like this:

$$\text{Corrective 3D-space} = 3D_1 + S_1 (P_1 + R_1)$$

Where:

$3D_1$  - objective three-dimensional space,

$S_1$  - the subjective experience of a given motor-game situation by a teacher- rehabilitologist and a child,

$P_1$  - the plan of the teacher- rehabilitologist for this situation,

$R_1$  - is the final correction result.

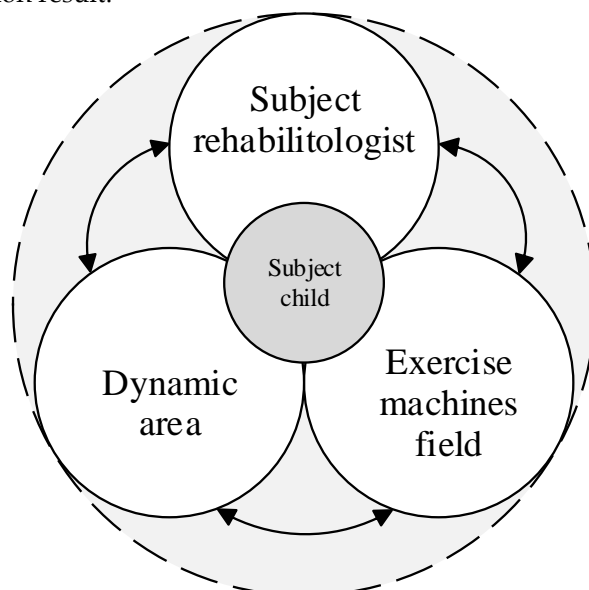


Figure 3. Correction 3D-space of real motor play situation

It is very interesting to consider here the concept of "living space" and the theory of the psychological field developed in 1951 by Kurt Lewin in the mainstream of Gestalt psychology. With its help, the scientist explained the features of human behaviour. The main conceptual positions are given below:

1. Each person (child) lives and develops in the psychological field of the objects around him.
2. Each object has its own valence for a person (child) – a kind of energy charge that causes a specific voltage that requires discharge. We are talking about an energetic physical field.
3. Human (child) behaviour is divided into volitional and field behaviour. Volitional field caused by internal needs and motives. behaviour field caused by external objects.
4. The course of human actions is entirely reduced to the specific conditions of the current field.

Lewin proceeded from the key position that the basis of human activity in various forms of its manifestation are needs (quasi-needs). Formed in the current situation in connection with the adopted intentions or goals, they direct human activity. The need creates a system of tension in the personality that strives to discharge. According to K. Lewin, this is the satisfaction of the need. The discharge of the need is carried out in a certain situation, which the author of the theory calls a psychological field. Each thing in this psychological field is characterized not by its physical properties, but in relation to the need of the subject, which determines the fact that one object has an incentive force, and the other does not have such an incentive force and has a negative valence. Thus, the objects of the field represent positively and negatively charged valences in relation to the need.

For our research, this concept has great importance, first of all, because the process of physical rehabilitation of children with musculoskeletal system disorders occurs in a certain object-spatial environment: in the hall, where next to the child there can be a step, fitball, trampoline, ladder, swing, toy. Only due to the selection of a toy (object) that the child likes, it is possible to enhance his corrective motoric play activity. For example, one of our children with cerebral palsy (Vladik O.) likes swinging on the "Airship" simulator (a suspended barrel with slings for manual gripping). There is a training structure that constantly attracts the mentally disabled child to the gym. This case demonstrates the concept of field behaviour.

For many years, the basis of our work with children was *the play method, a kind of theatricalization of motoric play activity*. Rehabilitation classes were held in the form of a performance, a kind of physical culture fairy tale, with its main plot and the necessary dosed dramatization. The child's urge to resolve the dramatic situation modelled by the teacher in favour of justice, goodness and truth greatly enhances the final correctional result. Thus, we already see two vectors that coincide in motivational orientation: subject - field (according to K. Lewin) and dramatization - play (according to N. Efimenko) or strong-willed (according to K. Lewin). These vectors can coincide and give significant results in physical rehabilitation.

Further, we want to consider one more amazing phenomenon, which this article is mainly devoted to – **the phenomenon of dynamic space** as a relatively autonomously existing substance. This does not mean the separate existence of space from time and motion. We mean the primordial ability of space to be itself from the very beginning, regardless of the objects in it (1st Newton's concept). Two dual extremes can be identified here: on the one hand, there is a space that is densely filled with objects (which is observed today in gyms and physical rehabilitation centres), and, on the other, absolutely open (free) space. Try to answer the question – what space will motivate the child more strongly towards motoric play activity? According to our experience, it is the open space that immediately calls the child to fill its emptiness with motoric play manifestations. In this regard, remember the feeling that arose when you were alone on the edge of a huge (in the perception of a child) football field? At the same time, there was no one, there were not any balls. However, you really wanted (and perhaps you did) just run across this field from edge to edge on a diagonal and satisfy your need for relaxation, which arose at the sight of such a large and open space.

In this regard, we propose to introduce a new physical rehabilitation concept – open space (inviting space, attracting space, motivating space, engaging space). This is a relatively large space, free from objects and structures, in which no one is present. It is necessary initially to release the conditional *mesospace* (for example, the kindergarten's sports ground) and give it to take its place in the *macrospace* (on the common territory of the kindergarten). These two spaces should feel comfortable in the general cosmic megospace. Such alignment reminds the Russian toy – matryoshka when each small matryoshka is put into a large matryoshka and at the same time they do not embarrass each other.

And now let's move a child with musculoskeletal system disorders to this open space. In this situation, the child will often have a positive attitude to what he or she saw, a spatial field will arise that will entice the child to master this open space, i.e. to move. The child's body in this situation can be considered as a mini-space that interacts with the mesospace. These interactions should be comfortable for both spaces and this can be achieved by adjusting the three vectors of space (Fig. 1). We called the resulting subjective relationship between the child and open space – a dynamic space, which includes not only the physical three-dimensional space but also the subjective attitude to it, and the child's emerging motivation for motoric play activity.

Since we are dealing with the physical rehabilitation of children with musculoskeletal system disorders, it became necessary to transform this concept (dynamic space) into a new one – **correctional 3D space**. Now we need not only to motivate the child to a sufficiently longer motoric role activity in this space but also to carry out a purposeful correction of his motoric impairments. Based on our own practical experience, this can be achieved with the following:

- artificial reduction of the motoric play zone spatial parameters;
- artificial increase of the motoric play zone spatial parameters;
- artificial contravention of the harmonious relationships of the motoric play zone spatial parameters (length, width and height);
- artificial complication of the motoric play zone spatial parameters for physical rehabilitation of the child.

Let us consider more specifically the proposed methodological approaches to children with various disorders of muscle tone. We will take the first item of this conditional algorithm. It is known that a child with the spastic syndrome is recommended to take a grouping pose, or an embryo pose, to achieve general relaxation of the whole body and the necessary initial tonic harmonization. To do this, the teacher needs to reduce the length parameter of the space in which the child will assume a position lying on his back or on his side. In this variant, the rehabilitologist can place the child between two rollers, between two modules, between themselves and a roller or module, between themselves and the wall. With the decreasing of the spatial parameter, the child must take a grouping pose, which is necessary to achieve a correction effect.

Space can be reduced using appropriate material forms: for example, place the child in a plastic basin, car camera, special plastic barrel, box, module, etc. to take a pose where he/she sits with ankles crossed and knees apart, which is close in biomechanical parameters to the embryonic position.

Using sand therapy, it is possible to form reduced parameters by preparing the wells of the appropriate size, where the child will be placed for posture treatment. You can also use reduced mounds to achieve a semi-embryo position while lying on your stomach. You can fill two sandy hills, placing them at a close distance, and place the child between them on his/her back on warm sand in the embryo or semi-embryo position.

A methodical technique with spatial parameters decrease in all three dimensions can be applied when exercising in a hammock during aerial yoga classes. The hammock is made of thin but durable fabric, which allows it to stretch, curl, sag. Additional slings help the teacher to form, with the help of this tissue and body weight, the necessary corrective postures based on a decreasing of the child's motoric play space, which is in the hammock.

In paired correctional techniques (baby yoga, paired body training, baby plastic show, dynamic gymnastics, etc.) of an adult and a child, the motoric play space decreasing is achieved by the corresponding actions of an adult aimed at forming the necessary corrective posture. In this case, the body of an adult can be considered as a kind of biological simulator on which the child is located.

The first direction of a minimized space modelling for a child's exercise can be considered as the formation of the initial position of an adult before the start of correctional training with a child with a spastic syndrome of motoric disorders:

1. The adult takes the initial position lying on his back and bends his lower limbs (while he can lean on the back on bent forearms), forming his body a kind of hammock, in which the child will sit in a bent embryonic position.

2. The adult takes the initial position on the side in the "semi-embryo" position - it is assumed that the child will take a similar starting position in front of the adult (with his back to him) for the necessary initial relaxation.

3. The adult takes the initial position on low all fours, bending the torso and limbs as much as possible (in the embryo position), and the child can lie on top of the adult along or across his/her body in the "semi-embryo" position, which will allow him/her to relax tense spastic muscles.

4. The adult takes the initial position sitting with bent legs, leaning on the floor from behind with straightened arms. To relax the muscles, the child can take the following positions: sitting on the hips of the adult and repeating his original position, or lying on his stomach on the bent knees of the adult facing him.

5. The adult takes the initial position, sitting ankles crossed knees apart, bending the torso and upper limbs to support the child (wrapping his arms around him) on his hips in a similar position.

6. The adult takes the initial position on middle "all fours" (on the palms and knees), while the child can crawl under the adult and take a pose on low all fours (embryo pose), sitting along or across the body of the teacher or one of the parents.

7. An adult takes the initial position on high all fours on bent upper and lower limbs. The child is placed under the adult in the following positions: on low all fours, on medium fours with flexed trunk and upper limbs; sitting in Turkish, sitting in a grouping position and the like.

8. The adult takes the initial position on low knees, while the child is positioned with his stomach across the knees of the adult in the "semi-embryo" position.

Now we will consider the methodological possibilities of a purposeful artificial space increasing the motoric play corrective zone, in which the child will be periodical during the lesson. This area includes the following:

➤ Artificial increase of space (length) for the initial position of the child in order to stretch spasmodic muscle groups.

➤ Working with spherical surfaces that stimulate the extension of the limbs and stretching of the spasmodic flexor muscles.

➤ Artificial height increase of the playing objects-stimulus location to enhance the tendencies to straighten and extend the flexed limbs of a child with a spastic syndrome.

➤ Increasing the distance length that the child must overcome in the classroom by various means: by rolling, crawling, moving on the buttocks, squatting, kneeling, on the feet, and the like.

- Height increases to which the child must climb, independently or with the help of an adult, by various means, using a Swedish ladder or other climbing structure.
- Increasing the length and height of the throwing trajectory of various objects.

We will proceed to consider in more detail the correctional 3D space artificial increase by using spherical surfaces. Traditional stuff includes stuffed rollers of various diameters: from 20 - 30 cm to 45 - 55 cm. In this range, the following pattern is observed: the larger the roller diameter, the more spherical its supporting surface, the greater extension effect will be observed. This will help to achieve the desired corrective effect.

From our own experience, we can give an example of using a plastic barrel with a volume of about 40 - 50 litres, which has proven itself very effective in the corrective work with children with spastic movement disorders. The barrel construction is more rigid, which gives the child confidence when he is on top of it in a supine position. The barrel rolls better back and forth, which enhances the correction effect.

Modern technical capabilities make it possible to use spherical barrel-shaped foam modules, designed in different colours to attract attention and motivate a child to a motoric play activity.

Speaking about the artificial length increase to increase the effectiveness of physical rehabilitation of children with the spastic syndrome of motoric disorders, it is worth mentioning the effective use of fitballs of different diameters: from 45 cm to 100 cm and more. The child is placed on the fitball in the supine position, after which the teacher performs sequential swinging back and forth, to the sides, shaking, a combination of swinging with shaking.

An artificial length increase of the body and motoric play space can also be achieved if the child is stretched by two specialists along the longitudinal line of the body: two arms and two legs, the arm and leg of the same name, the opposite arm and leg (diagonal version). Thus, the correction potential of increasing the length of the conventional 3D space is used.

In a similar way, it is possible to implement the correctional possibilities of artificially increasing the motoric play zone width in which the child is here and now. On the fitball, you can not only stretch the child's body (his spasmodic flexor muscles) in the direction of length but also spread the upper and lower limbs in both directions, overcoming the tension in the adductor muscles that bring limbs together. In addition, when the trunk is extended, the height of the back deflection will increase, which will also additionally stretch the muscles of the superficial frontal myofascial line.

With deliberate distortion and complication of the spatial parameters of the conditioned correctional 3D space, the child's coordination abilities are stimulated, which is very important for children of early and preschool age with a spastic type of motoric disorders (especially with cerebral palsy). This deliberate complication can be achieved in different ways:

- A. Artificial narrowing of the movement path for the child.
- B. Artificial increase of the supporting surface on which the child will move.
- C. The presence of artificial horizontal or vertical obstacles in the path of a child's movement.
- D. An artificial complication of the space for the child's movement: using a non-standard trajectory for movement, changing the width and height of the conditional "corridor", where the child will move, combining horizontal and vertical obstacles like a "maze" and the like.

As we can see, in the version of the correctional 3D space, the contradiction between the dual opposites is harmoniously resolved: a relatively spacious free space is temporarily filled with the necessary number of objects (simulators) to create more favourable conditions for the physical rehabilitation of this children.

## Conclusion

Having analyzed theoretically from the standpoint of materialism and idealism, the concept of space in its three-dimensional unity, and admitting the dialectical interaction of the material and the ideal, we proposed to consider the phenomenon of space as a conditional four-dimensional substance, which includes both three traditional objective parameters of space and the subjective aspect of the relationship to the certain motoric play situation of the child and the teacher-rehabilitologist. This conceptual approach is based on the theory of the psychological field of K. Levin. We proposed the concept of dynamic space, which functions due to the arising spatial psychological field.

In practical terms, we considered options of using the capabilities of the corrective 3D space to increase the effectiveness of physical rehabilitation of children with neuro-orthopaedic movement disorders: an artificial reduction of the motoric play zone spatial parameters, an artificial increase of the motoric play zone spatial parameters, an artificial contravention of the harmonious relationships of the motoric play zone spatial parameters (length, width and height), an artificial complication of the motoric play zone spatial parameters for physical rehabilitation of the child.

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## Model Of Future Doctors' Professional Readiness Formation

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### Abstract

It has been proved that an important component of professional future training of a doctor to work in a specialty is his knowledge, abilities, skills and experience in using medical terminology. The readiness for professional activity of future doctors implies knowledge of medical terminology, the ability and possibility to use it, as well as the personal characteristics of students, which testify to the effectiveness of vocational training in the use of medical terminology. It is substantiated that cognitive orientation is an important component of the structure of future medical doctors' vocabulary readiness for the use of medical terminology, i.e. the formation of an adequate level of knowledge of Latin medical terminology among medical students. It is established that indicators of cognitive-orientation component formation are knowledge of the essence and structure of medical terminology, knowledge of forms and types of medical terms, understanding of the essence of professional speech activity of future doctors with the use of medical terminology. The results of the diagnostic phase of the experimental study showed the need to improve the vocational training of future doctors to use medical terminology by implementing certain pedagogical conditions and using the developed structural and functional model. It is distinguished that the results being obtained during the experimental verification of our proposed methodology of future doctors' professional training to use medical terminology, testify to its effectiveness and expediency of introduction into the educational process of higher medical school.

**Keywords:** professional readiness, future doctor, cognitive-orientation component, medical term, control group, experimental group.

### Introduction

Ukraine's desire for European integration necessitates the fulfillment of a number of tasks related to improving the quality of specialists' professional training in various fields of social activity, in particular, medical [Fedchyshyn, 2019, p.66]. One of the ways of increasing the competitiveness of doctors is the orientation of the educational process at the Higher Medical Educational Establishment for the formation of students' readiness for future professional activity. Therefore, purposeful professional training of the future specialist physician requires a thorough conceptual and terminological analysis of the basic study definitions, which are fundamental for revealing the problem of future doctors' professional training for the use of medical terminology.

### Review of Literature

The professional readiness of the doctor concerns not only the general care of patients with the basics of manipulation technique, but also the knowledge of medical terminology and the ability to use it in professional activity, which necessitates the need to take into account the features of vocational training of future doctors to use medical terminology [Vykhreshch, 2019].

Occupation as a type of work requires a person of appropriate professional training. This involves mastering a certain amount of professional knowledge (appropriate level of theoretical background) and practical skills to perform specific professional functions. Yes, the doctor should not only treat professionally, but also skillfully apply knowledge of medical terminology, which is an important tool in communicating with colleagues in Ukraine and abroad, in understanding professional literature, in competent prescription writing, and so on [Melnychuk, 2019, p.166].

The concept of future doctors' vocational readiness means the presence of knowledge of medical terminology, the ability to communicate professionally, using professional terminology; special skills in reading medical terminology, writing and application skills. Based on the requirements of educational

qualification characteristic (EQC) of the doctor, which outlines the content and level of preparation of the graduate in the specialty «Medical Care», the future specialist of the relevant qualification should:

- know the rules of word formation of lexical units (terms); rules of their compatibility; basic information on the history of language development;
- be able to read professional orientation materials, write prescriptions, have rules of interpretation and construction of clinical, anatomical and pharmaceutical terms;
- have the skills of forming (i.e. the use of nouns and adjectives, personal endings of verbs); designing medical terms; letters necessary for writing recipes, graphics and spelling, reading (phonetic language); use basic techniques of word-formation, reading, writing and translation of professionally oriented material [Rezanovych, 2002].

Each specialist in order to master the profession and successful professional activity must be properly understood and he should use appropriate vocabulary accurately, and therefore know the terminology of the specialty [Bilavych, 2019].

The terminology of modern medicine is one of the most complex systems. The total number of medical terms is not known for sure. According to experts, the terminological fund of modern medicine exceeds 500 thousand medical terms. If a hundred years ago an educated doctor was well-versed in his current terminology, it is now almost impossible to master several hundred thousand medical terms (historical background: in the X century there were 1000 medical terms, in 1850 - about 6 thousand, in 1950 - about 45 thousand), yet no one has been able to simply teach them, so in the process of studying Latin the future doctors will not be able to work without the systematics and rules of word formation of terms from certain elements. As soon as students master these rules and become able to apply them, they will, accordingly, learn to understand even new terms [Petrova, 2009, p. 21].

Another feature of the future doctors' professional training in the aspect of medical terminology is interdisciplinary integration in the study and use of Latin. The need for learning Latin becomes apparent to future physicians as students become familiar with medical terms and elements while studying many disciplines. Thus, the study of anatomical, histological and pharmaceutical terms in practical classes in Latin enables students to master the basic concepts of the disciplines: «Human Anatomy», «Histology», «Pharmacology» and others.

An important component of the structure of future vocational readiness of physicians to use medical terminology is **cognitive orientation**. His criterion is the formation of an appropriate level of knowledge of Latin medical terminology among medical students. The term «cognitive» comes from lat. *cognitio* - knowledge, cognition, cognition [Sociological and Pedagogical Dictionary, 2004, p. 111]. Therefore, we consider the cognitive-orientation component as a set of professional knowledge of medical terminology, which is needed for future doctors in their professional activity. Indicators of the formation of the cognitive-orientation component of the professional-speech readiness of future doctors to use medical terminology were made on the basis of the requirements of the educational-professional program (EPP) [Typical Syllabus, 2013]. After all, the transformation of the goal into a result is due to the assimilation of the content of the study (the subjects studied).

According to the EPP, future doctors need to know the rules of emphasis, grammatical categories of nouns, their vocabulary form, Greek doublets and word-forming elements of nouns of all declensions; grammatical categories of verbs, systems of verb forms on the example of the vocabulary used in the recipe, structure of the recipe, rules for its spelling; to know the grammatical categories of adjectives, the degree of their comparison, and the wrong degrees of comparison of adjectives; to know the principles of formation of nomenclature names and terms; 1000 lexical units and basic word-forming elements used in the names of the drugs and indicate their therapeutic and pharmacological action, as well as anatomical, histological and clinical terms.

Therefore, indicators of the formation of the cognitive-orientation component are:

1. knowledge of the essence and structure of medical terminology;
2. knowledge of forms and types of medical terms;
3. understanding the essence of professional-speaking activity of future physicians using medical terminology.

To get the effective content understanding, it must have been met some certain requirements as scientific, systematic, comprehensive, purposeful, linking theory with practice.

## Results and Discussion

The cognitive-orientation component involves the formation of knowledge in the sphere of theoretical and methodological Latin basics, which determine the degree of scientific and theoretical readiness of students to use medical terminology in the professional medical activity.

In order to establish the level of motivation for the study of Latin by future doctors, a specific questionnaire was conducted, where the students were asked to work out a questionnaire for determining the motivation of students to use Latin medical terminology in future professional activity (formation of a motivational and value component). The first questionnaire determines the level of students' motivational sphere formation in the field of speech preparation for the use of medical terminology in Latin lessons and obtained the following results.

Regarding the main motives for Latin lessons, 115 students (28.75%) study it with great interest, strive to further improvement of their knowledge of medical terminology, as they are sure that they will definitely need it in their future professional activities. However, 119 future doctors (29.75%) believe that Latin lessons are necessary only for general development and are only one of the means of obtaining new professionally relevant information to some extent. The processing of questionnaire data indicated that 105 (26.25%) students would use Latin only during their studies, so they do not know whether the acquired knowledge, skills and ability to communicate in a professional environment. According to the results of the survey, 61 (15.25%) people will find no use of knowledge of Latin anywhere, so these students do not want to study it, they attend classes only in order to pass the exam [Nakhaieva, 2020].

Summarizing the results of the questionnaire, which reflects the level of aspirations of future doctors in the direction of learning Latin, it is established that students' motivation should be purposefully worked on.

In order to establish the level of knowledge of medical terminology, future doctors wrote a terminology dictation. The content of questions was formed to establish the level of theoretical professional readiness of students in the discipline «Latin language and the basics of medical terminology» (the formation of the cognitive-orientation component), the analysis of the success of medical terms' knowledge in professional disciplines: «Human anatomy» and «Anatomy of human», «Pharmacology» in the form of test control (to determine the level of knowledge of anatomical, histological and pharmaceutical terms (formation of the cognitive-orientation component) of future doctors' professional-speech readiness to use medical terminology)).

Thus, after analyzing the results of student knowledge control, it was found that a high level is inherent in 115 (28.50%) students; and low is found in 53 (13.25%) students. To determine the level of formation of future doctors' skills to use medical terminology, situational tasks were developed, which students solved with the help of test control to determine the level of formation of functional and activity component of future doctors' professional-vocational readiness to use medical terminology. As a result of working out the proposed tasks, students revealed the following levels of speech skills in the use of medical terminology: high - inherent to 113 (28.25%) students, medium level revealed 112 (28.00%) future doctors, satisfactory level was set at 115 (28.75 %) students and low - in 60 (15.00%) people. This, in our opinion, indicates that the preparation of future physicians for the use of medical terminology should be brought as close to practical as possible.

In order to establish the level of self-education activity and self-development of future doctors regarding the use of Latin medical terminology, a survey was conducted of medical university students to self-analyze the readiness of students of higher medical schools for using Latin medical terminology. Thus, it was found that a high level of striving for self-improvement is characteristic of 110 (27.50%) students, the average level was found in 108 (27.00%) future doctors, satisfactory was found in 121 (30.25%) students, and low - in 61 (15.25%) persons.

The results of the diagnostic stage are shown in table 1.

*Table 1. The results of the diagnostic phase of the experimental study*

Components of the readiness	Levels of students' readiness for using medical terminology								Average rate of the readiness (AR)
	high		average		satisfactory		low		
	NS	%	NS	%	NS	%	NS <sup>1</sup>	%	
Motivational value	115	28,75	119	29,75	105	26,25	61	15,25	3,72
Cognitive orientation	114	28,50	104	26,00	129	32,25	53	13,25	3,70
Functional activity	113	28,25	112	28,00	115	28,75	60	15,00	3,70
Personal development	110	27,50	108	27,00	121	30,25	61	15,25	3,67
<b>Average score</b>	<b>113</b>	<b>28,25</b>	<b>111</b>	<b>27,75</b>	<b>117</b>	<b>29,25</b>	<b>59</b>	<b>14,75</b>	<b>3,70</b>

The analysis of the table data shows that upon completion of the first year study at the higher school students, the formation of professional readiness to use medical terminology requires improvement in the direction of the formation of each component, as it is characterized by the following total score: high level revealed 113 students (28,25%) an average of 111 (27,75%) future physicians; satisfactory level is characteristic of 117 (29,25%) students; a low level was found in 59 (14,75%) people. Provided that each of these levels was characterized by a certain number of points (high - 5 points, average - 4, satisfactory - 3, and low - 2 points), then the average rate (AR) of the professional-speech skills of future doctors to use medical terminology at the diagnostic stage of the study was 3,7 points.

The results of the diagnostic phase of the experimental study showed the need to improve the professional training of future doctors to use medical terminology by implementing certain pedagogical conditions and using the developed structural and functional model.

The experimental study was divided into several stages.

The ascertainment phase of the experimental study lasted during 2017-2018, which identified control (CG) and experimental groups (EG) of students. A total of 386 future physicians participated in the experiment. The basic approaches to the definition of CG and EG were the following conditions:

1) in KG and EG there were almost the same number of students: in KG - 192 persons and in EG - 194 students;

2) students in groups of both categories had close rate of the formation of each component at the entrance control stage and, in general, professional and vocational readiness to use medical terminology.

In the control groups (CG) students were taught according to the traditional method. In the experimental groups (EG), future physicians' professional training in the use of medical terminology was performed by experimental methods. The division of students into CG and EG takes into account that the number of students in both categories of groups and the initial level of formation of all components of future professional readiness of physicians at the entrance control (EC) stage should be close in value. The results of the final stage of the experimental study on the input control indicators are shown in table 2.

The entrance control was carried out by questioning and testing after studying the first topic in the 1st semester of study in the 1st year, when the students had already acquired a certain knowledge of medical

<sup>1</sup> Hereandafter, we use the following abbreviations

CG - control group

EG - experimental group

EC - entry control

FC - final control

SC - stage control

AR - average rate

NS - number of students

terminology, since according to the syllabus the Latin language was learned during the 1st course, and were able to use their skills while studying other disciplines «Human Anatomy», «Histology», «Pharmacology».

**Table 2.** The results of the ascertainment stage of the experimental study on the input control indicators

Components of the readiness	Gr	Levels of students' readiness for using medical terminology at the entry stage								AR
		High		Average		Satisfactory		Low		
		KC	%	KC	%	KC	%	KC	%	
Motivational value	CG	51	26,56	47	24,48	54	28,13	40	20,83	3,57
	EG	52	26,81	48	24,74	55	28,35	39	21,10	3,58
Cognitive orientation	CG	48	25,00	44	22,92	57	29,69	43	22,39	3,51
	EG	46	23,71	47	24,23	60	30,93	41	21,13	3,51
Functional activity	CG	45	23,44	41	21,35	60	31,25	46	23,96	3,44
	EG	43	22,16	45	23,20	61	31,44	45	23,20	3,44
Personal development	CG	50	26,04	46	23,96	55	28,65	41	21,35	3,55
	EG	48	24,74	49	25,26	57	29,38	40	20,62	3,54
Average score	CG	48	25,00	44	22,92	57	29,69	43	22,39	3,51
	EG	47	24,23	47	24,23	58	29,89	42	21,65	3,51

While studying the first topic, students of CG and EG became acquainted with the history of Latin and the development of medical terminology; studied the Latin alphabet and classification of sounds, pronunciation of vowels, consonants, letter combinations, diphthongs; prefixes and roots of Latinized Greek words with the letter «y»; rules of Latin accent; structure of anatomic-histological and pharmaceutical terms; grammatical categories of the noun; signs of belonging of nouns to one or another abolition and definition of their basis anatomical, histological and pharmaceutical lexical nouns of five nouns.

Future CG and EG doctors learned to read and write in Latin; use the Latin dictionary in accordance with the Latin alphabet, spell correctly medical (anatomical, histological, and pharmaceutical) terms; determine the number of syllables in the Latin word; emphasize in three-component and multi-compound words; determine the genus, number, pronouns and different types of nouns .

Students of CG and EG were offered the exercise to write the words in the Latin letters: *carbo, aloe, kefir, cardiac, dyspepsia, equivalis, sapo, acidum, mayas, keratoma, tetracycline, exacte, mint, color, medicine, cuprum, lacquer, lacquer* others; a list of Latin words is presented to show their ability to determine the length or shortness of the penultimate syllable of each word and to emphasize it, because the correct pronunciation of Latin medical terms is a key condition for their use: *purpurea, globulus, medicamentum, Leonurus, diaeta, toxoplasma, sisanguis, bifolia, extractum, reflexus, naturalis, nomen, lamella, cerebrum, anatomy, oxydatio, Kalanchoe, injectio, gangraena, ligamentum, infusum, vesica, stomachus, palpebra, thermometrum, amyllum* and others. Besides, a test was conducted in human anatomy, histology, pharmacology classes to determine the ability of CG and EG students to transform these terms into interdisciplinary integration.

For students from CG and EG the self-control of their knowledge on the studied topic was conducted to determine the level of mastering the educational material. The teacher used samples of test tasks.

*Determine the correct spelling of the Latin term*

«Sterilization»:

- sterilizatio
- sterilisacio
- sterilizacio
- sterilysatio
- sterilisatio

*Where the Latin consonant «c» is pronounced as «ts»:*

- carbo
- crystallus
- decoctum
- lac

e) coeruleus

*On in the first lesson you had to learn that the accent in Latin words can be placed on the 1st, 2nd and 3rd syllables from the end of the word. To specify a line in which the emphasis is placed on the 3rd syllable; you need to know not only the rules of emphasis, but also the position of the shortness of the 2nd syllable. Starting with these requirements, enter this line:*

- a) deltoideus, calidus, palatinus
- b) vesica, palpebralis, similis
- c) gastricus, gluteus, Urtica
- d) sanabilis, ramulus, pilula
- e) arthralgia, Aloe, fissura

*Competent use of Latin medical terminology is an adornment of the doctor's language. Specify the line where the basis of the noun is incorrectly defined:*

- a) costa, -ae f cost-
- b) labium, -i n lab-
- c) medicus, -i m medic-
- d) arcus, -us m arc-
- e) ulcus, -eris n ulcer-

Thus, the entry level of future professional physicians' readiness to use medical terminology was almost identical. The analysis of the results of the entry control (EC) indicates the same conditions for the entry of students of CG and EG in the experimental study.

Thus, according to the rate of the motivational value component formation of professional readiness among students of control groups, the average rate was 3,57 and the experimental groups – 3,58 points. At each level, the percentages of the formation of this component were very close, namely: high – 26,56% in the CG, 26,81% in the EG; average – in CG – 24,48%, in EG – 24,74% of students; satisfactory – 28,13% of the students from the CG and 28,35% of the students at the EG; low – in CG – 20,83%, in EG – 21,10% of future doctors.

Formation of the cognitive orientation component of future doctors' professional-speech readiness to use medical terminology in students of control and experimental groups was characterized by the following indicators: the average score in both categories of groups is 3,51 points. At each level, the percentages of the formation of this component were very close: at high – in CG – 25,00%, in EG – 23,71%; on average – in CG – 22,92%, in EG – 24,23%; satisfactory – in CG – 29,69%, in EG – 30,93%; at the low – in CG – 22,39%, in EG – 21,13%.

The rate analysis of the formation of functional activity component of future doctors' professional-speech readiness to use medical terminology at the stage of entry control in CG and EG groups shows that the average score was 3,44 points. The percentages of the formation of this component at each level were very close. A high level of CG was 23,44%, in EG – 22,16%; the average level was found in CG – 21,35%, and in EG – 23,20% of future doctors; a satisfactory level was characteristic in CG 31,25%, and in EG – 31,44% of students; with a low level in CG was 23,96%, and in EG – 23,20% of students.

Thus, the analysis of the results of the ascertainment stage of the experimental study shows that by the digital value of the formation rate of all components and in general the professional readiness of future doctors to use medical terminology, students of CG and EG entered experimental study with almost identical indicators. At the same time, the obtained digital data indicate that the future doctors' professional training requires the improvement and organization of training on the basis of the specified pedagogical conditions implementation, which should be tested experimentally. After all, the level of reliability of the main results of scientific research is significantly increased if they are based on experimental data.

In order to develop vocational skills, each EG student received one of the following tasks:

1. To write declension of all the singular and plural nouns and masculine nouns with the ending -us and -er.
2. To reconcile 2 noun masculine nouns with adjectives and adjectives ending in -us and -er.
3. To write declension of all the singular and plural nouns and adjectives of the middle kind with the ending -um.
4. To create ambiguous and long-term medical terms using nouns and adjectives of the 2 nd pronunciation of the male and middle kind.

5. To create clinical terms using the Greek equivalents of nouns of the 2<sup>nd</sup> cancellation.
6. To identify adjectives belonging to group I. Find the basis of the adjective.
7. To write declension of the adjectives (I-II groups) in the singular and plural.
8. To harmonize adjectives of group I and adjectives with nouns, to form ambiguous or long-standing anatomical, histological, pharmaceutical terms.
9. To form past participles from the four verbs.
10. To reject past participles in singular and plural.
11. To use past participles in prescription expressions.

After completing individual tasks, students exchanged results for their classmates to test. Thus, the future doctors performed two exercises, which led them to an in-depth study of Latin. After all, they were responsible not only for their own level of training, but also for the adequacy of assessing the knowledge of their groupmates. In the assignments the students were offered terms that had been studied in the courses of the disciplines «Human Anatomy», «Histology» and «Pharmacology».

During the discussions with the teachers of these disciplines it was found that EG students are better at learning the educational material, since they already have the knowledge and skills to build complex terminological constructs.

The results of the formation of the cognitive orientation component of the future doctors' professional speech readiness to use medical terminology are shown in Table 1.

A comparative analysis of the indicators of Table 3 shows more significant changes in the formation of the cognitive orientation component among the students of EG:

- according to the high level indicators, the number of students increased from 26,00% to 28,65% in the CG, and from 23,71% to 44,33% in the EG;

- in the average level in CG there was an increase in the number of such students from 22,92% to 26,04%, and in EG - a decrease from 24,23% to 15,46%, which is explained by a significant increase in the number of future doctors with high level;

- according to the indicators of satisfactory level in CG there was an increase in the number of students from 29,69% to 31,77%, while in EG the number of such students decreased slightly from 30,93% to 29,38%;

- the low level in both categories of groups decreased the number of such students: in CG - from 22,39% to 13,54%, and in EG - from 21,13% to 10,83%;

**Table 3.** The results of the formation of the cognitive orientation component of the future doctors' professional-speech readiness to use medical terminology

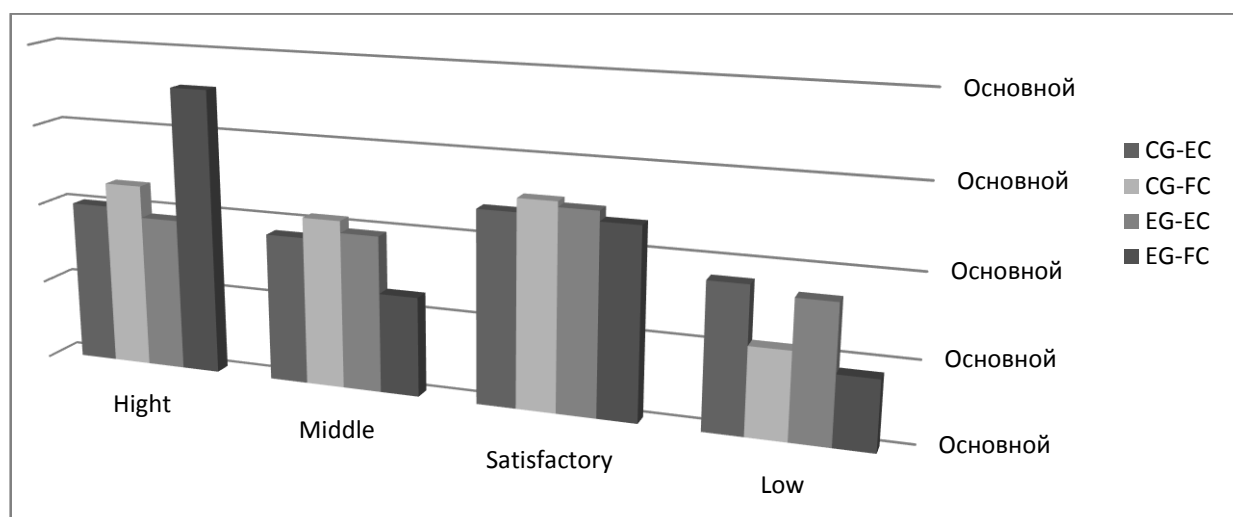
Groups and number of students	SC	Formation levels of the cognitive orientation component of future doctors' professional-speech readiness to use medical terminology								AR
		high		average		satisfactory		low		
		NS	%	NS	%	NS	%	NS	%	
CG - 192 st.	EC	48	25,00	44	22,92	57	29,69	43	22,39	3,51
	FC	55	28,65	50	26,04	61	31,77	26	13,54	3,70
EG - 194 st.	EC	46	23,71	47	24,23	60	30,93	41	21,13	3,51
	FC	86	44,33	30	15,46	57	29,38	21	10,83	3,93

- at the average rate in CG there was an increase from 3,51 to 3,70 (by 0,19 points), and in EG - more significant - from 3,51 to 3,93 (by 0,42 points), which is by 0,23 points higher than in CG.

Changes in the formation of the cognitive orientation component of the future doctors' professional-speech readiness to use medical terminology are shown in Fig. 1.

The analysis of the diagrams shows that the use of our methodology in the direction of the implementation of the second pedagogical condition in the experimental groups leads to a significant increase in the number of students with a high level of formation of this component.





**Fig. 1.** Dynamics of changes in the formation of the cognitive orientation component of professional-speech readiness of future doctors to use medical terminology

Proving the reliability of the obtained results and determining the reliability of the experimental study was based on the application of statistical methods of data processing pedagogical experiment. To test the hypothesis of the study was used to compare the variances and determine the F-Fisher criterion by formula 1. [Kyverialg,1980, p. 277]:

$$F_{emp} = \frac{\sigma_1^2}{\sigma_2^2} \quad (1),$$

where  $\sigma_1^2$  - greater variance, and  $\sigma_2^2$  - less variance, which were determined during the introductory and final determination of the results of vocational training, i.e, the level of readiness of future doctors to use medical terminology.

The variances were calculated by the formula 2:

$$\sigma^2 = \frac{\sum f(x_i - \bar{x})^2}{N} \quad (2),$$

where  $f$  is the number of students who have a certain level of professional-speaking readiness of future doctors to use medical terminology;

$(x_i - \bar{x})$  - the difference between the digital value of each level (5, 4, 3, 2) and the value of the average (AR);

$N$  is the number of students in those categories of groups (control or experimental) where the variance was calculated.

To verify the results obtained, we compared the empirical F-criterion of CG ( $F_{emp} - CG$ ) and EG ( $F_{emp} - EG$ ) with the indicators of theoretical F-criterion ( $F_{krit}$ ), whose numerical values are given in the standard table of A. Kiverialg [Kyverialg,1980, p. 278].

Provided that the number of degrees of freedom (number of students in the minus group 1) is in the range from 24 to infinity and from 120 to infinity (as in our study (192 - 1 = 191 for CG and 194 - 1 = 193 for

EG), then the  $F_{krit}$  score for CG and EG should be around 1.0. The results of calculating the F-criterion for each component and the overall professional readiness of future physicians to use medical terminology.

A comparative analysis of the empirical index of the F-criterion of CG and EG with the determined limits of  $F_{krit}$  showed the reliability of the results of the experimental study. Thus,  $F_{emp}$  – CG with a value of 1,0 for all components for generalized results of vocational training of future physicians to use medical terminology is beyond the limit of 1.0. Positive changes in CG students in the formation of each component and, in general, the vocational readiness of future doctors to use medical terminology are due to the natural influence of the traditional educational process. For EG,  $F_{emp}$  – EG values with a score of 1,004 for motivational value, 1,016 for cognitive orientation, 1,007 for functional and activity, 1,019 for personality and developmental components and 1,01 for generalized results confirms their validity and attests to their validity pedagogical conditions of vocational training of future doctors to use medical terminology [Nahajeva, 2016].

For the in-depth and purposeful study of the problem of future doctors professional training to use medical terminology through the implementation of pedagogical conditions, an experimental study was conducted, which consisted of three stages: diagnostic, ascertaining and formative. At the diagnostic stage, an unsatisfactory state of professional-speech readiness of future physicians to use medical terminology was established: 113 (28,25%) students found a high level; an average of 111 (27,75%) future physicians; satisfactory level is characteristic of 117 (29,25%) students; a low level was found in 59 (14,75%) people. Provided that each of these levels was characterized by a certain number of points (high – 5 points, average – 4, satisfactory – 3, and low – 2 points), then the average rate (AR) of the professional-speech skills of future doctors to use medical terminology at the diagnostic stage of the study was 3,7 points.

## Conclusions

The analysis of the results of the ascertaining stage of the experiment showed that by the digital indicators of the formation of all components and, in general, the future doctors' professional and speech readiness to use medical terminology, CG and EG students entered the experimental study with the same indicators.

At the formative stage of the study, the effectiveness of the pedagogical conditions of professional training in the use of medical terminology of EG students during the study of subjects: «Latin language and basics of medical terminology», «Human Anatomy», «Histology», «Pharmacology» was experimentally tested. The author's methodology was based on the systematic use of innovative methods. The practical classes used a special database of thematically selected schemes, which reflected educational material in the discipline «Latin language and the basics of medical terminology», presented in close connection with anatomical, histological, clinical and pharmaceutical terminology [Hantimurova, 2019]. Oral and written exercises were based on lexical material related to the profession of doctor or scientist in the field of medicine. This contributed to the formation of professional-speaking readiness of future doctors to use medical terminology. The classes used the technologies of development of critical thinking, interactive forms and methods of teaching («Basket of concepts and terms», «Graphic schemes», «Fishbone», «Clusters», «Sinkwein», dialogue, demonstration and solving of situational problems, etc.), information technology tools. In order to activate students' self-educational activities, they organized a «Medical-terminological dictionary», which facilitated the formation of professional readiness of students to use medical terminology [Vykhreshch, 2020].

Thus, the effectiveness of the formation of future doctors' professional speech readiness to use medical terminology depends on the purposeful realization of certain pedagogical conditions, the developed structural-functional model and the application of the method of students' professional training during the course «Latin and medical terminology basics», «Human Anatomy», «Histology», «Pharmacology».

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## Mma Exercises in Physical Education of 17-18 Year Old Students

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### Abstract

In modern science there is a permanent search for new effective forms of organization of the educational process in physical training at higher education institutions of different orientation. The article presents a solution of the actual scientific and practical task of improving the level of physical fitness of students and increasing the readiness of young people of military age to fulfill their national service obligation and advancement of the content of physical education in agrarian institutions of higher education by means of the program of sectional classes using the means of MMA.

Due to the conducted research, for the first time, the structure and content of the program of sectional classes with the priority use of means of MMA all-around in physical education of students of institutions of higher education has been scientifically substantiated; the effectiveness of the use of means of military sports all-around for students of agricultural institutions of higher education was determined by indicators of their physical condition, physical development, functional and psychological state, physical fitness.

The effectiveness of the author's program is confirmed by the improvement of functional capabilities, normalization of physical condition, enhancement of the level of physical fitness, increase of interest of young men to engage in physical education and importance of instrumental and terminal values.

**Keywords:** physical fitness, process, sectional classes, double-event, means, methods, improvement.

### Introduction

In modern science there is a constant search for new effective forms of organization of the educational process in physical training at higher education institutions of different orientation. From this point of view, the issues of substantiation of physical activity norms, the ways of preserving and improving students' health are actual [7, 9].

Different social, political and economic conditions in Ukraine dictate the urgent need to increase the level of readiness of young people to fulfill their patriotic duty and, accordingly, a high level of functional, physical and psycho-emotional preparedness. The topicality of such researches increases due to the scientist's criticism regarding the low level of students' readiness and the lack of effective reforms in physical education at universities [16, 17].

In recent decades, there has been an increase in scientific research on the development and improvement of methods (programs) for mixed-sport trainings and complex combat sports for students, the formation of the normative base of complex combat sports and the improvement of physical training of athletes of the military-sports complex. An effective solution of this task could be the use of the means (features) of complex combat sports in the physical education of student youth. Moreover, it has applied (practical) and humanistic value [1, 2, 3, 4].

It should be mentioned that in the scientific literature the main accent is made on the development of the complex combat training programs mostly for qualified athletes (8, 18). On the one hand, there is also considerable research on the theoretical and methodological basis of the use of military combat sports and MMA in the Armed Forces Specialist Training System. On the other hand, there was no scientific discussion and substantiation of the use of MMA sport for student groups at higher education institutions [13, 14, 15].

The analysis of scientific works revealed some contradictions between the level of students' physical preparedness, the readiness of young people of conscript age to perform military duty and the content of physical education at universities. The solution of such kind of contradiction is an urgent scientific challenge

that might be overcome through MMA training programs in the physical education of future agrarian professionals.

**The purpose of the study** is to improve the content of students' physical education at higher agricultural institutions by the use of MMA sectional classes.

### Material and Methods

Theoretical analysis was used to summarize the data of scientific and methodological literature on topical issues in the field of research. Analysis of documentary materials enabled to study the program-regulatory requirements and documents devoted to physical education of students at higher agricultural institutions, requirements for their preparedness. Sociological methods (surveys, questionnaires) were used to study the motivation of students of different specialties at higher agrarian institutions to be physically active and to exercise. Pedagogical testing enabled to determine the level of students' physical skills and their division by the levels of preparedness. Besides, it enabled to determine those indicators at different stages of the research.

Medical and biological methods (anthropometry, spirometry, the Ruffier functional test, time of heart rate recovery (HR) after 20 squats, method of physical state level estimation according to V. Belov); psychological methods (the «Interlaced lines» test, Jacobs method, the «Number Placement» method, the Munsterberg test, the method of determining the value orientations of M. Rokich) were used to obtain objective empirical data on physical condition, physical development, functional and psychological state of physical fitness of agrarian students.

Pedagogical experiment was aimed at determining the effectiveness of the author's program of section sessions on physical education of students of higher agricultural institutions. The basis of the program was the use of MMA exercises.

Mathematical statistics methods have been used to obtain objective data on the various aspects and collections of digital data in the course of a study at various stages.

In order to solve those tasks within the framework there were measured the indicators of 128 first- and second-year students (17-18 year old) of Sumy National Agrarian University. Among the students there were representatives of the following specialties: construction, veterinary and agronomic. The following indicators were established: features of physical development, functional state, physical fitness and psychophysiological characteristics. Students were also interviewed for motivational priorities and attitudes toward physical education.

The next stage of research (September 2017 - June 2018) was a parallel comparative pedagogical experiment. It was conducted to test the effectiveness of the MMA section program. At this stage, control and experimental groups were formed. The control group enrolled 16 students aged 17-18 years (only male), and the experimental group - 15 students of the same age (only male). The aim of experiment was to determine the effectiveness of the MMA section program in comparison with the traditional one.

The structure and content of the author's program was based on the requirements represented in special literature on MMA [2, 4, 9, 10]. At the same time it was adapted and integrated into the pedagogical experiment. The initial material was composed of the following sections: theoretical and psychological training, technical and tactical training, general and special physical training. The ratio of time allotted to different types of training was as follows: 6 hours (5%) for theoretical and psychological training, 34 hours (28.2%) - for technical and tactical, 40 hours (33.4%) - for general physical and 40 hours (33.4%) - for special physical training.

### Results

On the basis of the analysis of scientific literature and the normative-legislative acts, it was determined that the modern trends of physical education at higher education institutions are the following: the improvement of the quality of organization of physical-fitness, sports, mass, training, educational and extra-curricular activities of students; the use of physical culture features and exercises for all-round development of personality; the search for optimal ways to increase students' motivation for physical education and sports taking into account their motivational priorities during developing physical education programs; the formation of valuable categories of personal physical culture [6].

Summarizing the data of scientific and methodological literature on the problem of physical education of students at higher agricultural institutions and taking into account the specifics of their educational and professional activity enabled to find out the content of physical education at universities. This requires the formation of vital motor skills necessary for further every day and professional activities; professionally applied orientation of the educational process; development and implementation of appropriate regulatory software, including professional and qualification requirements for future specialists in agrarian specialties [5].

The content of physical education of students at higher agricultural institutions should also be based on the norms of weekly physical activity and taking into account their physical development, functional and psychophysiological state and physical fitness of students-agrarians. That is why there is the need for the development of innovative fitness programs, taking into account the specific educational and professional activities of the agricultural sector specialist; a regulated organization of mass sports events to preserve and promote students' health and popularization of a healthy lifestyle; the formation of a harmoniously developed personality; the construction of educational process on physical education taking into account students' motivational priorities; creation of adequate material and technical base at higher agrarian institutions; the increase of qualification of teachers and coaches in sport [3].

It was established that the present social and political conditions in our country have intensified the studies on the use of martial arts at universities of various types. Scientists confirm that there is a close relationship between the means of these sports and the patriotic upbringing of personality, along with the improvement of physical fitness and different components of professional physical training of student youth.

According to the first stage of our research the MMA features and exercises might be used as a solution of the contradiction between the level of students' physical fitness, the readiness of conscript youth to perform military duty and the content of physical education at universities [8].

The survey has identified the students' interests and motivation to be physically active and to participate in classes during studying at university. It has been established that most students (56,7%) have a positive attitude to physical education and sports. The reason for the negative attitude of students was determined by excessive physical activity (35,1%) and absence of the exercise which they are interested in (25,9%).

It was found that important motives for agrarian students are the following: the improvement of body structure (33,3%), the increase of health status (22,0%) and the opportunity to communicate with friends (12,7%). Besides, we found that 26,3% of students are interested in MMA exercises during university classes. Some of them (9,1%) prefer the exercises connected with fight.

The next stage of the research enabled to determine the level of physical fitness and functional status of students. It has been established that most of them have the average level (Table 1). We took into account such indicators as height and body mass, chest circumference, the level of physical development according to the Kettle index. It was determined that the biological age of the 17-18 year old students corresponds to their chronological age. According to the Kettle body mass index the students have an average level of physical development (table 2).

*Table 1. Functional indicators of 17-18 year old students (n = 128)*

Indicators	$\bar{x}$	S	m	V
Heart rate at rest, bpm	76,35	3,78	0,39	5,32
Systolic bloodpressure, mmHg	118,56	5,6	0,52	5,2
Diastolic blood pressure, mmHg	74,5	6,12	0,45	8,9
VitalCapacity, ml	4115,00	162,07	0,02	6,35
A recovery heart rate after 20 squats in 30 seconds, bpm	128,7	2,74	0,07	0,12
The Ruffier index	11,78	2,98	0,23	25,8

It was revealed that the functional indicators of the students are also within the normal range. According to the Ruffier index, the students with a number  $11,78 \pm 2,98$  were below the average level.

According to the method of V. Belov it was found that students have mostly average level of physical state. However, according to the results of determining the level of physical fitness indicators in 9 tests were lower than average level (77 points).

According to the method of M. Rokich it was revealed that the most significant orientations for the agrarian students are important specific and individual values of personal life and interpersonal relationships. At the same time the least significant orientations are acceptance of others, passive and ethical values.

In addition, experimental part of the research proved the effectiveness of implementation of section classes with MMA exercises into the educational process of agrarian students.

During the development of the author's program we have captured the content of the Basic curriculum of physical education for higher education institutions of III – IV level accreditations, as well as a profессиogram for the natural-humanitarian group specialties.

The tasks of the author's program with MMA exercises for agrarian students were planning of rational organization of sectional classes and independent activity of students; the increase of the physical fitness level and psychophysiological indicators of students; formation of positive motivation for physical education.

The experimental factor was the implementation of section classes based on the use of MMA exercises into the content of physical education of Sumy National University.

It was carried out only in agreement with the administration of the University and enabled to realize the right of the students for the variability and independent choice of the content of physical education during studying.

According to the construction of the curriculum and the role of physical education at Sumy National Agrarian University, the section classes with MMA exercises were conducted twice a week.

MMA classes were conducted in a specialized gym individually and in pairs, and sometimes in small groups. During the classes there were used streaming and frontal ways of exercise organization.

The general organization of section sessions corresponded to the recommendations of specialists and included three parts: preparatory (warm-up), main (work out) and final (cool-down). The development of students' physical skills and the studying of new types of exercises and techniques were planned in the main part of the class.

It should be mentioned that MMA classes had different load regimes. That is why we offered different duration of preparatory part (warm-up). But at the same time it was compensated by the greater intensity and focus on the global impact on muscle groups. The main part of the classes was aimed at studying the elements of MMA and repetition of already learn material. Also, the final part of the class was extended in duration. It was connected with the intensity of the main part of the class, because the heart rate during it was high that is why its normalization also required more time [14].

In total, 120 hours of classes were conducted with the students of the control and experimental groups. Sectional classes were conducted twice a week for 8 months, lasting two academic hours for each. The students of the experimental group were given individual explanations and recommendations regarding the use of MMA exercises.

The author's program provided the use of basic pedagogical and specific methods such as verbal (description, story, explanation, conversation, analysis, lecture, commentary, instructions and commands), visual (direct and indirect visualization) and practical (strictly regulated exercise – continuous, interval, rhythmical, variable, game, competitive, circle training).

For the students of the experimental group, there were applied two main training regimes:

1) Regime with 130-150 bpm heart rates. In that regime students worked in true steady state, which allows exercising for a long time. Such training improves the body's capabilities, which are the physiological basis of overall endurance (stamina) and physical preparedness;

2) Mixed regime with 150-170 bpm heart rates.

During classes we paid attention to the heart rate – it should be in a range from 60 to 80% of the maximum, recommended for the age of the students. For the students with higher than average level of physical fitness, there were used section sessions with a total duration of 50-60 minutes and an intensity of 60-70% of the maximum recommended heart rate. For the students of average level of physical fitness, the duration of the section session was 45-50 minutes with a slightly higher intensity (70- 75% of the maximum).

For the students with a low level of physical fitness, the duration was 40-45 minutes; the intensity was 75-80% of the maximum according to heart rate.

The MMA session program envisaged three consecutive stages: familiarization (creating an idea about technical action); studying (formation of motor skills) and training (improvement of motor skills).

For the contingent of the experimental group, it was proposed the following sequence of exercises:

- studying the position of the grouping in the sitting position, then lying on back;
- practicing a roll in the grouping position, over back and head;
- working out the end positions when falling back (on the back) and to the side;
- practicing pre-emptive hits and kicks while lying on the ground;
- learning to fall consistently from low, medium, high racks;
- learning to fall through a training stick (gym bench, partner);
- practicing a fall in motion in combination with other elements and actions;
- learning to roll over the shoulder from the seat and in motion;
- practicing a fall followed by the rapid adoption of the pre-battle position.

For all MMA technical elements the learning took place in the following order: by sections (with the help of preparatory exercises); overall at a slow pace; in step and run; performing actions after sudden signals and commands with change of direction and speed of movement with overcoming obstacles and other actions.

According to the results of the pedagogical experiment, there were revealed the following changes in the indicators of physical fitness of the students (table 2).

**Table 2.** Changes of physical fitness indicators of 17-18 year old students during the pedagogical experiment

Test	Stages of research					
	Before experiment	After experiment	increase, %	Before experiment	After experiment	increase, %
	indicator	indicator		indicator	indicator	
Control group (n=16)			Experimental group (n=15)			
1. Balance («flamingo»), number of attempts	13,1	9,2***	44,4	12,6	7,4***	71,4
2. Upper limb movement time, seconds	12,9	11,5	12,2	12,6	10,4*	21,1
3. Long jump, centimeters	158,7	164,5	3,6	159,1	178,9*	12,4
4. Set-ups, number of times in 30 seconds	17,2	17,8	3,5	17,4	19,1*	9,8
5. Bent arm hang, seconds	8,2	8,8	7,3	8,4	9,2*	9,5
6. Shuttle running 5x10 m, seconds	14,2	13,1***	8,4	14,4	12,4*	16,1
7. High jump, centimeters	26,7	27,8	4,1	26,4	28,1*	6,4
8. Hand-held dynamometry, kilograms	27,4	28,7	4,7	27,8	30,5*	9,7
9. Running 3000 m, minutes	17,8	16,9	5,3	17,4	16,5	5,4

**Notes:** \* - significant difference between the students of the experimental group before and after the pedagogical experiment at  $p \leq 0,05$  ( $t_{table}=2,05$ ;  $n=15$ );

\*\* - significant difference between the students of experimental ( $n=15$ ) and control ( $n=16$ ) groups before and after the pedagogical experiment at  $p \leq 0,05$  ( $t_{table}=2,05$ );



\*\*\* - significant difference between the students of the experimental group before and after the pedagogical experiment at  $p \leq 0,05$  ( $t_{table} = 2,04$ ;  $n = 16$ ).

Under the influence of the author's program, a significant improvement in the following indicators of functional status was found in the experimental group: heart rate at rest (increase 4,84%), vital capacity of lungs (increase 7,65%), the Ruffier index (increase 23,4%), heart rate recovery time after 20 squats in 30 seconds (increase 9,81%).

According to the V. Belov method, the positive influence of the author's program on the following indicators was determined: rate recovery time after 20 squats in 30 seconds, a long jump, bent arm hang. Moreover, the number of colds during the year decreased (table 3).

**Table 3.** Express assessment of the level of physical state of 17-18 year old students by V. Belov method

Level of physical state	Stages of research			
	initial	ending	initial	ending
	Control group (n=16)		Experimental group (n=15)	
Very low	3	2	2	1
Low	4	3	3	1
Average	9	11	10	11
High	-	-	-	2
Very high	-	-	-	-

Under the influence of the author's program, at the end of the pedagogical experiment, 13,4% of agrarian students had a high level of physical state.

During the experimental study, the motives and interests of the students in experimental group in physical education and sports also have changed. At the beginning the most significant motives were communication with friends (20%), respect among classmates (20%), avoidance of possible troubles made by the teacher (26,7%). At the end of the research the following motives were the most important for the youth: improving the body shape (26,7%), curiosity (26,7%), improving health and improving motor performance (20% for each).

Testing the level of physical fitness by 9 tests allowed to establish significant increasing the experimental group in comparison with the control group in the following indicators: speed (8,98%), explosive force (8,79%), strength endurance in «Set-ups test» (6,29%), strength endurance on the «Bent arm hang test» (2,21%), general endurance (7,73%), static strength (4,79%).

## Discussion

The current trends in improving the structure and content of physical education at higher education institutions indicate the need to take into account the professional and applied physical training of students and the existing challenges of social and political development of the country. Specialists of physical education are assured that it is important to consider the personal needs and motivation of students, as well as to use the varied content of physical education, and improve the defense capacity of student youth.

Generalized requirements for students 'professional preparedness include the acquisition of skills in various sports and physical activities, obtaining competencies in the use of physical culture and sports, the development of motivation for systematic training and improving the level of health, the formation of appropriate self-orientation values, increasing physical and psychological readiness to perform different activities [12, 16].

The main motivational priorities of 17-18-year-old agrarian students in the process of physical education are improvement of body shape (33,3%) and improvement of health status (22,0%). At the same time some values are related to physical and mental health, an active lifestyle, obtaining loyal friends and material stability of life, upbringing, diligence, accuracy and efficiency in affairs [8, 9].

It should be mentioned that the majority of students has positive attitude to physical education and sports at university (56,7%). However, there are some negative factors such as overloading during physical culture classes (35,1%), lack of interesting exercises (25,9%), subjective estimation of their own level of physical fitness (22,1% of respondents rated it as «satisfactory» and 16,2% - «poor»).

Testing of physical fitness 17-18 year old agrarian students indicated directions for further improvement.

For the most part, students had lower than average levels by the method of V. Belov (77 points). It is characterized by the following results of tests: «Balance («flamingo»)» - 7 errors in one attempt (11 points, average level); «Long jump» - 175,4 cm (9 points, average); «High Jump» - 25,8 cm (7 points, below average); «Hand-held dynamometry» (7 points, below average); «Upper limb movement time» - 12,7 seconds (7 points, below average); «Bent arm hang» - 8,7 seconds (7 points, below average); «Set-ups» - 17 times in 30 seconds (7 points, lower than the average level); «3000m Run» - 17,7 minutes (11 points, average); «Shuttle Run 5x10 m» -14,7 seconds (11 points, average level).

At the same time there search of functional indicators and physical development of students (heart rate, systolic blood pressure, diastolic blood pressure, vital capacity of the lungs) showed that the largest fluctuations were observed in the Ruffier index, which indicated their compliance with the general dynamics.

According to the results of the researches, the data of other scientists were confirmed and new theoretical provisions were disclosed, in particular: the level of motor activity of student youth; motivation of students to exercise during physical culture classes; peculiarities of professional training of students of different specialties.

There was developed information about the modern requirements for students' readiness and the tendency of physical education of higher education institutions.

It was improved scientific data on motivation of students of higher education institutions to physical education; the structure and content of physical education at higher education institutions; the efficiency of the use of MMA exercises and its influence on the indicators of students' physical fitness, physical development and psychological state.

The new scientific data is the substantiation of the structure and content of the program of section classes using MMA exercises in the physical education of agrarian students.

## Conclusions

1. The program of section classes using MMA exercises for students was substantiated. Its peculiarities are the orientation of technical and tactical preparation for the study of appropriate motor skills and practical development of tactical elements and their combinations in MMA. At the same time, general physical training was aimed at the use of MMA exercises to improve students' health and physical fitness, develop motor skills and positively influence the motivation to exercise. Theoretical and psychological training included individual discussions with students about proving the importance and necessity of using MMA exercises in physical education as a component of professionally applied physical training and psychological readiness to defend the Motherland.

2. Implementation of the author's program of section classes with MMA exercises proved its effectiveness in the following groups of indicators:

- improvement of functional opportunities, normalization of physical state. In particular, the students of the experimental group in comparison with the control improved the heart rate at rest by 4,83%, the vital capacity- by 7,25%, the heart rate recovery time after 20 squats in 30 seconds- by 10,02%, the Ruffier index - by 18,05%,  $p \leq 0,05$ ;

- increase in the level of physical fitness in the experimental group in comparison with the control was the following: by tests for determination of balance-27,02%, speed - 8,98%, explosive force - 8,79%, force endurance (by the test «Set-ups» - 6,29%, in the test «Bent arm hang» - 2,21%), general endurance -7,73%, static strength- 4,97% from the initial level,  $p \leq 0,05$ ;

- increase of the interest in physical education and value orientations. Dominant values for students are active lifestyle, health and friendship, upbringing, accuracy and responsibility.

## Conflict of interests

The authors declare that there is no conflict of interests.

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# Analysing Listening Skills High School of Physical Education and Sports Students

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## Abstract

Beginning from the moment a person is born, he/she always tends to listen, both in his/her daily life and in his/her education life. In this direction, the objective of this study is to analyse the opinions of physical education and sports teacher candidates about listening skill. The sample of the study is the students studying at Ardahan University School of Physical Education in the 2019-2020 academic year. The sample of the study consists of 100 students selected by random sampling method. A form consisting of two parts has been used as a data collection tool in the study. In the first part of the data collection tool, there is a personal information form including students' gender, class and sports branch information. In the second part, Listening Skills Scale has been used. Kolmogorov-Smirnov test has been used to test the normality of the scale scores in the analysis of the data, and since the data collected from the scale showed normal distribution, the parametric t test, the one-way ANOVA test and the Tukey test from the Post Hoc tests have been used to determine which groups differ in multiple comparisons. Consequently, there is no significant difference according to the variables of gender, age, sports branches. However, a statistically significant difference has been observed from freshman to senior when the comparisons of the listening skill scale according to the grade levels are carried out.

**Keywords:** Communication skills, University students, Listening.

## 1. Introduction

People in society integrate the vast majority of their life with the listening process starting from their education life. There is listening phenomena on the basis of the information we acquire. Listening has a great effect on understanding what is around us and communicating what we understand.

It is clear that the education of listening skill, which is encountered both in school life and in every moment of daily life, is not given much importance. There is a misconception about listening that this skill is innate and does not need to be developed. However, listening, which forms the basis of other skill areas, should be taught to individuals in educational institutions, especially in the family (Emiroğlu & Pınar, 2013).

Listening is one of the most fundamental areas of communication. Listening is the most important element in the realization of empathic communication. It is not enough to hear the other person. It is necessary to understand what he/she says, to think and to be an active listener. Real listening means paying full attention to what is being said and understanding them. (Url 1, 2020).

Listening is defined as a psychological process that starts with the awareness of sounds and images and paying attention to them, continues with the recognition of certain auditory signs and ends with their interpretation (Ergin & Birol, 2000). Listening is an effective process that includes hearing, understanding, integrating understood information with preliminary information, and responding if necessary (Wolff et al, 1983). Again, listening is the activity of perfectly understanding the message that the speaker wants to give and responding to the stimulus in question (Demirel & Şahinel, 2006).

People use listening and reading as a means of understanding, and speaking and writing as a means of expressing (Bulut, 2013). Listening is a skill that is constantly used in daily life and can be improved. The development of listening skill, which is the only language skill used from the moment of birth, begins primarily in the family and the immediate environment where the mother tongue is a teaching center (Ünal & Özer, 2014).

Listening is the process of structuring sounds and speech by making sense in the mind. This complex process consists of hearing, focusing attention and understanding. In the first stage, voices and speeches are heard. In the second stage, attention is focused on the stimuli and the ones that are of interest or necessary

are selected. Selected information and thoughts are passed through various mental processes such as understanding, sorting, classifying, questioning, relating, organizing and evaluating. In the last stage, the information, feelings and thoughts made sense are integrated with the prior knowledge of the individual. Thus, what is heard is structured in the mind and the listening process is completed (MEB, 2009; Doğan & Özçakmak, 2014). In interpersonal relationships, verbal communication has two important elements, namely speaking and listening. The ability of the source (the speaker) that initiates the communication (speaking) to reach the target of what he/she transmits (message) to the other party depends on being a good receiver (listener). Therefore, no matter how healthy a conversation is, errors and deficiencies in the listening dimension will cause the communication to break (Kemiksiz, 2016). It should be thought that there is listening when there is a conversation, and vice versa. In reading from the language skills aimed at comprehension, there are complementary obligations such as looking at the text visually. It is more difficult to gather at one point the other elements that play a role in providing eyes and concentration in listening. Therefore, the time to concentrate in listening is more difficult than reading (Doğan, 2019). Underlying the lack of communication, which constitutes the core of the problems people experience in today's social environment, lies in the inability to perform the listening activity completely and correctly (Maden, 2014). "Understanding" is not always possible while listening. Misunderstandings can also occur. One way to avoid misunderstanding may be for the listener to state what he or she understands of what they are listening to through feedback. Listening using feedback is called active listening. The person who wants to use active listening skill must put himself/herself in the other's shoes for a moment. (Url 2, 2020).

Human beings are not always successful in communication for various reasons. One of the most common problems in communication in daily life is the lack of correct listening habits. Understanding is the most important thing in successful communication. In order to be a good listener, people need to make a conscious effort and develop new skills suitable for the environment (Yıldırım, 2007).

It is possible to mention eight kinds of factors that affect listening. These are:

**Physiological Factors:** The function of the eye in reading is taken over by the ear in listening. Therefore, it is important that students do not have any hearing problems in terms of listening.

**Physical Factors:** First of all, hearing should be performed in a healthy way in the environment where listening takes place.

**Psychological Factors:** The negative mental state of the listener is one of the most important obstacles to perceiving what he/she is listening to.

**Mental Factors:** Listening is a dynamic and lively activity. A trained memory is required for good listening.

**Social Factors:** The traditions and customs of the society and common understanding of social education are also important factors in listening.

**Teacher Factor:** The teacher's or speaker's attitudes and behaviours have some effects on the audience and thus affect listening.

**Speaker (Transmitter) Factor:** Similar to listening skill, speaking skill is a form of communication with a predominant psychological aspect.

**Subject Factor:** Topics that are above the level of the audience, that are outside of their interests, and whose key words and concepts are not well known, do not qualify as a good listening material for the audience (Çifçi, 2001; Uğur, 2019).

Listening is the key to success. It is difficult to imagine success without being a good listener. Listening opens new horizons for people. Moreover, listening is the key to learning (Mackay, 1997; Durukan & Maden, 2010).

## 2. Method

In this research, "Scanning and Description Model" has been used. It is a research approach that aims to define and describe a situation that exists in the past or present in its entirety. In this model, there is no effort to change or influence whatever is the subject of research. What you want to know is obvious. The goal is to be able to observe and identify that thing correctly. Observing without attempting to change is the main goal (Karasar, 1984).

### 2.1. Participants

The population of the study consists of the students studying at Ardahan University School of Physical Education in the 2019-2020 academic year. The sample of the study is 100 students selected by random sampling method.

### 2.2. Measurement

A form consisting of two parts has been used as a data collection tool in the study. In the first part of the data collection tool, there is a personal information form including students' gender, class and sports branch information. In the second part, "Listening Skills Scale" developed by Cihangir and Çankaya (2012) is used. The scale consists of 15-item five-point scale (1 = Never, 5 = Always). 8 items in the scale are positive (2, 5, 8, 9, 11, 13, 14, 15) and 7 items are negative (1, 3, 4, 6, 7, 10, 12). Negative items were reverse-coded while calculating the total scores of the scale. Thus, the higher the total scores mean that the listening skill is high. The scores that can be obtained from the scale are between 15 and 75 points. In this study, the Cronbach Alpha reliability coefficient of the scale has been found to be 0.79.

### 2.3. Data Analysis

The scales used in the study have been controlled and transferred to the "SPSS 22.0 for Windows (Statistical Package for Social Sciences)" statistical program, and the frequency, percentage and arithmetic averages have been calculated. In the normality test of the scale scores, the skewness and kurtosis values varied between +1.96 and -1.96. and the data showed normal distribution to the variables regarding "Kolmogorov-Smirnov" test statistics. Since the data collected from the scale showed normal distribution, t test, one-way ANOVA test from parametric tests and Tukey test from Post Hoc tests have been used to determine which groups differ in multiple comparisons. In the analysis of all data, the value 0.05 has been taken as the confidence level.

## 4. Results

*Table 1. Findings of the Athletes Participating in the Study Regarding the Demographic Features*

	N	%
Gender		
Female	42	42,0
Male	58	58,0
Age		
18-23 years old	84	84,0
23-28 years old	14	14,0
28 years old and above	2	2,0
Class		
Freshman	20	20,0
Sophomore	27	27,0
Junior	18	18,0
Senior	35	35,0
Sport Branch		
Individual	55	55,0
Team	45	45,0

In Table 1, when the gender status of the participants has been considered, 42% (n = 42) are female athletes and 58% (n = 58) are male athletes. 84% of the participants (n = 84) are between 18-23 years old, 14.0% (n = 14) are between 23-28 years old and 2.0% (n = 2) are over 28 years old. The class status of the participants is as such: 20.0% (n = 20) are freshman, 27.0% (n = 27) are sophomore, 18.0% (n = 18) are junior and 35.0% (n = 35) of them are senior. While 55.0% (n = 55) of the participants do individual sports, 45.0% (45) of them do team sports.

**Table 1.** Distribution by Items of Listening Skills Scale

	Items	$\bar{X}$	SS
Q1	I get bored listening to people who don't think like me.	3,710	1,008
Q2	I ask questions to understand the other person better.	3,920	,860
Q3	I don't like to listen to other people's words for a long time.	3,550	1,067
Q4	As I listen to the other person, my thoughts shift to other areas.	3,880	,819
Q5	I try to make him/her feel that I want to understand better the person I am talking to.	3,950	,978
Q6	I don't think I have to listen to others long.	3,330	1,239
Q7	When talking to someone, it happens that I don't listen to their words even though I look at their face	3,920	,981
Q8	I can understand the feelings and thoughts of the other person and convey them to him/her through my words and / or non-verbal actions.	3,930	,934
Q9	When there is a conflict, I try to patiently listen to the other person's feelings and thoughts in order to better understand them.	3,840	,950
Q10	It happens that I pretend to be listening even though I am not listening to someone.	3,940	,919
Q11	While listening, I try to put myself in the person's shoes.	3,900	,948
Q12	I have difficulty in making eye contact with the other person while listening.	4,030	1,029
Q13	When I listen to the other person, I make sure that my body is facing him/her.	4,130	,949
Q14	When I listen to the other person, I pay attention to their verbal and non-verbal messages.	4,260	,883
Q15	While listening to the other person, I try to understand their feelings.	4,260	,811
	<b>TOTAL</b>	<b>58,60</b>	<b>14,370</b>

In terms of the responses given to the listening skill scale according to 100 participants, all of the averages have been determined to be "3 = Sometimes" option and above. According to the items of the Listening Skills Scale, it has been understood that all participants focused on positive results.

**Table 2.** Descriptive Statistics of the Listening Skills Scale

	n	$\bar{X}$	Sd	Min	Max
Listening Skill Scale	100	54,670	6,974	39	70

The average values of the factors of the listening skill scale are given in the table. It has been presented that the average of the listening skill scale is  $54,670 \pm 6,974$  and the low score is 39 and the highest score is 70.

**Table 3.** T Test Results for Independent Groups regarding their Scores from the Listening Skills Scale by Gender

	n	$\bar{X}$	Ss	t	p
Female	42	3,973	,515	1,204	,232
Male	58	3,852	,475		

\* $p \leq ,05$

In Table 4, T-Test Results for Independent Groups regarding their points from the Listening Skills Scale by gender are shown. Considering Table 4, there is no significant difference in the results of the Independent Groups T-Test for female students (= 3,973) and male students (= 3,852) regarding the average scores they got from the Listening Skills Scale.

**Table 4.** T Test Results for Independent Groups regarding their Scores from the Listening Skills Scale by Sports Branches

	n	$\bar{X}$	Sd	t	p
Individual Sport	55	3,849	,530	-1,204	,223
Team Sport	45	3,968	,441		

\* $p \leq ,05$

In Table 5, T-Test Results for Independent Groups regarding their points from the Listening Skills Scale by gender are displayed. Looking at Table 5, there is no significant difference in the results of the Independent Groups T-Test for female students (= 3,973) and male students (= 3,852) regarding the average scores they got from the Listening Skills Scale.

**Table 5.** One-Way Variance Analysis Results regarding the Scores they got from the Listening Skills Scale by Class Levels

Dimension		n	$\bar{X}$	Sd	f	p	Significant Difference
Listening Skills Scale	Freshman	20	4,156	,417	3,355	,022	1.S-4.S.
	Sophomore	18	3,871	,381			
	Junior	27	3,977	,506			
	Senior	35	3,744	,552			

\* $p \leq ,05$

Table 6 shows the results of one-way analysis of variance for Independent Groups regarding the scores they obtained from the Listening Skills Scale according to their class levels. Looking at Table 6, there is a statistical difference between the average scores of freshman (= 4.156), sophomore (= 3,871), junior (= 3,977) and senior (= 3,744) from the Listening Skills Scale. Tukey test, one of the Post-Hoc tests, has been used to test the source of significant difference. The direction of the difference has been found in the direction of freshman and senior.

**Table 6.** One-Way Analysis of Variance Results regarding the Scores they obtained from the Listening Skills Scale by Age Groups

Dimension		n	$\bar{X}$	Sd	f	p	Significant Difference
Listening Skills Scale	18-23 years old	84	3,922	,482	2,747	,069	
	23-28 years old	14	3,704	,479			
	28 years old and above	2	4,500	,707			

\* $p \leq ,05$

Table 7 presents the results of one-way analysis of variance for Independent Groups regarding the scores they obtained from the Listening Skills Scale by age groups. When Table 7 is examined, it has been concluded that there is no statistically significant difference between the average scores of students between the ages of 18-23 (= 3.922), the ages of 23-28 (= 3.704), and students over the age of 28 (= 4.500).

#### 4. Discussion and Conclusion

In this study; the opinions of physical education and sports teacher candidates on listening skill are analysed. It is aimed at making comparisons according to gender, age, sports branch and class variable.

According to the gender variable, there is no significant difference in the results of the Independent Groups t test for the average scores of female students (= 3,973) and male students (= 3,852) from the Listening Skills Scale.

According to sports branches, there is no significant difference in the results of the Independent Groups t Test for the average scores of female students (= 3,973) and male students (= 3,852) from the Listening Skills Scale.

According to the variables of age groups, it is observed that there is no statistically significant difference between the average scores of students between the ages of 18-23 (= 3.922), students aged between 23-28 (= 3.704), and students over the age of 28 (= 4.500).

According to their class levels, it seems that there is a statistically significant difference between the average scores of freshman students (= 4.156), sophomore students (= 3,871), junior students (= 3,977) and senior students (= 3,744) from the Listening Skills Scale.

Ceyran found in his study in 2016 that female students have a significant advantage over male students in gender factor. This result is not in line with our study.

Again, in their study on the listening styles of Turkish teacher candidates in 2011, Maden and Durukan found that there was no significant difference in listening habits according to gender variable. They



also concluded that the class variable has an effect on the listening style. These findings are in parallel with our study.

Similarly, Yoncalık and Çimen concluded that there was no difference in terms of gender in their study about the levels of listening skills in interpersonal communication of physical education and classroom teaching students in 2006. These findings show parallelism with our study.

Kurudayıoğlu and Kana found in their study in 2013 that the relationship between pre-service teachers' self-efficacy perceptions and their classrooms was not statistically significant. These findings do not support our study.

Consequently, there is no statistically significant difference in the listening skill scale of physical education and sports teacher candidates according to gender, sports branches and age. When comparing the positive and negative items of the scale separately, no significant difference has been found according to gender and age. However, when comparing the listening skill scale according to class levels, a statistically significant difference has been observed from freshman to senior.

Adding lessons to students' listening skills within the scope of undergraduate and graduate sports education may be beneficial for the development of listening skills.

The departments that provide sports education (coaching, sports management and recreation) can be analysed and comparisons can be made. The relevant teaching programs available at the Sports education and training faculties of universities can also be compared. Listening's effect on other language skill areas such as writing and speaking, which are related to language skills, can be studied.

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# Artistic Gymnastics Improves Biomarkers Related to Physical Fitness and Health at Primary School Age

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## Abstract

Artistic gymnastics requires the performance of a variety of technical elements on different apparatuses where gymnasts have to overcome their body mass. Maintaining optimal health and a good level of physical fitness is crucial in order to successfully perform the routines. The aim of this study was to assess health and physical fitness related biomarkers in young gymnasts, whilst estimating the benefits of regular gymnastics practice at primary school ages. The study included 90 children, 49 of whom (mean age 9.5 years) were practising artistic gymnastics for at least 2 years with an average of 6 hours per week, and a control group of 41 children (mean age 8.9 years). The participants completed the Alpha-Fit physical fitness test battery (BMI, %Fat, handgrip strength, standing long jump, 4x10m shuttle run test and 20m multistage fitness test). Percentile scores were calculated for the results of each test. The height, body mass, BMI, and %Fat of the male and female gymnasts were significantly lower than those of the control groups ( $p < 0.001$ , with very large effect size  $d > 1.20$ ). All gymnasts had their body fat within the norms. The results from the standing long jump test, 4x10m shuttle run test, as well as the 20m shuttle run test, were significantly greater in favour of the gymnasts in comparison to the control groups for both genders ( $p < 0.001$ ,  $d > 1.20$ ). These findings show that practising artistic gymnastics has a positive impact on the health-related biomarkers of children's physical fitness, and it contributes to sustaining a normal health status.

**Keywords:** Alpha-fit, BMI, children, gymnasts, health.

## 1. Introduction

Nowadays, millions of children are involved in gymnastics all over the world, and that requires detailed understanding of the health-related benefits in both genders, and particularly at a young age. Unlike other sports, artistic gymnastics requires the performance of a variety of technical elements on different apparatuses where gymnasts have to overcome their body weight and mostly multiply it several times when tumbling and dismounting [22]. Maintaining optimal health and a good level of physical fitness is crucial in order to successfully perform the routines. Assessing the gymnast's physical fitness level, as well as identifying the exact components which need to be developed are both important goals in the coaching practise. Measuring and tracking the biomarkers related to physical fitness can provide information on the impact of the sport on each gymnast's health [10].

The health-related physical fitness has been described in the literature as a multidimensional structure, which includes body composition, musculoskeletal fitness, motor fitness, and cardiorespiratory fitness [2, 3, 51, 52]. It has also been shown in both, cross-sectional and longitudinal studies in Europe, that the health-related physical fitness is a major factor in children's health [50, 52]. The modern field-based test batteries are created on the basis of assessing the biomarkers related to physical fitness and health, and there are more than fifteen physical fitness test batteries for children and adolescents applied around the world [11, 26]. One of the most used fitness test batteries applied in longitudinal and cross-sectional studies on health biomarkers in relation to physical fitness in children, is the Alpha-fit test battery, which has been shown to be valid, reliable and safe [13, 15, 52, 55].

Gymnastics is one of the sports activities which can be practised from a very young age, and children involved in gymnastics are introduced to foundational elements, such as jumping, hanging, rotating, crawling, and rolling [47]. Further understanding of the health-related benefits on both genders in primary school children can benefit not only the coaches involved in gymnastics, but also the physical education teachers, parents and gymnasts as well. Therefore, the aim of this study was to assess health-related biomarkers of physical fitness at primary school age whilst estimating the benefits of regular gymnastics practice at young ages.

## 2. Methods

### 2.1. Participants

The study included 49 primary school children (19 boys and 30 girls) who were practising artistic gymnastics with a minimum of 2 years and an average of 4 hours per week, and a control group consisted of 41 children (18 boys and 23 girls). All participants were from the United Kingdom. The gymnasts were from five gymnastics clubs in three different areas (London, Bexhill-On-Sea, and Basingstoke) all registered with British Gymnastics Federation. The control group was from primary school children in London who were not seriously engaged (not more than one session per week) in any sports, apart from their Physical Education lessons.

An informed consent form was obtained from the parents/guardians of all participants prior to this study.

### 2.2. Health-related physical fitness assessment

All participants completed the Alpha-Fit test battery [2], which includes different anthropometric measurements, such as height, weight, BMI, waist circumference, skinfolds (%Fat), and field-based fitness tests (handgrip strength test, standing long jump, 4x10 m shuttle run test, and the 20 m shuttle run test), which are all related to the children's health. The anthropometric measurements were taken twice, and the mean was used in the analyses, as described in the test manual of the Alpha-fit battery. The handgrip strength test, standing long jump test and 4x10 m shuttle run test were performed twice, and the better score was used in the analyses, whilst the 20 m shuttle run test was performed once [2].

#### 2.2.1. Body composition

Height was measured by using the Leicester Height Measure to the nearest 1 mm. This height measure has become the standard in practice, and has been used extensively and over a period of time in the National Child Measurement Programme in England [19]. Body weight and body fat percent (%Fat) were registered by using Tanita BF-689 Children's Body Fat Monitor, within an accuracy of 50 g. This scale applies the bioelectrical impedance method to assess body composition and has a specialised application for anthropometric measurements of children between the ages of 5 and 18. In addition, two skinfolds (triceps and subscapular) were measured to an accuracy of 1 mm by using the Lange Skinfold Caliper, produced by Beta Technology Inc, Cambridge. The sum of the skinfolds was used to obtain %Fat by applying Slaughter's equations [20, 57], which are recommended for children, as this method is both simple and accurate [2, 9, 35]. Furthermore, recent international norms for Caucasian children [41] were applied to calculate percentile scores (PRs) of %Fat for each participant, and the following cut-offs were used: %Fat > 85<sup>th</sup> PRs is classified as 'overweight'; %Fat > 95<sup>th</sup> PRs is 'obese'; and %Fat < 2<sup>nd</sup> PRs is 'underfat' [41].

The body mass index (BMI) was calculated as: body mass/height<sup>2</sup> (kg/m<sup>2</sup>). The WHO AnthroPlus specialised software, produced by the World Health Organisation [62], was applied in order to calculate the percentile scores of height, weight and BMI of the children. The following classification of the BMI percentile scores was used: BMI > 85<sup>th</sup> PRs is classified as 'overweight'; BMI > 97<sup>th</sup> PRs is 'obese'; BMI < 15<sup>th</sup> PRs is 'thinness'; and BMI < 3<sup>rd</sup> PRs is 'severe thinness' [60].

Waist and arm circumferences were measured with the Lufkin W606PM tape measure to the nearest 0.1 cm. Waist-to-height ratio (WHtR = waist circumference/height) was calculated, and the recommended cut-off of 0.500 was applied to assess increased health risk in children [4, 40]. The upper arm muscle area (UAMA) was calculated in accordance with two parameters (arm circumference in cm and triceps skinfold in cm) by applying the following formula [1]:

$$\text{UAMA (cm}^2\text{)} = (\text{Arm circumference} - \pi \times \text{triceps skinfold})^2 / 4\pi$$

Furthermore, the percentile scores for the UAMA were also calculated for each participant by using the recent norms for children [1]. In addition, the relative UAMA (cm<sup>2</sup>/kg) was obtained by dividing the UAMA (cm<sup>2</sup>) by body mass (kg).

Lean body mass (kg) was calculated by subtracting the body fat (kg) from the body weight.

#### 2.2.2. Musculoskeletal fitness

Handgrip strength was measured for both hands by using the TKK digital hand dynamometer (TKK 5101 Grip-D, Takey, Tokyo, Japan) to assess upper body isometric strength. The individual optimal grip

span was determined for each participant prior to testing by using the equations for girls and boys between the ages of 6 and 12 [14]. The elbow of the tested hand was fully extended, as this position had been shown to be the most appropriate protocol in order to evaluate maximal handgrip strength in children [27] and in adolescents [16]. The tested hand was free of the body, and the testing procedure was strictly followed [2, 45]. In addition, the relative handgrip strength was also calculated by dividing the average handgrip strength of both hands (kg) by the body weight (kg).

The standing long jump test was recorded to within an accuracy of 1 cm, in order to assess lower body explosive strength. The distance was measured from the take-off line to the point where the back side of the heel lands on the ground, as described in the Alpha-Fit test [2].

Percentile scores for the average handgrip strength and the standing long jump tests were calculated from the existing norm for European children [42, 46]. Unfortunately, there is still a reference gap between 9.9 and 12.9 years without percentile scores in the published norms for those tests, which has to be filled in, in order to appropriately assess children's physical fitness [42]. Therefore, the recently proposed values for the tests from the Alpha-Fit battery [29], which had been obtained by means of a linear interpolation from the existing norms [42, 46, 49, 59] were used in order to calculate the missing percentile scores.

### 2.2.3. Motor fitness

The 4x10 m shuttle run test (4x10 m SRT) at maximum speed was applied to measure speed of movement, agility and coordination, in accordance with the procedure described in the Alpha-fit test battery [2]. The test was recorded in seconds by using the Fastime 4 Stopwatch, to an accuracy of 0.1 sec. The percentile scores of the results from this test were calculated by using the existing norms [46, 49], and the interpolated values of the 4x10 m SRT [29] for the missing norms between the ages of 9.9 and 12.9.

### 2.2.4. Cardiorespiratory fitness

The BeepShuttle Junior software for children [32] was applied to administer the 20 m shuttle run test (20 m SRT) with the original 1-minute protocol, which starts at a speed of 8.5 km/h and increases by 0.5 km/h after each minute, as described by Leger et al. [36]. This software facilitates the administration of the 20 m SRT by applying audio signals and visualisation, and calculates the estimated maximal oxygen uptake ( $\text{VO}_2\text{max}$ ) by using Leger's equation [37]. In order to assess the  $\text{VO}_2\text{max}$  of the participants, BeepShuttle Junior computed the percentile score for each individual based on age- and gender-specific international norms [42, 59].

### 2.3. Statistical Analyses

The statistical analyses were conducted by using SPSS Statistics 19, IBM, USA software, using descriptive statistics and the Kolmogorov-Smirnov test of normality. All parameters with a normal distribution were compared by using the independent t-test, and those with an abnormal distribution by utilising the non-parametric Mann-Whitney U test. Statistically significant differences between the average values were evaluated at  $p < 0.05$ , and all data in the text are presented as mean  $\pm$  SD. Percentile scores were compared to some fixed percentile values, such as 25<sup>th</sup>, 35<sup>th</sup>, 40<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup>, 85<sup>th</sup>, and 90<sup>th</sup>, by using one sample t-test in order to support the results analyses. Cohen's effect size was calculated for the parameters which showed significant differences, and was classified as follow:  $d > 2.00$  - huge (H),  $d > 1.20$  - very large (VL),  $d > 0.80$  - large (L),  $d > 0.50$  - medium (M),  $d > 0.20$  - small (S), and  $d > 0.01$  - very small (VS), [12, 56].

## 3. Results

The female and male participants in all groups included children from different ages between 7 and 11, and therefore, the comparison between the mean values of the parameters, as well as the calculation of the effect size between the groups, has been analysed by using the percentile scores.

The anthropometric parameters with their corresponding percentile scores (PRs) of the primary school female gymnasts and the female control group are presented in Table 1. There was no significant difference between the mean ages of both groups. The mean percentile scores of the height, weight, BMI and %Fat in the female gymnasts were significantly lower than those in the control group. Moreover, the gymnasts' percentile scores were also lower than the WHO international norms in girls at the same age, significantly lower than the 40<sup>th</sup> percentile for height (28.9 PRs,  $p < 0.05$ ), and the 50<sup>th</sup> percentile for weight (37.7 PRs,  $p < 0.05$ ) and BMI (39.2 PRs,  $p < 0.05$ ). The World Health Organization does not produce weight-for-age

percentile scores for children over 10 years of age, due to the fact that this indicator cannot distinguish between height and body mass at an age when many children are experiencing the pubertal growth spurt [61].

The mean percentile scores for %Fat in the female gymnasts (12.0 PRs where the %Fat was calculated by Slaughter's equations, and 15.2 PRs where the %Fat was calculated by using the bioelectrical impedance method) were significantly lower than the 25<sup>th</sup> percentile ( $p < 0.05$ ) in girls at the same age, in accordance with the international norms [41]. In addition, the female gymnasts had significantly lower mean values in comparison with the control group in relation to their arm circumference (20.1 cm vs 23.0 cm,  $p < 0.01$ ), upper arm muscle area (24.4 cm<sup>2</sup> vs 27.2 cm<sup>2</sup>,  $p > 0.05$ ), and lean body mass (23.6 kg vs 29.0 kg,  $p < 0.01$ ). This is probably due to the fact that the gymnasts had significantly smaller body sizes, such as height, weight and circumferences. On the other hand, the female gymnasts had significantly higher relative upper arm muscle area (0.91 cm<sup>2</sup>/kg vs 0.73 cm<sup>2</sup>/kg), which is probably a reflection of their higher muscle mass per unit weight.

The mean waist-to-height ratio (WHtR) of the female gymnasts, as well as the individual values of WHtR for all 30 girls engaged in artistic gymnastics, were below the boundary of 0.500, which distinguishes children at risk as far as their health is concerned [4, 40]. In contrast, five of the twenty-three girls from the control group had their WHtR above the value of 0.500.

The individual percentile scores of the anthropometric parameters in the group of female gymnasts showed that there are no 'obese' children, and only one gymnast was below the normal limits for her age (BMI < 3<sup>rd</sup> PRs, 9.8% Fat, %Fat > 2<sup>nd</sup> PRs). Additionally, only one of the 30 female gymnasts was assessed as 'overweight' (BMI = 91.7 PRs, 27.4% Fat assessed by the bioelectrical impedance method, %Fat = 85.5 PRs). However, the same gymnast showed lower values of those parameters when assessed by Slaughter's skinfold method (20.5% Fat calculated by Slaughter's equations, %Fat = 60.2 PRs), and the WHtR was not above the boundary of 0.500. Furthermore, her upper arm muscle area (37.0 cm<sup>2</sup>) was the greatest in the group, and her relative upper arm muscle area (0.96 cm<sup>2</sup>/kg) was above the mean for the group of female gymnasts. Therefore, the BMI did not provide an adequate assessment, due to the large amount of muscle mass in this individual, and probably the body fat monitor for children (Tanita BF-689) did not adequately assess the %Fat in some children with greater muscle mass.

**Table 1.** Anthropometric parameters and the corresponding percentile scores (PRs) of the female artistic gymnasts ( $n=30$ ) and the control group of primary school girls ( $n=23$ ), (mean  $\pm$  SD), in addition to the effect size vs the control group

	Female gymnasts ( $n=30$ )	Control group Females ( $n=23$ )	p	Effect size vs Control group
Age (years)	9.37 $\pm$ 1.35	9.03 $\pm$ 0.54	$p > 0.05^x$	
Sports experience (months)	44.90 $\pm$ 17.96	-	-	
Sessions per week	2.93 $\pm$ 1.05	-	-	
Height (cm)	130.60 $\pm$ 7.36	139.92 $\pm$ 9.07	$p < 0.001^*$	
Height - percentile score	28.88 $\pm$ 23.45	75.07 $\pm$ 30.76	$p < 0.001^x$	1.72 VL
Weight (kg)	27.18 $\pm$ 4.61	37.81 $\pm$ 10.01	$p < 0.001^*$	
Weight - percentile score ( $n=21; 23$ ) <sup>a</sup>	37.71 $\pm$ 22.81	80.93 $\pm$ 25.94	$p < 0.001^x$	1.76 VL
BMI (kg/cm <sup>2</sup> )	15.83 $\pm$ 1.45	19.08 $\pm$ 3.51	$p < 0.001^*$	
BMI - percentile score	39.18 $\pm$ 23.55	74.37 $\pm$ 26.37	$p < 0.001^x$	1.42 VL
Arm circumference (cm)	20.11 $\pm$ 1.57	22.97 $\pm$ 3.31	$p < 0.01^x$	
Waist circumference (cm)	55.28 $\pm$ 3.19	64.22 $\pm$ 8.53	$p < 0.001^*$	
Waist-to-height ratio	0.41 $\pm$ 0.03	0.47 $\pm$ 0.06	$p < 0.001^x$	
Subscapular skinfold (mm)	5.32 $\pm$ 1.62	11.94 $\pm$ 6.26	$p < 0.001^x$	
Triceps skinfold (mm)	8.42 $\pm$ 1.76	14.68 $\pm$ 5.59	$p < 0.001^x$	
%Fat (Slaughter)	13.21 $\pm$ 2.47	22.13 $\pm$ 5.99	$p < 0.001^*$	

%Fat (Slaughter) percentile score	12.02 ± 14.00	63.31 ± 33.98	p < 0.001 <sup>x</sup>	2.08 H
%Fat (TANITA for children)	16.48 ± 3.99	26.09 ± 7.42	p < 0.001 <sup>*</sup>	
%Fat (TANITA) percentile score	15.15 ± 20.05	63.55 ± 35.66	p < 0.001 <sup>x</sup>	1.74 VL
UAMA (cm <sup>2</sup> )	24.42 ± 4.42	27.18 ± 6.38	p > 0.05 <sup>x</sup>	
UAMA - percentile score	66.46 ± 23.38	78.14 ± 22.19	p < 0.05 <sup>x</sup>	0.51 M
Relative UAMA (cm <sup>2</sup> /kg)	0.91 ± 0.12	0.73 ± 0.09	p < 0.001 <sup>x</sup>	
Lean Body Mass (kg)	23.56 ± 3.82	29.02 ± 6.09	p < 0.01 <sup>*</sup>	

<sup>a</sup> - WHO does not provide weight-for-age reference data for children older than 10 years of age [61]

<sup>\*</sup> - compared by using the t-test for independent samples

<sup>x</sup> - compared by using the Mann-Whitney U test for independent samples

H - huge effect size, VL - very large, M - medium

The mean percentile scores for height, weight and BMI in the control group are above the average for this age (significantly higher than the 50<sup>th</sup> PRs, p < 0.001), but within the WHO norms. Moreover, the mean percentile score of %Fat is also within the norm (> 2<sup>nd</sup> PRs and < 85<sup>th</sup> PRs), as provided for children [41], and the mean WHtR is below the boundary of 0.500.

The individual percentile scores of the anthropometric parameters in the control group showed that nine of the primary school girls (39.1%) were 'overweight' (BMI > 85<sup>th</sup> PRs, %Fat > 85<sup>th</sup> PRs), one of whom had her WHtR above 0.500. Four of the girls (17.4%) in this group were assessed as 'obese' (BMI > 97<sup>th</sup> PRs, %Fat > 95<sup>th</sup> PRs), three of whom had their WHtR above the boundary of 0.500, which is linked to a risk as far as their health is concerned.

**Table 2.** Results from the Alpha-Fit health-related physical fitness tests, and the corresponding percentile scores of the female artistic gymnasts (n=30) and the control group of primary school girls (n=23), (mean ± SD)

	Female gymnasts (n=30)	Control group Females (n=23)	p	Effect size vs Control group
<b>Musculoskeletal Fitness: Upper body strength</b>				
Handgrip strength test† (kg)	14.18 ± 2.97	16.45 ± 4.13	p > 0.05 <sup>x</sup>	
Handgrip strength test (percentile score)	54.10 ± 29.24	75.83 ± 26.44	p < 0.01 <sup>x</sup>	0.77 M
Relative handgrip strength (kg/kg body weight)	0.52 ± 0.07	0.45 ± 0.11	p < 0.01 <sup>x</sup>	
<b>Musculoskeletal Fitness: Lower body strength</b>				
Standing long jump (cm)	154.61 ± 16.81	123.48 ± 21.70	p < 0.001 <sup>*</sup>	
Standing long jump (percentile score)	92.25 ± 11.65	55.55 ± 31.00	p < 0.001 <sup>x</sup>	1.66 VL
<b>Motor Fitness</b>				
4x10 m shuttle run test (sec)	11.97 ± 0.71	13.88 ± 1.25	p < 0.001 <sup>*</sup>	
4x10 m shuttle run test (percentile score)	91.01 ± 10.31	52.37 ± 28.04	p < 0.001 <sup>x</sup>	1.93 VL
<b>Cardiorespiratory Fitness</b>				
VO <sub>2</sub> max (ml/kg/min)	52.06 ± 4.17	45.88 ± 2.08	p < 0.001 <sup>x</sup>	
VO <sub>2</sub> max (percentile score)	89.26 ± 17.08	54.12 ± 22.34	p < 0.001 <sup>x</sup>	1.80 VL

† - values expressed as average of right and left hands

<sup>\*</sup> - compared by using the t-test for independent samples

<sup>x</sup> - compared by using the Mann-Whitney U test for independent samples

VL - very large effect size, M - medium

The results from the health-related physical fitness tests, as well as the corresponding percentile scores of the primary school female gymnasts and the control group, are presented in Table 2. The female gymnasts showed approximately equal values of handgrip strength in their left and right hands ( $14.1 \pm 3.15$  kg vs  $14.2 \pm 3.05$  kg,  $p > 0.05$ ). The girls from the control group showed a greater difference in handgrip strength between their left and right hands ( $16.8 \pm 4.18$  kg vs  $16.1 \pm 4.31$  kg,  $p > 0.05$ ). The female gymnasts had a lower average (of both hands) handgrip strength in comparison with the control group ( $14.2 \pm 2.97$  kg vs  $16.5 \pm 4.13$  kg,  $p > 0.05$ ), as well as a lower percentile score relating to handgrip strength ( $54.1 \pm 29.24$  kg vs  $75.8 \pm 26.44$  kg,  $p < 0.01$ ), as shown in Table 2. This is due to the greater weight and height of the girls in the control group. However, the female gymnasts had a significantly higher relative handgrip strength of both hands ( $0.52 \pm 0.07$  kg/kg body weight for the gymnasts vs  $0.45 \pm 0.11$  kg/kg body weight for the control group,  $p < 0.01$ , Table 2), as well as a significantly higher relative upper arm muscle area ( $0.91$  cm<sup>2</sup>/kg vs  $0.73$  cm<sup>2</sup>/kg,  $p < 0.001$ , Table 1), which confirms that the gymnasts had better strength parameters in relation to their body weight.

The lower body strength, assessed with the standing long jump, was significantly higher in favour of the female gymnasts in comparison with the control group ( $154.6 \pm 16.81$  cm vs  $123.5 \pm 21.70$  cm, respectively,  $p < 0.001$ ). The mean percentile score of this parameter is also significantly higher in favour of the gymnasts ( $92.3 \pm 11.65$  vs  $55.6 \pm 31.00$ ,  $p < 0.001$ ), and it is even significantly higher than the 85<sup>th</sup> percentile ( $p < 0.01$ ) than the European norms for girls at the same age. The individual results showed that 24 out of the 30 female gymnasts had percentile scores higher than 90.

The motor fitness, assessed with the 4x10 m shuttle run test, showed significantly better results in favour of the female gymnasts in comparison with the girls from the control group ( $12.0 \pm 0.71$  sec vs  $13.9 \pm 1.25$  sec, respectively,  $p < 0.001$ ). The mean percentile score of the 4x10 m shuttle run test was significantly higher in the girls engaged in gymnastics ( $91.0 \pm 10.31$  vs  $52.4 \pm 28.04$ ,  $p < 0.001$ ), and similarly to the standing long jump test, the gymnasts had significantly higher percentile score ( $p < 0.01$ ) than the 85<sup>th</sup> percentile of the European norms. The individual results revealed that 21 of the 30 gymnasts had percentile scores higher than 90, which is probably due to the develop motor skills from the gymnastics training.

The cardiorespiratory fitness, assessed with the 20 m shuttle run test, showed significantly better maximal oxygen uptake (VO<sub>2</sub>max) in favour of the female gymnasts in comparison with the control group ( $52.1 \pm 4.17$  ml/kg/min vs  $45.9 \pm 2.08$  ml/kg/min, respectively,  $p < 0.001$ ). The mean percentile score of the VO<sub>2</sub>max was also significantly higher in the group of the gymnasts ( $89.3 \pm 17.08$  vs  $54.1 \pm 22.34$ ,  $p < 0.001$ ), and it was significantly higher ( $p < 0.01$ ) than the 80<sup>th</sup> percentile of the European norms for girls at that age.

The individual results of the VO<sub>2</sub>max, showed that 25 out of 30 gymnasts had percentile scores higher than 80, which suggests that in spite of the anaerobic nature of this sport, the artistic gymnastics training in young age (7-11-year-old gymnasts) improves the aerobic fitness in girls.

**Table 3.** Anthropometric parameters and their percentile scores (PRs) of the male artistic gymnasts (n=19) and the control group of primary school boys (n=18), (mean  $\pm$  SD), in addition to the effect size vs the control group

	Male gymnasts (n=19)	Control group Males (n=18)	p	Effect size vs Control group
Age (years)	9.69 $\pm$ 1.49	8.79 $\pm$ 0.52	p < 0.05*	
Sports experience (months)	48.42 $\pm$ 21.01	-	-	
Sessions per week	3.05 $\pm$ 1.08	-	-	
Height (cm)	133.26 $\pm$ 7.62	136.56 $\pm$ 6.96	p > 0.05*	
Height - percentile score	33.94 $\pm$ 18.60	73.13 $\pm$ 19.38	p < 0.001*	2.06 H
Weight (kg)	28.88 $\pm$ 4.39	37.09 $\pm$ 6.86	p < 0.001*	
Weight - percentile score (n=10; 18) <sup>a</sup>	41.01 $\pm$ 19.97	88.58 $\pm$ 14.45	p < 0.001 <sup>x</sup>	2.87 H
BMI (kg/cm <sup>2</sup> )	16.17 $\pm$ 1.02	19.83 $\pm$ 2.97	p < 0.001*	
BMI - percentile score	43.42 $\pm$ 21.26	86.94 $\pm$ 17.63	p < 0.001 <sup>x</sup>	2.22 H
Arm circumference (cm)	20.27 $\pm$ 1.66	22.84 $\pm$ 2.50	p < 0.01*	



Waist circumference (cm)	57.65 ± 3.71	66.19 ± 6.78	p < 0.001*	
Waist-to-height ratio	0.42 ± 0.04	0.49 ± 0.05	p < 0.001 <sup>x</sup>	
Subscapular skinfold (mm)	4.45 ± 0.89	13.11 ± 6.31	p < 0.001 <sup>x</sup>	
Triceps skinfold (mm)	7.12 ± 1.88	14.22 ± 9.07	p < 0.01*	
%Fat (Slaughter)	10.69 ± 2.85	23.72 ± 8.63	p < 0.001*	
%Fat (Slaughter) percentile score	23.04 ± 20.20	82.82 ± 23.29	p < 0.001 <sup>x</sup>	2.75 H
%Fat (TANITA for children)	14.88 ± 2.09	25.08 ± 7.21	p < 0.001*	
%Fat (TANITA) percentile score	23.17 ± 21.17	78.88 ± 29.32	p < 0.001 <sup>x</sup>	2.19 H
UAMA (cm <sup>2</sup> )	25.95 ± 3.85	27.12 ± 5.41	p > 0.05*	
UAMA - percentile score	67.30 ± 18.88	80.91 ± 24.66	p < 0.05 <sup>x</sup>	0.62 M
Relative UAMA (cm <sup>2</sup> /kg)	0.91 ± 0.08	0.77 ± 0.17	p < 0.01 <sup>x</sup>	
Lean Body Mass (kg)	25.72 ± 3.58	27.83 ± 3.18	p > 0.05*	

<sup>a</sup> - WHO does not provide weight-for-age reference data for children older than 10 years of age [61]

\* - compared by t-test for independent samples

<sup>x</sup> - compared by Mann-Whitney U test for independent samples

H - huge effect size, M - medium

The anthropometric parameters and their percentile scores of the male gymnasts vs the control group are presented in Table 3. Although, there is a difference of nearly one year between the mean age of the groups, they were compared based on the calculated age- and gender-specific percentile scores for each parameter. Similarly, to the female gymnasts, the mean percentile scores of the height, weight, BMI and %Fat in the male gymnasts were significantly lower from those of the control group. Moreover, the mean percentile scores (PRs) of those parameters in the male gymnasts were also lower than the 50<sup>th</sup> percentile of the WHO norms for boys in the same age (weight PRs = 41.0, p > 0.05; BMI PRs = 43.4, p > 0.05; height PRs = 33.9, p < 0.01).

The mean percentile scores of %Fat in the male gymnasts (23.0 based on the results from the skinfold method, and 23.3 based on the bioelectrical impedance) were significantly lower than the 35<sup>th</sup> percentile (p < 0.05) in boys at the same age as provided by the international norms in children [41].

Similarly, to the female gymnasts, the male gymnasts had lower mean values of their arm circumference (20.3 cm vs 22.8 cm, p < 0.01), upper arm muscle area (26.0 cm<sup>2</sup> vs 27.1 cm<sup>2</sup>, p > 0.05), and body lean mass (25.7 kg vs 27.8 kg, p > 0.05) in comparison with the control group. This is due to the smaller body sizes (weight and circumferences) in the children engaged in artistic gymnastics. However, the male gymnasts had significantly greater relative upper arm muscle area in contrast to the control group (0.91 cm<sup>2</sup>/kg vs 0.77 cm<sup>2</sup>/kg, respectively, p < 0.01). Those findings show that the children practising gymnastics have greater muscle mass of their arms per unit of weight.

The individual percentile scores of the BMI in male gymnasts showed that none of the boys was classified as 'obese', and only one gymnast had a percentile score of 85 which is in the lower 'overweight' cut off. However, this gymnast had low %Fat (14.1% calculated with the bioelectrical impedance method, and 13.9% calculated by the skinfold method), low percentile scores of %Fat (9.0 and 8.7, respectively), and the WHtR was not greater than the accepted 0.500 cut off. Moreover, he had the highest upper arm muscle area in the group of the male gymnasts (33.4 cm<sup>2</sup>), and his relative upper arms muscle area was 0.86 cm<sup>2</sup>/kg, which was close to the mean of his group. In this case, the BMI score was not accurate, due to the greater muscle mass, which cannot be assessed appropriately in athletes from the strength sports [8].

The mean percentile score of the BMI in the control group (87.0) was assessed as 'overweight' and was significantly higher than the 50<sup>th</sup> percentile of the WHO norms for boys. The individual results showed that 5 of the 18 boys (2.8%) in the control group were 'overweight' (BMI > 85<sup>th</sup> PRs), and 3 of those 5 boys had high %Fat (%Fat > 85<sup>th</sup> PRs). Moreover, 7 boys (38.8%) from the control group were assessed as 'obese' (BMI > 97<sup>th</sup> PRs), 6 of whom had %Fat > 95<sup>th</sup> PRs.

**Table 4.** Results from the Alpha-Fit health-related physical fitness tests, and their percentile scores of the male artistic gymnasts (n=19) and the control group of primary school boys (n=18), (mean  $\pm$  SD)

	Male gymnasts (n=19)	Control group Males (n=18)	p	Effect size vs Control group
<b>Musculoskeletal Fitness: Upper body strength</b>				
Handgrip strength test† (kg)	16.91 $\pm$ 3.44	15.42 $\pm$ 2.90	p > 0.05*	
Handgrip strength test (percentile score)	58.60 $\pm$ 18.62	66.37 $\pm$ 24.34	p > 0.05*	NS
Relative handgrip strength (kg/kg body weight)	0.58 $\pm$ 0.08	0.42 $\pm$ 0.08	p < 0.001*	
<b>Musculoskeletal Fitness: Lower body strength</b>				
Standing long jump (cm)	176.78 $\pm$ 22.44	124.56 $\pm$ 23.04	p < 0.001*	
Standing long jump (percentile score)	96.24 $\pm$ 4.36	45.72 $\pm$ 30.28	p < 0.001 <sup>x</sup>	2.37 H
<b>Motor Fitness</b>				
4x10 m shuttle run test (sec)	11.18 $\pm$ 0.89	13.36 $\pm$ 1.08	p < 0.001*	
4x10 m shuttle run test (percentile score)	92.41 $\pm$ 6.09	49.44 $\pm$ 25.25	p < 0.001*	2.37 H
<b>Cardiorespiratory Fitness</b>				
VO <sub>2</sub> max (ml/kg/min)	53.98 $\pm$ 3.93	46.36 $\pm$ 2.67	p < 0.001 <sup>x</sup>	
VO <sub>2</sub> max (percentile score)	88.63 $\pm$ 15.89	43.13 $\pm$ 21.56	p < 0.001 <sup>x</sup>	2.41 H

† - values expressed as average of right and left hands

\* - compared by t-test for independent samples

<sup>x</sup> - compared by Mann-Whitney U test for independent samples

H - huge effect size;

NS - not significant

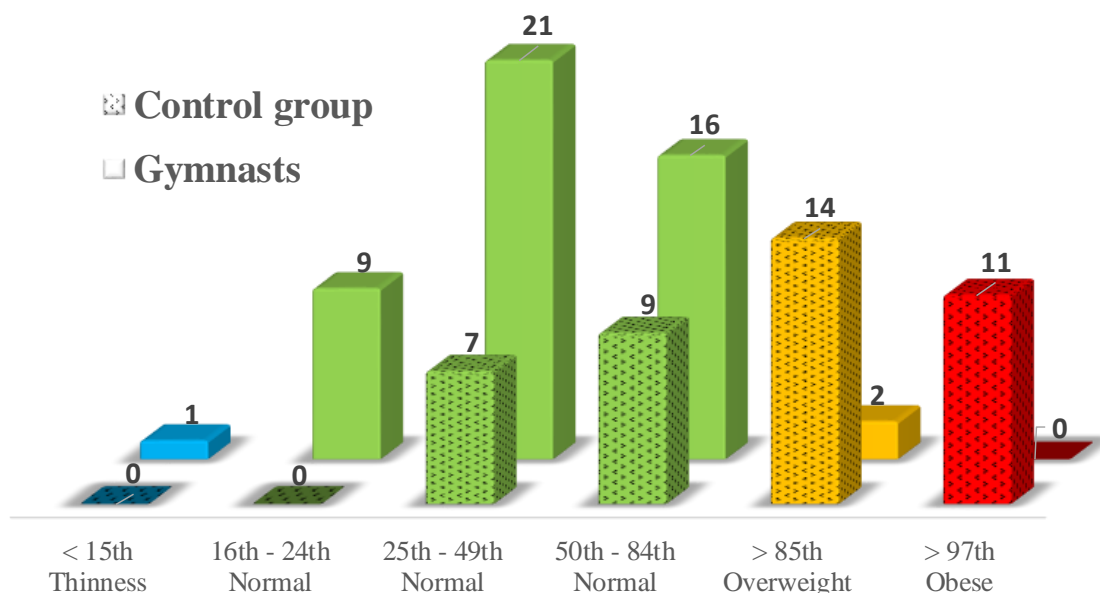
The results of the health-related physical fitness tests and their corresponding percentile scores in the male gymnasts and the control group are presented in Table 4. The male gymnasts showed 1 kg non-significant difference in the handgrip strength values of left vs right hands (16.4  $\pm$  3.54 kg vs 17.4  $\pm$  3.42 kg, respectively, p > 0.05), with the highest individual difference of 2.5 kg. The control group also showed a difference of 1 kg between left and right hands (14.9  $\pm$  3.11 kg vs 15.9  $\pm$  2.92 kg, respectively, p > 0.05), but those boys had greater individual differences reaching 4.8 kg.

There were no significant differences between the mean handgrip strength expressed as average of right and left hands (16.9  $\pm$  3.44 kg for the gymnasts vs 15.4  $\pm$  2.90 kg for the control group, p > 0.05) and their mean percentile scores (58.6  $\pm$  18.62 kg for the gymnasts vs 66.4  $\pm$  24.34 kg for the control group, p > 0.05), as shown in Table 4. However, the male gymnasts had significantly higher relative handgrip strength (0.6  $\pm$  0.08 kg/kg body weight vs 0.4  $\pm$  0.08 kg/kg body weight, p < 0.001).

As it was the case with the female gymnasts, the lower body strength, assessed with the standing long jump, was also significantly higher in favour of the male gymnasts in comparison with the control group (176.8  $\pm$  22.44 cm vs 124.6  $\pm$  23.04 cm, respectively, p < 0.001). The mean percentile score of the standing long jump test was also significantly higher in favour of the male gymnasts (96.2  $\pm$  4.36 vs 45.7  $\pm$  30.28, p < 0.001), and it was significantly higher than the 90<sup>th</sup> percentile (p < 0.001) of the European norms for boys at the same age. The individual results showed that 17 out of the 19 male gymnasts had percentile scores higher than 90.

The 4x10 m shuttle run test showed significantly better results in favour of the male gymnasts in comparison with the boys from the control group (11.2  $\pm$  0.89 sec vs 13.4  $\pm$  1.08 sec, respectively, p < 0.001). The mean percentile score of the 4x10 m shuttle run test was significantly higher in the boys practising gymnastics (92.4  $\pm$  6.09 vs 49.4  $\pm$  25.25, p < 0.001), and the male gymnasts also had significantly higher percentile score (p < 0.001) than the 85<sup>th</sup> percentile of the European norms. The individual results of the motor fitness showed that 14 of the 19 male gymnasts had percentile scores higher than 90.

The cardiorespiratory fitness, assessed by the 20 m shuttle run test, using the BeepShuttle Junior software [32], showed significantly higher maximal oxygen uptake ( $\text{VO}_2\text{max}$ ) in favour of the male gymnasts in comparison with the control group ( $54.0 \pm 3.93$  ml/kg/min vs  $46.4 \pm 2.67$  ml/kg/min, respectively,  $p < 0.001$ ). The mean  $\text{VO}_2\text{max}$  percentile score was also significantly higher in the group of the gymnasts ( $88.6 \pm 15.89$  vs  $43.1 \pm 21.56$ ,  $p < 0.001$ ), and it was significantly higher ( $p < 0.01$ ) than the 75<sup>th</sup> percentile of the norms for boys at that age. The individual results of the 20 m shuttle run test, showed that 15 out of 19 male gymnasts had percentile scores higher than 80.



#### BMI Percentile Scores

**Figure 1.** Distribution of the BMI percentile scores in the artistic gymnasts (boys and girls together,  $n=49$ ) and the control group ( $n=41$ )

The distribution of the BMI percentile scores for all gymnasts (boys and girls,  $n=49$ ) and the control groups (boys and girls,  $n=41$ ) are presented in Figure 1. The results showed that 46 out of the 49 artistic gymnasts had their BMI within the norms, and the other 3 gymnasts have been discussed in this article. These findings show that the gymnastics training in childhood, both in boys and girls, contributes to maintaining a normal weight, and thereby sustaining a normal health status.

Sixteen out of the forty-one primary school children in the control group had their BMI within the WHO norms. The percentile scores of the other 25 children were above the 85<sup>th</sup> percentile (14 children were assessed as 'overweight', and 11 as 'obese'), and 10 of those children had their WHtR above the 0.500 cut off, and the %Fat was greater than the 95<sup>th</sup> PRs, all of which identified them as children at risk, as far as their health is concerned.

#### 4. Discussion

The percentile scores of the main anthropometric parameters, including height, weight, BMI, arm and waist circumferences, and %Fat in the male and female gymnasts were significantly lower than those of the control groups (Table 1 and Table 3). Moreover, the mean percentile scores (PRs) of height and %Fat in the gymnasts were also lower than the 50<sup>th</sup> percentile of the WHO norms for children at the same age and from the same gender. However, such lower mean values are within the published results in children engaged in gymnastics [6, 21, 25, 31, 34]. Although gymnasts are shorter on average and their height-for-age progressively decreases as the age increases [7, 25], review on the role of training on the growth of the gymnasts concluded that adult height of artistic gymnasts of both genders is not compromised by intensive gymnastics training at a young age or during the pubertal growth spurt [39]. Thus, artistic gymnastics plays a unique role as a sport which provides opportunities for those with smaller body sizes in a world where

many sports are biased in favour of tall or big athletes [54]. Although having smaller body sizes, the boys and the girls practising gymnastics showed significantly higher relative upper arm muscle area in comparison with the control groups (Table 1 and Table 3), which highlights their greater muscle mass per unit of body weight.

On the whole, the percentile scores of the BMI provided an accurate assessment of the groups (Figure 1), but failed to appropriately evaluate the body composition of individual gymnasts with greater muscle mass. Although widely used for the assessment of body composition [17, 24, 48], the BMI has shown to be inappropriate for professional athletes [8], adolescent athletes [38], and individual cases of child athletes with greater muscle mass [28, 31, 33]. Therefore, the %Fat and strength parameters (relative upper arm muscle area and relative handgrip strength) should be mainly used in the anthropometric analyses of artistic gymnasts.

The gymnastics training contributes to the maintaining of normal weight (Figure 1), and helps sustaining a normal health status both in boys and girls involved in this sport. The %Fat was very low, both in female and male artistic gymnasts (Table 1 and Table 3), which is normal for children and adolescents involved in gymnastics [21]. The values of %Fat from our study are similar to those reviewed by Benardot (2014), where the average %Fat for children and adolescents practising gymnastics ranged from 9% to 22% [6].

The results showed that around 61% of the children in the control groups were 'overweight' or 'obese', which is even higher than the 30-45% overweight/obesity rate reported in the literature [18, 53]. This high percent of children with excess weight in the control groups is probably due to the lack of engagement in enough physical activities in their lifestyle.

The wide application of the physical fitness test battery 'Alpha-Fit' provided an excellent opportunity to compare the health-related fitness levels between the groups in this study, as well as the participants and children from different countries around the world based on age- and gender-specific international norms.

The artistic gymnasts showed approximately equal values of their handgrip strength in left and right hands, which was more evidently in the female gymnasts ( $14.1 \pm 3.15$  kg for left vs  $14.2 \pm 3.05$  kg for right hand,  $p > 0.05$ ). These findings of body symmetry are in accordance with our previous study in children engaged in artistic gymnastics [30, 33]. Although, there were no significant differences between the mean handgrip strength (expressed as average of right and left hands) between the gymnasts and the control group for both genders in our study, the gymnasts actually had significantly higher relative handgrip strength, as well as relative upper arm muscle area (Table 1 and Table 3). These findings show that the children practising artistic gymnastics have better relative strength parameters in addition to a greater muscle mass per unit body weight. Percentile scores of such parameters (relative handgrip strength and relative upper arm muscle area) should be obtained in future research in order to appropriately assess artistic gymnasts.

The lower body strength, assessed by the standing long jump test, was significantly greater in favour of the gymnasts in comparison with the control groups for both genders, and 84% of all artistic gymnasts had percentile scores higher than the 90<sup>th</sup> percentile of the international norms, which is probably due to the well-developed muscles of their lower limbs from the gymnastics training (especially from the exercises on floor and vault), as well as the familiarisation of the standing long jump technique, which is often used in testing gymnasts [21].

The motor fitness, assessed with the 4x10 m shuttle run test, was also significantly better in favour of the gymnasts in comparison with the control group for both genders (Table 2 and Table 4), and 71% out of all artistic gymnasts had percentile scores higher than the 90<sup>th</sup> percentile of the international norms. These findings suggest that children from both genders develop better motor fitness, including agility, coordination, and speed of movement, as a result of practising artistic gymnastics. The 4x10 m shuttle run test has shown to have a high correlation with the standing long jump test in a sample of young artistic gymnasts, who completed the Alpha-Fit test battery ( $r = -0.73$ ,  $p < 0.001$  and  $-0.83$ ,  $p < 0.001$  for girls and boys, respectively), and those gymnasts showed the largest registered Cohen's effect size for these two tests in the groups with greater experience in gymnastics [25]. Additionally, children and adolescents practising rhythmic gymnastics also achieved their best results in those two tests, after completing the Alpha-fit battery [44].

The cardiorespiratory fitness, assessed with the 20 m shuttle run test, showed significantly better absolute results and percentile scores in favour of the gymnasts for both genders in comparison with the control groups (Table 2 and Table 4). The mean  $\text{VO}_2\text{max}$  for the female and male gymnasts in our study ( $52.1 \pm 4.17$  ml/kg/min and  $54.0 \pm 3.93$  ml/kg/min, respectively) were close to the published values of  $\text{VO}_2\text{max}$  for gymnasts (around 50 ml/kg/min) in different studies in the literature [5, 23, 43, 58]. Moreover, Jemni (2011) found out that the  $\text{VO}_2\text{max}$  values in elite and non-elite gymnasts (50 ml/kg/min on average) have not changed in the last few decades [21]. Furthermore, Barantsev (1985) registered  $\text{VO}_2\text{max}$  values of gymnasts at different ages, and found out that the  $\text{VO}_2\text{max}$  values gradually decrease from  $53.2 \pm 6.3$  ml/kg/min for 12-year-old gymnasts to  $50.9 \pm 6.2$  ml/kg/min for 14-15-year old gymnasts, and to  $47.2 \pm 6.7$  ml/kg/min for 25-year-old male gymnasts [5]. According to Jemni (2011), this decrease in  $\text{VO}_2\text{max}$ , which is visible after puberty in gymnasts, is due to the prevalence of intense strength training, required to master the complex technical elements from the routines of the male gymnasts [21].

The individual results of the 20m shuttle run test in the gymnasts showed that 82% of all gymnasts had percentile scores higher than 80, which suggests that in spite of the anaerobic nature of this sport, the artistic gymnastics training in young age (7-11-year-old gymnasts) improves the cardio-respiratory fitness both in boys and girls compared to non-particularly active children. Although most of the literature confirm that gymnastics practice doesn't improve maximal oxygen uptake in adult gymnasts [23], the difference we found in our study could be because of the young age of our groups, hence these gymnasts were still in young developmental stages.

## 5. Conclusions

Practising artistic gymnastics maintains children's weight in the normal limits, and has a positive impact on all of the health-related biomarkers of their physical fitness. The children engaged in gymnastics (both boys and girls) had significantly better physical fitness variables, in comparison with the control groups, as well as the international norms for children in the same age and from the same gender.

The skinfold method using Slaughter's equations, as well as the bioelectrical impedance method (by using Tanita BF-689 for children) are both appropriate for the assessment of %Fat in children, but the body fat monitor (Tanita) might not take into consideration the specific nature of the body composition in child athletes in separate cases. Body fat percentage should be used as part of anthropometric assessments, as well as relative parameters for strength per unit of body weight (relative handgrip strength and relative upper arm muscle area) should be applied for gymnasts instead of the absolute ones, in order to accurately assess their health-related physical fitness. Percentile scores for relative handgrip strength and relative upper arm muscle area in children should be obtained in future research.

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## Game Characteristics in Professional Tennis at Different Levels of International Tournaments

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### Abstract

Fast tennis shots and quick movements are required in professional tennis; however, the game performance can be different in various international tournament levels. The aim is to analyse and compare game characteristics and the frequency of rally shots in male matches at the Australian Open and at the ITF Men's World Tennis Tour tournament, the Milovice Open. We analysed 1,738 points in seven matches at the Australian Open and 1629 points in fifteen matches at the Milovice Open. Based on previous research, selected game characteristics such as point duration, rally length, time between the points, rally pace or work to rest ratio were compared between the tournaments. In both tournament levels, 60 % of rallies were finished within the first four shots of the rally. Other observed variables were also very similar in both tournaments, but the rally pace was significantly different. The players played in a significantly faster rally pace at the Australian Open ( $1.22 \pm 0.03$ ) compared to the Milovice Open ( $1.27 \pm 0.05$ ),  $p=0.02$ . These findings show a difference in game performance between the top and lower international level of tennis tournaments. Coaches can use information about the match game performance to optimize the practice sessions.

**Keywords:** Performance analyses, Game performance, Perception, Motor behaviour, Match play statistics.

### 1. Introduction

The game characteristics of a tennis match can be different in various levels of international tennis tournaments or between the genders [1,2]. The structure of professional men's international tournaments starts at ITF tournaments (International Tennis Federation). The ITF Men's World Tennis Tour (previously known as Futures tournaments) are the lowest professional tournaments with the lowest prize money and ranking points. Next, the players can progress to a higher level of tournaments that are the ATP (Association of Tennis Professionals) Challengers and ATP Tour tournaments. Each category of these tournaments can have different prize money and ranking points. The top tournaments are the Grand Slams (Australian Open, French Open, Wimbledon and U.S. Open).

Even though the on-court performance in tennis can be different; the task for the players at different levels remains the same. The players need to react very quickly on an incoming ball, coordinate their movement and hit the ball. Players usually try to hit the ball as fast as possible to hit a winner or to provide the opponent with as little time as possible. The ball flight duration from the server to receiver is between 0.5–1.2 s depending on the serve quality and type, its initial velocity and spin and the court surface [3,4].

Previous studies showed that men reach much higher serve speeds compared to women [5,6]. Differences in game performance including strength levels, running speed or court coverage by genders were previously published [2,7,8]. Some studies compared the specific parts of the game performance between the beginner and experienced tennis players such as the quality of forehand stroke [9] or anticipation skills [10]. Only a limited number of studies compared game performance in various level of tennis tournaments. International level players, compared to national level players, reached higher speeds of serve, return and groundstrokes or hit the balls more precisely [11]. Professional tennis matches have a longer duration, and players play more aggressively from the baseline than junior players [12]. On the other hand, Janak & Zhanel [13] did not reveal any difference in the level of the game characteristics between junior and adult players. Researchers and experts [13–15] suggest that analyses of various match records of game performance and performance indicators may provide valuable information and significant feedback for scientists, coaches and players.



Weber et al. [16] stated that more than 50 % of points in male and female matches are decided within the first 4 shots of the rally. Various match characteristics were previously reported and examined in international tennis matches. The time between the points differ from 19.4 s to 33.1 s [16-18], however the ITF and Grand Slam rules allow 25 s between the points [19]. Intermittent load is typical for tennis including repeatable high intensity movements and rest. A work to rest ratio in tennis is 1:2-1:5 depending on the court surface [20-25]. Morante & Brotherhood [26] found a time difference in point duration between the male and female tennis players at Wimbledon 2005 and the 2005 Australian Open. They showed the mean point duration was at the Australian Open 6.4 s in male and 7.0 s in female matches. During this time, the player performs high intensity acyclic and cyclic movements [1,21], however Reid et al. [2] argue, that men play at a higher pace. Carboch & Placha [27] examined the rally pace during the rally (i.e. how quickly the ball travels between the opposing players, in other words, how much time the player has to hit the ball since the opponent hits the ball in the whole rally). They revealed that the rally pace was faster in the late stage (1.16 s) compared to the early stage (1.23 s) in the Australian Open female matches. Moreover, it was found that the ball change does not affect the rally pace [28]. The ball change varies at this level of the tournaments, as the ball change at the ITF Men's World Tennis Tour is after 11 and 13 games thereafter using 4 balls in play and at the Grand Slams the ball change happens after 7 and every 9 games thereafter using 6 balls in play.

Tennis balls can slowly lose pressure through the balls core and the ball wear becomes used. Each ball is subject to have 105 racket or ground impacts [29]. Damage is not only in the racket-ball interaction that damages the ball wear, but by the surface as well. The mass reduction is increased by impact speed and the number of impacts causing the felt cover degradation [30,31]. This affects the ball flight characteristics; used balls have larger drag, smaller lift force, reduced stiffness and different aerodynamic properties [32,33]. The players need to adapt to this during the match and for the new balls after the ball change as well. In practical terms, used balls become slower and may reach less spin rate, which can affect match tactics or serving strategy [34]. The ball degradation is expected to be bigger at the ITF Men's World Tennis Tour, as the ball change is not as often as in the Grand Slams and there are fewer balls in play as mentioned above.

The purpose of this study is to analyse and compare how specific game characteristics differ at the lowest and highest international tournament level including the play with new and used balls. To the authors' knowledge, selected game characteristics used in this study (based on [27]) were not examined between the tournament levels, i.e. what is the difference in game performance at the top and at the bottom international tennis levels. The aim is to analyse and compare game characteristics and the frequency of rally shots in male matches at the Australian Open and at the ITF Men's World Tennis Tour tournament, the Milovice Open.

## 2. Methods

### 2.1. Participants

We analysed 15 matches at the ITF Men's World Tennis Tour, the Milovice Open in 2019 (MO), 15,000 USD in prize money and 7 male matches at the Australian Open (AO). In 15 randomly selected matches of MO, we analysed 1629 points. Nine of the matches were 1<sup>st</sup> round matches, three 2<sup>nd</sup> round matches, two quarter-finals and final match. Professional tennis players  $n = 21$  ( $22.9 \pm 4.7$  years) in these matches had a mean ATP ranking of  $1019.9 \pm 343.4$ . In 7 male AO matches we observed a total of 1738 points. Four of the matches were first round matches, two semi-finals and final match. In these matches professional tennis players  $n = 12$  (mean  $28.0 \pm 4.9$  years) and had a mean ATP ranking of  $45.0 \pm 35.7$ . Both tournaments have been played on the same hard court Plexicushion acrylic surface. This study was approved by the Ethics Committee at the Faculty of Physical Education and Sport, Charles University.

### 2.2. Procedures

The match recordings were obtained from television or internet broadcasts. The quality of the video was found appropriate for the subsequent analyses. A spreadsheet with all the observed variables was prepared in advance for each match. The evaluator marked down if the server put the ball in play with the first or second serve and the variables were [27]: (1) Number of rally shots (rally length) – every stroke (racket-ball contact) was considered as a shot excluding the occasions when the ball just touched the racket frame and continued behind the striking player (this was not considered as a shot). (2) Point duration – the measurement of this variable was started by the striking of the ball by the server (in the case of a 1<sup>st</sup> serve

fault, the measurement was started by the striking of the ball at the 2<sup>nd</sup> serve) until the point was finished. The point was finished in the following cases - when the ball was out (touched the court outside the lines or hit the permanent fixture); the ball ended up in the net; when the ball bounced for the second time. (3) Time between the points - the time was measured when the previous point was finished to the racket-ball contact by the following first serve. The time was measured only during the games themselves (from the end of the first point of each game until the last point of the game). This variable was not measured during changeovers and after the end of the game or during tie-breaks. The time between the points was not measured in the following unusual situations, which would delay the expected continuation of the play: racket change, medical time out, discussion or argument with the umpire, a player's challenge (use of electronic line calling system), unusual crowd behaviour delaying the game. (4) Rally pace - was flowingly calculated: point duration divided by rally shots. (5) Work to rest ratio (point duration/time between the points). Data were excluded from the sample when a player made a double fault (time between the points was not excluded); when the ball became invisible (e.g. landed in the stands).

Each match was observed twice. Point duration and rally shots were observed during the first observation. The time between the points was observed during the second observation. The time was measured using a stopwatch. After every point, the video-recording was stopped and the evaluator marked the measured variables into the spreadsheet. In unclear situations, the video-recording was paused or reviewed.

Data for new balls were collected from every two games after the ball change. The first ball change was after 7 games and every 9 games thereafter in case of the AO and after 11 games and every 13 games at the MO. We did not use data from the first 2 games of the match as the same balls were used for the warm-up. Data for the used balls were collected from the last two games prior to the ball change.

### 2.3. Data analyses

All of the matches were analysed by one evaluator. The evaluator had a one-hour practice session for data observation and measurement before he started the match analyses. The intra-rater reliability using Intra-Class Correlation reached in all the observed variables  $\geq 0.98$ . Firstly, we calculated the means of each variable from every single match. Data were analysed using descriptive statistics and paired samples T-tests (within the tournament) or independent samples T-tests including Levene's test for equality of variances (between the AO and MO). Effect sizes (Cohen's *d*) were calculated and can be interpreted as small (0.20 to 0.49), moderate (0.50 to 0.79), and large ( $d \geq 0.80$ ) [35].

### 3. Results

The overall comparison of tournaments is detailed in table 1. The values between the tournaments are very similar except to the rally pace. The rally pace was significantly faster at the AO compared to the MO, which is accompanied by a large effect size. The same variables were compared after all the points were played, when the players hit the first serve in (table 2). T-tests did not show any significant differences between the tournaments when the play continued after the first serve. Only large effect size was revealed in the rally pace, being faster at the AO.

**Table 1.** Comparison of all observed variables between the Australian Open and the Milovice Open.

	Australian Open	Milovice Open	Mean Difference	95 % CI		T-test	<i>p</i>	Cohen <i>d</i>
				Upper	Lower			
Rally shots	4.85±0.48	4.84±0.69	0.01	-0.53	0.55	0.04	0.97	0.02
Point duration (s)	5.93±0.67	6.18±1.05	-0.25	-1.03	0.53	-0.68	0.50	-0.28
Time between points (s)	21.46±2.88	22.34±1.51	-0.88	-2.81	1.06	-0.95	0.35	-0.38
Rally pace (s)	*1.22±0.03	1.27±0.05	-0.05	-0.09	-0.01	-2.49	0.02	-1.21
Work to rest ratio	1:3.63±0.38	1:3.72±0.19	-0.09	-0.60	0.41	-0.39	0.70	-0.30

\*Significantly different than Milovice Open ( $p < 0.05$ ).

Table 2 also shows detailed scores of observed variables in all the points, when the players missed the first serve and used the second serve. Rally pace was significantly faster at the AO after the ball got into the play after the second serve and the time between the points was significantly longer at the MO, both variables are supported by large effect sizes. If we compare the same variables within the tournament, we can see some differences between the game characteristics after the first and the second serve. At the AO, paired samples T-tests showed that there were significantly more: rally shots after the second serve  $t(6) = -4.34, p = 0.005$ ; longer point duration after the second serve  $t(6) = -3.05, p = 0.013$ ; and longer time between the points after the second serve  $t(6) = -10.83, p < 0.001$  (means and standard deviations can be seen in table 2). Large effect size was observed in rally shots ( $d = -1.95$ ), point duration ( $d = -1.48$ ) and work to rest ratio ( $d = -0.92$ ), and medium effect size in the time between the points ( $d = -0.64$ ). At the MO, T-tests revealed significant difference in all observed variables between the first and second serve, including large effect size except medium effect in the rally pace. The players hit more rally shots after the second serve  $t(14) = -9.41, p < 0.001$  ( $d = -1.94$ ); had longer point duration after the second serve  $t(14) = -12.46, p < 0.001$  ( $d = -1.80$ ); longer time between the points after the second serve  $t(14) = -12.46, p < 0.001$  ( $d = -2.27$ ); slower rally pace after the second serve  $t(14) = -3.19, p = 0.007$  ( $d = -0.60$ ); and different work to rest ratio  $t(14) = 5.47, p < 0.001$  ( $d = 0.85$ ).

Large effect size was revealed in the rally pace between the tournaments both with the play with the new and used balls; or medium effect size was shown in the time between the points with the new balls or in the work to rest ratio with the used balls (table 3). However T-tests did not show any significant difference between the tournaments in the play with the new or used balls. The effect of ball change was also tested within the tournament. At the AO, paired samples T-tests showed that there were significantly different work to rest ratios with the new balls ( $M = 1:3.92, SD = 0.59$ ) compared to used balls ( $M = 1:3.25, SD = 0.58$ )  $t(6) = 24.63, p < 0.001$ . Large effect size between the new and used balls was found in the rally shots ( $d = -0.82$ ) and work to rest ratio ( $d = 1.16$ ); and medium effect was revealed at the point duration ( $d = -0.78$ ). At the MO, T-tests did not show any significant difference in all observed variables between the play with the new or used balls and only medium effect was found in the work to rest ratio ( $d = -0.51$ ).

**Table 2.** Game characteristics of the tournaments after the 1<sup>st</sup> and 2<sup>nd</sup> serve.

	Australian Open	Milovice Open	Mean Difference	95 % CI		T-test	p	Cohen d
				Upper	Lower			
1 <sup>st</sup> serve in								
Rally shots	4.43±0.53	4.22±0.71	0.21	-0.42	0.85	0.70	0.49	0.34
Point duration (s)	5.43±0.72	5.33±1.05	0.09	-0.83	1.02	0.21	0.83	0.11
Time between points (s)	20.72±2.81	20.88±1.68	-0.16	-2.15	1.83	-0.17	0.87	-0.07
Rally pace (s)	1.22±0.04	1.26±0.05	-0.04	-0.08	0.01	-1.58	0.13	-0.88
Work to rest ratio	1:3.85±0.53	1:4.07±0.90	-0.22	-0.86	0.42	-0.71	0.49	-0.15
2 <sup>nd</sup> serve in								
Rally shots	5.63±0.69	5.80±0.91	-0.17	-0.98	0.64	-0.44	0.66	-0.21
Point duration (s)	6.71±0.99	7.49±1.33	-0.79	-1.97	0.40	-1.39	0.18	-0.67
Time between points (s)	*22.45±2.56	24.48±1.49	-2.03	-3.82	-0.23	-2.36	0.004	-0.97
Rally pace (s)	*1.19±0.09	1.29±0.05	-0.10	-0.16	-0.04	-3.28	0.02	-1.37
Work to rest ratio	1:3.39±0.47	1:3.38±0.71	0.01	-0.60	0.63	0.05	0.96	0.02

\*Significantly different than Milovice Open ( $p < 0.05$ ).

**Table 3.** Game characteristics during the play with the new and used balls.

	Australian Open	Milovice Open	Mean Difference	95 % CI		T-test	p	Cohen d
				Upper	Lower			
New balls								
Rally shots	4.44±0.57	4.58±1.35	-0.15	-1.00	0.71	-0.36	0.72	-0.14
Point duration (s)	5.38±0.77	5.83±2.00	-0.45	-1.68	0.79	-0.76	0.46	-0.30
Time between points (s)	20.84±2.52	22.80±2.64	-1.97	-2.15	-4.46	-1.65	0.11	-0.76
Rally pace (s)	1.21±0.04	1.26±0.07	-0.05	-0.11	0.02	-1.56	0.13	-0.88
Work to rest ratio	1:3.91±0.56	1:4.29±1.07	-0.38	-1.28	0.53	-0.87	0.40	-0.44
Used balls								
Rally shots	4.95±0.67	4.87±1.00	0.08	-0.79	0.95	0.20	0.84	0.09
Point duration (s)	6.04±0.92	6.21±1.41	-0.17	-1.39	1.05	-0.29	0.77	-0.14
Time between points (s)	21.15±2.65	22.12±2.25	-0.97	-3.24	1.30	-0.89	0.38	-0.21
Rally pace (s)	1.22±0.04	1.27±0.06	-0.05	-0.11	0.00	-2.01	0.06	-0.98
Work to rest ratio	1:3.25±0.58	1:3.75±1.04	-0.51	-1.39	0.38	-1.20	0.25	-0.59

Frequency analysis of rally shots is detailed in table 4. The table shows not only overall tournament frequencies, but frequencies after the 1<sup>st</sup> and 2<sup>nd</sup> serve or with the new and used balls play as well. Notably, specific comparisons between the AO and MO are quite equal. To better illustrate and visualize the frequencies, figure 1 shows the distribution of the rally shots, which is remarkably similar.

**Table 4.** Frequency analysis of rally shots between the tournaments.

	Australian Open					Milovice Open				
	Overall	1 <sup>st</sup> serve in	2 <sup>nd</sup> serve in	New Balls	Used Balls	Overall	1 <sup>st</sup> serve in	2 <sup>nd</sup> serve in	New Balls	Used Balls
1	8,6	12,7	0,7	9,8	10,1	8,1	12,9	0,8	7,5	9,7
2	21,9	23,4	18,9	26,4	17,4	21,5	24,3	17,3	22,1	20,9
3	16,2	16,2	16,1	19,4	16,6	17,5	17,9	16,8	18,1	14,8
4	12,2	10,7	15,1	9,3	11,0	12,7	12,5	13,0	14,6	13,3
5	9,0	9,0	9,2	9,6	8,4	10,3	10,3	10,4	6,5	11,2
6	7,8	6,5	10,1	4,8	9,6	6,5	4,3	9,9	5,5	6,6
7	5,7	4,8	7,6	6,5	7,0	6,1	4,9	7,9	9,0	6,1
8	4,7	4,7	4,3	3,7	4,5	4,2	2,6	6,5	2,0	5,1
9	2,9	2,8	3,3	2,5	3,9	3,1	2,4	4,0	4,5	3,1
10	2,2	1,7	3,3	0,8	2,2	1,8	1,2	2,8	1,0	2,0
11	2,4	2,1	3,0	2,2	2,2	2,3	1,9	2,9	2,0	1,5
12	1,4	1,4	1,4	0,8	1,4	1,5	1,3	1,7	1,0	1,5
13+	4,9	4,0	6,9	4,2	5,6	4,4	3,5	6,0	6,0	4,1
Points played	1738	1156	582	343	347	1629	983	646	199	196

All the values in rows 1 - 13+ are reported as a valid percent.

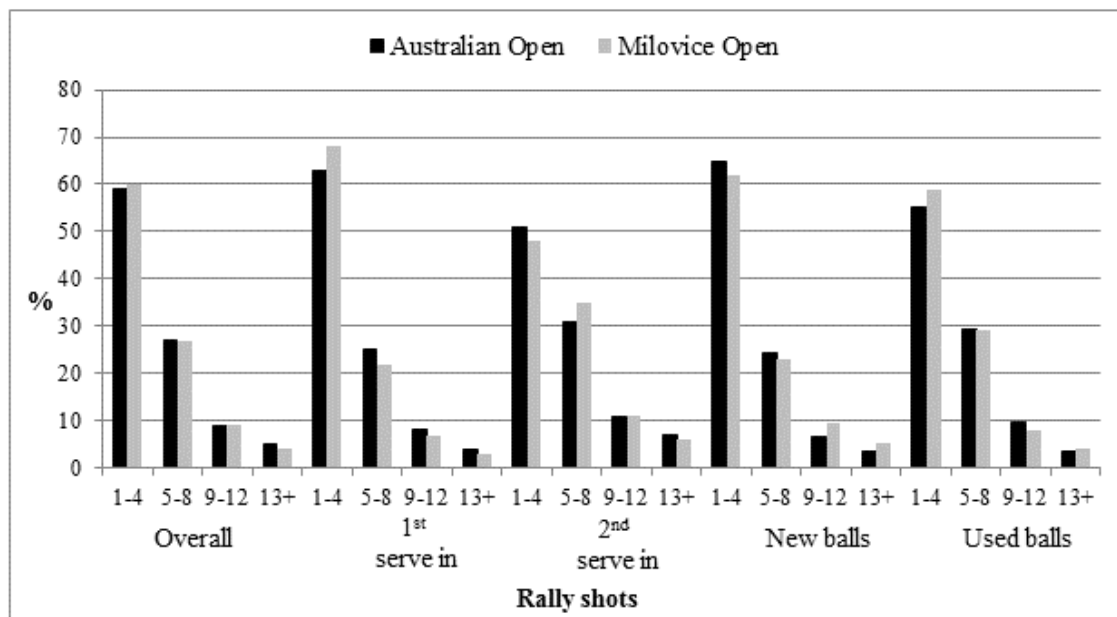


Figure 1. Distribution of rally shots.

#### 4. Discussion and Conclusion

The aim was to analyse and compare game characteristics and the frequency of rally shots in male matches at the AO and at the ITF Men's World Tennis Tour tournament the MO. The game characteristics were shown to be quite equal between the tournaments except for the rally pace. The rally pace (mean duration of the shot ball flight time between the opposing players) was different between the tournament levels. A different rally pace may be explained by the quality of the players and their game performance, as better ranked players may be able to hit the groundstrokes faster and move around the court quicker.

Remarkably, there was a bigger difference in the rally pace after the second serve between the observed tournaments, hence the rally pace became faster after the second serve in the AO compared to the rally pace after the first serve. However, in the MO, the rally pace became slower after the second serve compared to the first serve. This may be attributed to the better quality of the return shots of players at the AO, as the players may return the ball with higher speed (or hit fewer defensive shots). Another explanation may be that the game performance of lower ranked male players at the MO may partly be closer to the female game performance. Some authors [2] reported that male play is at a higher pace, compared to women, as men reach significantly higher movement speed and cover more meters on the court. Also Morante & Brotherhood [26] stated that men reach higher stroke frequency. But still, we can only assume and cannot really compare these gender game performances, even at this level at the MO, the male players serve faster compared to top female players. A theory could be mentioned here that the top players at the AO were able to cover more meters (which can also include better anticipation skills) or move faster on the court than the lower ranked players at the MO. If the player is moving slowly on the court, he can be late to position for his stroke. Consequently, the player needs to expand sideways during the hitting phase, leading to a lower stroke speed (loss of power), which can also change the stroke intention (instead of hitting a winner to avoid the error) [36]. However, Reid & Duffield [24] stated that the fatiguing effect on the players' movement and their shot result is still unclear. Of course, the rally pace can be affected by fatigue, especially in long matches or after long rallies.

Muscle fatigue is present in long matches [37] and negatively influences a player's overall performance, e.g. biomechanical forces, ball speed, motion flexibility, or decreases metabolism and physiological processes [38-41]. On the other hand, Gescheit et al. [42] argue that fatigue does not affect the

stroke speed in consecutive long matches, but decreases the total movement in explosive tasks of lower limbs such as sprinting and jumping. Some game characteristics are very similar after the first serve between the tournament levels (table 2). More discrepancies between the tournament levels can be observed after the second serve. Longer point duration at the MO can suggest that players at this level can have less efficient shots and try to keep the ball more in play or players at the AO could have more aggressive playing styles. Notably, the point duration increased by 2 s after the second serve in the MO, that resulted in a longer time between points. This suggests that the players try to rest more after a longer point duration.

In both tournament levels, the point was obtained within the first four shots in 60 %. This is 10 % more than on a clay court [16, 43]. These values can be explained because of the court surface or that the players developed a more aggressive playing style. Our study also splits the data after the first and second serve, showing that after the second serve it is around 50 % of points and that was similar in both tournaments. The work to rest ratio in our study is similar to previous studies [22,24]. Together with the mentioned rally pace, these pieces of information can help the coaches utilize the practice sessions better.

As the used balls become slower, it can allow the player to have more time to reach the incoming ball and can make it harder to hit a winner. The results also indicate that the different ball change did not affect the rally pace [28]. Interestingly, equally in both tournaments (even with different ball change), the rally pace with the used balls was 0.01 s slower than with the new balls. The effect of ball degradation did not show any differences between the tournaments, other than the rally pace as already mentioned above. The ball stiffness slowly decreases after the impacts; therefore used balls have a reduced stiffness as compared to the new balls. Practically, it should be easier to hit a winner with the new balls. Balls with greater stiffness contact the racket for less time during a hit than softer balls, resulting in a significant difference in control and reaction forces felt by the player's arm [34]. The point was finished within the first four shots of the rally at the AO in 10% more cases with new balls than with the used balls, even though the balls are changed more often at the AO. However, at the MO the difference reached only less than 4 %. We would expect a bigger difference in the MO due to larger ball degradation (more ball impacts due to the ball changes and fewer balls in play). However, one explanation may be that players at the MO hit the ball with more control and play more carefully with the new balls as not to make an unforced error. Or as they could feel a bigger difference between the balls after more games played, they try to adapt to the new balls more carefully.

We tried to provide insight to specific variables from the practical view with the focus on the rally pace, which was (to the authors' knowledge) not used before by other researchers in this way. The authors are aware that the study was limited by the sample size of matches, especially for the new and used balls results. Many researchers are now able to use data from sophisticated software (e.g. Hawk-Eye system), which easily allows collecting huge amounts of data and can observe a lot of variables. However, we used "old school" notational analyses by hand to measure specific components of the game performance, which consisted of indirect match observation and manually marking down every value for each variable. In regard to this, it takes much more time to obtain the data (especially when we observed each match twice) than using automated software. Therefore we believe that we observed a sufficient number of points and the results are in this way very valuable. This study indicates some significant differences between the tournament levels and we believe these results can provide useful information for the coaches. Next, the rally pace and other game characteristics can be affected by various factors, such as the individual playing style of opposing players, their tactics and strategy, by weather conditions and fatigue, etc. Further studies should examine the players' game performance from a similar view on other court surfaces, or between the junior and professional players. It is very likely that similar results could be obtained from another tournament played on the same surface.

We analysed specific parts of the game performance between the Grand Slam and lower international tournament. Overall, players at the AO tournament played at a faster rally pace than at the MO. This difference was even larger after the second serve. This has been the most important finding between the tournament levels. Comparison of other game characteristics such as point duration, rally length, time between points, work to rest ratio or shot frequencies was very similar. This study provides insight into the practical aspects of specific game performance characteristics in professional tennis matches that could be used by coaches to optimize the training session, tactics and enhance the performance.

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# Organizational and Process Design Solutions for Sports Facilities

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## Abstract

Currently, special attention is given to the construction of sports venues. Every new facility is not just walls and grounds: most of them are well-designed buildings, stadiums, skiing runs, cycle tracks, impoundments, ice rinks, roller skiing trails, beach sports recreation centers, providing up-to-the-minute equipment for mass sports activities. The latest and most efficient engineering solutions must be applied in construction of such complex systems. Modern sports facilities are built from complex projects; engineers try to design the most convenient conditions for sports activities. They also strive to make facility meet its operational purpose, while being architecturally beautiful and unique. Sometimes organizational and process design solutions are very labor intensive, because technical standard framework does not provide necessary data, in particular the standard time of roofing process, which requires expert-based set of norms. The paper analyzes the experience of Russia and several foreign countries on trial organizational and process design of roof at sports facilities. As a result of the research, a flow chart was drawn up for making a plan of the construction of a sports facility, taking into account the decomposition of works according to the degree of their typing in terms of standards of technical rate setting. These developments work for improvement of organizational and process design. In addition, they shape a comprehensive approach to estimation of non-standard labor intensive works, which require extra study through actual technical regulation at construction sites.

**Keywords:** Management, Organizational and process design, Scheduling, Sports facility.

## 1. Introduction

Construction of long-span buildings and structures is a complex process that requires a careful approach of the developer and contractor as well as a sound technology of work. Construction of large-scale objects has its own direction in design, though there is no definition in technical standard base of what a «long-span structure» or a «long-span facility» are (table 1).

**Table 1.** Classification criterion of a long-span building / structure

No.	Source of standard documentation	Classification criterion of a long-span building / structure		
		Span, m	Metric area	Cantilever, m
1.	Resolution of the Moscow Government No. 567-PP dated June 25, 2006 "On measures to ensure the reliability of civil buildings with long-span structures"	>18	-	-
2.	"Manual on scientific and technical support and monitoring of buildings and structures under construction, including long-span, high-rise and unique ones" MRDS 02-08, section "Terms and definitions"	>36	-	-
3.	MDS 20-2.2008 "Temporary recommendations on ensuring the safety of long-span structures from progressive collapse in case of emergency impacts"	>36	-	-
4.	Town-Planning Code of the Russian Federation "Article 48.1. Highly dangerous, technically complex and unique facilities"	>100 (term «unique» is used)	-	-
5.	Code of Practice dated 25.10.2017 No. 304.1325800.2017 "SP 304.1325800.2017 Structures of long-span buildings and facilities. Rules of operation"	>18 (civil) >30 (industrial)	>50 people	>9

## 2. Literature Review

A number of regulatory documents [2,3,4,5] and scientific sources [1,6,7,8,9,10,11] were analyzed and studied, in order to write this paper and fully convey the most relevant and precise information, scrutinize various data and terms.

## 3. Method

Public, industrial and special buildings are usually designed with long spans. The necessity for such structures arises when intermediate supports obstruct the planned work process. The bearing elements of such objects can be made of the following basic materials - in-situ reinforced concrete, prefabricated reinforced concrete, precast elements. Such long-span buildings are usually made single-span. Facilities of industrial and special type generally are rectangle, while public ones can be polygonal-, round- or oval-shaped.

*Existing methods for construction of long-span sports facilities on the example of football stadiums.*

Every country discusses the matter of human life expectancy and healthy life style. The President of Russia gave interesting figures: to date, 54 million Russians take sports on a regular basis, what is almost 40% of the country's population. Moreover, there has been set a goal to increase this figure to 55% by 2024 [11]. Accordingly, there is a great need for the active construction of sports facilities, including those for major international competitions.

Many sports venues, such as football stadiums, have a large area and exclude, due to the architectural solution, the presence of bearing pillars inside the building, i.e. those buildings are long-span. Sports facilities range by their functional purposes (table 2). The paper considers those stadiums in more details, the roofing of which was conducted in various methods depending on structural system of cover (table 3). Having analyzed a number of such sports venues, it becomes clear that distinctive feature of the design and implementation of organizational and process solutions lies primarily in erection of long-span architecturally vivid roofing and facades (table 4).

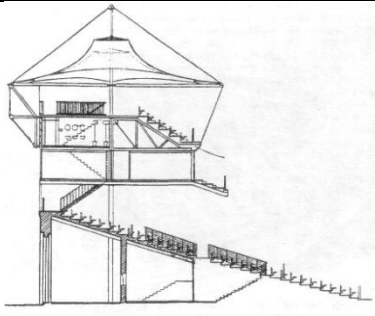
**Table 2.** Classification of sports facilities by functional purpose

No.	Facility	Description	Athletic discipline
1.	Sports and recreation facility (premises)	Equipped with special technical means and intended for fitness and health, sports services	All team sports, gymnastics, wrestling, powerlifting
2.	Sports arena	Sports ground with grandstands. Outdoors >1500 people, indoors >500 people.	All team sports, gymnastics
3.	Gym hall	A sports, indoor facility >18 m long, >9 m wide and >5 m high (if the size is smaller, it is deemed a "facility for sports purposes"), there is equipment for different sports or universal. It may be situated in a sports building. .	All team sports, gymnastics, wrestling, powerlifting, track-and-field athletics
4.	Indoor arena	A covered separate or built-in structure that meets the size requirements of the educational and training process and the rules of competitions in sports using large-sized plane structures (fields, sports grounds, etc.) as the main ones. Seats for spectators are possible.	Football, track-and-field athletics, equestrian sport, swimming
5.	Sports complex	A group of similar and different types of volumetric and plane structures for training and competitions, located in the same territory and run by one management. Facilities can be interlocked, located under the same roof or free-standing.	All team sports, gymnastics, wrestling, powerlifting, track-and-field athletics
6.	Stadium	It is a complex with sports arena.	Football, cycling, running, track-and-field athletics
7.	Universal Sports and	Arena for 1000 and more people. The sizes of the main ground and the auditorium are suitable for different	Team sports, hockey, figure skating




	Entertainment (Demonstration) Hall (Sports Palace)	sports. Versatility is achieved through transformation.	
8.	Swimming pool	An open-air or indoor facility with a main swimming-bath of at least the size set by the competition rules. It is possible to combine conditions for several sports in one bath. It is possible to arrange seats for spectators.	Competitive swimming, water polo, springboard diving, synchronized swimming
9.	Shooting range	It is a complex, consisting of open or semi-enclosed facilities.	Various kinds of shooting
10.	Skiing center	A complex of facilities, including changing rooms, ski storage and other service rooms and trails for training and skiing. A skiing run may include a ski stadium - a start and finish area >400m in length and width with a judge's room, grandstands for spectators	Alpine skiing, snowboarding, biathlon, orienteering, freestyle, ski jumping

**Table 3.** Classification of the main structural systems of stadium roofs

No.	Type of roof structure	Options of roofing structural system	Description	Drawing
1.	Canopy above the stadium stands (cantilever-beam system)	Stadium in Hong Kong	Canopy roof of Hong Kong stadium is made with wave-like folded plates from synthetic materials, which are placed on the metal-elements structure	
2.	In-situ reinforced concrete cantilever beams	Stadium in Düsseldorf, Germany	One end of the beams rests on the girder of in-situ triangular reinforced concrete frames, and they are suspended by cables to the upper part of the girder at two other points. The section of the beam is T-shaped, between the beams the covering is a suspended reinforced concrete cylindrical shell.	

3.	Steel cables	Cricket ground in London, UK	Canopy tent structure covers the stands of the renovated cricket venue in London. To steel tubular masts attached cables and suspended a dome made of transparent synthetic material - polycarbonate.	
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*Table 4. Examples of sports facilities*

No.	Name	Purpose	Capacity, people	Unique elements (non-standard structural / architectural / organizational and process solutions, previously not implemented in civil engineering)	Photos from Internet sources
1.	The Volgograd Arena, Volgograd, Russia	Football stadium	45,568	Roofing	
2.	Otkritie Arena, Moscow, Russia	Football stadium	45,360	Roofing, facade	
3.	Bilbao Arena, Bilbao in the province of Biscay, Spain	Basketball arena	8,793	Roofing, facade	

**The Volgograd Arena's** roof resembles a bicycle wheel made from strong steel cables. The facility is located in a historical place; its compactness is achieved due to the canonical shape of the facade tapering downwards. The pattern on its self-supporting structures of the facade is inspired by local traditional weaving from canes and a firework at the celebration of the Victory in the Great Patriotic War. Primarily, the main pre-construction activities were performed, including the dismantling and disposal of building structures of the former Central stadium and the previously existing utility systems. Then the work of the principal construction period – making a foundation pit and a foundation slab – was performed. Further, the stadium's supporting structures were erected, on-site utility systems were laid, cast-in-situ structures and stands of the stadium were constructed with a total volume of more than 120 thousand m<sup>3</sup> of concrete. In 2017, the installation of horizontal structures of the stadium roof was completed, including a unique cable-stayed system with a membrane covering. [7.8]

When erecting **Otkritie Arena**, one of the trickiest moments was to assemble the stadium's roofing system. The workers mounted 8700 tons of metal at a height of 29 to 36 meters with the help of a large number of complex lifting mechanisms. The roof structure involves two longitudinal trusses (an

architectural truss is a building part installed for the rigidity and strength of the structure. It is usually used when building complex spans) installed along the football pitch, and two transverse trusses forming a cross-linked system over the stadium. The roof trusses framed along the upper and lower chords with steel sheets 4 mm thick, were assembled on the ground on special trolleys in just near the facility to cover. The trolleys had conductors and devices to ensure the necessary accuracy of putting together the roof elements. The design of the trolleys allowed them to move along horizontal and inclined rail tracks with trusses fixed on them. To lift the trolleys to the design level, two inclined mounting beams were installed. The trolleys with the next roofing block were moved via two block and tackle systems. After reaching the design mark, the trolleys rested against a special buffer; the roofing block was lowered onto steel cages and pushed into the final position by rolling-on method with the help of two light blocks and tackles. In the final position it was first raised via jacks to release the rollers, and then lowered back to the final position. One of the advantages of this method is that there is no need to use a crane of large-tonnage capacity. The facade of the stadium is made of cement-mineral panels. Their advantage consists in their ability to take a wide range of shapes. The construction project was developed by the architect bureau AECOM. Initially, they wanted to make the facade of blocks and bricks, but later decided to use newer technologies of "dry construction". The walls of the facade are resistant to moisture, which is an important factor, since only one of the four stands is heated. The scaly facade was designed by Dexter Moren Associates, the British bureau. The design of the outer walls is such that they are effectively protected from atmospheric agents. [9]

A noteworthy green facade solution was made for **Bilbao Arena** in Spain. The structure of the arena is inspired by a leaf of a tree. The facade plating is made of leaf-like steel plates that can be removed to allow more light and air to enter the building. This design helps cut expenses on electricity; the halls are well-aerated; an air conditioner is not required. The largest arena is located at the top of the building, while the smaller sports grounds are at the lower part of the complex. The upper arena is naturally illuminated due to glass partition-walls of utility spaces which let the outdoor light in. There is a rainwater collection tank, which is not common for this type of structure. Water is collected in a special container and transferred to the disposal of the city municipality. This water is further used for washing the streets of Bilbao. The sports arena occupying 30,808 m<sup>2</sup> requires a huge amount of electricity, but due to its energy efficient design the actual consumption is reduced many times over. The total area of the building is 80,000 m<sup>2</sup>, and the problem of air conditioning of such a space is also solved in environmentally friendly way: by "perforation" of the green facade. [10]

Proceeding from architectural and design solutions for similar projects, some options of organizational and process design also contain uncommon solutions. For instance, in the Russian Federation besides the concept design and detailed design documentation, which is developed by engineering companies, certain regulations impose upon a contractor a duty to develop organizational and process solutions formalized in the form of production documents (Work execution design, Flowsheets of operational sequence, Production procedures) [2]. Such organizational and process solutions are prescribed even at the design stage in the Construction Management Plan. However, this solution requires a deeper investigation into options for performing works at the stage of construction.

#### 4. Results

A building or a structure should be erected in compliance with an activity schedule contained in the process control documentation. The procedure of compiling such a schedule, in particular for construction of unique long-span sports facilities, is shown in the flowchart below (see Figure 1).

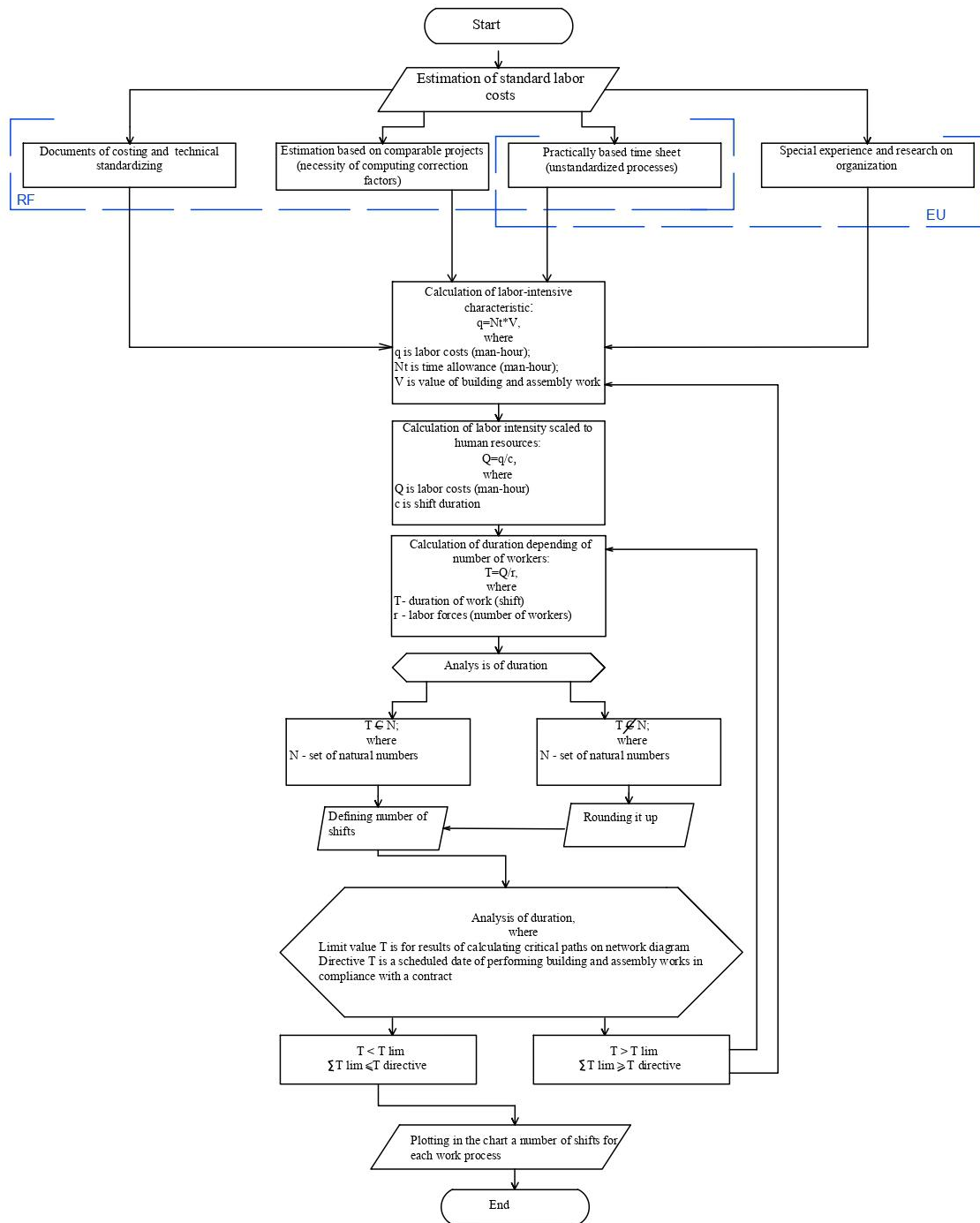


Figure 1. Flowchart of the process of plotting a linear Gant chart for performing one particular type of work.

As one can see from the chart above, the process of compiling an activity schedule is based on technical rationing. Time allowance is given in a number reference papers, yet there are no some of certain building and assembly works performed when erecting a unique structure with the use of unstandardized

technologies. Within the framework of this study, the authors propose to resolve the complex of building and assembly works associated with construction of sports facilities into elementary processes, which are offered to systemize by splitting into certain groups on the grounds of standardization of process rating. After analyzing a number of projects, two types of work are given (see Figure 2).

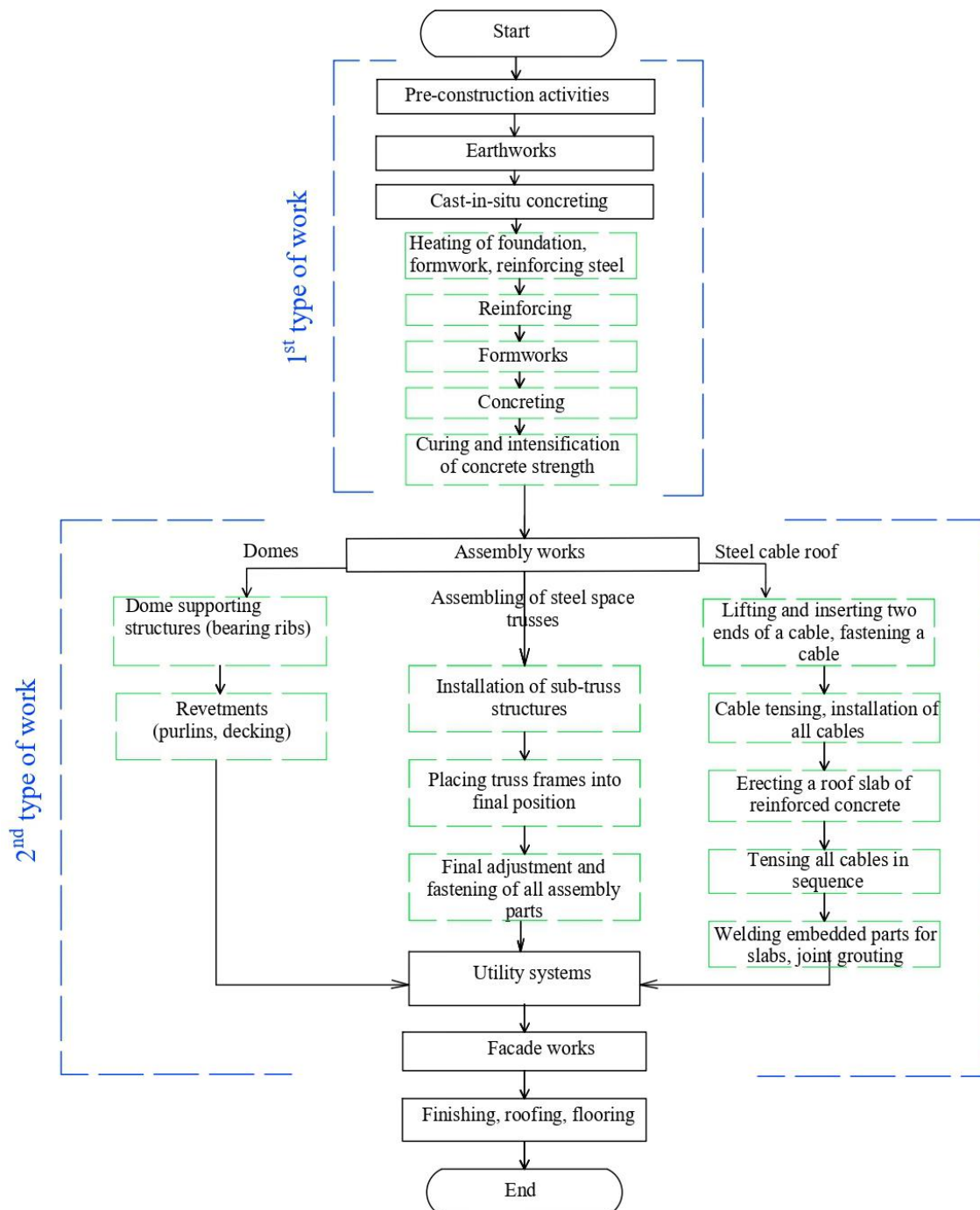


Figure 2. Flowchart of the process of erecting a stadium

In terms of organizational and process solution, the first type of work is similar to the one pertaining to projects meant for other purposes. The second type comprises works that require quite time-consuming process of determining time rates (practically-based time sheet on site). However, after resolving these



groups of works into processes one can distinguish “standardized” ones, technical rate setting of which require no additional time. Exotic technology for erecting stadium’s roofing such as a method of circular lengthwise launching may serve as an example of trial design. Another one – suspended cantilever method, which is more common and time-tested, may be used as an example as well. (see Table 5)

**Table 5.** Example for assembling space trusses

$N_{en}/n$	Works	Processes	Mathematical formalization $q_{i,j}^{I,II,III}$
I	1 <sup>st</sup> category works on erecting sports facilities that do not require practice-based rate setting		
$I_1$	In-situ concreting [1.1]	Reinforcing	$q_{11}^I$
$I_2$		Formworks	$q_{12}^I$
$I_3$		Concreting	$q_{13}^I$
$I_4$		Curing and intensification of concrete strength	$q_{14}^I$
$I_5$		Maintenance	$q_{15}^I$
II	2 <sup>nd</sup> category works on erecting sports facilities that require unstandardized mechanical means		
$II_1$	Suspended cantilever method [1.2]	Assembly of steelwork of external abutments	$q_{11}^{II}$
$II_2$		Preparation of basement for vertical support members	$q_{12}^{II}$
$II_3$		Pre-assembly activities, mounting, ground level assembly works	$q_{13}^{II}$
$II_4$		Подача монтажного блока на рабочей площадке временных опор Conveying sub-assembly on temporary supports' site	$q_{14}^{II}$
$II_5$		Pre-assembly of sub-assemblages	$q_{15}^{II}$
$II_6$		Dismantling steelwork and temporary supports	$q_{16}^{II}$
III	3 <sup>rd</sup> category works on erecting sports facilities that require practice-based rate setting		
$III_1$	Method of circular lengthwise launching [1.3]	Installation of launching nose	$q_{11}^{III}$
$III_2$		Assembly of auxiliary mounting elements to perform launching	$q_{12}^{III}$
$III_3$		Installation of jack, winches and guide casings	$q_{13}^{III}$
$III_4$		Elementwise supply of launching to a bay with regular assembly	$q_{14}^{III}$

Mathematical formalization of the calculation of labor costs for building and assembly processes and works is presented in the formulas

$$Q^I = \sum_{i=1}^n Q_i^I = \sum_{i=1}^n \sum_{j=1}^m q_{ij} \quad [1.1],$$

where

$Q^I$  - total labor intensity of building and assembly works of the 1<sup>st</sup> category;

$Q_i^I$  - labor intensity of the  $i$ -th work of the 1<sup>st</sup> category;

$\sum_{j=1}^m q_{ij}$  - sum of labor intensity of  $j$  processes of the  $i$ -th work of the 1<sup>st</sup> category;

$i$  - counting number of work in this category;

$j$  - counting number of the work process in this category;

$n$  - number of works in this category;

$m$  - number of work processes in this category

$$Q^{II} = \sum_{k=1}^{n'} Q_k^{II} = \sum_{k=1}^{n'} \sum_{l=1}^{m'} q_{kl} \quad [1.2],$$

where

$Q^{II}$  - total labor intensity of building and assembly works of the 2<sup>nd</sup> category;

$Q_k^{II}$  - labor intensity of the  $k$ -th work of the 2<sup>nd</sup> category;

$\sum_{l=1}^{m'} q_{kl}$  - sum of labor intensity of  $l$  processes of the  $k$ -th work of the 2<sup>nd</sup> category;

$k$  - counting number of work in this category;

$l$  - counting number of the work process in this category;

$n'$  - number of works in this category;

$m'$  - number of work processes in this category

$$Q^{III} = \sum_{h=1}^{n''} Q_h^{III} = \sum_{h=1}^{n''} \sum_{r=1}^{m''} q_{hr} \quad [1.3],$$

where

$Q^{III}$  - total labor intensity of building and assembly works of the 3<sup>rd</sup> category;

$Q_h^{III}$  - labor intensity of the  $h$ -th work of the 3<sup>rd</sup> category;

$\sum_{r=1}^{m''} q_{hr}$  - sum of labor intensity of  $r$  processes of the  $h$ -th work of the 3<sup>rd</sup> category;

$h$  - counting number of work in this category;

$r$  - counting number of the work process in this category;

$n''$  - number of works in this category;

$m''$  - number of work processes in this category

## 5. Conclusion

The introduction of an algorithmic approach to elaboration and technical and economic assessment of organizational and process design solutions in the case of trial design of technology for assembling large-span structures for sports buildings and facilities allows improving and optimizing procedures of working out organizational and process documents through resolving building and assembly works into categories. This allows maximizing the use of experimental data on erection of such objects. Algorithmization of organizational and process design reveals the following tasks that require further study:

1. Standardization of organizational and process solutions for the construction of unique sports facilities in order to optimize organizational and process design in general and the possibility to timely develop various options for assembly technology (including uncommon non-standard technologies).

2. Application of the described prerequisites for creating an automated algorithm for the development of rational organizational and process solutions for the construction of unique large-span sports facilities (and corresponding software).

The proposed standardizing of works was used when working out an organizational and process model for the construction of several sports facilities. The example is trial designs of a technology for assembling the roofing of Otkritie Arena in Moscow (Russia). Depending on a type of structural properties of sports facilities' roofing, elaboration of various standard organizational and process models allows accelerating the development of organizational and process documentation, determination of key production parameters (total labor intensity, duration, cost) according to a way of implementation of a corresponding technology. Trial design also optimizes the range of tasks associated with technical regulation of building and assembly processes at site.

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# Influence of Sports Constructions on the Urban Environment during Reconstruction and Updating of the Developed City Building

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## Abstract

Development of the urban environment assumes updating of the developed evaluation methods of working conditions and accommodation in settlement borders. Sports facilities are essential part of city and municipal infrastructure nowadays. This article presents an overview of approaches to evaluating the effectiveness of sports facilities as a tool for improving the quality of people's life. Moreover, this paper presents mechanisms that can improve the effectiveness of a sports facility. Achievement of the requirements to the level of accommodation of the population provided by the regulating documentation in the territory of the city demands timely updating of subjects of the residential real estate, subjects of industrial and cultural function as well as the city infrastructure. The author provides information about the integral indicator of living standard and about urban environment quality index, which are calculated using information about sports facilities. The paper provides a comparative analysis of sports registries of different countries, which provide access to information about sports infrastructure for the population; the criteria necessary for improving the Russian registry are identified.

**Keywords:** sports facilities, standard of living, regional development, influence on the national economy development, value chain, efficiency of creation of sporting facilities

## 1. Introduction

Nowadays special attention is paid to the issues of the development of sport and sports infrastructure in the Russian Federation. The state actively develops complex of actions for the involvement of the population in healthy lifestyle and also takes measures for the creation of conditions for inclusion of Russia in the global sports industry. The purposes of the Government of the Russian Federation within the implementation of data of the program are the following:

- the increase in the share of the population playing sports up to 55%;
- the increase in the indicator of healthy life of citizens up to 67 years [16].

During the last 10 years the programmes aimed at the development of sport and physical culture in regions of Russia have been offered, approved and implemented in the country. And most significant the most large-scale ones among them were:

- federal target programme "Development of Physical Culture and Sport in the Russian Federation";
- regional programmes "Development of Physical Culture and Sport";
- the use of mechanisms of public-and-private partnership (PPP) for the implementation of infrastructure projects in the field of physical culture and sport [17].

Such programmes solve the following problems:

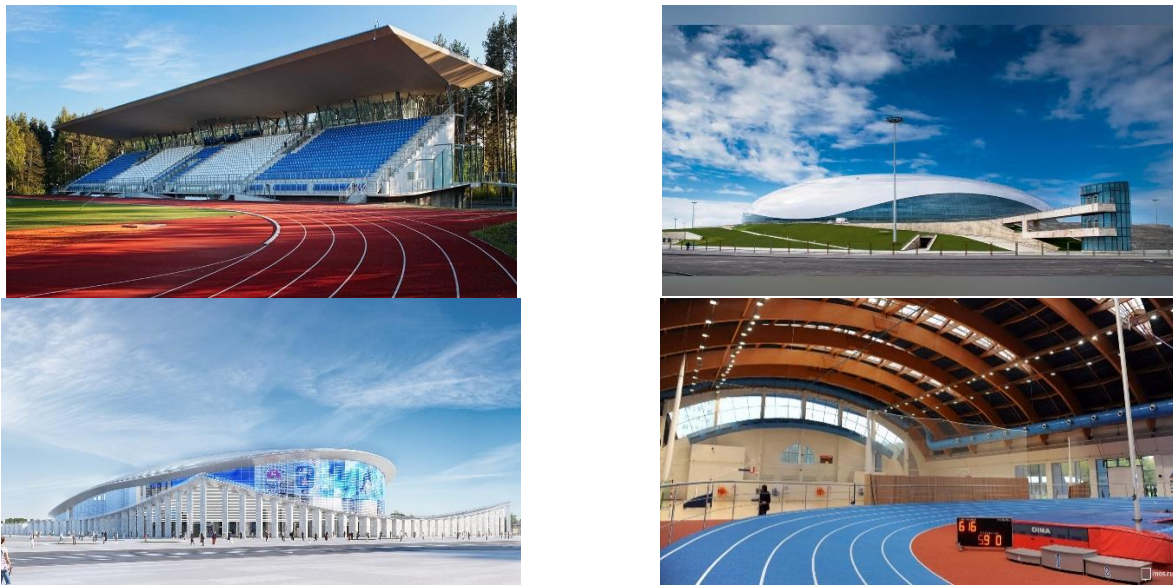
- creation of the necessary conditions providing to citizens opportunity regularly to be engaged in grade and physical culture;
- increase in the level of training of athletes in elite sport;
- development of infrastructure of physical culture and sport, including within public-private partnership;
- reconstruction of the facilities located in step availability with the creation of comfortable conditions for the persons with limited opportunities;
- improvement of material and technical resources for training of athletes of the highest sport and trainers taking into account the climatic features in the regions of Russia;
- creation of necessary conditions for the preparation and preserving of sports reserve;
- the strengthened development of sports infrastructure in the North Caucasian Federal District, the Republic of Crimea and Sevastopol, the Kaliningrad region and the Arctic zone [18].

During the last 10 years great large sports competitions took place in the territory of the Russian Federation. The most significant of those events were:



1. The XXII Olympic winter Games and XI Paralympic winter games in Sochi in 2014;
2. The XXVII World summer Universiade in Kazan in 2013;
3. The XXIX World winter Universiade in Krasnoyarsk in 2019;
4. FIFA World Cup 2018 [12].

The developed sports infrastructure [8, 9, 20], including both material infrastructure (sports constructions), and organizational infrastructure (sports schools, clubs, etc.) is necessary both for the involvement of the population in sports activities and for holding large sporting events [12]. In the beginning of 2010 there were 243,141 sports constructions in Russia, in the end of 2019 their quantity increased up to 311,905. Thus, the special attention to the problems of development of sport and physical culture in the Russian Federation has led to the construction of 68,764 new sporting facilities [17] (Fig. 1).



*Figure 1. Examples of the modern sports facilities constructed in Russia*

At the same time, it is important to understand that the development of sport and the construction of sports infrastructure is not the purpose itself. It serves only as a tool for the improvement of quality of life of the population [21]. Besides, such significant investment projects can promote the economic growth in those regions where they are performed.

## 2. Literature review

The carried out analysis of references has proved that theoretical-and-methodical researches of problems of the innovative development of the industries and spheres of economy are studied in works by such scientists as Akmayeva R.I., Bukhonova S.M., Varnavskiy V.G., Viktorova T.S., Doroshenkoy Uy.I., Zoidova K.X., Ivanova N.I., Komilova S.D., Retneva A.D., Smirnova M.O., Somina I.V., Snaplyan O.O., Fatkhutdinov R.A., Chernaya M.V., etc.

The research of problems of the economy development and the service industry development were considered in works by the leading domestic and foreign scientists: Agayevts V.U., Voskolovicha N.A., Demidova L., Yerokhin L.I., Kangiz Haksever, Kiel M.Yu., Lifitsa I.M., Radzhabova R.K., Fakerova H.N., Habibova S.H., Hodzhayev P.D., Hlebovich D.I., Khusainov M.K., Sharopov F. R., Shinkevich A.I. and others.

The significant contribution on studying of the problems of economy, the organization and management of physical culture and sports, such scientists as Alyoshin V.V., Aristov L.V., Bannikov A.M., I. S. Barchukov, Bloodless V.A., Vakalova L.G., Vilkin Ya.R., Gadzhiyev A.A., Galkin V.V., Zhestyannikov L.V., Zholdak V.I., Zavadskaya Z.L., Zoidov K.H., Zolotov M.I., Zubarev Yu.A., Kosovo Yu.A., Kuzin V.V., Kuzmicheva E.V., Kutepov M.E., Mirsaidov A.B., Novokreshchenov V.V., Nogumanov, R.U., Pochinkin A.V., Radzhabov R.K., Saidov M.H., Samandarov I.H., Smirnov M.O. and others.

### 3. Methodological Approach

Special attention of modern scientific literature is paid to the issue of interaction of the service industry of physical culture and sport and national economy. It is connected with the expansion of scales of sports actions and increase in interest of society in individual and group sports occupations where the additional market supply and demand on the rendered sports services is formed. At the same time, there is fierce competition which induces the sports organizations to make and provide high-quality services, to introduce the innovation technologies and to the increase in the efficiency of the activity.

Besides, there is the commodity saturation, where two types of the market are allocated: the first appearance "The market of the seller - sellers have more rights, and buyers are more active; the second type "The market of the buyer - is more than power at the buyer, and sellers are more active".

At the same time, the nature of the market of services of physical culture and sports has communication with the features of territories (regions) of rendering these services. On the other hand, this market contributes much to the active development of the region and increase in its investment attractiveness.

### 4. Results

Construction of sporting facilities and holding large sports competitions renders long-term effect on the urban environment of municipal units where such events are held. On the example of the cities hosting large sporting events for the last 20 years it is possible to judge that the solution of city problems for the investment account in construction of sporting venues and infrastructure, necessary for competitions, is tended.

The rendered effect can be divided into the following groups:

- Town-planning;
- Social;
- Economic;
- Ecological. (Figure 2).

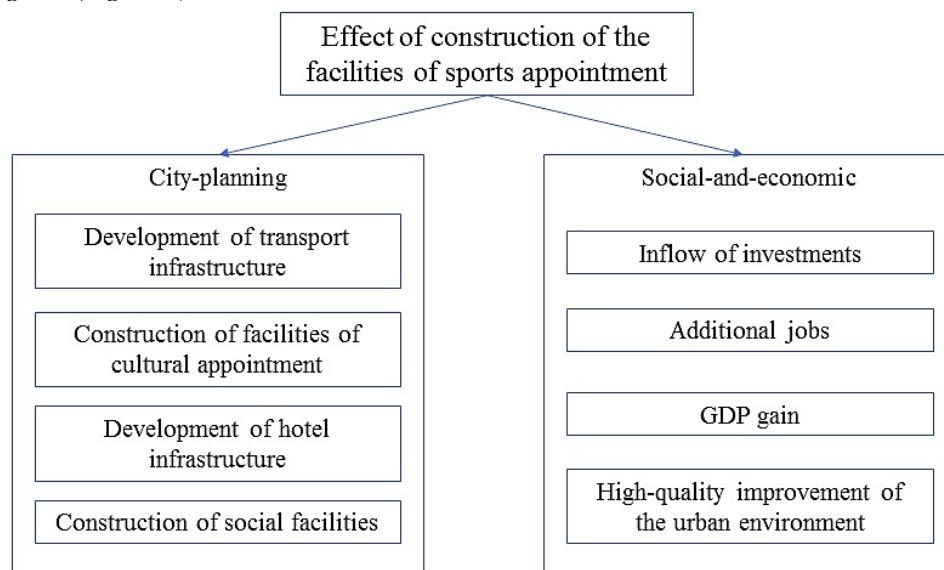


Figure 2. Classification of influence of construction of sports facilities on the urban environment

According to the existing legal acts, the state gives administrative support to municipalities in issues of development of infrastructure during the holding large-scale sporting events and construction of large sporting facilities.

In particular this support means:

- The accelerated terms of coordination of documentation and holding governmental activities on project appraisal,
- Simplification of approval process of the project documentation on planning of the territory,

• Possibility of change of regional regulatory legal acts for the needs of the infrastructure development.

It should be noted that when updating of the developed building of the city the great influence renders the integrated approach to placement of sports constructions on forming of the comfortable and qualitative urban environment. Development of sports infrastructure is the indicator of the quality level and comfort of life, both for the certain city, and for the state in general. With respect thereto, construction of sports constructions is one of priority tasks of federal and municipal authorities.

Facilities of sports appointment have to form the network having optimum indicator of availability to citizens. At the same time, it is necessary to consider that built sports construction have various functional focus and each separate sport requires the building corresponding on orientation.

Thus, design of placement of sports constructions is conducted at stage of development of the master plan and has significant effect on forming of the qualitative urban environment. Placement of sports constructions of the city has to provide availability to locals which is defined by transport and pedestrian radiuses of service which expansion is possible due to improvement and development of transport infrastructure.

Thus, we have complex network of city constructions of various orientation with need of ensuring certain level of availability, that is in design process of network of sports constructions of the city there is the need for the development of transport infrastructure.

Nevertheless, the construction of sports infrastructure is not the purpose itself. It serves only as a tool for the improvement of quality of life of the population, which was estimated in this article.

Data on level of living and security with sports constructions of Russia, Germany and Finland are provided in Table 1. On the basis of the table it is visible that the quantity of sports constructions on 100,000 people in Russia is 213 pieces while in Finland this indicator reaches 652, and total GDP of Russia is almost identical to GDP of Germany.

*Table 1. Level of living in Germany, Finland and Russia*

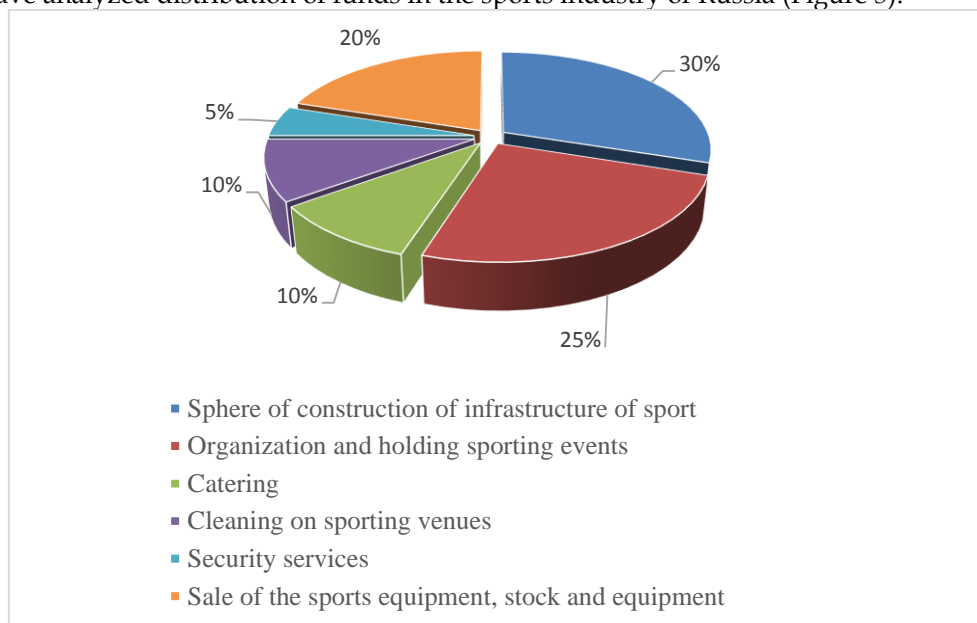
Indicators		Germany	France	Russia
Population size / persons		83,019,200	5,519,586	146,510,064
Quantity of sports constructions		231,441	36,000	311,905
Quantity of sports constructions on 100,000 people		279	652	213
GDP (at par consumer capability)	Total	4.356 trillion dollars	46,380 billion dollars	4, 213 trillion dollars
	Per catipa	52,470 dollars	46,380 dollars	28,755 dolars
Average salary / month	Per catipa	3,979.22 euro (283,619 rubles)	3,560.59 euro (253,781 rubles)	46,509 rubles
Living minimum / month	Per catipa	1,240 euro (88,381 rubles)	1,170 euro (83,392 rubles)	11,185 rubles
Minimum salary / month	Per catipa	1,526 euro (108,757 rubles)	1,700 euro (121,167 rubles)	11,185 rubles

Comparing the provision of the population with sports facilities and GDP (according to the purchasing power) per capita it is possible to draw the conclusion that, nowadays the budget allocated for the development and maintenance of sports infrastructure in Russia is not sufficient [18].

In modern financial and economic conditions of the development of the infrastructure of sport in Russia the investment attraction is the key factor for the solution of many problems. There are fulfilled investment attraction methods thanks to which the investor is capable to find necessary financing sources for implementation of the business projects. However, starting this or that project, it is necessary to estimate in details all the risks, nuances and problems of its realization, including the investment climate, investment

profitability, investment policy, the investment mechanism, investment strategy, investment process, the investment management, the investment budget, investment behavior and, at last, investment potential.

We have analyzed distribution of funds in the sports industry of Russia (Figure 3).



*Figure 3. Distribution of funds in the sports industry of Russia*

It is not a fact, that the level of provision of the population with sports facilities directly guarantees its commitment to active lifestyle. For example, the provision with sport objects in Dmitrov, which is situated near Moscow makes 24%, and the share of the citizens who are systematically going in for sports makes 29%. There is one more example, e.i.: in Sergiyev Posad the provision with sporting facilities makes only 8%, and the share of citizens athletes exceeds 17%. Possibly, in Sergiyev Posad organizers of sporting events work with the population more actively that emphasizes once again importance of human factor in promotion of active lifestyle.

Statistically, the Belgorod region takes the 1st place among the regions of the Russian Federation according to the provision with sport facilities. The Moscow region in this rating only the 79th, Moscow - the 80th, St. Petersburg - the 76th. Whether but everything in fact is so badly in the Russian capitals? More likely, it is the result of imperfection of statistics which not fully reflects the valid picture. Ratio of quantity of the facilities of sport and the population in various regions and municipal units variously. However, and the need for them varies. That means not only the sizes of water mirrors or the areas of gyms and plane structures, but the priorities, traditions and the needs for these or those sporting facilities as well as the financial opportunities of regions and their inhabitants. The needs of the population for the infrastructure of sport differ.

According to the information posted on the website of the Government of the Moscow region in Moscow area in the next 5 years are going to construct 103 sports and improving complexes. In spite of the fact that today in the Moscow region 7,485 sports-and-improving and sports facilities work, it make only 14% of standard requirement. By 2017 Moscow area needs to come to average values across the Russian Federation. The regional target programme "Development of Physical Culture and Sport in the Moscow Region for 2013-2015 Years" according to which 50 sports and improving complexes have to be constructed has been for this purpose adopted. More than 6.4 billion rubles, and from local authority budgets of 600 million rubles are allocated for the programme of implementation from the regional budget.

The ratio between II (integrated indicator) of level of living and the number of sporting facilities in the territory of each region is provided in Table 2 made on the basis of data on integrated indicator [10]. Integrated indicator of level of living is the characteristic quality evaluation of life in the territory of the territorial subject of the Russian Federation made on the basis of the analysis of 72 indicators.

*Table 2. Integrated indicator of the level of living in the Russian regions*



##	Region of the Russian Federation	Quantity of sporting facilities	Quantity of population
1	Moscow	21,902	12,506,486
2	St.-Petersburg	7,697	5,351,935
3	Moscow region	10,721	7,503,385
4	Tatarstan	11,013	3,894,284
5	Belgorod region	5,892	1,549,876
6	Krasnodar region	10,396	5,603,420
7	Voronezh region	6,166	2,333,768
8	Khanty-Mansi Autonomous district	3,220	1,655,074
9	Lipetsc region	3,522	1,150,201
10	Kaliningrad region	2,029	994,599

According to the data provided in Table 2 it is obvious, that there are more sports constructions in regions with higher population. However, in the most inhabited territorial subjects of the Russian Federation (Moscow, Moscow region, St. Petersburg) more people are the share of each sports construction that speaks about quantitative lack of sports infrastructure. In less inhabited regions of Russia the population is provided with sports constructions [2, 12] better.

The following important characteristic of level of living is the index of quality of the urban environment. For the analysis of comfort of accommodation in the region are used 36 indicators among which:

- variety of cultural and leisure and sports infrastructure;
- availability of sports infrastructure.

The indicator of variety of cultural and leisure sports infrastructure pays off by means of coefficient of variation (variety) by the quantity of cultural and sports facilities in the city. The more in the city of different types of cultural sports facilities, the it is more than a coefficient and, respectively, the indicator is higher.

The indicator of availability of sports infrastructure pays off as follows: the first 50 percent of assessment on the indicator are calculated as share of the population living in radius of 2,020,800 meters from the sports grounds, in the total number of the population, the second 50 percent of assessment on the indicator are calculated as the relation of quantity of sports constructions to the population size of the city [3].

Turning on of these indicators in the system of forming of quality evaluation of the urban environment indicates the need of improvement of sports infrastructure for the cities of Russia on an equal basis with the level of illumination of streets and level of gardening.

On the basis of the above data we created Table 3 which proves the techniques of efficiency evaluation of activity of sports construction existing nowadays.

**Table 3.** Current and offered criteria for the evaluation of the efficiency of sports facilities (according to the internal corporate documentation)

Current criteria	Offered criteria
Assessment of the population which is regularly playing physical culture and sport in the region	Area of sports zone of object (for each sport)
Quantity of weeks, taken by sports activities of the people, regularly going in for sports	Operating costs
Actual load of sports facilities	Modern engineering systems equipment
Annual capacity of sports facilities	Sports equipment (level, type)
Calculation of the actual load of sports facilities	Regional features of location of sports facilities
Power of sports facilities depending on type	Typology of sporting facilities
Calculation of annual capacity of sports facilities	

Improvement of the criteria for evaluation of the efficiency of sports facilities construction is necessary for the improvement of quality of management of the subject. That in turn leads to the improvement of quality of the provided sports services.

## 5. Conclusion

At the moment the state gives rather great influence to questions of sport and its promoting in Russia. Demonstrates to it strategic objectives (to increase percent of the population playing sports up to 55%, to increase indicator of healthy life of citizens up to 67 years) the Ministries of dispute. Nevertheless, not enough attention is paid to efficiency evaluation of the sporting venue that reduces the speed of achievement of strategic objective. Thus, the change of the register of sports facilities will have the beneficial effect on promoting of sport in the territory of the Russian Federation as the citizens will be able to obtain all the necessary information on sports facilities and to choose the most suitable one quickly. On the other hand, the change of technique of efficiency evaluation of sporting venues will allow to optimize work of constructions that will allow them to increase quality and the quantity of the provided services, and accounting of regional specifics will provide to the population availability of the most demanded sports.

Thus, the competent management of the sporting venue and information on it will allow regions of Russia to popularize sports and healthy lifestyle more actively. That, undoubtedly, favorably influences successful development of each region and country in general as promotes improvement of quality of life of the population and preserving and accumulation of human capital.

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# Influence of Large Sporting Events on the Development of Infrastructure of the Region and Its Investment Attractiveness

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## Abstract

Holding large sporting event preparation for which requires construction of sporting venues and development of the corresponding infrastructure can render the significant effect on development as national economies in general, and on the urban environment of single municipal units. This article considers the impact on the development of infrastructure of the region which is made by holding large sporting events. It is proved that now the countries which hold large sporting events often begin their planning long before holding the action (10 years and more). The creation of infrastructure for athletes, tourists and the audience the most important thing in this process. However, material factors (new sports constructions, new roads, hotels, the modernized engineering infrastructures) and non-material factors (positive image, improvement) are not less important benefits, which will be received by the region and the population thanks to the implementation of the large-scale project. According to the conducted research it is possible to note that the considerable investment resources are provided to the regions which have acquired the right to host large sporting event, at the same time, also responsibility for efficiency of their development is conferred.

**Keywords:** infrastructure, development of the region, investments, sporting event, development, planning, construction, image of the region.

## 1. Introduction

In the modern world the great value is attached for the development of various sports directions, in particular, for the large-scale sports events.

Large sporting events of the international level have huge impact on functioning of national economies of the country, but they make the strongest impact on the development of the region infrastructure, level of its providing with human resources and investment attractiveness for the potential investors.

The countries, holding sports mega-events, begin their planning long before holding this action (generally beginning of 8 years and more). One of the main in this process is the creation of certain infrastructure for athletes and that is important, for the audience. We should not lose sight of the most important factors, such as: material benefits (modern sports constructions, new roads, hotels, advanced engineering infrastructures) and intangible benefits (positive image) which will receive the region and the population from implementation of such large-scale project. Considerable investment resources are always provided to the regions which have acquired the right to host large sporting event as well as the responsibility for efficiency of their development is conferred.

Modern large-scale sports are the serious commercial action. Such competitions bring quite good income which is distributed among the organizers of the event later. Sporting events of large-scale sort represent important sports and global cultural event, drawing to themselves attention of thousands, millions and billions of people practically worldwide. Thus, it is necessary to create the positive image, the international authority and recognition for the country which applies for role of the hostess.

It is also important for the other participants of the event, including various sports organizations, the enterprises of small and medium business, sponsors and individual entrepreneurs, and other persons, who participate in the organization of sales process of the actions.

The examples of active participation of the cities of Russia in the organization and carrying out in the territory of large-scale sporting events which influence not only development of sport in national and international scales are used, but also create favorable conditions for investments into the tourist industry of the country became the practical material of this research. Improvement of the Russia's image and the creation of brands of the cities by the means of sports component can be performed basing on holding the international sporting events, such as World Summer Universiade - 2013 in the city of Kazan, the 2014

Winter Olympics in the city of Sochi, the water sports World Cup in Kazan in 2015, the World Ice Hockey Championship with washer of 2016 will be held Moscow and St. Petersburg, the 21st FIFA World Cup of FIFA which final tournament took place in 2018 in Russia in 11 cities at 12 stadiums, the World university and student's sports competitions of the 29th (XXIX) Winter Universiade which will take place in 2019 in the Russian city of Krasnoyarsk. Along with that the need for development and promotion of the idea of creation of image of the territory among the population and its positioning as reference point of sports and tourist development appears.

The relevance of the chosen subject of research is defined: first, lack of complex developments of theoretical bases of development of sports event marketing for the purposes of development of the city and the region; secondly, requirement of more complete use of capacity of the sphere of event marketing with orientation to increase in attractiveness of the territory; thirdly, insufficiency of methodical providing for forming of the competitive offer of the territory based on holding sports event. At the same time the methodology of efficiency evaluation of marketing events in the majority of publications is absent. Low-investigated there are issues of systematization of instruments of promotion of geo-brands, efficiency of branding and event marketing. Many questions connected with intrinsic aspects of geo-brand, territorial branding, event marketing, efficiency of marketing communications remain poorly studied. It causes the need of research of the efficiency of sports event marketing from geo-brand value position and also the choice of subject, goal setting and research problems of final qualification work.

## 2. Literature Review

Information base of this research was presented by monographs, theses, publications in scientific publications and periodicals, statistical and analytical documents, activities reports in the field of sustainable development within preparation and holding the XXII Olympic Winter Games and the XI Paralympic Winter Games in Sochi, the action programmes of the Organizing committee of Sochi 2014 in the field of sustainable development, interests and expectations of internal and outer sides, monthly short reports on influence of Games. The information on activity and competence of executive bodies of regions is usually public and provided on their websites.

The significant contribution on studying of the problems of economy, the organization and management of physical culture and sports, such scientists as Alyoshin V.V., Aristov L.V., Bannikov A.M., I. S. Barchukov, Bloodless V.A., Vakalova L.G., Vilkin Ya.R., Gadzhiyev A.A., Galkin V.V., Zhestyannikov L.V., Zholdak V.I., Zavadskaya Z.L., Zoidov K.H., Zolotov M.I., Zubarev Yu.A., Kosovo Yu.A., Kuzin V.V., Kuzmicheva E.V., Kutepov M.E., Mirsaidov A.B., Novokreshchenov V.V., Nogumanov, R.U., Pochinkin A.V., Radzhabov R.K., Saidov M.H., Samandarov I.H., Smirnov M.O. and others.

## 3. Methodological approach: Concept of development of infrastructure for holding large sporting events on the example of World Cup 2018

The controlling FIFA committee pays the main attention to the projects directly related to ensuring holding the World Cup during the preparation for actions, namely:

- Subjects to sports appointment;
- "Fan zones";
- Hotel infrastructures;
- Transport infrastructure.

Also the International Federation of Association Football (FIFA) makes the following demands to the country organizer of the World Cup:

- Creation of the transport infrastructure conforming to the requirements stated by the International Federation of Association Football
- The right of free pass for the audience between host cities of matches
- Handling capacity of the airports of not less than 20% of total capacity of stadiums
- Service of the international flights, ensuring takes off and landing of planes at night day

The Concept of transport service of World Cup 2018 has been developed during the preparation for holding action in the Russian Federation. The main task of the Concept is the assessment of the existing transport infrastructure in host cities, distribution of traffic of arrival and departure of visitors of the World Cup as well as the development and providing measures for modernization of the existing system of transport to the level corresponding to criteria of FIFA.



The concept of the transport service for the FIFA World Cup of 2018 in Russia possesses the whole range of the mandatory requirements necessary for the execution, namely:

- Respect for stability, efficiency, safety of functioning of the transport system when transporting participants and guests of the championship;
- Ensuring the balanced work of the transport system (mainly at the expense of public transportation);
- Observance of the requirements of the international environmental standards and ensuring availability to persons with limited opportunities;
- Creation of the effective heritage for the created infrastructure facilities.

The offer on forming of the uniform transport environment, the scheme of tourist traffic for competitions, the organizations of long-distance transportations became the result of the Concept development. According to the Concept, the integrated approach to the modernization of transport infrastructure both the Russian Federation in general, and host cities of competitions in particular are being developed.

The movement of guests of the championship within the city, ensuring effective and trouble-free operation of transport hubs and the main points of attraction of fans, for example, of "Fan zones" and also service of stadium and adjacent territories were in the zone of responsibility of regions within ensuring transport availability of objects World Cups 2018. It is necessary to note, that the issues of the development of large infrastructure facilities as well as financings of actions for their development belong to federal level.

The main idea of the Concept is preserving of unique spirit of the city and also ensuring the maximum availability of sporting facilities to guests and participants of the championship. According to the approved Concept, all the facilities of transport and tourist infrastructure have to be in the close proximity to sports facilities.

The Programme of preparation for carrying out in 2018 in the Russian Federation of the FIFA World Cup which consists of 272 actions with distribution of responsibility for their realization, completion dates and financing sources was developed and approved in addition to the Concept. Several subprogrammes are included into the programme, namely:

- Construction and reconstruction of sporting facilities;
- Construction and reconstruction of hotel infrastructure;
- Construction and reconstruction of the transport system;
- Preparation of communications infrastructure;
- Preparation of health care system;
- Preparation of auxiliary infrastructure of sporting facilities;
- Construction and reconstruction of power supply facilities;
- Realization of the preparatory activities connected with construction of stadiums;
- Realization of other actions connected with preparation for holding the FIFA World Cup;
- Safety;
- Realization of actions for the programme management.

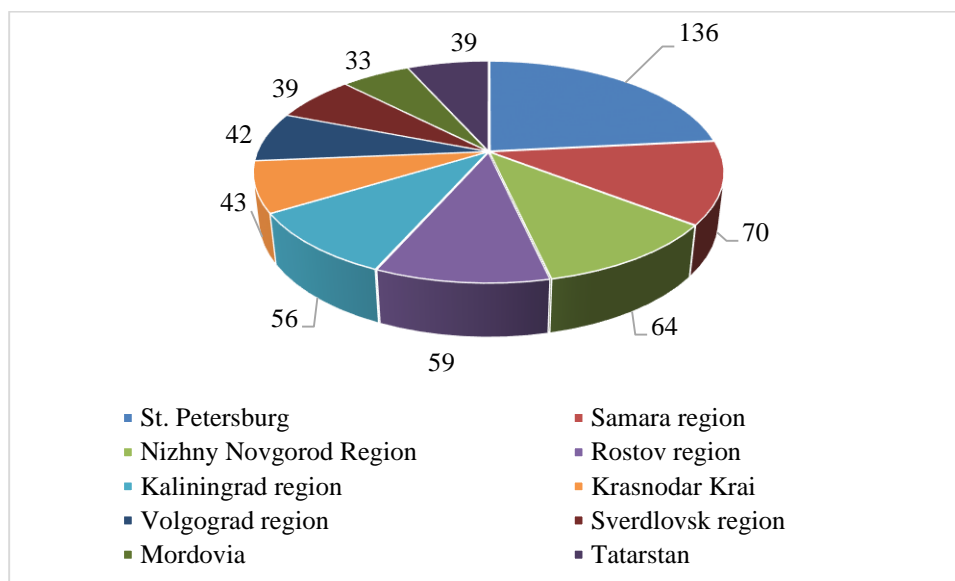
Realization of the actions provided within the programme had significant effect both on the quality of the held event, and on the city infrastructure of host cities. That allows to speak about the significant improvement of the urban environment.

#### 4. Results

The total effect of World Cup-2018 organization on GDP of the country in 2013-2018 was estimated as 820 billion rubles according to McKinsey, 678 billion rubles were allocated with the budgets of various levels.

Such influence on GDP (presented on Figures 1, Table 1) was caused by the essential volume of investment into infrastructure, expenditure of tourists during the championship and also other expenses for preparation of action. The increase in GDP has led to the growth in incomes of the population and created more than 220 thousand jobs as well.



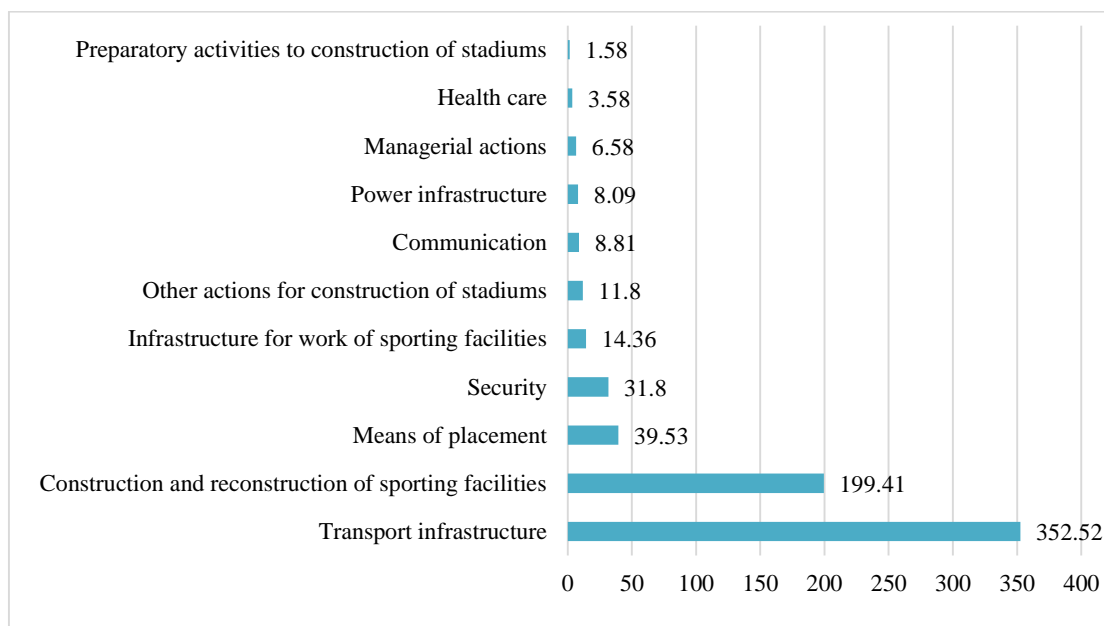


**Figure 1.** Contribution of preparation and holding World Cup 2018 to Russia's GDP according to regions organizers' data (billion rubles)

**Table 1.** Influence of World Cup 2018 on GDP by years

Years	Contribution to GDP, billion rubles
2013	15
2014	68
2015	114
2016	169
2017	222
2018	232
2019-2023 (annually)	120-180

The contribution of preparation and holding of World Cup 2018 to GDP of the country was about 1% of annual figure, besides the influence of the championship on the economy was essential even after the end of competitions and made up about 120-180 billion rubles in year (Figure 2).



**Figure 2.** Costs for World Cup 2018 from the budget for branches of the national economy, billion rubles

Thus, not construction of sports buildings and constructions, and expenses on transport infrastructure became the most essential cost item by preparation for World Cup 2018 that speaks about the large volume of investments into municipal economy at the organization of large sporting events.

For completeness of understanding of influence of large sporting events on the urban environment of regions organizers of World Cup 2018 it is necessary to consider in more detail the infrastructure changes performed by preparation for competitions (Table 2).

**Table 2.** Infrastructure transformations in host cities of World Cup 2018

City	Infrastructure transformations
Volgograd	<ul style="list-style-type: none"> <li>• Reconstruction of the airport;</li> <li>• Construction of the additional terminal;</li> <li>• Reconstruction of the railway station;</li> <li>• Construction of rail road spur;</li> <li>• Capital reconstruction of road and transport network;</li> <li>• Reconstruction of embankments;</li> <li>• Construction of facilities of municipal infrastructure;</li> <li>• Construction of hotels;</li> <li>• Modernization of medical institutions;</li> <li>• Development of park zones</li> </ul>
Yekaterinburg	<ul style="list-style-type: none"> <li>• Reconstruction of roads, construction of new outcomes;</li> <li>• Reconstruction of the airport;</li> <li>• Reconstruction of the railway station;</li> <li>• Updating of the park of urban transportation;</li> <li>• Improvement of park zones;</li> <li>• Restoration of facades of historical buildings;</li> <li>• Gardening of the city;</li> <li>• New stops and booths;</li> <li>• Cleaning of the city of outdoor advertising;</li> <li>• Creation of the public underground parking;</li> <li>• Construction of sports grounds</li> </ul>



Kaliningrad	<ul style="list-style-type: none"> <li>• Reconstruction of the airport;</li> <li>• Repair is expensive;</li> <li>• Modernization of park zones;</li> <li>• Reconstruction of embankments;</li> <li>• Development of hotel infrastructure</li> </ul>
Nizhny Novgorod	<ul style="list-style-type: none"> <li>• Modernization of the airport;</li> <li>• Reconstruction of the railway station;</li> <li>• Modernization of the subway;</li> <li>• Reconstruction of roads;</li> <li>• Improvement of current state of park zones and embankments;</li> <li>• Gardening of the territory;</li> <li>• Repair of facades of buildings;</li> <li>• Development of hotel infrastructure</li> </ul>
Samara	<ul style="list-style-type: none"> <li>• Modernization of the airport;</li> <li>• Reconstruction of the railway station;</li> <li>• Introduction of contactless pay system in the subway;</li> <li>• Reconstruction of transportation network of the city;</li> <li>• Construction of hotels;</li> <li>• Repair of facades of buildings;</li> <li>• Reconstruction of park zones;</li> <li>• Improvement of embankments;</li> <li>• Repair of city hospitals;</li> <li>• Purchase of the modern medical equipment</li> </ul>
Rostov-on-Don	<ul style="list-style-type: none"> <li>• Construction of the airport;</li> <li>• Construction of road outcomes, bypass roads, bridges;</li> <li>• Construction of the intercepting parking;</li> <li>• Repair of facades;</li> <li>• Improvement of park zones;</li> <li>• Arrangement of embankments;</li> <li>• Repair of city hospitals;</li> <li>• Purchase of the modern medical equipment;</li> <li>• Updating of the park of the city equipment</li> </ul>
Saransk	<ul style="list-style-type: none"> <li>• Reconstruction of the airport;</li> <li>• Modernization of the railway station;</li> <li>• Reconstruction of recreation center;</li> <li>• Construction of the new body of higher education institution;</li> <li>• Development of hotel infrastructure;</li> <li>• Arrangement of park zones;</li> <li>• Repair is expensive</li> </ul>

Thus, data of the comparative table confirm large-scale modernization of infrastructure of host cities of World Cup 2018 and significant influence of holding sporting events on forming of the qualitative and comfortable urban environment (Figure 3).



*Figure 3. New stadium constructed on the left coast of Oka river in Nizhny Novgorod for World Cup 2018*

Common features of development of the cities when holding large sporting events are:

- Reconstruction and construction of facilities of transport infrastructure (airports, stations, roads);
- Development of network of sporting venues;
- Development of public spaces;
- Construction and reconstruction of hotels;
- Modernization of medical infrastructure.

In addition, the positive effect consists in loading of the existing capacities, creation of additional jobs, growth of employment of the population, development financing of regions from the federal budget, increase in business activity in the construction industry and economic growth of host cities.

## 5. Conclusion



Thus, holding the international sporting event can potentially bring both for the country, and for the region sure and indirect economic benefits. The capital construction and construction of infrastructure facilities connected with this action, long-term benefits, such as decrease in forwarding charges thanks to improvement of network automobile or the railroads and also the tourism expenditure coming from other cities and the countries for visit of games are among sure gains. Indirect benefits can include effect of advertizing which represents the accepting city or the country as the potential destination for tourism or business in the future, and strengthens feeling of civil pride and national community and also raises prestige of the accepting city or country [7]. But there are also potential negative sides connected with possible increase in the required volume of financial resources, inefficient use of the earth, inadequate planning and insufficient use of objects that determines need of the use of various tools by forecasting and prevention of these threats.

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## Investigation of Psychometric Properties of Female Muscularity Scale

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### Abstract

**Objective:** The aim of this study was to investigate the psychometric properties of the Female Muscularity Scale (FMS).

**Method:** Two different samples were determined to reach the research aim. The first of these is a sample of 153 female participants doing exploratory factor analysis. The second sample consisted of 213 women exercising with confirmatory factor analysis and additional analyzes. IBM SPSS Statistics 22 and AMOS 22 software were used in the analysis of the obtained data.

**Results:** According to the results of Exploratory Factor Analysis, the two-factor structure was determined as attitude and behavior according to the results of exploratory factor analysis. As a result of the exploratory factor analysis conducted to test the construct validity of the inventory, 68% of the two-factor structure variance was determined. Internal consistency coefficients were calculated to test the reliability of the scale. Internal consistency coefficients obtained for 213 participants were 0.94 in the "Attitude" sub-scale and 0.92 in the "Behavior" sub-scale. The results of the Confirmatory Factor Analysis ( $\chi^2 / sd$  (2.231) value, especially the index of fit, indicates that the model shows a good fit. The results of the confirmatory factor analysis conducted to test the construct validity of the scale showed that the indices of the scale, which consisted of two sub-scale, totaling 10 items, were acceptable.

**Conclusion:** In conclusion, the results of the study revealed that the 10-item FMS is a useful scale for determining the level of drive for muscularity in the Turkish sample of female participants.

**Keywords:** Drive for muscularity, Woman, Athletes, Female muscularity.

### 1. Introduction

Body image research focused primarily on women and the desire to achieve a slim physique widely<sup>1</sup>. Relatively little is known about the risk factors for body dissatisfaction in men and women<sup>2</sup>. Although relatively few men and women perceive their bodies as too large, traditional assessment methods may have underestimated the prevalence of body dissatisfaction in men<sup>3</sup>. One limitation of previous research is that evaluating desired body shapes cannot distinguish between increased fat in general and increased muscle mass<sup>4</sup>. Classical psychological theory suggests that there are three main categories of body structure: endomorph, mesomorph, and ectomorph. In the mesomorphic category, a hyper mesomorphic or muscular mesomorphic subtype is defined, which means a "muscular" body shape characterized by the well-developed chest and arm muscles and broad shoulders tapering to a thin waist<sup>5</sup>. The vast majority of research on body image has ignored the hypermomatic or muscular mesomorphic body structure subtype that might be particularly relevant when investigating body image in men. In recent years, there has been increased interest in body image studies related to muscularity<sup>6</sup>. Increasing evidence suggests that many men have body image concerns and reported impaired self-esteem as a result of dissatisfaction with their bodies<sup>3,7</sup>. Women often try to lose weight, while men often try to increase their weight<sup>3</sup>. Indeed, research has shown that most men want to be more muscular and often assume a muscular appearance is more attractive to women<sup>8</sup>. However, studies show that women tend muscularity in recent years<sup>9</sup>.

One of the scales transferred to the context of women is the drive for muscularity scale. For example, the 15-item The Drive for Muscularity Scale (DMS) is a self-report measure that assesses the interest in gaining both weight and muscle mass<sup>10</sup>. However, although the scale was shown to have acceptable internal consistency among women ( $\alpha = .82$ ), the factor structure found in male samples was not supported in studies with women. So, there are no separate sub-scales for concerns and behaviors of muscularity or not<sup>11</sup>. In addition, this scale shows no relationship with body dissatisfaction criteria or self-esteem among female dissatisfaction and adolescent women and shows that muscularity concerns come short the valuation criteria<sup>10, 12</sup>. This may be because the Drive for Muscularity Scale items especially emphasizes male muscularity. Similarly, the Swansea Muscularity Attitudes Questionnaire (SMAQ) evaluate the pathways associated with gaining muscularity to activities aimed at potentiating<sup>6</sup>. Since the SMAQ was originally

designed for men, a version for women has been created by adapting the wording of the items to adapt the scale to more female views (e.g. by replacing the term masculine with the feminine). However, this adapted version failed to demonstrate the convergent validity with DMS and demonstrated low internal consistency, particularly for sub-scales measuring perceived benefits of muscularity<sup>12</sup>. As such, SMAQ is limited in its usefulness as an assessment tool for studying drive for muscularity among women.

The Drive for Muscularity Scale (DMS) evaluates the importance given to muscles, increasing muscularity, and behaviors that increase muscularity<sup>13</sup>. However, the scale showed only a small proportion of variance shared with a measure of desire for a muscular body and its association with lifting weight behavior reported in women was only minor to moderate. The fourth version of the Socio-Cultural Attitudes towards the Appearance Questionnaire, which includes the muscular body internalization sub-scale, was developed<sup>14</sup>. Although this sub-scale includes an item that assesses participation in muscle-building behaviors, the evaluated superstructure is not dissatisfaction or anxiety regarding personal muscle level and related behaviors, but support for ideal muscles shape. Therefore, adapting the scales originally developed for men, as demonstrated by the lack of incorporation with more general body image anxiety measures that may result from gender differences. Social ideals for assessing muscularity concerns and associated behavior among women appear to have limited success in generating a useful tool for muscularity<sup>11</sup>. For this reason, the previously developed muscularity scale may be the most appropriate scale to assess such anxiety through activities that traditionally follow male muscularity types and in women, such as weight training or bodybuilding<sup>15</sup>. However, most women do not want to gain more muscle mass. Because it contradicts the slim-ideal body understanding of a thin and toned female body. Distinguishing muscle mass and muscle tone can be particularly helpful in understanding women's concerns. Therefore, this scale, which evaluate muscle concerns specifically related to the female slim and athletic body ideal, including muscle tone, is essential to understanding the role these concerns play in body image dissatisfaction in women.

Consequently, the aim of this study was determined to examine the psychometric properties of the female muscularity scale in women who exercises.

## 2. Method

Two different samples were determined to achieve the research aim. The first of these is the sample group consisting of 153 female participants who exercises, in which the exploratory factor analysis is performed. The second sample is the sample group consisting of 213 female participants who exercises, in which confirmatory factor analysis and additional analyzes were performed.

### 2.1. Participants

For exploratory factor analysis, FMS was applied to women between the ages of 18-45 who exercises. Participants in the study were women from different exercise branches (swimming (n = 14), pilates (n = 13), reformer (n = 20), walking (n = 23), jogging (n = 11), zumba (n = 32), dance (n = 20), extreme sports (n = 7) and fitness (n = 13)). The average of the experiences of women participating in the study is  $4.53 \pm 2.917$  years.

For confirmatory factor analysis, FMS was applied to exercising women aged 19-48 years. Participants in the study were women from different exercise branches (swimming (n = 14), pilates (n = 43), reformer (n = 29), walking (n = 30), zumba (n = 47), dance (n = 22), and fitness (n = 28)). The average of the experience of women participating in the study is  $5.27 \pm 3.816$  years.

### 2.2. Data Collecting Tool

FMS is a scale developed by Rodgers ve ark. (2018)<sup>9</sup> to evaluate the psychometric properties of the female muscularity scale in women who exercises. The scale is a 5-point Likert-type scale (1 = Strongly disagree-5 = Strongly agree) consists of 10 items.

### 2.3. Translation Process

In the process of translating the scale into Turkish, the standard "translation-back translation" method suggested by Brislin (1970)<sup>16</sup> was used. The scale was translated from English to Turkish and then back to English with this method. The scale was separately translated from English to Turkish by two experts working in the field of English linguistics. The items in the scales obtained were examined by these two experts and four experts from the field of physical education and compared with each other and items with

the same translation were determined. Each translation type of the articles with the same translation and the items with different translations was given to the expert again and translated back into English. The accuracy of the translation was evaluated by comparing the reversed form with the original in terms of meaning and form, and the scale was finalized. In the process of translating the scale into Turkish, a new expression was not developed, it completely adhered to its original form. In addition to demographic characteristics of the participants such as age, height and weight, a 6-item personal information form created by the researchers were used to determine how much, how often, and for how long they participated.

#### 2.4. Data Analysis

IBM SPSS Statistics 22 and AMOS 22 package programs were used for the analysis of the data obtained after the application. First, Explanatory Factor Analysis (EFA) was used to examine the factor structure of the scale. Second, the accuracy of individual parameters was tested using the confirmatory factor analysis (CFA) results and then the suitability of the created high-level model was tested. In the CFA method, it was analyzed based on the Maximum Likelihood Estimations. Fit indices based on CFA, Chi-square- $\chi^2$ , Goodness of Fit Index (GFI), Standardized Root Mean Square Residual (SRMR), Root Mean Square Error Approximation (RMSEA), Comparative Fit Index (CFI), Normed Fit Index (NFI) is the Non-Normed Fit Index (NNFI). It is stated that RMSEA and SRMR values indicate a good fit in the range of 0-0.05 and acceptable fit in the range of 0.05-0.10; NNFI and CFI values between 0.97-1 indicate good fit and 0.95-0.97 indicate acceptable fit; NFI and GFI values between 0.95-1 indicate good fit and 0.90-0.95 acceptable fit. Secondly, the relationship between the sub-scale of the scale was examined with the Pearson correlation coefficient. Finally, to determine the reliability of a Likert-type scale, Cronbach's alpha values, which are the best way to test internal consistency, were examined in the study. Also, the test-retest method, which is an additional method for reliability, was also used. The final form was applied to 55 participants at 15-day intervals and examined with the Pearson correlation coefficient. The suitability of the number of participants was determined by Kaiser-Meyer-Olkin (KMO). The KMO participant suitability coefficient obtained for this study is 0.88. The fact that the Chi-square value of the Barlett Sphericity test, which is used to check whether the data comes from the multivariate normal distribution, is 957.118 ( $p < 0.001$ ) indicates that the responses to the scale items are factorability.

### 3. Results

#### 3.1. Structure Validity

To evaluate the construct validity of the Female Muscularity Scale, exploratory factor analysis, confirmatory factor analysis, item discrimination, and item-total correlation techniques were used.

#### 3.2. Exploratory factor analysis

Factor analysis is a statistical analysis performed to obtain evidence regarding whether the scale measures the structure it wants to measure or not in scale development and adaptation studies. According to Büyüköztürk (2006)<sup>17</sup>, factor analysis is an effort to explain the measured structure with the least number of factors by using variables that measure the same structure together. For this reason, to determine the factor loadings and factorability status of the items in the scale, exploratory factor analysis was performed. Before starting the exploratory factor analysis, the accuracy of the data was tested. Evaluations were made whether the data collected represented the sample or not.

There are different ideas about sample size in exploratory factor analysis. For example, Comrey and Lee (1992)<sup>18</sup>; state that 50 people are very good and 100 people are weak, 200 is medium, 300 is good, 500 is very good and 1000 is the perfect sample number. However, Tabachnick and Fidell (2001)<sup>19</sup> state that a large sample is not needed to obtain a high load value, therefore 150 people are sufficient. Another opinion belongs to Kline (1994)<sup>20</sup>. According to Kline (1994)<sup>20</sup>, the sample size depends on relative criteria such as the number of items or factors, and the sample size should be 10 times the number of items.

Apart from these, another test evaluating the appropriateness of factor analysis to be made for sample size is Kaiser-Meyer-Olkin (KMO)<sup>21</sup>. High KMO means that each variable explains another variable perfectly. The values taken as the basis for evaluating the KMO test are as follows: The value between .50- .60 is bad, the value between .60 and .70 is weak, the values between .70 and .80 are medium, the values between .80 and .90 are good and .90 It can be interpreted that the values on it are in perfect conformity<sup>22</sup>. In this study, it

is seen that the Kaiser-Meyer-Olkin value was calculated as .88. Accordingly, it can be said that the sample size is perfectly suitable for factor analysis. In addition, the results of the Bartlett's test of sphericity, which was made regarding whether the data came from the multivariate normal distribution, were also interpreted ( $\chi^2=957.118$ ;  $p=.000$ ). Accordingly, Bartlett's test of sphericity results shows that although the data come from the multivariate normal distribution, it is suitable for factor analysis.

When performing factor analysis, whether all items in the scale are under the defined factor structure or not depends on the significance of the load value, which shows its relationship with that factor. Although there are still different opinions about the value that the item factor loadings should be, it is seen that it is preferred that this value should be .45 and above<sup>20, 17</sup>. It is also known that this value is accepted up to .30. In this study on the Female Muscularity, factor loading was determined as .30. As a result of the factor analysis made with all items, there is a two-factor structure with an eigen value above 1. However, Lord (1980)<sup>23</sup>; In the first factor, the factor loading is high and the factor eigen value variance and factor eigen value it explains are high in parallel to this, whereas the similarity between the eigen values of the second factor and the next factor, if any, indicates unidimensionality, the opposite of this multidimensionality. Büyükoztürk (2007)<sup>24</sup>, on the other hand, as a piece of additional information, observing more than one sudden decrease after the first factor in the sloping plot of eigen values. The fact that there is a horizontal change afterward may prove that the scale has a factorial structure in the number of sudden decreases. Because the number of factors was determined as 2 in the analysis, there was no overlap. Therefore, the main elements that should be evaluate on Table 1 is the factor loading of the items. Accordingly, data breakpoint was accepted as .30. It has been observed that all items meet this acceptance. Table 1 is given, showing the factor load values, and then the scree plot was evaluated as additional evidence for this situation.

*Table 1. Factor loadings*

	The Female Muscularity Scale	
	Attitude	Behavior
FMS4	,902	
FMS3	,863	
FMS5	,718	
FMS1	,676	
FMS2	,633	
FMS6		,862
FMS7		,855
FMS9		,747
FMS8		,620
FMS10		,430

As seen in Table 1, the factor loadings of all items in the scale vary between .43 and .90. According to Kline (1994)<sup>20</sup>, factor loadings between 0.30 and 0.60 indicate a medium level, and between 0.6 and 1 indicates a high level. However, the amount of variance explained by the two-factor structure is 68%. Especially in two-factor structures, according to Scherer, Wiebe, Luhter, and Adams (1988)<sup>25</sup>; the variance explained is between 40% and 60% in social sciences. In addition, the variance explained by the female muscularity scale is at an acceptable level. When the slope accumulation graph that supports this decision is examined; After the first point, the slope makes a plateau at two different points. In addition to this, as seen in Figure 1, it is seen that the eigen value of the two factors of the scale is above 1.



Figure 1. Slope plot graph

### 3.3. Confirmatory Factor Analysis

Another analysis conducted to increase the validity evidence of the scale is the confirmatory factor analysis. Confirmatory factor analysis on 213 people was conducted with the knowledge that all items measure two different factors. The two-factor structure of the Female Muscularity Scale determined by the maximum possibility analysis was tested by CFA. To apply the maximum possibility method, there must be a certain hypothesis. This hypothesis should be provided by the size of the sample size, it should be ensured that the multivariate normality hypothesis is encountered and the variables are continuously variable. To apply the maximum possibility method, the scatter diagram matrix was examined to test the multivariate normality hypothesis and the distributions were found to be suitable for the multivariate normality<sup>26</sup>. A second element is a hypothesis that the normality distributions of the data are coincident. In this case, the skewness and kurtosis values were examined, and the skewness value was found to be 1.39, and the kurtosis value 1.50. According to Tabachnick and Fidell (2001)<sup>19</sup>, the values of skewness and kurtosis in the range of -1.50 - +1.50 indicate that the data show a normal distribution. In this study, CFA was performed after the hypothesis was provided. The researchers used different fit indices to evaluate the model's compatibility with the data. The most used fit indices are ( $\chi^2$ , sd,  $\chi^2$ /sd, GFI, AGFI, NFI, CFI, SRMR, and RMSEA values). However, in this study, other fit indices were also included. The point that should be considered here is that the  $\chi^2$  value is sensitive to the sample size and as the sample size increases, they tend to differ. The fit indices of the analysis are given in Table 2 in detail.

Table 2. Measurement Model Goodness of Fit Indices

Model fit indices	Value	Acceptable fit criteria	Perfect fit criteria
$\chi^2$ /df	2.231	$2 \leq \chi^2 / sd \leq 3$	$0 \leq \chi^2 / sd \leq 2$
AGFI	.891	$.85 \leq AGFI \leq .90$	$.90 \leq AGFI \leq 1.00$
GFI	.939	$.90 \leq GFI \leq .95$	$.95 \leq GFI \leq 1.00$
CFI	.978	$.90 \leq CFI \leq .95$	$.95 \leq CFI \leq 1.00$
NFI	.969	$.90 \leq NFI \leq .95$	$.95 \leq NFI \leq 1.00$
NNFI (TLI)	.968	$.90 \leq NNFI (TLI) \leq .95$	$.95 \leq NNFI (TLI) \leq 1.00$
RFI	.945	$.90 \leq RFI \leq .95$	$.95 \leq RFI \leq 1.00$
IFI	.979	$.90 \leq IFI \leq .95$	$.95 \leq IFI \leq 1.00$
RMR	.082	$.05 \leq RMR \leq .08$	$.00 \leq RMR \leq .05$
RMSEA	.076	$.05 \leq RMSEA \leq .08$	$.00 \leq RMSEA \leq .05$



SRMR	.026	.05 ≤ SRMR ≤ .10	.00 ≤ SRMR ≤ .05
PNFI	.663	.50 ≤ PNFI ≤ .95	.95 ≤ PNFI ≤ 1.00
PGFI	.674	.50 ≤ PNFI ≤ .95	.95 ≤ PNFI ≤ 1.00

When the fit indices are examined in Table 2, it was found as  $\chi^2=69.157$ ,  $sd=31$ ,  $\chi^2/df=2.231$ ,  $GFI=.936$ ,  $AGFI=.891$ ,  $NFI=0.969$ ,  $CFI=0.978$ ,  $SRMR=0.026$  and  $RMSEA=0.076$ . In addition, as a result of the maximum probability analysis, all items in the scale were determined to have high eigen values.

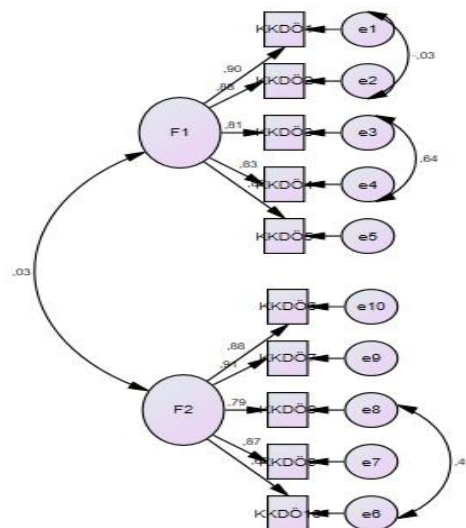


Figure 2. Explanation rates of the implicit value of the items

As seen in Figure 2, explanation rates of the factor structure of the items is between .79 and .91.

Table 3. The Female Muscularity Scale Between Sub-Scale Correlation Matrix

		Attitude	Behavior
Attitude	r	1	,761**
	p		,000
	n	213	213
Behavior	r	,761**	1
	p	,000	
	n	213	213

### 3.4. Item Analysis

Table 4. Item Analysis Results for Sub-Scale of Attitude

	FMS1	FMS2	FMS3	FMS4	FMS5
FMS1	1,000	,791	,712	,753	,751
FMS2	,791	1,000	,738	,736	,721
FMS3	,712	,738	1,000	,880	,659
FMS4	,753	,736	,880	1,000	,693
FMS5	,751	,721	,659	,693	1,000

$p < .001^{**}$

Table 4 shows the correlations of all items in the scale related to the Attitude sub-scale. Accordingly, it was determined that the total item correlation in the scale was between .70 and .88 ( $p = .000$ ). According to this table, it can be interpreted that the validity of the items under one factor is medium and high.

**Table 5. Item Analysis Results for Sub-Scale of Behavior**

	FMS6	FMS7	FMS8	FMS9	FMS10
FMS6	1,000	,799	,704	,760	,526
FMS7	,799	1,000	,709	,794	,575
FMS8	,704	,709	1,000	,702	,723
FMS9	,760	,794	,702	1,000	,538
FMS	,526	,575	,723	,538	1,000

$p < .001^{**}$

Table 5 shows the correlations of all items in the scale related to the behavior sub-scale. Accordingly, it was determined that the total item correlation in the scale was between .53 and .80 ( $p = .000$ ). According to this table, it can be interpreted that the validity of the items under one factor is medium and high.

### 3.5. Reliability

Cronbach Alpha reliability coefficient was evaluated to test the reliability of the scale. In the analysis, it was found that the reliability coefficient calculated for the two-factor structure was .94 in the attitude sub-scale of the scale and .92 in the behavior sub-scale. It is stated that the Cronbach Alpha reliability coefficient is between .70 and .80 has acceptable reliability, between .80 and .90 has a good level of reliability and if it is above .90 has a high level of reliability. In this case, it is possible to say that the reliability of the two-dimensional FMS scale is high.

**Table 6. Cronbach's Alpha Values for the Female Muscularity Scale**

	Cronbach's Alpha	Number of items
Attitude	,94	5
Behavior	,92	5
Scale Total	,83	10

### 3.6. Test-retest reliability

**Table 7. Test-Retest Values for the Female Muscularity Scale**

The Female Muscularity Scale	
	r: 0,79 p: ,000 n:55
	r: 0,82 p: ,000 n:55

As a result of the correlation analysis performed in terms of test-retest reliability, it was found that the Female Muscularity Scale scores in women did not change in time.

## 4. Discussion and Conclusion

The study aims to test the validity and reliability of the Female Muscularity Scale. For this aim, the first exploratory factor analysis was performed for construct validity. Cronbach Alpha coefficients were examined to determine internal consistency. A two-factor structure, attitude and behavior, was determined according to the results of the Explanatory Factor Analysis conducted to determine the factor patterns of the items in the DMS. Two-factor structure determined as a result of exploratory factor analysis conducted to test the construct validity of the scale explain 68% of the variance. Sub-scale factor loadings of the original scale developed by Rodgers et al. (2018)<sup>9</sup> are between 0.74 and 0.91 in the "Attitude" sub-scale. In the "behavior" sub-scale, it varies between 0.80 and 0.92<sup>9</sup>. Similarly, based on the findings and these results, we

can say that the factor loadings of DMS are at an acceptable level. At the same time, our findings Rodgers et al. (2018)<sup>9</sup> is in line with the findings obtained.

Internal consistency coefficients were calculated in testing the reliability of the scale. Internal consistency coefficients obtained for 213 participants were determined as 0.94 in the "Attitude" sub-scale and 0.92 in the "Behavior" sub-scale. Rodgers et al. (2018)<sup>9</sup>, on the other hand, internal consistency coefficients of .93 in the attitude sub-scale and .90 in the behavior sub-scale were obtained. The reliability findings we have obtained as a result of our research Rodgers et al. (2018)<sup>9</sup> is in line with the findings obtained. These values are above the 0.60-0.80 values, which are expressed quite reliably by Alpar (2001)<sup>26</sup>. Behavior sub-scale is below these values. However, although the item factor loadings are generally desired to be 0.45 and higher, items with a factor loading of 0.30 can also be kept in the scale<sup>20, 28</sup>. In this case, we can say that the factor loadings and internal consistency coefficients of the DMS are at an acceptable level, according to the results we obtained, which are parallel to the findings in the literature.

The factor structure of the Female Muscularity Scale was also tested with CFA. Firstly, fit indices values were calculated for the model with two latent variables (factors) specified in the original scale. The fit indices, especially the  $\chi^2/sd$  (2.231) value, indicate that the model has a good fit. Confirmatory factor analysis results to test the construct validity of the scale showed that the fit indices of the scale consisting of two sub-scale and a total of 10 items were at an acceptable level. When the obtained fit indices are compared with the good fit or acceptable fit indices values, it is seen that the model is within the measure of the good fit indices<sup>29</sup>. Fit indices and basic parameter estimates for the measurement model are compatible with the data of the model. These results are similar to the fit indices values of the original the Female Muscularity Scale developed by Rodgers et al. (2018)<sup>9</sup>. Rodgers et al. (2018)<sup>9</sup> calculated the fit indices values of the scale as a result of the analysis, he made in the participation of students studying at different universities of the United States, whose age range is 18-25; CFI = .97, GFI = .93, RMSEA = .08. Another finding is that the correlation and internal consistency results of the sub-scale of the scale are positive and significant. These results are in line with the findings obtained by Rodgers et al. (2018)<sup>9</sup>.

In conclusion, the findings of the study revealed that the 10-item FMS is a scale that can be used to determine the muscular drive level of Turkish exercise female participants. This study is important in terms of introducing a new scale to the Turkish literature that will be used to determine the muscularity levels of female participants who exercises in the field of sports and exercise psychology. But it does contain some limitations. Although the results revealed sufficient psychometric properties for this participant group, studies for different samples and age groups are needed. In future studies, keeping the participant size high will provide more reliable information. In addition, in other studies, the fear of negative evaluation of the muscularity in women, body image, eating disorders, etc. Its relation to the subjects can be examined.

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# Investigation of the Faculty of Sport Sciences Students' Identity Perceptions According to the Variables of Gender and Doing Sports

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## Abstract

The purpose of this study is to determine whether there is an effect of gender and sports on the sports science students' perceptions of identity. A total of 216 students, 96 (44.4) women and 120 (55.6) men studying at Faculty of Sport Sciences, Akdeniz University, participated in the study voluntarily. The mean age of the participants was determined as 21.31±1.37. In the data collection process, the Identity Scale developed by Çoşkun (2004) and a form to gain certain demographical information developed by the researchers were used. The identity scale consists of 35 questions, developed as 5-point likert and 3 sub-dimensions: personal identity, social identity and collective identity. The internal consistency of the collected data was examined with Cronbach's alpha and personal identity was found as .88, social identity as .77 and collective identity as .80. Statistical analyses were conducted with SPSS 25 package program, and frequency (f) and percentage (%) were used in descriptive statistics. In addition, independent sample t-test analysis was conducted to determine the differences between the two groups. As a result of the research, according to the gender, significant differences were found in favor of female participants in the personal identity sub-dimension, and in favor of male participants in the social identity sub-dimension. According to the variable of doing sports; there were statistically significant differences in favor of the participants doing sports in all sub-dimensions.

**Keywords:** Identity, Sports, social identity.

## 1. Introduction

In addition to its physiological and psychological contribution, sports enable people to gain social development, adaptation to group work, solidarity and social membership. Sport is a concept that benefits individuals to socialize by giving them a sense of personal and social identity, as well as being all physically active (Küçük & Koç, 2004; Bruner, Dunlop and Beauchamp, 2014).

Identity is, by definition, a human-specific symptom as a social entity, as well as the characteristics and qualities, the conditions that make a person to become who she or he is. Identity can also be defined as an organism that can actively think, have thoughts, construct knowledge and define itself (Hart, 1988). Stryker and Burke (2000) said that identity exists in many modern sciences and mentioned the following three different relations of this term; social identity, collective identity and personal identity (Tajfel, 1981).

In the relevant literature, the concept of identity was examined in two dimensions as personal identity and social identity. The concept of personal identity includes human characteristics such as emotions, thoughts and personal values. On the other hand, the social identity was developed by Tajfel and Turner (1986) in the 1970s and deals with intra-group and inter-group events. In social identity theory, the importance of creating a new identity for people through groups to which they belong or feel belonging, was highlighted. For instance, being in a fan group is thought to have an impact on people's personality and character through the time they spend in that group. Therefore, researchers frequently examined the concept of personal identity within the theory of social identity (Turner, 1985).

Identity of individuals and the reasons affecting identity have always been a subject of research in various disciplines including sports literature. Sport has an important place in the identity formation of people. In particular, social identity has been conceptualized and evolved into more functional phenomenon. In several studies, it has been revealed that there is a positive relationship between team performance and team identity which has been explained through the social identity theory (De Backer et al., 2011; Murrell and Gaertner, 1992). It is also possible to say that soccer players' perceptions of harmony and justice regarding the coach affect their social identity as well as their performance (Zuccheromaglio, 2005). Dyck (2003) also suggests that the successful sports activity directly or indirectly affects the identity of people.

Universities aim to raise socially qualified people together with their education missions and to enable them to take place in social life. The units that undertake the sportive mission in universities are undoubtedly the Faculty of Sports Sciences. Although students studying at the faculties of sports sciences have been involved in sports during some of their lives, some of them do not continue their active sports life. This research has been designed with the hypothesis that whether doing sports actively has an impact on the concept of identity even if it has a sports background. Thus, the purpose of the research is to examine the identity of students studying at the faculty of sports sciences with regard to the status of doing sports actively.

## 2. Material and Method

### 2.1. Research Model

In this research, the survey model, which is a descriptive research method, was used. Survey model is applied to understand participants' thoughts, perceptions or attitudes, and the studies in which the survey model is utilized, includes more participants compared to other research designs (Büyüköztürk, Çakmak, Karadeniz & Demirel 2009).

### 2.2 Research Group

A total of 216 Faculty of Sports Sciences students studying at Akdeniz University ( $M_{age} = 21.31 \pm 1,37$ ) participated in this study voluntarily. The descriptive information is presented in Table 1.

**Table 1.** Descriptive Statistical Information of Participants

Gender	f	%
Female	96	44,4
Male	120	55,6
Total	216	100,0
Active sports	f	%
Yes	114	52,8
No	102	47,2
Total	216	100,0

### 2.3. Data Collection Tools

The personal information form prepared by researchers and the Identity Scale, which was developed by Coşkun (2004), were used to collect data. Identity Scale was determined as valid and reliable to use on university students. It consists of 35 items using a Likert scale with 5 steps and has three sub-dimensions as follows Personal identity, social identity and collective identity (Coşkun, 2004).

### 2.4 Data Analysis

The internal consistency of the responses to the Identity Scale was examined with Cronbach alpha ( $\alpha$ ). The results obtained are as follows; personal identity was found as .88, social identity as .77 and collective identity as .80. In addition, the alpha obtained for the total scale was determined as .94. For the analysis of the data, descriptive statistics (percent (%), frequency (f)) and independent sample t-test analysis were used to determine whether there is a significant difference between the two groups. Spss 25.0 statistical package program was used for analyses and the statistical significance level was accepted as  $p < 0.05$ .

## 3. Findings

**Table 2.** The average, standard deviation and kurtosis-skewness results of the responses given to the identity scale sub-dimensions

Sub-Dimensions	n	$\bar{X}$	Ss	skewness	kurtosis
Personal Identity	216	38,22	,8,26	-1,143	1,561
Social Identity		21,91	5,75	-,145	-,226
Colletive Identity		27,34	6,77	-,643	,253

Table 2 shows means, standard deviations and the skewness and kurtosis values, which were utilized to test normality, for each sub-dimension. When skewness and kurtosis values are examined, it is determined that the analysis results are in the range of +2 -2 values for all sub-dimensions and therefore show normal distribution (Tabachnick ve Fidell 2013).

**Table 3.** The t-test analysis results according to the gender

Sub-Dimensions	Gender	n	$\bar{X}$	Ss	t	p
Personal Identity	Female	96	39,87	8,55	2,667	,008*
	Male	120	36,90	7,80		
Social Identity	Female	96	20,90	5,45	2,331	,021*
	Male	120	22,72	5,88		
Collective Identity	Female	96	27,34	7,01	,007	,995
	Male	120	27,35	6,60		

$p < 0.05$

In Table 3, independent sample t-test was conducted to determine whether the personal identity, social identity and collective identity of the participants showed a statistically significant difference according to the gender variable. In the results, a statistically significant difference was found in the sub-dimension of personal identity,  $t(214) = 2,667$ ,  $p = ,008$ ,  $2 = .03$ . According to the results, the average of the female participants (39.87) is higher than the average of the male participants (36.90). When the eta-square value of the difference obtained is examined, it can be said that the effect size is small (Richardson, 2011).

In the results, a statistically significant difference was found in the sub-dimension of social identity,  $t(214) = 2,331$ ,  $p = ,021$ ,  $\eta^2 = .03$ . According to the results, the average of the male participants (22.72) is higher than the average of the female participants (20.90). When the eta-square value of the difference obtained is examined, it can be said that the effect size is small (Richardson, 2011).

**Table 4.** T-test analysis results according to the status of doing sports actively

Sub-Dimensions	Active Sports	n	$\bar{X}$	Sd	t	p
Personal Identity	Yes	96	39,44	6,34	2,274	,024*
	No	120	36,85	9,83		
Social Identity	Yes	96	23,31	4,72	3,835	,000*
	No	120	20,35	6,39		
Collective Identity	Yes	96	28,78	5,92	3,387	,001*
	No	120	25,73	7,31		

$p < 0.05$

In Table 4, independent sample t-test was conducted in order to determine whether the personal identity, social identity and collective identity of the participants showed a statistically significant difference according to the status of doing sports actively. In the results, a statistically significant difference was found in the sub-dimension of personal identity,  $t(214) = 2,274$ ,  $p = ,024$ ,  $2 = .02$ . According to the results, it is seen that the average of the participants (39.44) who actively involve in sports are higher than the average of the non-active participants (36.85). When the eta-square value of the difference obtained is examined, it can be said that the effect size is small.

A statistically significant difference was found in the social identity sub-dimension,  $t(214) = 3,835$ ,  $p = ,000$ ,  $2 = .06$ . According to the results, it is seen that the average of the participants (23.31) who are actively doing sports are higher than the average of the participants (20.35) who do not do sport actively. When the eta-square value of the difference obtained is examined, it can be said that the effect size is medium.

A statistically significant difference was found in the collective identity sub-dimension,  $t(214) = 3,387$ ,  $p = .001$ ,  $\eta^2 = .05$ . According to the results, it is seen that the average of the participants who are actively doing sports (28,78) is higher than the average of the non-active participants (25,73). When the eta-square value of the difference obtained is examined, it can be said that the effect size is medium (Richardson, 2011).

#### 4. Discussion and Conclusion

The average of identity scale sub-dimensions used for research purposes was 38.22 for personal identity, 21.91 for social identity and 27.34 for collective identity sub-dimension.

A statistically significant difference was found in favor of female participants (39.87) in the personal identity sub-dimension according to the gender variable of the students of the faculty of sports science who participated in our study. On the other hand, according to the gender variable, there was a statistically significant difference in the social identity sub-dimension in favor of male (22,72) participants.

Statistically significant differences were detected in all sub-dimensions of the identity scale according to the status of doing sports actively or not. Statistically significant differences were determined in the personal identity(39.44), social identity (23.31) and collective identity sub-dimensions (28.78) in favor of participants engaging in sport actively.

In their researches, Karakaş (2017), Proios (2012) and Namlı and Tekkurşun Demir (2018) found significant differences in favor of male participants in the social identity sub-dimension. We can say that these results are in line with the findings of our research.

However, Elasky (2006), Yanar, Kırandı & Can (2017) and Saraç and Toprak (2017) reported that they found significant differences in favor of female participants in the social identity sub-dimension according to gender variable. It can be said that the differences obtained are due to the sample sizes and differences. It has been observed that the studies in the related literature are both supportive and not supportive of our findings.

When the researches are examined, it is seen that the perception of social identity of people who do team sports is perceived more stronge (Murrell and Gaertner, 1992). In the studies conducted, the concept of personal identity in general was discussed in the literature on the social identity theory because it tries to be explained within the scope of social identity theory. Researches conducted in which people's social identity perceptions develop as a result of being in the sports environment are supportive (Bruner et al. 2017). In the results of our research, significant differences were found in the personal identity, social identity and collective identity sub-dimensions in favor of individuals who actively do sports. When the related literature is examined, it is seen that most of the studies support our research findings.

As a result it seems possible to say for people who are in sports environment that it contributes to their own identity with the development of feelings such as competitiveness, solidarity and friendship. In social identity theory, the effect of the group of people on the character of that person is examined. In this context, our research results fully support this and reveal that doing sports makes an important contribution to the perception of identity. As a suggestion; It is thought that the sample group of our research can be expanded and more comprehensive results can be achieved. In addition, it is thought that examining the identity perceptions of individuals who do sports according to variables such as type of sport, age, and educational status may provide a better understanding of the impact of sports on identity.

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## Whole Body Vibration Training Impact on Pulse Wave Velocity in Obese Postmenopausal Women with Arterial Stiffness

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### Abstract

**Background:** Menopause boosts the age-related increment in blood vessel firmness during the early postmenopausal stage and that this increase is likely related, to estrogen lack.

**Aim of the study:** is to determine the effect of whole body vibration training (WBVT) on pulse wave velocity in obese postmenopausal women with arterial stiffness.

**Materials and Methods:** Forty obese postmenopausal women with arterial stiffness participated in this study. They were selected from the vascular department, Kasr El Einy hospital. Their ages were ranged from 60 - 70 years and Body mass index (BMI)>35 kg/m<sup>2</sup>. They were randomly divided in two groups, Group (A) included 20 patients who received WBVT for 12 weeks, 40 minutes/session, in addition to their regular medications prescribed by their physician. Group (B) only received their regular medications prescribed by their physician. Brachial-ankle PWV, femoral-ankle PWV (legPWV) were measured before and after 12 weeks.

**Results:** Both brachial-ankle PWV and leg PWV showed statistically significant decrease in group A, while there was no significant reduction in group B.

**Conclusions:** Whole body vibration is a useful tool in decreasing arterial stiffness in obese postmenopausal women.

**Keywords:** Arterial stiffness, Menopause, whole body vibration, Pulse wave velocity.

### Introduction

Arterial stiffness is a term utilized to characterize the arteries' ability to expand and contract during the cardiovascular cycle (1). It is a unique property dependent on vascular capacity and structure. It is affected by frustrating elements like blood pressure, age, gender, body mass index, pulse rate. Arterial stiffness happens as an outcome of natural maturing and arteriosclerosis. Expanded blood vessel solidity is related with an expanded danger of cardiovascular events, for example, myocardial localized necrosis and stroke (2).

Stiffening of large arteries is by all accounts an unavoidable succession of the typical maturing procedure and age is thusly the most significant determinant of blood vessel firmness, the enormous focal conduits harden continuously with age, the flexible properties of the smaller muscular arteries change little with age (3).

It is shown that age is a more significant determinant of brachial-ankle pulse wave velocity (baPWV) in females than in males, autonomous of blood pressure variables (4). Furthermore, baPWV increments with respect to the square of increment in age beginning around the age of 50–60 years in females. These discoveries recommend that menopause is a significant factor affecting blood vessel firmness in healthy female subjects. A few investigations have shown that estrogen beneficially affects stiffening of arteries (5).

There was a rising pattern in predominance of higher blood vessel firmness with menopause and the propelling span of menopause. As maturing is an unmistakable list for arterial stiffness, It is affirmed that menopause expanded the age-related blood vessel firmness, which bolstered the view that menopause for itself may raise the arterial stiffness estimated by baPWV (6), due to effect of the exhaustion of the ovarian hormones after menopause on vascular maturing by breakage and denaturation of elastin formation and expanding collagen deposition in arteries(7).

Pulse wave velocity has been assumed as a biomarker legitimately identified with vessel stiffening that can possibly give signals on early vascular maturing and foresee cardiovascular events. It is regularly decided through Pulse wave velocity (PWV) between two blood vessel sites (8).

Pulse wave velocity Index (PWV) estimated by ultrasonography was determined as the proportion between the distance and the foot-to-foot time delay and was represented in meters every second (9). It is the speed at which the pressure wave produced via cardiovascular contraction propelling from the aorta to the fringe arteries is chiefly controlled by the conduit artery wall stiffness and lumen diameter (10).

It has been all around perceived that PWV increments with age, hypertension and hyperglycemia and in this way mirrors the summation of major cardiovascular dangers (11).

A cross-sectional investigation among postmenopausal women done by Lebrun et al (12), gives proof that the vast majority of the set up cardiovascular hazard factors are determinants of aortic PWV. Expanded PWV marks an expanded danger of stroke, coronary illness, and passing inside 10–12 years.

Treatment is regularly as preventive procedures prophylaxis. Medication treatment for fundamental conditions and sorts of medical procedure, for example, Angioplasty and stent position, Coronary artery bypass surgery, Endarterectomy and Thrombolytic therapy (13)

Physical movement both preclude and helps treat many set up hazard factors, including hypertension, insulin resistance and glucose intolerance, elevated triglycerides and obesity. Exercise combined with weight reduction can reduce low-density lipoprotein cholesterol (LDL-C) and bound the decline in HDL-C that frequently happens with a decrease in dietary saturated fat (14).

Stiffness of large arteries increments with age, even in sound people with no cardiovascular malady, however is less articulated in the individuals who participate in standard continuance endurance exercise. Indeed, even once settled, large artery stiffening can be reduced by a program of physical exercise (15)

Whole body vibration (WBV) is a conventional term utilized where any vibration of any frequency is moved to the human body. Vibration training then again is where differing frequencies/amplitudes/forces will be moved into isolated body parts utilizing exact joint plots for the time being (approximately 1 minute sets). This is done to make a pure eccentric muscle response and empower anaerobic action (consuming energy without oxygen something contrary to cardio) (16)

It is a training technique utilizing low amplitude, low frequency mechanical stimulus to exercise musculoskeletal structures for the improvement of muscle power and malleability. Vibration training has been supported as a helpful strategy in the treatment of osteoporosis, sarcopenia, and metabolic syndrome. (17)

Whole Body Vibration is a basic and advantageous exercise for old and immobile patients since it doesn't require using traditional powerful exercise, for example, free weight or dynamic movement. Though, there have been hardly any studies researching the impact of WBV on arterial stiffness. This research was implemented to find out the impact of WBV on arterial stiffness in obese postmenopausal women, which could be added to rehabilitation program for managing arterial stiffness.

## Methods

### Study design and randomization

This study is a single blind randomized controlled study. The participants were randomly allocated to Study group (A) (n=20) or control group (B) (n=20) by an independent individual who chose at random from sealed envelopes containing numbers made by a random number generator. The randomization was limited to permuted squares to guarantee that equivalent numbers were designated to each group A and group B. The successions appointed to the participants were set in envelopes containing the allocation to each group A and group B. The aim and procedures of the study were informed to eligible patients. All patients signed a written informed consent.

### Ethical approval

All relevant national laws and institutional policies have been followed up in human use research, followed the principles of the Helsinki Declaration and affirmed by the Research Ethics Committee of the Faculty of Physical Therapy, University of Cairo.

## Subjects

Forty obese postmenopausal women with arterial stiffness shared in this study. They were chosen from alluded Patients from the vascular department, Kasr EL Einy Hospital, Cairo, Egypt. The patients were chosen according to the inclusion and exclusion criteria as follows;

**Inclusion criteria:** Forty postmenopausal women (over one year without menstruation), Obese (BMI > 35.0 kg/m<sup>2</sup>), their age from 60-70 years of age, sedentary non-smokers, free from obvious CV diseases or psychiatric conditions as surveyed by clinical history, and not taking medication or hormone treatment in the year prior to the examination.

**Exclusion criteria:** Participants were excluded in the event that they had joint prosthetic gadgets, recent thrombosis, or wounds in the legs, Heart failure, Cardiac dysrhythmias, Metal or artificial inserts (for example pacemaker, artificial cardiac valves, or recent stents), Chronic back pain (after fracture, disc disorders or spondylosis), Uncontrolled Diabetes Mellitus with peripheral vascular illness or neuropathy, Tumors (excluding metastases in the musculoskeletal system), Spondylolisthesis without gliding movement disorder and Parkinson, Chondromalacia of the joints of the lower limbs, Venous deficiency with ulcus cruris and Epilepsy.

All Patients were randomly divided into 2 equal groups Group (A) included 20 patients who received WBVT for 12 weeks the duration of one session was 40 minutes including warming up and cooling down, in addition to their regular medications prescribed by their physician.

Group (B) only received their regular medications prescribed by their physician and dietary modifications advices.

## Methodology

### Assessment

Arterial Stiffness was measured by determining PWV through duplex scanner Ultrasonography (ATL Ultramark IV, operating frequency 7.5 MHz) connected to a vessel wall movement detector system. It is calculated by measuring the time taken for the arterial waveform to pass between two points a measured distance apart, and involves taking readings from the two sites simultaneously, or gating separate recordings to a fixed point in the cardiac cycle. Participants were asked to maintain in supine and rest for 5 minutes before the PWV examination, and then the cuffs were wrapped on both sides of their brachium and ankle together. The pressure waveforms were recorded simultaneously from the brachial and anterior tibial arteries by automatic waveform analyzer (BP-203RPE III, OMRON, Japan), conducted by experienced technicians who were blinded to the clinical information.

### Treatment

Prior to beginning the first treatment session, each patient was instructed briefly about treatment procedures and benefits of WBV training to gain their confidence and cooperation throughout the training course. Their body mass index were calculated, blood pressure and resting heart rate. Each patient was instructed to drink a plenty of water before and after the exercise session to avoid loss of body water during session.

Each patient was asked to wear comfortable clothes and flat light shoes to avoid hurting from the friction of the platform. Each patient stood on the platform of the device and hands rested on hand rails to maintain balance. Platform vibration was used at lower speeds for 2 to 3 min until the patients have become used to in then slowly increased until reaching to 26 Hz lasted for 20 minutes 3 times / week for 12 weeks.

Patients in group A were trained by whole body vibration training 3 times/week, for 12 weeks. The duration of one session was maximally 40 min, including warming up and cooling down consisted of:

1-Warming up: in the form of stretching exercise for major muscles groups and circulatory exercise time of warming up (5-10min)

2- Active phase: exercises for upper and lower body on a vibration platform. Training load was increased gradually according to the overload principle.

3- Cooling down: in calm atmosphere, relaxation, stretching exercise and breathing exercise (10-15 min)

## Results

Comparing the general characteristics of the subjects of both groups revealed no significant difference between both groups in the mean age, weight, height, and BMI ( $p > 0.05$ ), as shown in table (1)

**Table 1.** Descriptive statistics and t test for the mean age, weight, height and BMI of the study and control groups.

	Group(A)	Group(B)	MD	t- value	p-value	Sig.
	M± SD	M± SD				
Age (years)	61.7 ± 1.97	62.1 ± 2.04	-0.4	-0.62	0.53	NS
Weight (kg)	100.5 ± 6.52	99 ± 7.01	1.5	0.7	0.48	NS
Height (cm)	160.95 ± 2.28	161.25 ± 3.5	-0.3	-0.32	0.75	NS
BMI (kg/m <sup>2</sup> )	38.8 ± 2.43	38.05 ± 2.05	0.75	1.04	0.3	NS

M: Mean.	SD: Standard deviation.	MD: Mean difference.
t value: Unpaired t-value.	p-value: Probability value.	NS: Non-significant.

As shown in table (2), At the beginning of the study there was statistically non- significant difference between both groups pretreatment while after the study arterial stiffness showed statistically significant decrease in group (A) in brachial ankle Pwv from 14.1± 0.3m/sec to 12.7±1.4 m/sec. While there was non significant change in control group (B) in brachial ankle Pwv from 14.0±0.3 to 13.9 ±0.2 m/sec.

The mean ± SD PwV of the Leg Pwv post treatment of group A was significantly decreased from 9.9 ± 0.3 m/sec to become 9.4±0.2 m/sec.

While there was non-significant change in Leg Pwv in control group B from 9.8 ± 0.2 m/sec to become 9.8± 0.3 m/sec post study.

**Table 2.** Comparison of post treatment mean values of brachial ankle PWV and leg PWV between the study and control groups

Brachial ankle PWV (m\sec)		Study Group(n= 20)	Control Group (n= 20)	t-value	P- value
	Pre- treatment		14.1(0.3)	14.0(0.3)	0.4
Post-treatment		12.7(1.4)	13.9(0.2)	4.4	0.0001(S)
t- value		4.4	1.7		
p-value		0.0003(S)	0.09(NS)		
Leg PWV (m\sec)	Pre- treatment	9.9 (0.3)	9.8 (0.2)	1.2	0.2 (NS)
	Post- treatment	9.4 (0.2)	9.8 (0.3)	4.4	0.001 (S)
	t- value	6.3	0.4		
	p-value	0.0001(S)	0.7 (NS)		

p-value: Probability value. S: Significant. NS: Non-Significant.

## Discussion

The present study was designed to study the effect of WBVT on arterial stiffness in obese postmenopausal women diagnosed with arterial stiffness. The results of this study revealed that arterial stiffness showed statistically significant decrease in group (A) with non significant change in group (B)

The results of our study came in accordance with **Alvarez-Alvarado(18)** et al, in which they revealed that after 6 weeks of WBVT, there was a significant reduction of carotid-femoral PWV (aortic stiffness,  $P < 0.05$ ), femoral-ankle (leg arterial stiffness,  $P < 0.01$ ) and baPWV (systemic arterial stiffness,  $P < 0.01$ ) compared with controls. They came into conclusion that WBVT led to reductions in arterial stiffness, central BP and wave reflection in young obese women.

A study implemented by **Figuroa et al(19)** proved that WBV exercise training for 12 weeks improved systemic and leg arterial stiffness, BP, and leg muscle strength in postmenopausal women with pre

hypertension or hypertension. They postulated that WBV exercise training may decrease cardiovascular and disability risks in postmenopausal women by reducing leg PWV and increasing leg muscle strength.

Another study by **Figueroa et al (20)**, concluded that WBV training decreases ankle SBP in postmenopausal women with high ankle SBP. WBV training reduces aortic SBP, legPWV, and baPWV, but not carotid-femoral PWV, in postmenopausal women independently of ankle SBP. Therefore, reductions in peripheral and central SBP induced by WBV training are explained by a reduction in peripheral PWV.

These results also proved by **Miyaki et al (21)** where they came to a conclusion that addition of WBV training to a lifestyle-modification program in overweight and obese women thus decreased arterial stiffness

**Watanabe et al (22)** found a significant decrease in PWV and a significant increase in VO<sub>2</sub>max levels in WBV training group, suggesting that regular short-term aerobic exercise combined with WBV training might more effectively reduce arterial stiffness and improve cardiorespiratory fitness than aerobic training alone.

Also, the results of this study came in accordance with **Rubin et al.,(23)**who found that WBV mechanically stimulates abdominal and leg arteries, which may reduce arterial tone and decrease arterial stiffness via mechanical stimuli to arteries.

**Otsuki et al (24)** stated that mechanical stimuli to artery, such as compression, elicit vasodilation and acutely decrease arterial stiffness. As whole-body vibration(WBV)-induced oscillation is propagated at least to lumbar spine.

The results of this study agreed with (**Yamada et al.,(25)**)who found that blood volume in the vastus lateralis acutely increased after a WBV session. It may be possible that WBV is beneficial not only to the skeletal system and musculature but also to the cardiovascular system.

According to **Schindl et al,(26)** a few minutes lasting stance on a vibrating platform leads to an increase in the relative moving blood volume of quadriceps and gastrocnemius muscles. Mean blood flow in the popliteal artery was also increased and its resistive index decreased. According to the authors' opinion, trying to attenuate the imposed vibration on the body evokes rhythmic muscle contractions.

Another study **Lai et al(27)** by found that 3 months 30 Hz and 3.2 g horizontal WBV training had a positive effect on arterial stiffness in middle-aged and older adults and could therefore be regarded as a supplementary exercise scale. They showed that after 3 months of WBV training, the bilateral baPWV were significantly reduced ( $P=0.014$  and  $P=0.041$ ). However, compared with the control group, there was no significant difference; meanwhile, the two groups had no significant changes in bilateral blood pressure or heart rate

These findings indicate that WBV exercise training decrease arterial stiffness in obese postmenopausal women, WBV exercise training may decrease cardiovascular and disability risks in obese postmenopausal women.

## Conclusion

Whole body vibration exercise training has positive effects on arterial stiffness in obese postmenopausal women. As, this study demonstrated the possibility of WBV as an adjunctive to exercise training. It may be worthwhile to further investigate WBV for humans who cannot sufficiently perform aerobic exercise training.

## Acknowledgement

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## Declaration of Competing Interest

The authors declare that there is no conflict of interest associated with this manuscript.

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## Molecular Genetic Technologies for Improving Occupational Safety in Extreme Conditions

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### Abstract

The purpose of the research in this article is to justify the need for screening genotyping when selecting candidates for work in extreme conditions. Materials and methods: analysis of literature sources on genetics, psychology, and occupational safety; Russian and international biomedical and genetic databases; protocols and reports of accident investigation, accidents, and catastrophes. Results. Based on the analysis of literature data, protocols of investigation of the causes of air crashes, accidents on highways, mines, chemical enterprises, etc., it can be concluded that many causes of accidents, accidents and catastrophes caused by the so-called "human factor" can be eliminated or leveled with proper organization of psychophysiological testing during professional selection, appropriate physical and psychophysiological training of employees. However, one of the key reasons for reducing occupational safety in extreme conditions is almost impossible to correct, since it is genetically determined. This is fatigue, the degree and speed of development of which when performing professional activities directly depend on endurance. No amount of training can increase endurance above a genetically determined level, and therefore can not reduce the speed and degree of fatigue. You can only reduce the subjective feeling of fatigue – fatigue. But at the same time, fatigue remains, and hidden, which significantly increases the risk of inappropriate reactions and erroneous actions in the event of danger and, ultimately, leads to an accident, a catastrophe. It is shown that at the stage of professional selection, the determination of alleles is sufficient as screening indicators of an increased risk of fatigue D, 34T, S and 3R gene ACE, AMPD1, 5HTT and MAOA associated with General, physical, and neuropsychic endurance, respectively. Conclusions. 1. screening genotyping of candidates for work in extreme conditions in order to identify nucleotide polymorphisms associated with endurance-fatigue is a key condition for improving labor safety by preemptively reducing the role of the "human factor" in the occurrence of accidents, accidents and catastrophes in hazardous industries. 2. identification of alleles is sufficient as screening indicators of an increased risk of fatigue when working in extreme conditions D, 34T, S and 3R gene ACE, AMPD1, 5HTT and MAOA, accordingly, they are associated with an increased risk of rapid development of General, physical and neuropsychiatric fatigue.

**Keywords:** occupational safety, extreme conditions, human factor, professional selection, endurance, fatigue, screening genotyping, nucleotide polymorphisms.

### Introduction

Most of the professions of budget-forming, defense and many other enterprises and industries that ensure state security and economic independence of the country are associated with working in extreme conditions, respectively, with a high risk of accidents, accidents and catastrophes. However, despite multimillion-dollar investments in the development and implementation of measures to improve occupational safety in extreme conditions, the trend towards increasing cases of serious and fatal injuries, man-made accidents and catastrophes with numerous human casualties and colossal destruction has not yet been eliminated. In 2000-2014, there were 8,588 emergencies in Russia, in which irreplaceable losses amounted to 14,826 people, and sanitary losses – 5,841 million people [1]. Analysis of the results of many years of research shows that at least 60-70% of accidents, accidents and injuries in industry and transport are caused by the so-called "human factor", i.e. the main culprit of accidents is, as a rule, not the equipment, not the organization of labor, but the working person himself, who for one reason or another committed erroneous actions, especially in emergency situations. According to Russian researchers and various analytical and expert centers in the United States, about 90% of car accidents are caused by drivers [2, 3].



Based on this, it becomes obvious that when selecting applicants for jobs associated with increased danger, with extreme mental and physical stress, it is necessary to take into account the peculiarities of the psychophysiological qualities of applicants, which some employers paid attention to at the beginning of the last century [4, 5].

As early as 1919, it was established that 85-90% of all industrial accidents occur in a very small part of workers (10-15% of the total number), which, according to researchers, indicates a different predisposition of people to dangers and mistakes, which may be innate [6, 7].

Together with the results of further research, there is every reason to conclude that the safety of a person's work in extreme conditions depends not only on the social environment, length of service and work experience, but also on their innate psychophysiological qualities. Therefore, psychophysiological testing aimed at identifying these qualities in the selection of candidates for work in extreme conditions will improve labor safety. Taking into account that many psychophysiological qualities that affect labor safety in extreme conditions are innate, it seems appropriate to identify genetic factors (nucleotide polymorphisms) associated with these qualities during professional selection. Therefore, the question naturally arises whether it is possible to limit oneself to traditional and widely used psychophysiological testing, or whether it is still necessary to develop and implement molecular genetic technologies when selecting applicants for work in extreme conditions.

The purpose of the study is to justify the need for screening genotyping when selecting candidates for work in extreme conditions.

### Materials and Methods

Analysis of literature sources on genetics, psychology, and occupational safety; Russian and international biomedical and genetic databases; protocols and reports of accident investigation, accidents, and catastrophes.

### Results

Analysis of the results of numerous studies on various aspects of improving occupational safety in extreme conditions has shown that psychophysiological testing allows us to quantify the psychophysiological qualities of a person that determine the safety of their professional activities in extreme conditions. If these qualities do not meet the requirements of the profession, a person constantly works at the limit of physiological capabilities, which inevitably leads to the development of fatigue, unwillingness to work, injuries and accidents. Therefore, it is necessary to identify applicants whose psychophysiological qualities do not meet the requirements of the chosen profession and restrict their access to activities associated with increased danger and extreme conditions [8,10].

For example, the assessment of the type of higher nervous activity allows us to identify individuals with a strong nervous system who, unlike applicants with a weak nervous system, will be able to maintain self-control in an extreme situation, correctly assess the situation and find the optimal solution [11-15].

It is also important to assess the level of anxiety among applicants. Individuals with low levels of anxiety tend to underestimate a particular situation in a critical situation and act late. Individuals with high levels of anxiety usually react to changes in the environment quickly, but unusually violently, which can lead to erroneous actions and, consequently, to accidents and injuries.

However, when implementing psychophysiological testing in the practice of professional selection, certain difficulties arose that still cannot be overcome. In particular, there were some contradictions in the interpretation of the prognostic significance of the type of nervous system associated with a predisposition to accidents. People with a weak nervous system are not recommended to choose professions associated with the occurrence of extreme situations. The nerve cells of these individuals do not withstand prolonged and strong arousal, and quickly pass into a state of protective inhibition [16].

People with a mobile type of nervous system, characterized by rapid switching from one type of work to another, high speed of work, good distribution of attention between different types of activities, in conditions of lack of time and in extreme situations, have a low risk of accidents. However, such people are characterized by haste, carelessness, the desire to quickly move to another type of work, without finishing the job, they often do not delve deeply into the essence of problems, instructions, with prolonged stress, they quickly get tired and lose all interest in work, which ultimately creates the prerequisites for accidents and

emergencies when working in extreme conditions.

Their opposite, people with an inert type of nervous system, which is characterized by slowness, slowness, poor switching, as if "lag behind" in their adaptation to rapid changes in the environment and therefore in extreme situations have an increased risk of accidents. However, such people are able to withstand long-term stress, and their performance only increases during work. They tend to work more thoughtfully and strive for order. Having a good long-term memory, when performing new tasks, past knowledge is attracted, which ultimately reduces the risk of accidents, however, only in the absence of a time deficit, when you do not need to quickly choose the right solution [15, 16].

Thus, determining the strength and type of the nervous system using psychophysiological techniques does not always allow us to unambiguously predict the safety of work in extreme conditions.

It should be particularly noted that psychophysiological testing only States the degree of phenotypic manifestation of professionally significant psychophysiological qualities of the subject at the time of testing, while the recorded indicators only indirectly reflect the innate predisposition to accidents and do not always adequately reflect the innate predisposition to accidents [17].

In particular, quantitative indicators of the phenotypic manifestation of genetically determined low endurance qualities can be improved as a result of special training. However, in some cases, this can be achieved due to the almost complete depletion of adaptive and compensatory mechanisms. But the risk of rapid development of fatigue, which is genetically determined by low endurance, remains, which, despite good results of psychophysiological examination, can lead to accidents, accidents and catastrophes. The opposite conclusion is not excluded, when in the absence of a genetic predisposition to accidents, the impression of its presence is created due to the negative impact on the psychophysiological indicators of various factors – family quarrels, socio-industrial conflicts, climatic conditions, lack of sleep, etc.

Thus, only the direct determination of genetic factors that determine the formation of psychophysiological qualities necessary for safe work in extreme conditions will allow to optimize professional selection and thereby reduce the role of the "human factor" in the occurrence of emergencies, accidents and catastrophes. Based on this, in many countries over the past few years, molecular genetic methods of professional selection of applicants for work in extreme conditions have been actively introduced, in particular, in the practice of selecting special constants of the armed forces and cadets of military educational institutions of NATO countries, Russia, the Republic of Belarus, etc., as well as in the practice of selecting and specializing athletes [18-22].

Working in extreme conditions is often associated with extreme physical and mental stress, with a constant awareness of the presence of potential, and often real danger, i.e. with constant stress, a sense of anxiety and anxiety. In turn, the degree of adaptation to extreme loads is genetically determined, and if the functional reserves of the body do not match the required loads, adaptation and compensatory mechanisms are rapidly depleted, fatigue develops, which is often the cause of injuries, accidents and catastrophes [23-31].

As a result of the study of performance when driving cars over long distances, it was found that professional skills of drivers are quite well preserved in normal, "normal" conditions, but long, strenuous work or the occurrence of "abnormal", emergency situations accelerate the development of fatigue [32-35].

With the development of fatigue occurring disorders of perception, reduced attentiveness, diminishing memory and thinking, reduces visual acuity, the intensity and stability of attention, speed switch, the degree of automaticity of previously developed skills, impaired precision, and coordination, reduced speed of information processing increases rapidly as the time of sensorimotor reactions and detection of danger, a possible wrong assessment of the situation, disturbed and commitment to action in case of an unexpected change in the situation. Decision-making processes are dominated by ready-made stereotypical forms. Not only does the number of errors increase, but their structure also changes: the first is dominated by a small quantitative error then be a serious, quality.

When working in extreme conditions, the neurons of the brain become fatigued much earlier than the working muscles. At the same time, fatigue is the result not so much of the physical or mental load itself, but of insufficient implementation of functional reserves (energy, physiological, psychological, etc.) in response to this load, which have individual differences. Therefore, the conditions of occurrence and the nature of fatigue in one person are not necessarily the same in another [36]. The more the ratio between the use of resources during work and their recovery is disrupted, the faster fatigue develops [37]. Insufficient

activation of energy resources and reserves may be due to low adaptive capabilities of the muscular, cardiovascular and Central nervous systems. Based on this, it seems appropriate for screening genotyping when selecting applicants for work in extreme conditions to limit the definition of those polymorphisms that are associated with the adaptive capabilities of these systems, in particular polymorphisms C34T gene AMPD1, I/D gene ACE, L/S gene 5HTT and 3R/4R gene MAOA.

Product of the gene **AMPD1** is an adenosine monophosphate deaminase of skeletal muscle (AMPD1 or AMFD-M), which catalyzes the deamination AMP before IMP and, being one of the integral enzymes of adenylic nucleotide metabolism, it determines the energy potential of muscle cells [38]. The carriers of allele 34T gene AMPD1 a shortened catalytically inactive enzyme is synthesized, which reduces the maximum rate of contraction and increases the relaxation time of skeletal muscles.

Presence of an allele 34T negative impact on well-being in physical activity (weakness, fatigue and muscle cramps even after a medium intensity exercise) and is used in sports medicine as prognostic sign of fatigue during prolonged high-intensity exercise [39, 40]. The frequency of the T allele is 19% in African Americans, 11-12% in the European population, about 15% in the Russian and 0% in the Japanese population [41, 42]. Consequently, at least 10-15% of the Russian population has an increased risk of developing rapid fatigue during prolonged physical activity.

In cases where blood circulation does not meet the body's need for oxygen and nutrients during increased physical activity, a number of mechanisms are activated to increase the IOC, in particular, the activation of the renin-angiotensin-aldosterone system, in which the key role is played by the angiotensin-converting enzyme (ACE), which catalyzes the conversion of low-activity angiotensin I into one of the most powerful vasoconstrictors angiotensin II (at II) [43].

Carriers of the D allele of the ACE gene form at II significantly more, and the ability to perform long-term physical work is 7-8 times less than in homozygous carriers of the I allele. This is due to the fact that carriers of the D allele have muscles and the cardiovascular system that are evolutionarily adapted to intense but short-term loads [44-49]. During prolonged exercise, homozygous carriers of the D allele experience a subjective feeling of discomfort, and the heart, which is not predisposed to prolonged exercise, begins to increase compensatorily (myocardial hypertrophy), which can lead to disability and death [44, 50, 51], including during professional activities (for example, pilots during a flight, drivers driving a car, etc.).

The effectiveness of serotonin stimulation in the brain is of leading importance in resistance to neuropsychic stress. Termination of the action of serotonin after release into the synaptic cleft is carried out by its active transfer by the serotonin Transporter protein 5NTT back to the neuron from which it was isolated and by inactivation under the action of the enzyme monoamine oxidase A (MAOA). Changes in any of these links affect the effectiveness of serotonin stimulation - small amounts of serotonin excite synapses, while large amounts, on the contrary, paralyze synaptic transmission. There are two alleles of the serotonin Transporter gene (5 NT), designated as long (L) and short (S), associated with the efficiency of serotonin return to the presynaptic neuron.

Carriers of the S allele synthesize less of the serotonin Transporter, resulting in increased basal serotonin levels in the synaptic cleft and may have a less favorable self-perception throughout life, in particular a feeling of fatigue.

Carriers of the S allele show increased sensitivity to emotional stimuli, have less control over their behavior, are more susceptible to stress, are more prone to anxiety reactions during social interaction, and develop fatigue during intense physical and mental stress. Even before physical activity, they assess themselves as more tired, less active, with a reduced mood and well-being compared to carriers of the L allele [52-56]. There is no doubt that the combination of these qualities does not meet the requirements of working in extreme conditions.

At the same time, there is evidence that military carriers of the S allele demonstrate better indicators of neurodynamic properties under high physical loads and are characterized by faster recovery of neurodynamic properties after multi-day extreme physical exertion [57, 58]. Along with other factors that require further study, this may be due to the fact that the effectiveness of serotonin stimulation also depends on the activity of the enzyme monoamine oxidase A (MAOA), which catalyzes the inactivation of serotonin through its oxidative deamination [59-61]. The more active the MAOA enzyme, the faster the disorders of higher nervous activity caused by a stressful situation are neutralized and the faster a person is able to make the right decisions. MAOA activity depends on the number (from 2 to 5) of repeated sequences of 30 BP in

the promoter region of the MAOA gene. The fewer repeats (R), the less the enzyme is synthesized, hence the lower the rate of serotonin inactivation. Carriers of the 3R allele synthesize MAOA in 5 times less than carriers of the 4R allele [62, 63]. A low-activity allele (3R) was shown to be associated with a tendency to antisocial behavior, increased aggressiveness, a lower intelligence coefficient, and a low coefficient on the "damage avoidance" scale compared to carriers of high-activity gene variants [64-71]. Carriers of a low-activity allele are more anxious and impulsive, prone to feelings of guilt, and tend to overestimate the dangers that threaten them [72-74]. It is quite obvious that a low-activity allele is associated with qualities that are not compatible with working in extreme conditions. In the European population, the low-activity 3R allele occurs with a frequency of 32-35% [62], i.e. at least 1/3 of the population does not meet the requirements of working in extreme conditions due to its innate psychophysiological qualities.

Thus, the introduction of screening genotyping into the practice of professional selection, aimed at identifying candidates with nucleotide polymorphisms associated with an increased risk of rapid development of fatigue, is one of the necessary measures to improve labor safety in extreme conditions by preventive reduction of the role of the human factor.

## Conclusions

1. screening genotyping of candidates for work in extreme conditions in order to identify nucleotide polymorphisms associated with endurance-fatigue is a key condition for improving labor safety by preemptively reducing the role of the "human factor" in the occurrence of accidents, accidents and catastrophes in hazardous industries. 2. As screening indicators of an increased risk of fatigue when working in extreme conditions, it is sufficient to identify alleles D, 34T, S and 3R of the ACE, AMPD1, 5NTT and MAOA genes, respectively, associated with an increased risk of rapid development of General, physical and neuropsychiatric fatigue.

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## Formation of Ethical and Axiological Competencies When Using Ict in Education

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### Abstract

At present, the concept of a competency-based approach to education is gaining ground, which is the basis of substantial changes to ensure that education meets the needs and capabilities of the public in the period of informatization and global mass communication. From the standpoint of the competency-based approach, the meaning of education is the development of the ethical and axiological abilities of students to independently solve problems in various fields and activities based on the use of social experience, an element of which is also the students' own experience. It is the competency-based approach that is determined by one of the foundations of the "Strategy for the Modernization of Education" - the main state document in the field of Russian education today and in the near future.

**Keywords:** competence, education, technology, information and communication technology, science, pedagogy, student, teacher.

### Introduction

**Competence** - the willingness to use the acquired knowledge, skills, as well as ways of working in life to solve practical and theoretical problems.

**Competence** - the level of personality skills, reflecting the degree of compliance with a certain competency and allowing you to act constructively in changing social conditions [1,11].

The introduction of information and communication technologies allows both to increase the efficiency of human activity and to make it more diverse. The creation, development and application of ICT in vocational education is determined by a number of positive factors [2,15]:

Firstly, the introduction of ICT in vocational training of students significantly accelerates the development of professional competencies and the accumulated pedagogical and technological experience.

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Secondly, the introduction of technology (ICT) improves the quality of education, develops professional competencies, and allows graduates to successfully adapt to the environment and the ongoing social changes.

Thirdly, the active and effective implementation of educational technologies (ICT) in the training of graduates is an important factor in the process of reforming the traditional education system in the light of the requirements of a modern industrial society [3,12].

ICT in training and education of students is mainly aimed at achieving the goals:

- Organization of the educational process using ICT;
- The introduction of educational technologies in management activities;
- the formation of a database of educational resources;
- organization of leisure for students;
- creation of a single local network;
- organization of permanent access to information and communication technologies for students, teachers and executives [4,13].

A large number of teachers note that the use of ICTs allows to intensify the work of students in training sessions and increase cognitive interest through various forms of work in organizing activities using ICT tools [4,14]:



- individual work with the training system;
- Creation and use of presentations in training sessions;
- modeling: the use of ready-made models and the development of new ones;
- automatic testing systems;
- design method of work;
- game forms, contests, quizzes, participation in distance contests;
- the use of instrumental training programs; use of web technologies;
- Creation using Microsoft Office and the use of organization tools.

The development and improvement of the material base of educational institutions is ongoing:

- organization of permanent access to the Internet;
- updating the computer park;
- The library fund is updated with educational, reference and methodological literature.

An example of the use of ICT is the holding of subject decades, weeks, exhibitions, contests of professional excellence, video presentations, participation in video conferences, communication with other educational institutions, during the master class in the laboratory.

In this regard, ICT - competence can be defined as - a combination of knowledge, skills and experience. Willingness to use the acquired knowledge, skills, as well as ways of working in life to solve pedagogical problems using ICT tools and techniques, namely:

- carry out information activities on the collection, processing, transfer, storage of information resources, on the production of information in order to automate the processes of information and methodological support;
- evaluate and implement the capabilities of educational electronic publications and the educational information resource distributed on the Internet;
- organize information interaction between participants in the educational process and an interactive tool that operates on the basis of ICT tools;
- create and use psychological and pedagogical testing, diagnostic methods for monitoring and evaluating the level of knowledge of students, their progress in learning; carry out educational activities using ICT tools in aspects that reflect the characteristics of a particular school subject [5,16].

A teacher who uses ICT in his activities should be psychologically prepared for the continuous improvement of his knowledge.

In this regard, even within the walls of a pedagogical university, a future teacher must also develop professional readiness for constant self-education and advanced training in the field of ICT.

The formation of ICT - teacher competencies must be carried out in the following areas:

- psychological (solving the problem of motivation and increasing interest, students);
- pedagogical (self-education and advanced training);
- methodical (substantiation of the tasks, content and principles of teaching this academic discipline);
- didactic (the formation of the optimal content of the training course);
- information technology (the formation and use of funds multimedia software training and education) [5,17].

Teachers who have gained knowledge in the field of new educational technologies need to constantly prove themselves in them, to have a professional environment for operational interaction.

This requires a comprehensive solution to issues such as:

- 1) continuous training in the use of ICT in education;
- 2) hardware and software update and maintenance of the equipment and information resources of the OS, technical support of ICT and providing access to the Internet;
- 3) information and methodological support of the pedagogical activities of teachers using ICT. This makes the issue of creating a continuous system of continuing education for teachers in the use of ICTs in the educational process through regular information and educational and methodological support during the inter-course training of teachers in the field.

The solution to this problem lies in a reasonable combination of full-time course training and independent work, studying on the basis of materials designed for distance education and posted on the global computer network Internet.

These tasks can be successfully solved within the framework of the methodological support system for advanced training of pedagogical personnel, which can be defined as an integrated set of measures, actions, resources, as well as managerial processes and influences.

The main goal of vocational education is to prepare a qualified employee of the appropriate level and profile, competitive in the labor market, competent, responsible, fluent in his profession and oriented in related fields of activity, capable of efficient work in his specialty at the level of world standards, ready for continuous professional growth, social and professional mobility; meeting the needs of the individual in obtaining appropriate education [6,18].

The most important direction in the implementation of the concept of modernization of Russian education is the training of new generation teaching staff and the formation of a fundamentally new culture of pedagogical work, the training of highly qualified teachers and the necessary information culture so that they are ready and able to apply new information technologies in the process of training and educational management. The introduction of information and communication technologies in the professional activities of teachers is a priority in modernizing Russian education today in connection with the introduction of new educational standards.

Professionally competent is such a teacher's work in which pedagogical activity, pedagogical communication is carried out at a fairly high level, the personality of the teacher is realized, good results are achieved in teaching and educating students. The development of professional competence is the development of the teacher's creative personality, the formation of readiness for adoption of a new one, the development and susceptibility to pedagogical innovations [1,19].

The following components of pedagogical ICT competencies can be distinguished: - general user competency; - general pedagogical ICT - competence; - subject-pedagogical ICT - competence in relevant subjects and educational fields. It is possible to determine the levels of ICT formation - competencies: - basic - an invariant of knowledge, skills and experience necessary for a teacher to solve educational problems using ICT. - subject-oriented - the development and formation of readiness for implementation in educational activities of specialized technologies and resources developed in accordance with the requirements for the content and methodology of a particular subject [7,20].

The ability of a competent specialist to go beyond the scope of the subject of his profession allows us to define competency as the highest degree of readiness. A teacher who uses ICT in his activities should be psychologically prepared for the continuous improvement of his knowledge.

Teachers who have gained knowledge in the field of new educational technologies need to constantly prove themselves in them, to have a professional environment for operational interaction.

The process of informatization of modern society necessitated the development of a new model of the education system based on the use of modern information and communication technologies.

There are many programs, electronic textbooks, websites, publications, written and developed for teachers and teachers. A huge number of various courses on information technology offer their services to teachers.

Summing up, we found out that for the formation of basic ICT competency it is necessary [8]:

- knowledge of the functioning of the PC and the didactic capabilities of ICT;
- mastery of the methodological foundations for the preparation of visual and didactic materials using Microsoft Office tools;

- use of the Internet and digital educational resources in teaching activities;
- formation of positive motivation for the use of ICT.

And according to the new provision on certification, if a teacher does not own a computer, then he cannot be certified for the first or highest category.

To increase the level of ICT competence, the teacher can

- participate in seminars at various levels on the use of ICT in educational practice;
- participate in professional contests, online forums and teacher councils;
- use in preparing for lessons, on electives, in project activities a wide range of digital technologies and tools: text editors, image processing programs, presentation preparation programs, table processors;
- ensure the use of the collection of the Center and Internet resources;
- form a bank of training tasks carried out with the active use of ICT;
- develop their own ICT projects [8].

**Conclusion** The introduction of ICT in the professional activities of teachers is inevitable in our time. Professionalism of a teacher is a synthesis of competencies, including subject-methodological, psychological-pedagogical and ICT components. In the scientific pedagogical literature, many works are devoted to clarifying the concepts of "competence" and "competence". The use of ICT tools in the educational process is aimed at intensifying the learning process, implementing the ideas of developmental learning, improving the forms and methods of organizing the educational process, which ensure the transition from mechanical assimilation by students of actual knowledge to their mastering of the ability to independently acquire new knowledge. The effective use of the widest range of opportunities realized on the basis of ICT tools is associated today with the formation of ICT competency as the most important component of the general intellectual information and communication competence of all participants in the educational process. The effective use of the widest range of opportunities realized on the basis of ICT means is associated today with the formation of ICT competency as the most important component of the general intellectual information and communication competence of all participants in the educational process [9-10].

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## Competency Based Modular Educational Programs

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### Abstract

It has been established that the basic documents on development of higher education of the Republic of Kazakhstan declared the principles of competence approach and modular learning, but in practice their implementation is faced with certain difficulties and that it is particularly difficult to implement the competency based approach in the absence of professional standards. In this regard, the goal was set to develop a methodology for the formation of integrated standards and implement it for a modular educational program of any specialty. The essence of this methodology consists in that development of integrated standard is not a single process. It is divided, because at the initial stage the representatives of education sphere determine only the expanded list of competences, then the employers enter the process independently on them, and the faculty formulates the learning outcomes only after specification of the competences' list.

To achieve this goal, an algorithm for the development of modular educational programs has been created, methods of document analysis, retrospective analysis and questionnaires were applied, experimental work on the formation of the list of competencies was carried out. The experts who participated in assessing of the competencies importance showed the high qualifications, good knowledge in the labor market and the skill to formulate the required data. On the basis of this list, the list of necessary competencies for "Computer science and software" specialty has been compiled.

**Keywords:** educational standard, professional standard, modular educational program, "Computer science and software" specialty.

### Contribution/ Originality

For the first time in the pedagogical science of Kazakhstan methodology for the formation of integrated standards has been developed, and algorithm for the development of modular educational programs has been created. Practical significance of the study is determined by the fact that this algorithm is implemented on the example of a certain specialty. In this regard the study contributes to the theory and practice of pedagogy.

### 1. Introduction

Credit training technology has been introduced in the higher education system of Kazakhstan. This technology is one of the fundamental principles of the Bologna process. Alongside with the credit technology principle such principles as competency based approach and modular training are of great importance.

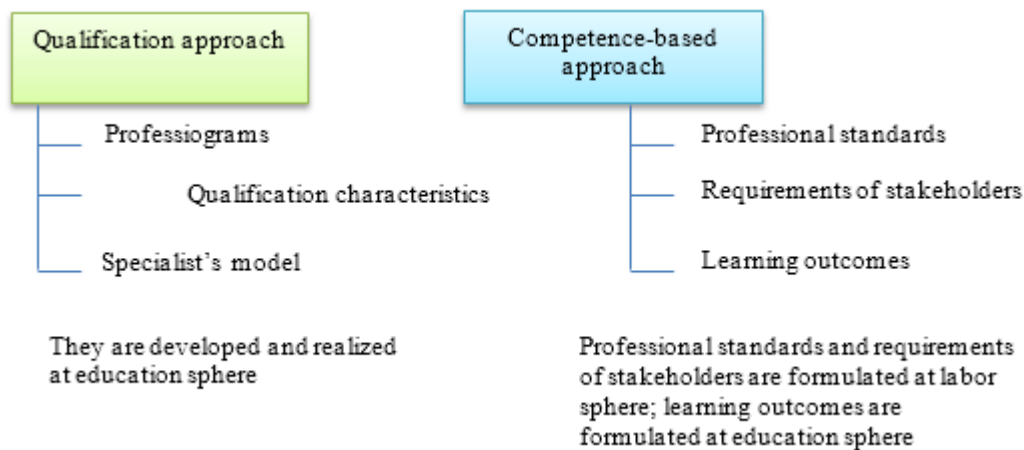
However, although these principles are declared in the basic documents on education development in our country, in practice, implementation thereof encounters certain difficulties. Peculiarity of the objectives to implement at each of these principles is that they should be solved integrally, because a Modular Educational Program (MEP) is a set of modules aimed at mastering certain competencies. The need to solve of the problems proceeds from the global trends:

1) in educational process the emphasis is transferred from the subject (disciplinary) result to the expected results of the knowledge and skills mastering by a student;

2) competences are formed based on the requirements of employers or their associations, and then the required learning outcomes are determined by the competences.



Currently there exists perception of the necessity to reorient assessment of the student's learning outcome from the "knowledge, skills, abilities" concepts of to "competence / competency" concepts. It means the necessity to make the transition from qualification approach to the competency based one in vocational education (Figure 1). Thus, the learning outcomes constitute one of the most important structural elements of the higher education systems (Nabi, 2013).



*Figure1*

Nevertheless, it was believed that it is impossible to describe this result, and much less to standardize it.

Approach to the learning outcome as to a possible basis for recognition of the education content and qualifications (degrees) has become decisive due to Kazakhstan entering into the Bologna process.

There are three known types of standards required for vocational education and training, namely:

- professional standards to describe the functions which a specialist should perform, and the requirements to the competencies needed to perform these functions;
- assessment standards to describe the assessment process needed to award the qualifications;
- Educational standards to describe the learning outcomes required for the qualification gaining, teaching objectives and methods of, and the training context.

In the Republic of Kazakhstan the situation with professional standards is such that they have not been developed yet for most sectors of the country's economy, and there are only 70 professional standards for the training of specialists with higher and postgraduate education (The State Program, 2016).

In connection with this situation the university teachers are bound to seek independently the ways of standards development with due regard to both the requirements of employers, and the experience and knowledge of the education sector representatives. We named such standards as educational-and-professional (or integrated) standards and determined a goal: "to develop a methodology of the integrated standards formation and to implement it for Modular Educational Programs (MEP) on some specialty".

The methodology will consist of two tasks:

- 1) to develop a structure of the integrated standard;
- 2) to develop the document layouts for initial data collection.

## 2. Methodologies

### 2.1. Document analysis method

Cognitive activity is always based on practice, experiments, and observations, as a result of which the factors are established. The comprehending of factors begins with analysis. Analysis (from the Greek "breaking down the whole into elements") is a study method consisting in the mental division of the whole into its component parts in order to identify certain properties and links.

The document analysis method is a method of data collection during the research based on the use of information recorded in written or printed form, on a magnetic film, in electronic and iconographic format, etc. (Shevchuk D., no date). A document is information recorded on a physical medium with certain

requisites. Formalized analysis of documents (content analysis) is a method of data collection by means of the information available in documents. Various sources of information are analyzed. The content analysis is divided into several stages, the first of which is the definition of system of analysis categories, i.e., semantic units. In our case, in order to achieve the semantic units' conformity to the solution of the research problem we limited the circle thereof by two concepts ("professional standard" and "learning outcomes"), and have studied the relevant documents, in particular, the official documents (decrees, orders, etc.), scientific articles, questionnaires, etc.

## 2.2 Retrospective analysis

Retrospective analysis consists in the study of trends turned out during a certain period in the past. Its meaning consists in exhaustive characteristics it gives concerning the process in the statics (the level in the selected period of time) and in the dynamics during the past period (Pimchev, 1992). For the purposes of this article the retrospective analysis of the transition from educational standards to professional ones was conducted.

At the first stage (1994-2004), the State education standards have been developed. Their authors were universities teachers only. They have formulated the requirements to knowledge, skills, acquired habits of the trainees, and determined the education content, methods to check the degree of knowledge and skills mastering.

Due to the university system transition to the credit technology in education in 2004, the form, but not the content, of standards was revised, so they were also developed by the university professors. In the subsequent standards the terms "to master..." and "be competent ..." appeared in the requirements for graduates. The terms "professional-and-personal competence" and "learning outcomes» did not come into use in the state documents on educational policy until 2010, but in the State Program (2016) it is explicitly pointed out that the share of educational programs developed on the basis of branch frameworks and professional standards should reach 45% by 2019.

## 2.3 Questionnaire method

Questionnaire is a main tool of sociological research and constitutes a document containing a structurally arranged set of questions each of which is related to the research objectives. This relation is expressed in the need to obtain information reflecting the characteristics of object under study. It is expedient in two cases:

- a) when it is necessary to question relatively great number of respondents in relatively short time, and
- b) respondents should give their answers a good deal of thought, having a printed questionnaire before their eyes.

A necessary component of the questionnaire is the preamble, in which the questionnaire purpose is described, the respondent's motivation to questionnaire filling is grounded, and the necessary comments and instructions on the respondent's work with the questionnaire are given.

In our case, "closed" questions are preferable than "open" ones, because they are formalized and processed easier. Supplementing the qualitative ideas about its subject with formalized generalizations the pedagogical theory acquires the necessary strictness and stability; therefore we will use "polar" questionnaires with point rating. Based on them, we have compiled questionnaires for evaluating and processing the results.

## 3. Results

### 3.1 The methodology of Modular Educational Programs development

#### 3.1.1 Analysis of documents for the MEP development methodology substantiating

Competency-based approach involves the design of education focused on the outcome. Conceptual framework of the competency-based approach is to replace the teaching paradigm with the learning paradigm. This paradigm is defined as an educational process motivating not only to perform of actions but also to analyze them (Johnson and all, 1992).

As the world's best practices show, in most countries the learning outcomes are formulated in the labor sphere, i.e. by the employers, and allow forming the qualifications. Educational institutions translate them into the competences language; and it is generally accepted that knowledge, understanding, skills,



experience and attitudes (valuable aims) are integrated in the competencies: "Statements of what a student knows, understands and is able to do on completion of a learning process "(ECTS Users' Guide, 2015).

Award of qualification and issue of the relevant certificate; diploma or degree should be awarded based on the assessment of learning outcomes. This circumstance has effect on the function and content of the learning outcome assessment evaluation and compels to apply the special methods and tools of assessment. The learning outcomes determine the student's achievements in the process of mastering the knowledge and practical skills acquired and demonstrated by him/her upon successful completion of the training in whole or on separate module of the educational program. So the concrete individual educational achievements should be evaluated. Therefore, it is necessary to develop the objective criteria for assessment and indicators of the learning outcome achievement, to substantiate the methods and means for learning outcome assessment, and to form unified mechanism for outcome assessment.

When educational standards developing the main load falls on the education sector representatives, because they should implement following:

- to determine an object, a subject, the professional activity functions, and formulate the competences, etc., although this is a prerogative of the labor sphere representatives;
- to develop the education content, the requirements to the graduate's preparedness level and solve other problems.

It is not difficult to see that in this case the educational component prevails in the standards. Thus, the problem of standard's components equalization arises. To solve the problem let us consider one of the economic specialties, as an example. This is due to the fact that among a small number of professional standards there exists a standard of "economic activity", so there is a reason to analyze this document. The content analysis of the document showed that for the "economist" profession the following job functions are distinguished: analysis of the economic activity of the organization and determining of the basic indicators of labor and production management; improvement of the efficiency of labor organization and production profitability; planning of the economic activity arrangement; registration of the contractual obligations of the organization; work with computer facilities.

As you see, the activity goals (efficiency improvement) and the work performed by the specialist of any industry are named as job functions. Besides, the functions are defined in a general form and therefore are applicable to many professions. However, the main drawback is that the professional standard does not conform to the level defined by the National Qualifications Framework (National Qualifications Framework, 2016). Indeed, in the annex to the National Qualifications Framework its structure at the 6th level (Bachelor's) is defined as follows:

Level	Knowledge	Skills and abilities	Personal and professional competencies
6	Wide diapason of theoretical and practical knowledge in professional field	The independent developing and promoting different options of the professional problems solutions using theoretical and practical knowledge	Independent management and control of the labor and educational activities in frame of a strategy, policy and organization objectives, problems discussion, argumentation of conclusions and literate operating by information

The comparison shows that the requirements to the job functions of this level are not reflected in the professional standard.

Thus, in the considered professional standard there are serious shortcomings which do not allow it's accepting as a basis for description of the learning outcomes. We believe that these shortcomings are resulted from the poor preparedness of employers to development of the professional standards.

In order to assist in these shortcomings eliminating, we propose a methodology consisting of two tasks (see Introduction).

When the first problem solving we took into account the shortcomings identified earlier as well as the lack of reference to the professional activity sphere in the standard. Besides, we made a content analysis of a standard's elements structure. We define the order for formation of structural elements "from the general to the particular", i.e. from the professional activity sphere to the tasks from which the learning outcomes are formulated. Then the integrated standard's structure will take the form shown in Figure 2.

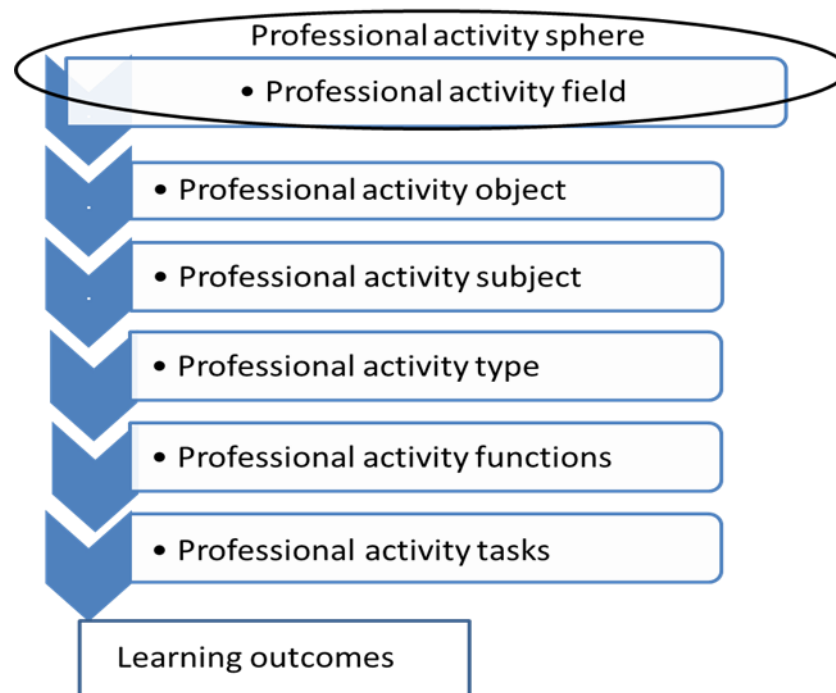


Figure 2

As it is seen on the diagram, only one box relates to educational standards.

Thus, the development of integrated standards can compensate the shortcomings of the professional standard. The methodology of its developing includes the opinion of experts, representatives of business structures, employers and other specialists, and excludes the educational component prevalence.

### *3.1.2 Stages of Modular Educational Programs development*

State Compulsory Educational Standards of the Republic of Kazakhstan are based on the educational paradigm, in which the competences constitute its main components. However, the practical implementation of new paradigm raises certain difficulties. The universities have not abandoned the qualification approach yet.

In our early works we paid attention to the systemic error has taken place for many years in the system of education quality assessment (Nabi, 2013; Nabi and all, 2016). Indeed, requirements to qualification of the higher educational institution graduates were given in the qualification characteristics of the graduate approved by the representative organ in the education field (Ministry) as a guideline document. As the qualification was confirmed by the state examination commission created in the higher educational institution, both the approval and its confirmation were carried out in the education sphere. This results in the situation when a graduate is to learn additionally under real industrial conditions. This model of the professional quality assessment is called "entry" control, and the approach may be called as qualification based one. When the qualification approach is applied a professional educational program is linked with the labor objects (subjects) and conforms to characteristics thereof.

MEP are developed in the context of the competency model of specialists training, this is specially indicated in the Rules (2011, 2016).

As is known, the modular training essence consists in the training content structuring into autonomous organizational and methodological units (modules). The module content and its scope may vary depending on didactic goals; profile and level of the learners' differentiation, there desire to choose the individual movement trajectory according to the educational course. Modules may be mandatory and elective.

The module is a complete set of skills, knowledge, attitudes and experience (competences) required to be mastered and described in the form of requirements which the learner should meet by the module completion, and representing an integral part of more general function. The module is significant for the labor scope (Abbasian & Omani, 2013). Each module is evaluated and is certified usually.

The module is formed as a structural unit of specialty curriculum; as an organizational and methodological interdisciplinary structure in a form of a set of sections from different disciplines united by a thematic basis; or as an organizational and methodological structural unit in an academic discipline framework.

We distinguish 3 types of works related to the MEP development: preparatory, basic and final.

During the preparatory work it is necessary to carry out a set of activities related to the employers.

Competences may be selected on the basis of the branch framework of qualifications and professional standards or, if there are no branch framework of qualifications and professional standards, based on the requirements of employers (see Figure 3). The second stage should end with the description of learning outcomes on the specialty (the whole EP), but this description should be carried out anew if it does not meet the requirements based on the results of expertise of the employers and foreign partners (see the 5th stage in Figure 3).

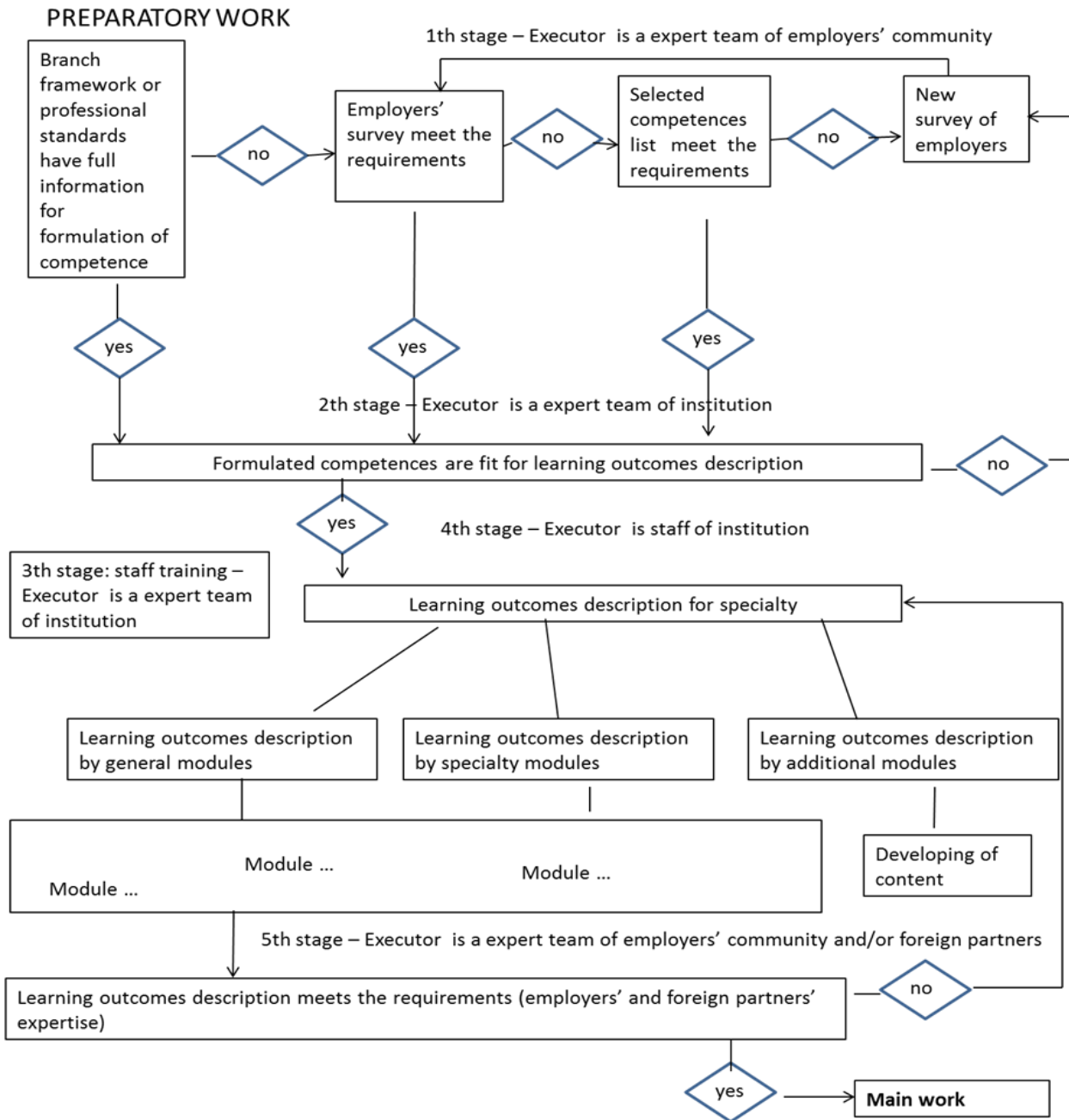


Figure 3

The fourth stage consists in description of the learning outcomes by modules. The modules combination should provide a necessary flexibility degree and freedom in selection and completion of the required specific educational material for the learning (and self-study) of a certain category of students and implementation of the special didactic and professional goals. At this stage, we propose to develop invariant modules, although within the modules there may be the changeable sub modules - course modules. If, according to the results of expertise conducted by the employers and foreign partners, the program meets the requirements, the main work may be commenced.

The main work is the most labor-intensive time-consuming and responsible. It also consists of several stages (Figure 4). For example, at the 3rd stage it is necessary to develop all documents concerning, in particular, the criteria for assessment of learning outcomes and the system of learning outcome assessment. However, it should be kept in mind that the expected learning outcomes shall be easily verifiable and

accompanied by appropriate assessment criteria. Assessment criteria for the learning outcomes are selected by the developers. We recommend using the Dublin descriptors or the Bloom's taxonomy.

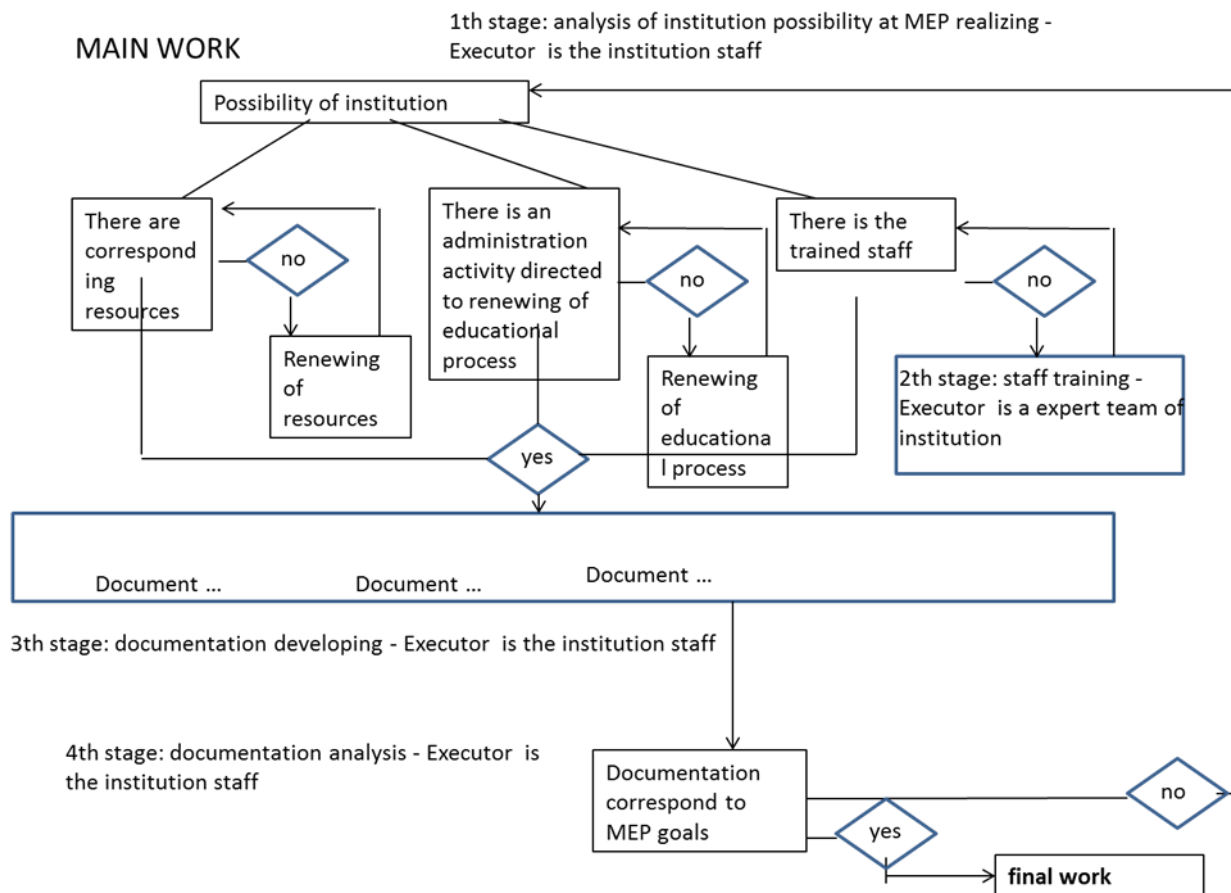


Figure 4

The system for assessment of the student's educational achievements includes forms of assessment, composition of educational assessors, place of assessment, assessment of the levels of learning outcome achievement, and others. The best scenario is when the documents will be drawn up as a Modular Educational Program.

Transition to the final work is possible only upon analysis of the documents.

The work is required for analysis, and in case of the program's positive results the distribution and expansion may be recommended (Figure 5). Analysis of the learning outcomes should be carried out on the basis of independent assessment including that carried out by the students.

**FINAL WORK**

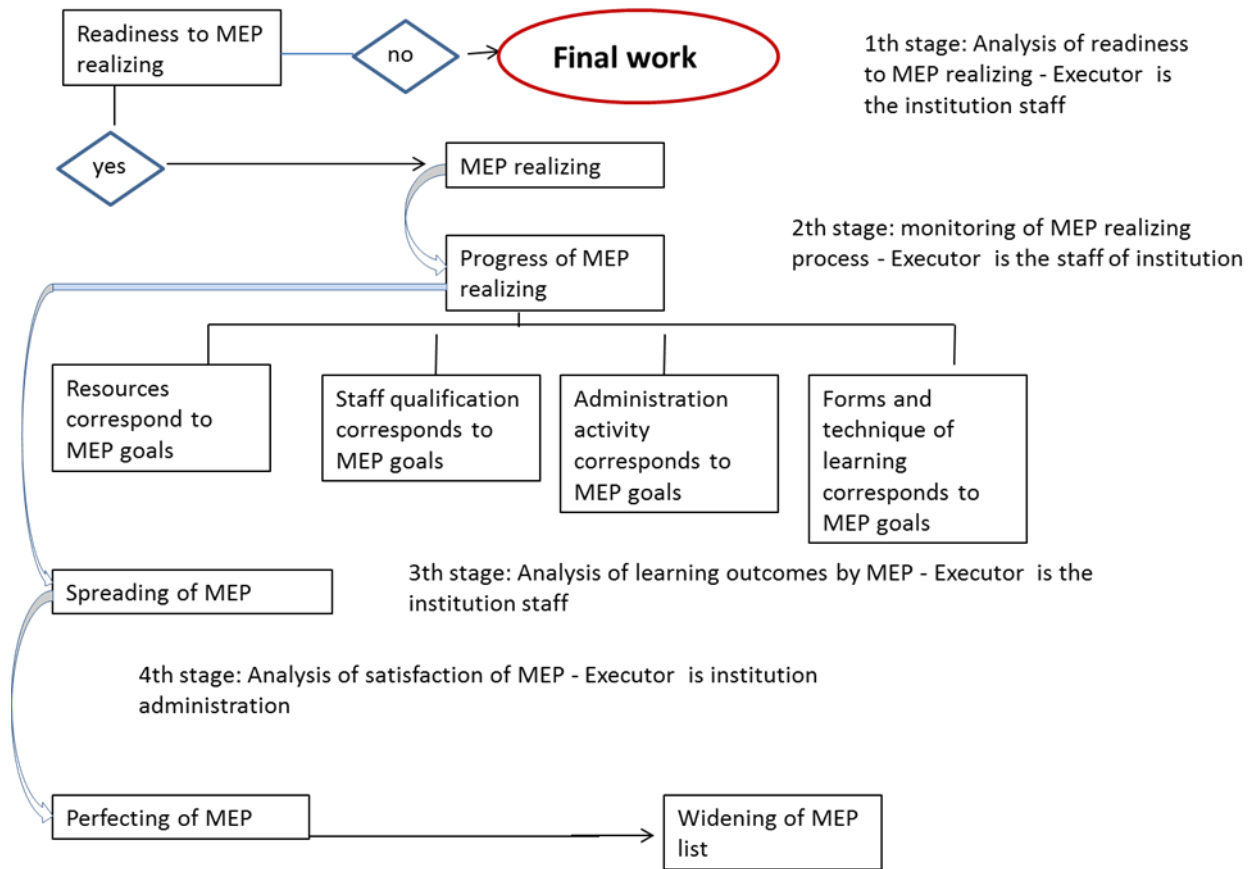


Figure 5

3.2 Implementation of the methodology for development of Modular Educational Programs

3.2.1 Methodology for initial data collection

Two forms of questionnaires for initial data collection are under development. The first questionnaire serves to evaluate the required professional competencies by the expert. Its form is presented in Table 1.

Table 1. Form of the questionnaire for evaluating by expert

We ask you to evaluate (in points from 1 to 5) the importance of the key and professional competencies of the bachelor in the specialty "computer technology and software" presented below and exclude non-core competencies (if any) or supplement the list		
#	Competence	Evaluation of a professional competencies importance
1		
2		
...		
...		
Position, surname, initials, signature		

Representatives of the large manufacturing enterprises and leading professors of the universities are involved as the experts. Joint work helps to take into account the labor market requirements and present them in an intelligible form. As a result, the comprehensive list of competences is formed.

The second questionnaire form is distributed among the representatives of business structures, employers and other specialists. They evaluate significance of the professional competences, selected on the basis of the first questionnaire results. Preliminary list of the competences will be ranked according to the

level of their criticality and selected for adding to the final list for formulation of the learning outcomes as the result of information collecting by means of the second questionnaire.

### 3.2.2 Modular Educational Program of the "Computer Science and Software" specialty

Analysis of European universities' experience in the development of modules indicates their great diversity. However, there is a certain tendency in their classification. For example, the modules are most often classified as follows:

- main modules are the modules which compose the relevant science core;
- supporting modules are the modules which support the vocational training (for example, in mathematical disciplines, physics, mechanics, etc. for technical specialties);
- organizational-and-communicative modules (for example, time management, team work, rhetoric, foreign languages);
- specialized modules expanding and deepening the competences in the chosen field, and optional ones;
- portable modules (diploma thesis works, master's dissertations, internships, projects establishing the links between theory and practice) (Kovtun & Rodionova, no date)

Module types given in the Rules for educational process management according to the credit technology of training and in the Teacher resource book (Omirbaev & Jarasova, 2014) are as follows:

1) general modules including the disciplines of cycles of general educational disciplines and basic disciplines forming the general educational competences not related directly to the specialty, as well as social, ethical, cultural competences (interpersonal, intercultural, civil), economic (entrepreneurial) and organizational-and-managerial competences;

2) specialty modules including the basic and profiling disciplines forming the specialty base and are aimed at the forming of general professional and special competences within the framework of specific educational program, as well as the general competences (critical thinking, creativity, active life position, innovativeness);

3) additional modules going beyond the qualifications and including cycles of disciplines that are not related to the specialty and aimed at the forming of additional competences (information technologies, foreign languages and others).

Comparison shows that the specialty modules consisting of major disciplines constitute analogues of the core modules; and the modules consisting of basic and general educational disciplines are similar to the supplementary modules.

As mentioned above, we have carried out the experimental work aimed at the questionnaires collecting and processing. At the 1st stage the list of competences was formed. At the second stage the business representatives, heads of the universities' structural subdivisions dealing with the computer technology and programming (other than teachers!) and specialty graduates participated in the experimental work. The specialists of "Center for Information Technologies "Paradigms" LLP, "Center for Sustainable Development of the Capital" LLP, "Open Systems Development" LLP, Branch of "Forte bank" JSC, "Pride Systems" LLP etc. were invited as experts.

The results of questionnaires processing are shown in Figure 6. As it is seen in the figure there are no competences rated very low (under 2.5) in the competence list compiled by experts. This points to the high qualifications of experts their good knowledge in the labor market and the skill to formulate the required data.

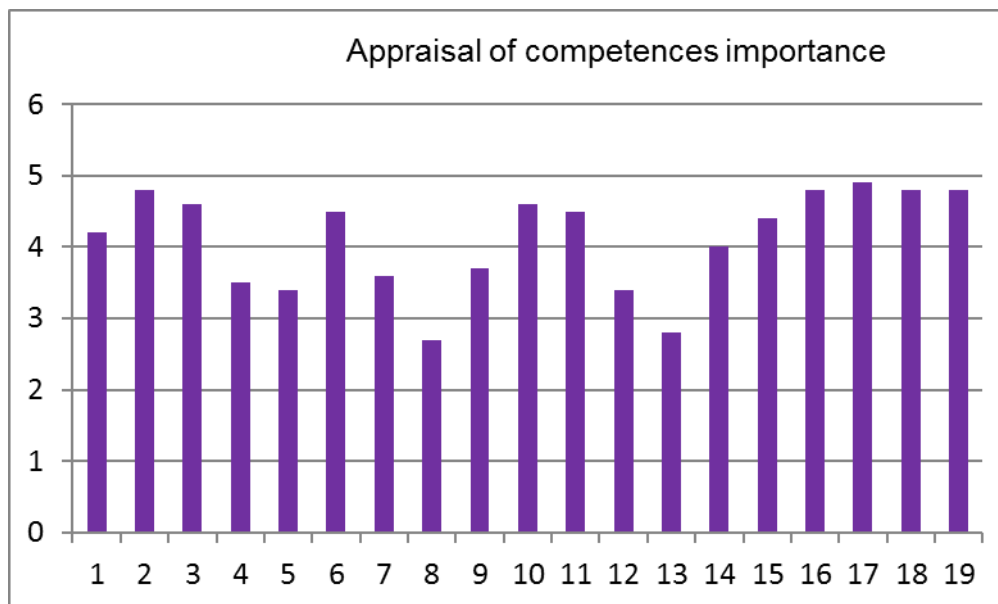


Figure 6

We formulate the names of modules according to the final list of competences, namely:

1) general modules

- business communication and record management;
- principles of research work;
- principles of marketing;
- principles of management;
- economics and accounting;
- principles of entrepreneurship and taxation in the Republic of Kazakhstan;
- engineering psychology;

2) special modules:

- integration of the program modules;
- Methodology for troubleshooting during installation and operation of the equipment;
- Methods and tools for assembly of the modules and software components;
- Customer service methods;
- Methodology for design in the programming;
- Complex SQL queries, query optimization;
- System integration;
- Mobile development;
- BackEnd development;

3) additional modules

- methodology for identification and discussion of the professional problems.

The Modular Educational Program for the "Computer Science and Software" specialty is obtained on the basis of the received data given in Table 2. When considering this curriculum, the following features should be taken into account. The state compulsory educational standards establish the disciplines cycles and the entire volume of credits (129) is divided between them in the ratio of 25, 50 and 25%. Each cycle contains obligatory disciplines and elective disciplines. The number of credits on compulsory subjects and recommended semester of their study are specified by the standard curriculum of the specialty.



*Table 2. Curriculum for the specialty "Computer Science and Software"*

Semester	Type of component	Name of discipline or module	Credits quantity	
			Kazakhstan's credits	ECTS credits
1	OC	Modern history of Kazakhstan	3	5
	OC	Kazakh (Russian) language	3	5
	OC	Foreign language	3	5
	OC	Mathematics	3	5
	OC	Algorithmization and programming	3	5
	EC	General module	5	8
Total			20	33
2	OC	Kazakh (Russian) language	3	5
	OC	Foreign language	3	5
	OC	Information and communication technologies	3	5
	OC	Physics	3	5
	EC	General module	5	8
Total			17	28
3	OC	Professional Kazakh (Russian) language	2	3
	EC	General module	5	8
	EC	General module	5	8
	EC	Special module	5	8
Total			17	27
4	OC	Philosophy	3	5
	OC	Professionally oriented foreign language	2	3
	OC	Architecture and organization of computer systems	3	5
	OC	System Programming	3	5
	OC	Electronics	2	3
	EC	General module	5	8
Total			18	24
5	OC	Digital Circuitry	2	3
	OC	Software Development Tools	2	3
	EC	General module	5	8
	EC	Special module	5	8
Total			19	27
6	EC	General module	5	8
	EC	Special module	5	8
	EC	Special module	5	8
	EC	Special module	5	8
Total			20	32
7	EC	Special module	5	8
	EC	Special module	5	8
	EC	Special module	5	8
	EC	Discipline "Technique for identifying and discussing of the professional problems"	3	5
Total			18	29
In all			129	200

#### 4. Discussion

To understand the methodology novelty you may refer to international experience. As it is known (see, an example, Oleinikova & Muravjeva, no date) in most European countries the employers' associations (corporations, unions, etc.) develop the professional standards that constitute the basis for development of the educational standards. However, in a number of countries (Ireland, Scandinavian countries and some others) such standards are not developed separately. But this does not mean a departure from the education model of focused on the result. This is a consequence of the fact the employers' representatives actively participate in the preparatory work consisting in the description of learning outcomes (the required competences for execution of the labor activities) and in formulation of the requirements to their evaluation, etc. Thus, in these countries the development of professional and educational standards is a single design process.

According to our approach which is different from the approach above the development of integrated standard is not a single process. It is divided, because at the initial stage the representatives of education sphere determine only the expanded list of competences, then the employers enter the process independently on them, and the faculty formulates the learning outcomes only after specification of the competences' list.

We reported the main provisions of the methodology to the teachers of the Kazakh National Agrarian University and Kazakh Innovation Humanitarian Law University and the executive staff of the International Educational Corporation. As a result of the discussion, we received comments and suggestions, in particular, concerning the need to develop interdisciplinary modules.

Problem of the proposed methodology innovativeness remained outside the scope of this study. We define innovativeness as a result achieved in the course of certain process with observing totality of conditions as a source to improve the system effectiveness. (Nabi et al., 2017). As you can see, innovativeness is closely related to validity. We have revealed the aspects of validity by the example of technology (Nabi et al., 2018) and model (Nabi et al., 2017). This seems to be easier than investigation of the methodology validity, because the latter will require substantiation of the methodology use to improve the process efficiency in specific conditions. Since the effectiveness definition takes the certain time, we consider it necessary to study the methodology validity in the further researches.

#### Conclusion

Competency based approach and modular training are important principles of the Bologna process. The world tendencies of education system development dictate the need to introduce these principles into the education system of our country.

When the competency based approach is applied the education goals are connected with both the labor objects performing specific functions and interdisciplinary integrated requirements to the educational process result. Therefore, the vocational education goal consists in the knowledge acquiring and the professional qualifications mastering by the students, and in forming the personal experience which gives them the opportunity to cope with various business and life situations and work in a team. Its implementation creates the conditions for the effective use of capabilities which make it possible to carry out the professional activities fruitfully in accordance with the workplace requirements. In this sense, competences go beyond the professional triad: "knowledge-skills-abilities" and include the informal knowledge. The competences and learning outcomes give an opportunity to rethink the goals and problems of the educational process.

The proposed methodology for development of integrated standards makes it possible to reduce the shortcomings of both educational and professional standards. These shortcomings consist in the prevalence of educational standards over professional standards, and lack of possibility for the professional standards to reflect the job functions performed in the workplace. The methodology under development consists of two interrelated tasks and is based on the principle known as "from general to particular" concerning formation of structural elements.

Each stage of the MEP development (preparatory, main, final) has its purpose, methods of goal achieving and the result. Transition to the next stage is possible only upon obtaining the result. At each stage the goal achieving algorithm represents a flowchart with a clearly defined transition depending on the "yes" or "no".

Implementation of the proposed methodology for development of Modular Educational Programs is shown on the example of the "Computer Science and Software" specialty. Extensive initial material (expert selection of competences at the first stage and evaluation of these competences by stakeholders at the 2nd stage) give the possibility to make a reasoned decision related to due regard to any competence. The final list of competences constitutes the basis for the MEP formation. The program consists of the disciplines of the mandatory component of the standard curriculum and the modules depending on the final list of competences.

In accordance with the structure of integrated standard, after the MEP forming it is necessary to formulate the learning outcomes.

The tasks considered in the study do not cover the full range of problems related to the MEP development. In this regard, we will continue our research in this area.

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# The Nature of Crisis: Can Covid-19 Reveal the Deficiencies in Global Economy Governance?

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## Abstract

The presented paper is devoted to the impact of the crisis as a philosophical and economic paradox on the modern civilization. How inevitable are crises? Are there universal methods for avoiding crisis situations? How effective are the anti-crisis paradigms implemented at the previous crisis stages of human development? These issues are considered by the authors in the framework of the study.

**Keywords:** philosophy of crisis, cyclicity, sustainable development, anti-crisis governance, global economy.

## Introduction

The sad events of the outgoing year associated with the COVID-19 pandemic have made research on the nature of crises, ways to avoid them and methods of mitigating the consequences extremely relevant today. Probably, for the first time, since the Second World War, mankind was faced with such a global shock, which affected almost all countries and continents. The scale of the damage, both economic and social, has yet to be realized and evaluated. It is also necessary to assess the operational response of states, governments, supranational entities to the challenges of the pandemic. To what extent are the selected measures and resources used adequate and sufficient to overcome the crisis? Are the paradigms tested in previous crisis situations ready to effectively "heal" the modern world? The authors will try to answer these questions within the framework of the presented work.

## Methodology

In the framework of the presented work, the authors used the following research methods:

- *at the theoretical level:* study and generalization, formalization, analysis and synthesis, induction and deduction, axiomatics;
- *at the experimental-theoretical level:* experiment, analysis, modeling, synthesis;
- *at an empirical level:* observation, measurement, comparison.

## Analysis

As a rule, the current crisis has much in common with the previous ones, and the methods of dealing with their negative consequences are chosen approximately the same. A distinctive feature of the current situation is that, if earlier the main goals were to restore the economy, rescue enterprises, the struggle to restore the payment system, etc., now there is talk about saving lives.

The problems of crises, their nature, rhythm, predictability have been worrying the minds of mankind for a long time, K. Marx introduced the concept of "limited effective demand" into the scheme of cyclical development of the economy, which, in his opinion, is an organic "defect" of capitalism [1, 2].

He proved that the cyclical development of fixed capital (renewal, aging and replacement of obsolete fixed assets) periodically creates a powerful negative synergistic effect in the form of destructive crises of overproduction caused by limited effective demand and supply of goods and services on the market. Limited effective demand (the demand of the population for consumer goods and services and companies - for machinery, equipment and other investment goods, raw materials, energy), recessions and stagnation of the economy - this is the "norm" of capitalism, its "incurable contradiction".

In modern economic science, the alternation of business cycles is considered by the wave theory of the outstanding Russian economist N.D. Kondratyev, who suggested the presence of long conjunctive waves in the development of society and thereby defined the development of the world economy as an uneven and

cyclical process [3-5]. This theory was put forward at the beginning of the twentieth century and was questioned by many scientists, but now everyone has already recognized the correctness of these conclusions.

In addition, crisis is one of the central concepts of philosophy. In philosophical language, a crisis denotes a borderline state of the system, a state close to the transition of the system to a new qualitative state. In addition, when studying such courses as "Theory of Organization", it is said about the life cycle of an organization, that is, about the laws of birth, functioning and destruction of an organization.

Thus, science recognizes that there are deep-seated problems associated with the development of society and cognition, which further form the crisis. Leader's skill - based on knowledge, be ready to anticipate the beginning of the crisis and do the maximum so as not to get destructive consequences.

World markets are interconnected, managing global development avoiding economic crises has become more and more difficult, since it requires joint efforts of political and monetary authorities of all countries of the world and not only the so-called "developed" ones.

However, in the modern world, completely different trends began to prevail, such as national protectionism, trade and currency wars, which increased the risks of a new economic crisis.

Following the rapid spread of the COVID-19 pandemic, another crisis - the crisis of supply has emerged [6-9].

Over the past 40 years, the world economy has struggled and quite successfully with only one type of crisis - a demand crisis caused by stock speculations and "financial bubbles", rising unemployment, debt burden of states, corporations and the population, falling incomes, etc. The last time the world economy faced a supply crisis was during the 1973 oil crisis, when all Arab OPEC member countries announced that they would not supply oil to countries (UK, Canada, Netherlands, USA, Japan) that supported Israel during the war with Syria and Egypt.

Over the next year, the price of oil rose from three to twelve dollars a barrel, causing high and prolonged inflation in the global economy.

Next, in connection with a decrease in household income due to the closure of enterprises for quarantine and the devaluation of the ruble, a third crisis arose - a demand crisis.

The particular complexity of this situation lies in the fact that the demand crisis and the supply crisis carry different risks and must be treated in different ways.

The experience of dealing with demand crises in recent years has led to the understanding that they can be dealt with by monetary methods - by expanding the monetary base, lowering lending rates and making it easier to obtain loans.

At the same time, it should be borne in mind that the expansion of the money supply in a supply crisis only aggravates the situation, leading to stagflation - simultaneous stagnation of production, high unemployment and high inflation. The first thing that almost all states did was closed the borders, not only for the movement of citizens, but also for the movement of vehicles and goods. In fact, the global economy that has been built in recent decades has not stood the test of time.

Nevertheless, to date, the decline in early 2020 has almost been eliminated, as can be judged by the dynamics of the share price index, it is higher than it was at the beginning of the year (Figure 1). Here we use indices as a kind of indicator of investor sentiment and a barometer of the business climate. Despite this fact the overwhelming majority of stocks do not show the dynamics that the indices show, on the contrary, they are trading at lows. The success of the indices is ensured only by technology giants, their total weight in the S&P 500 broad market index (Figure 1) is about a quarter.



*Figure 1. Change in SP 500 index 2019-2020 (daily data).*

Thus, here it is possible, once again, to question the fashionable thesis of today “the digital economy will save the world”. The economy cannot be digital. We are talking about the widespread use of digital technologies, which were known back in the days of Ancient Egypt. When the century of rapid development of technology began and steam and electricity began to act as the driving force of the economic structure, we did not talk about the "steam" or "electric" economy.

In the continue of the investigation let us consider the comparison of GDP growth with the number of cases in the developed countries with significant population and high pressure of pandemic (Figure 2, and Figure 3). The authors of the article, together with several colleagues from the Institute of Economic Forecasting of the Russian Academy of Sciences, conducted a study with the aim of obtaining threshold values for reducing the GDP of Russia and other developed countries. According to its results, it can be stated that the point of unacceptable damage to the economy is in the range below -8.5%. One can speak of a reversal of the negative trend when it hits the segment [-5%; - 3%]. When the decline values are reached in the interval above -1.5%, one can state a recovery trend in the country's economy.

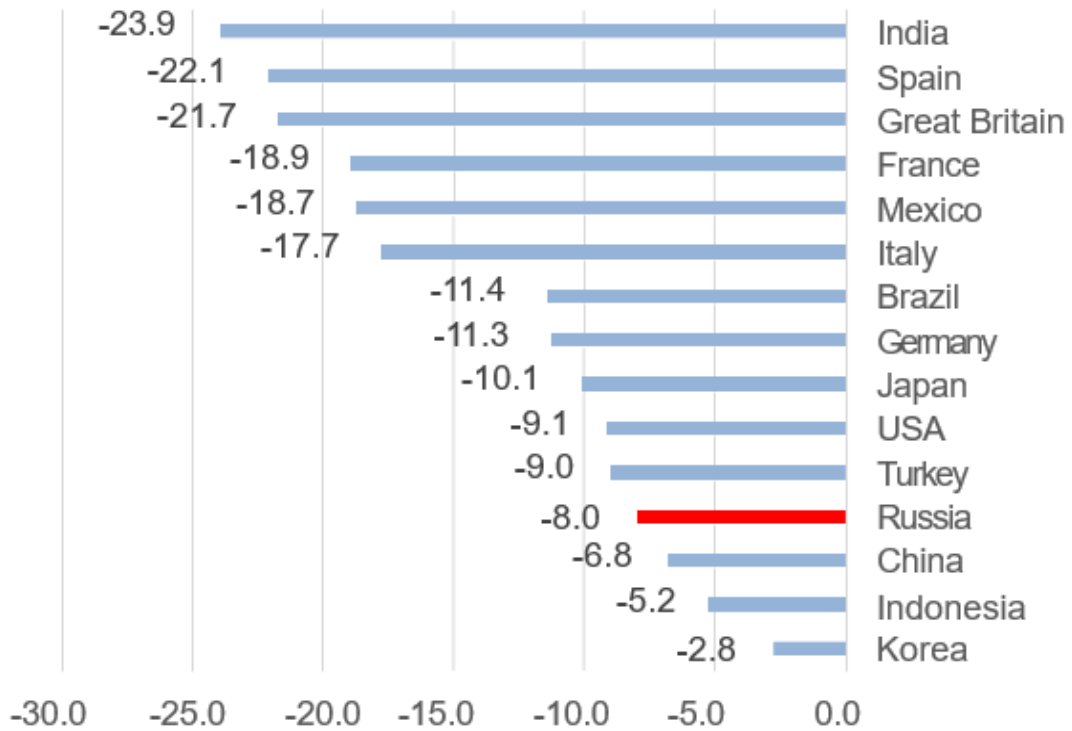


Figure 2. GDP growth, II quarter 2020, year-to-year.

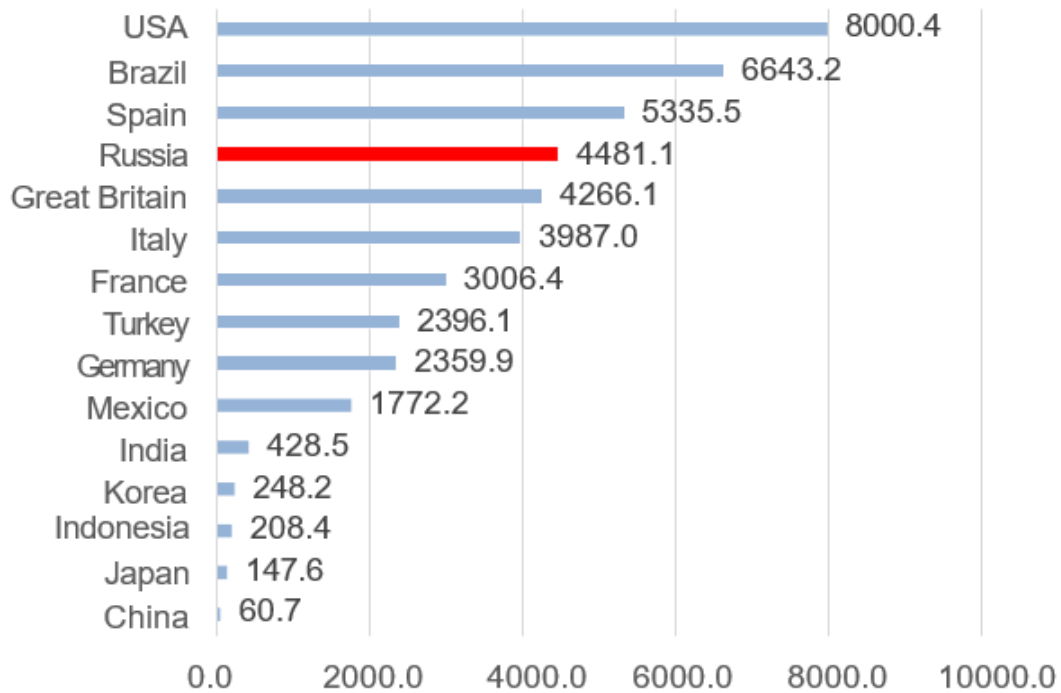


Figure 3. COVID-19 cases, end of II quarter 2020, per million.

The Russian economy was among the "best" in the 2nd quarter of 2020. Despite the fact that the incidence of COVID-19 in Russia is one of the highest in terms of a million population.

### Main Conclusions

1. The cyclical approach to the nature of the crisis considered in the article looks scientifically proven and time-tested. Modern economic science since is not able to invent effective means of countering cyclically arising crises. At the same time, the indicated cyclicity with mathematical exactly corresponds to the doctrine developed at the beginning of the last century by N.D. Kondratyev.

2. Global markets are interconnected, and it has become increasingly difficult to manage global development while avoiding economic crises, since it requires joint efforts of political and monetary authorities from all countries of the world, and not just the so-called "developed" ones.







3. As has been mentioned above, the main contribution in economy indices recovery belongs to the so-called "technology giants" e.g. Facebook, Google, Amazon, etc. At the same time, it should be noted that just yesterday the digital giants carried out the functions of transferring information, but now they also claim a political role - they decide who will be the president of the country, what the election campaign will be, who will say what, etc.

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# On the Evaluation of the Effectiveness of States' Measures to Overcome the Covid-19 Crisis: Statistics and Common Sense

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## Abstract

This investigation is dedicated to the endeavor of critical analysis of the measures that countries and their governments have carried out in order to mitigate the consequences of covid-19 pandemic. The main issues are: Were these measures relevant and effective, or they simply led to the chaos and decline of national economies as well as to the crash of trusts into the powers of current transnational unions and treaties? What was the role of the international organizations such as un and who? Can we consider the actions of russian government as sufficient and timely? Do we enter the new era of political and financial relations?

**keywords:** global economy, political and trade unions, international relations, sustainable development, anti-crisis governance, covid-19.

## Introduction

Any news broadcasts in the media begin with the announcement of dozens or hundreds of new deaths from coronavirus infection. The proportion of deaths from the first wave of COVID-19 was just over 0.7% of the 51 million deaths annually in the world. In Russia, 0.2% of the population is infected. As you can see, the picture is far from the horror and panic that is everywhere whipped up by all types of media. At the same time, it is deliberately ignored that more than 17 million people die from other infections in the world every year [1-5]. Every year about 10 million die from cardiovascular diseases, 1.6 million from tuberculosis, 1.34 million from viral hepatitis. Almost 900,000 children under the age of 5 die from pneumonia. Therefore, the activities of the world media in 2020 more and more resemble a propaganda weapon crafted the twentieth century in the darkest years of Nazism in Germany.

## Methodology

In the framework of the presented work, the authors used the following research methods:

- *at the theoretical level:* study and generalization, formalization, analysis and synthesis, induction and deduction, axiomatics;
- *at the experimental-theoretical level:* experiment, analysis, modeling, synthesis;
- *at an empirical level:* observation, measurement, comparison.

## Analysis

We still do not know how a new virus appeared in China, dubbed 2019-nCoV or SARS-CoV-2. At the end of last year, massive cases of respiratory infection began to be recorded in Wuhan, the capital of Hubei province. There was information about hospital mortality in 4-5%. China informed WHO of the emergence of a new disease on January 31, 2020, after the quarantine was introduced in Wuhan on January 23 (by order of Xi Jinping). By March, the disease had stopped, and the Chinese decided that it was the 72-day quarantine that had allowed the epidemic to be "defeated". This, of course, is not true - several months (from mid-December to early March) is the usual duration of an outbreak of any respiratory viral infection in one city. It should be emphasized that Chinese medicine has unique methods of treating a number of diseases but has never had any noticeable achievements in the fight against epidemics.

According to available statistics, the mortality rate from SARS-CoV-2 in Wuhan city was 1.2%, and outside the city in Hubei province, where there was no quarantine, it was 0.85%. This is fully consistent with the data of British statisticians from Oxford, who showed that the average mortality from a new infection in

economically developed countries, where the proportion of elderly people is high - 1.6%, and in developing countries with a predominantly young population - 0.8%.

Even before the introduction of quarantine in China, COVID-19 was introduced to the countries of Southeast Asia, Western Europe and the United States. Due to the appearance of patients in Western Europe and rumors about the high mortality rate of SARS-CoV-2, WHO on March 11, 2020, without sufficient grounds, announced a pandemic and global danger. The organization is now denying that a pandemic has been declared, saying its CEO only described the situation as "pandemic-like." That is, again the notorious "highly likely" approach.

After the announcement of a pandemic in the outbreak-affected countries of Western Europe, without any analysis, they began to copy the "Chinese way" of combating coronavirus, justifying quarantines and even closing production facilities with the allegedly high lethality of the new virus. These restrictions were observed less strictly than in China, due to the low level of confidence of the local population in their authorities.

Let us consider some statistics on disease and deaths caused by coronavirus infection. Most often, the scale of the spread of infection is judged by absolute data, at the same time, relative, specific indicators level the scale of countries and allow more correct comparisons. In this article, the analysis focuses mainly on relative performance.

The statistics cited by various organizations are not indisputable, it is sad that people get sick (most often the conversation is about the identified cases), but the result of the fight against the disease of entire countries, in which achievements in medicine, science, technology, technology are concentrated, the social responsibility of the population is mortality.

**Table 1.** Analysis of data on number of cases and mortality from COVID-19 in Russia and neighboring countries (per 1 million population).

Country	The number of cases, per 1 million of population	The number of deaths, per 1 million population
Georgia	34 015	318
Poland	26 040	450
USA	41 442	823
RF	15 728	273
Lithuania	12 330	98
Ukraine	16 794	283
Belarus	14 290	122
Kyrgyzstan	11 085	194
Azerbaijan	11 614	134
Kazakhstan	6 977	105
Estonia	5 586	60
Latvia	5 447	64
Norway	5 230	54
Finland	3 446	67
Japan	1 145	17
Mongolia	240	No data
China	60	3

Source: <https://www.worldometers.info>, date of reference 11/30/2020

The data in Table 1 show that among the neighboring countries, Russia, in terms of the number of diseases and mortality, is in third place.

In terms of the number of deaths, Russia is in 52nd place out of 219 countries (Table 2). A simple grouping of these indicators shows that Russia is in the 8th group, together with Poland and Austria.

**Table 2.** Grouped statistics on the spread of COVID-19 (per 1 million population)

Group Number	Number of deaths	Rating	Number of countries in the group	Countries
1	1100-1500	1,2	2	San Marino, Belgium (2)
2	900-1100	3-6	4	Andorra, Spain (5), Italy (6), Peru
3	700-900	7-22	16	Great Britain (8), Argentina, USA (10), North Macedonia, Mexico, Brazil, France (14), Chile, Bosnia and Herzegovina, Montenegro, Bolivia, Czech Republic, Ecuador, Armenia, Colombia, Panama
4	500-700	23-32	10	Slovenia, Sweden (24), Saint Martin, Romania, Moldova, Iran, Bulgaria, Netherlands (30), Switzerland (31), Hungary
5	300-500	33-51	19	Luxembourg, Poland (34), Portugal, Austria (44), Croatia, Canada (46), Georgia, Israel (48), etc.
6	200-300	52-68	17	Ukraine (54), Russia (58), Greece (65), etc.
7	100-200	69-96	28	Germany (71), Kyrgyzstan (72), Lithuania (75), Turkey (81), Azerbaijan (90), Belarus (91), etc.
8	Менее 100	97-220	122	India (97), Estonia (100), Finland (107), Japan (147), China (184), etc.
	169			The World in general mean value

Source: <https://www.worldometers.info>, date of reference 11/30/2020

How did the pandemic affect the economic decline of various countries? As can be seen from Figure 1, in terms of the rate of economic decline, Russia is not in the “leaders”, among which there are richer and more developed countries.

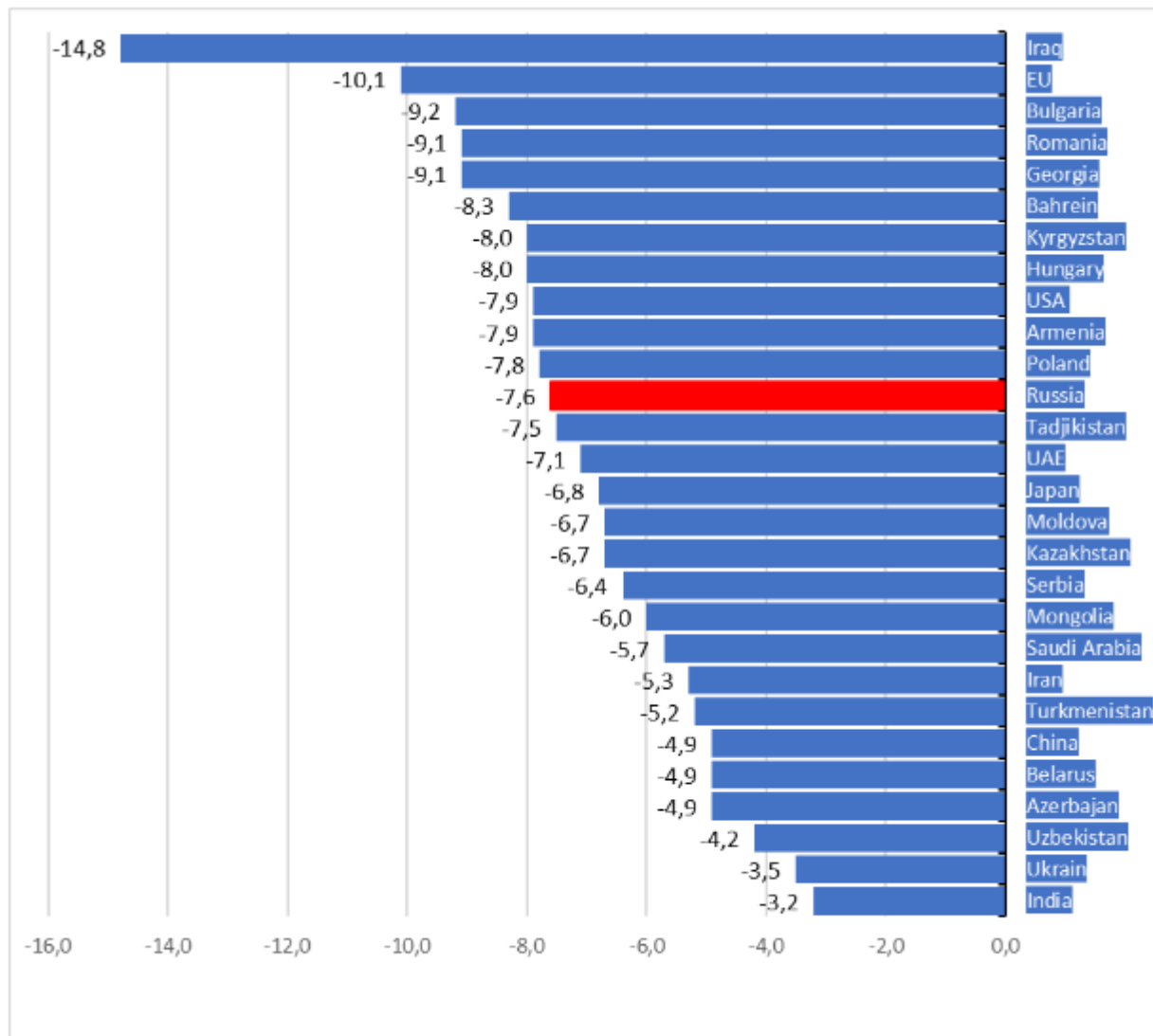


Figure 1. The impact of the pandemic on the growth rates of the economies of the countries of the world.

Source: World Bank; JHU. date of reference 11/30/2020

Practice has shown that the consequences of quarantines and all other measures to combat COVID-19 are more severe than the disease itself. According to experts, the expected decline in real production in the most economically developed countries may be quite significant, which may lead to a decrease in income by the end of the year by more than 10%. The Russian government has announced that the decline in our country will be smaller. This is probably true, since the cuts mainly affected the service sector, which is less developed in our country than in the West. However, despite the small share of small and medium-sized businesses in Russia's total GDP, the number of our fellow citizens involved in this area of the economy is quite large [6-9]. Therefore, the social consequences of the ruin of small and medium-sized entrepreneurs are alarmingly large. According to the Accounting Chamber, the unemployment rate in September 2020 in our country reached 6.3%, and the number of people without work in Russia is approaching 5 million. We can say that there are problems in ensuring the economic activity sectors of the economy, but it seems more likely that each country has a historically established way of life, economy, etc. At the same time, direct copying of someone else's experience does not guarantee survival at a critical moment.

In fact, WHO recognized that strict restrictions and the closure of enterprises, trade facilities, recreational and cultural and entertainment institutions did not have a significant positive impact on human health in the face of an outbreak of coronavirus infection. The speech of the head of the WHO New Diseases

Unit, Maria van Kerkhove, confirmed that against the background of restrictions, an increase in cancer and cardiovascular diseases was recorded [10].

The highest goal of economic development proclaimed today is the all-round increase in gross domestic product (GDP). Overall, it replaced the rather understandable goals of the economy's functioning: providing the population with the necessary minimum of food, housing, industrial goods; the elimination of poverty and misery; achieving economic independence, security, etc. Everything else in relation to this goal plays a subordinate role, acts as a means. Today, it is possible to increase GDP not by increasing the production of goods and services needed by society (the real sector), but by what can be called "products" of the "virtual sector". It includes financial transactions: banks, insurance companies, investment funds, pension funds, hedge funds, as well as any other financial institutions and intermediaries. But this does not save in the event of critical situations, especially those related to human health.

### Main Conclusions

1. Thus, we can conclude that world statistics based on GDP and its derived indicators in a critical situation is useless. In terms of the number of deaths, Russia was significantly "overtaken" by countries with a more developed economy and a high social standard of living. Countries that were previously part of the USSR are also not leading in these sad statistics.

2. Currently, the government of our country is mainly focused on the researches of the Higher School of Economics, which promotes exclusively liberal approaches. It is the recommendations of this organization that we owe to the ongoing long-term reform of domestic health care. The transformation of Soviet health care followed Western patterns, the industry began to develop as a service sector, as a scientific and industrial business. "Unprofitable" hospitals, polyclinics and infectious diseases beds were abolished based on purely financial criteria. The number of doctors and other medical personnel was reduced. Together, this led to great difficulties in 2020. The main problems in the fight against the spread of coronavirus infection in Russia are the shortage of doctors and the workload of medical institutions.

3. The excess mortality situation in countries without restrictions was even slightly better than in countries with restrictions. Probably due to the fact that it was possible to avoid some of the additional deaths in the groups of patients with cancer, strokes and heart attacks, for whom the opportunity to provide timely necessary medical care was preserved, in contrast to countries that massively redesigned hospitals "for Covid-19". In a number of countries, for example, in England and Germany, it was necessary to massively cancel planned operations for cancer patients or refuse medical care to patients with stroke and heart attack due to the lack of free hospital beds.

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## Multi-Year Training Load Structure in the Sprinter Training System

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### Abstract

The research addressed the task of building a multi-year training load structure for short-distance runners. In the course of the work, advanced practical experience was generalized, scientific and methodological literature was analyzed, and statistical data processing methods were used. The article hypothesized that the creation of a multi-year training system of sprinters based on the gradualness and succession principle is possible with the integrated use of results of scientific and experimental activities of the authors, who published their recommendations separately for beginners and qualified athletes. The integrated use of the data available in the scientific literature will make it possible to reduce the subjective influence and to designate an objective trend for more effective management of the multi-year training process for sprinters. The research work result is the multi-year training load structure for training the short-distance runners.

**Keywords:** sprint, multi-year training load structure, volume of training loads, the gradualness principle.

### Introduction

The sprint is one of the most complicated athletic disciplines in terms of achieving the maximum result. That's why the sprint is rated among the most popular and spectacular kinds of the track and field athletics. The issues of setting up the records and personal achievements actualize the efforts made by coaches, athletes and scientists, they stimulate the searches for new pedagogic approaches, loads and technical capacities (Ustinov, 2012; Kawamori & Haff, 2004). The cases were noted when the innovation ideas and the efforts made by coaches do not yield positive results. It is known that the methods and methodologies were used that ensure the results growth, but, in the future, the athletes have to pay for these results with their short sporting career and their own health.

A forced load method is one of such inventions. This method consists in application of great volumes of any high-intensity exercises in a short period of time, as a rule, at a phase of insufficient revival of the athlete (Huxley *et al.*, 2014; Carey *et al.*, 2017). Specialists know well that such an approach for achieving a desired result and satisfying the coach's ambitions is injurious to the athletes' health as well as deprives the young people of sporting and just healthy longevity. The forced intensification of the training process and the received "immediate results" have the seamy side too. An artificially-created but untimely success distorts the natural processes of the athlete's organism. The forced loads have a pernicious effect on the runners' organs and systems at the beginning of their sporting career and, particularly, in the period of its end (Cross *et al.*, 2018; Halson, 2014). These facts became well-known because not only the coaches' community faces a regularity that can be formulated in the following way: concentration of the high-intensity training loads in a relatively short period of time makes it impossible for an athlete to fully recover his or her strength, favors the accelerated wear of human organs and systems and the premature disablement. Apart from that, pursuit for the result does not give any time and chances for the scientifically-substantiated principles of more humane athletic training to be implemented (Stöggel & Sperlich, 2015; Collette *et al.*, 2018).

It is no secret that the athletes' training is a multifaceted and complicated process. The process must take into account and use the fundamental standards of the human vital functions. The general and special physiological regularities of the sporting training are an important subject of the scientific research. The qualitative conclusions on this issue help to make the pedagogic process more efficient. In the methodic literature, such regularities are represented in the form of specific principles. The principles of "consciousness and activity"; "individuality" and "systematicness"; "gradualness" and "succession" are characteristic for the physical training to the maximum extent. All the listed principles are applicable for the training process. The principles of "consciousness and activity"; "individuality" and "systematicness"; "gradualness" and "succession" are characteristic for the physical training to the maximum extent. All the listed principles are also applicable for the training process. However, among them the authors propose mentioning such principles that are of primary importance. The authors believe that the "gradualness" and

“succession” principles determine a success of a multi-year system of training the highly qualified athletes. In the first instance, the both principles are an indispensable condition of competent planning of the multi-year special sporting training. It is no secret that development of various systems of the organism under the influence of training loads must be implemented for a long time gradually and in successive order.

It is impossible to decrease the importance of the training principles in question. If these are high and stable sporting results, the success is determined, in a greater degree, by the physical loads that must be increased gradually with account taken of age and a level of the organism’s physical readiness. The training influence measures are in direct relationship to volumes and intensity of the exercises used. It is the volume and intensity that determine the permissible, necessary or excessive loads (Cross et al, 2018). The measure, which exceeds the adaptive capacities, makes the athletes’ organisms work in an extreme mode. A regular use of the excessive loads destroys the basis of the fundamental training level and poses a threat to the athletes’ health.

In the children and youth sports, inadequate loads can have destructive effect for several reasons. Firstly, the processes of making the basic functions of a young organism are violated or hindered. Secondly, a regular use of the training loads beyond the organism’s adaptive capacities does not allow the young athletes to reach maturity and to fully implement their own talents and aptitudes.

The sprint is one of the outstanding representatives of the youth sports, where the high-intensity loads are used frequently. The trainings in this kind of the track and field athletics are notable for great tension of many systems of the organism. In the children and youth sprint, quantity of the damaging and aggressive factors increases as the race intensity and the high-intensity exercises volume increase. As a result, the psychic and physical tension exceeds permissible standards, which makes many systems of the organism work in an extreme mode during the competitions as well as the trainings. It may be said that during the sprinters training, several kinds of too heavy loads are used. Each of them, in its own measure, creates the prerequisites for traumatization, illnesses or overtraining (Kawamori *et al.*, 2014; Zhigareva *et al.*, 2019; Foster, 2019).

The “gradualness” and “succession” principles imply a more adequate increase in the volume and the intensity of training loads during the whole multi-year training system. That’s why the pedagogic technology, which is based on the gradualness and succession, must be expressed in specific units. An initial level of the numerical concretization is a volume of the applied training loads. The volume, which increases gradually and in successive order, must correlate with standardized time intervals. In the scientific literature these intervals are designated by cycles. For successful prospective planning, in the first instance, it is necessary to determine volumes of the training loads in annual training cycles from a beginner to a highly qualified athlete (Foster *et al.*, 1998).

On the basis of the theses represented, the research for detecting a rational structure of the training loads is important, since it ensures a more full-fledged implementation of talents and faculty of young runners in their sporting career. Apart from a career, it is important for coaches to see to keeping the physical and psychic health of the athletes-beginners (Collette *et al.*, 2018)..

The specialists sort out two kinds of consequences of using the loads, whose intensity exceeds the adaptive capacities: short-term and long-term consequences under the influence of an extreme factor with a striking effect (Yurchenko *et al.*, 2018; Mirzoev, 2000). Apart from the short-term and long-term consequences, distant chronic violations, which restrict the motion activity and the ability to work, can appear. Thus, the research of permissible volumes of the training loads becomes important and timely.

**The research goal** is to determine an annual volume of the training loads in the multi-year system of the sprinters training with the use of the gradualness and succession principle.

In order to achieve the goal in view, it is necessary to solve the following tasks in the paper:

- 1.To determine an initial level of the training loads, whose magnitude is safe for the athletes-beginners’ health To determine the maximum value of the training loads volume, which corresponds to a level of readiness of the highly qualified sprinters.
- 2.What teacher cognition constructs do teachers reveal toward the communicative aspect of IELTS Preparation courses?
- 3.To calculate, by the mathematical statistics method, a trend line as the training loads increase from the beginner to the master of sports.
- 4.To determine, on the base of the trend line, by the extrapolation method, a structure of the training



loads for the 2nd and the 1st grades athletes of, and for the candidates for master of sports.

5.To build a multi-year structure of the training loads for sprinters from the beginner to the master of sports.

## Method

The article analyzes the existing developments and scientific-practical recommendations aimed at improving a system of training of the sprinters with different sporting qualification.

The authors hypothesize that the training process efficiency is determined by rational, specially calculated structured multi-year volumes of the training loads.

In order to confirm this information, this research was carried out. The assigned tasks were solved on the basis of an analysis of the specialized scientific methodological literature and generalization of the practical work experience results.

The scientific methodological literature has results of two pedagogic experiments (Bompa *et al.*, 2019; Mirzoev, 2005). The first research determined the training load volumes for the athletes-beginners (Yurchenko *et al.*, 2018). The second research established the training load volumes for the highly qualified athletes. A trend line was built between the numeric values of these two experiments (Skrygin, 1992; Ivanov, 1990; Zhigareva *et al.* 2019). With the use of the extrapolation method, specific magnitudes of the training load volumes for the 2nd and the 1st grades athletes and for the candidates for master of sports were received.

## Results

According to the results of the research work, the data, which was represented in Table 1, was received. The data fills the multi-year structure of the training loads from the athlete-beginner to the master of sports. The main advantage of the design developed is observation of the principle of gradual and successive increase in the training influence. All the training loads, which are represented in Table 1, are tested, approved and recommended for the use in building a rational load volume. The rationality concerns the load magnitude as well as the ratio of quantity of the exercises of different purposes for the runners-beginners, for the 2nd and the 1st grades athletes, and for the candidates for master of sports and more qualified sprinters (see Table 1).

*Table 1. Ratio of training loads for the 3rd grade athletes*

Training loads	Annual volume of the training loads for the 3 <sup>rd</sup> grade athletes (in units of the total volume)
Less than 80-meters race at a speed of 96-100% (out of max.)	14.8±1.8
100-300-meters race at a speed of 91-100% (out of max.)	20.0±2.6
100-300-meters race at a speed of 81-90 % (out of max.)	17.7±2.4
More than 300-meters race at a speed of 80% (out of max.)	105.6±3.1
Weight exercises (t)	33.5±3.2
Jump exercises (out of * 100%)	7700±109

Source: The table is drawn up by the authors according to the research results.

On the basis of the experimental data analysis in Table 1, it may be noted that the training process is aimed at the general physical training and the study of the sprint technique. The initial training stage tasks consist in the locomotive system strengthening through the jump work and the general weightlifting exercises (Balsalobre-Fernandez *et al.*, 2015; Støren, 2008; Blagrove, 2018; Lockie ,2017). The special training task for the athletes-beginners consists in the development of the quickness and technique of the maximum-intensity race. Priorities of the initial training stage are the basic physical and technical training; the locomotive system strengthening.

The listed aspects of the training work in the sprinters-beginners program require an observation of the following ratios of the loads of different purposes: general physical training – 30%, technical training – 30 %, exercised for training the locomotive system for the sprint – 15%, exercises for improving the general endurance – 20%, special race training – 5 % out of the amount of time spent for the training over a year.

Thus, the training load structure for the sprinters-beginners is mainly aimed at technical and general physical training. The specialized exercises volumes are planned with the minimum value (see Table 2).

This ratio of the exercises of different purposes excludes the possibility of forced influence on the young athletes' organisms (Rumpf, 2012).

*Table 2. Ratio of training loads for the 2nd grade athletes*

Training loads	Annual volume of the training loads for the 2 <sup>nd</sup> grade athletes (in units of the total volume)
Less than 80-meters race at a speed of 96-100% (out of max.)	16.4±2.4
100-300-meters race at a speed of 91-100% (out of max.)	22.7±3.2
100-300-meters race at a speed of 81-90 % (out of max.)	22.6±3.1
More than 300-meters race at a speed of 80% (out of max.)	117.4±4.1
Weight exercises (t)	63.3±5.0
Jump exercises (out of * 100%)	8870±126.7

Source: The table is drawn up by the authors according to the research results

The training load structure of the 2nd grade athletes has a number of specific features. The structure is characterized by the fact that, unlike the athletes-beginners, the maximum-intensity race volume at the sections of up to 80 meters grew to 16.4 kilometers. This volume grew by 11%. For the athletes with this qualification, it is necessary to increase the annual race volume with the maximum speed at the sections of from 100 to 300 meters by 2.7 kilometers, the race volume at the sections of from 100 to 300 meters at the submaximum speed – by 5 kilometers, and the race quantity at the sections of more than 300 meters at a speed of less than 80 % out of the maximum – by 21.8 kilometers. The listed exercises volumes increase in comparison with the initial training stage by 13.5%, 28% and 11.2%, respectively. To develop strength, the sprinters of the considered qualification group must use the weight exercises for sprinters. Such a kind of the training load is equal to 63.3 t for the annual training cycle, which makes up almost 90% of a growth of the plan of the 3rd grade athletes (Healy *et al.*, 2019). Apart from the listed training loads, it is important to use the jump exercises in the volume of 8870 jumps-off during the year, which exceeds a training load of the same purpose of the athletes of the previous qualification group by 15.2%.

In the training load structure for the 2nd grade sprinters, it may be noted that the training process is aimed at an initial level of specialization at a competitive distance. General training tasks are the locomotive system strengthening through the jump work and an increased volume of the combined developing exercises. Special training tasks consist in implementation of the muscle strength potential, which was acquired in the preparatory period, in the competitive distance race and the speed endurance development (Bompa *et al.*, 2019; Issurin, 2010). The training priorities for the 2nd grade runners are the technical training and the initial specialization level.

The listed aspects of the training work in the 2nd grade sprinter program must have the following ratio: 25% is allotted for the general physical training, 25% is allotted for the technical training, 20% is allotted for exercises for strengthening the locomotive system for the maximum-intensity race, 25% is allotted for improving the general endurance, 5% is allotted for the special race training out of the amount of time spent for the training over a year.

Thus, the training load structure of the second stage of the athletic improvement is mainly aimed at the technical and general physical training with the initial specialization elements. The represented ratio of exercises of different purposes makes it possible to come to the sporting specialization stage in a flexible manner and without detriment to the health (see Table 3).

**Table 3.** Ratio of training loads for the 1st grade athletes

Training loads	Annual volume of the training loads for the 1st grade athletes (in units of the total volume)
Less than 80-meters race at a speed of 96-100% (out of max.)	18±2.9
100-300-meters race at a speed of 91-100% (out of max.)	25.5±3.7
100-300-meters race at a speed of 81-90 % (out of max.)	27.7±3.8
More than 300-meters race at a speed of 80% (out of max.)	129.2±5.1
Weight exercises (t)	93.2±6.8
Jump exercises (out of * 100%)	10000±144.1

Source: The table is drawn up by the authors according to the research results.

The training load structure of the 1st grade athletes acquires the regularities that are different from two earlier-considered designs. It is characterized by the fact that the maximum-intensity race volume growth at the sections of up to 80 meters made up 1.6 kilometers. Increase in this kind of a load loses momentum and makes up only 11%. For athletes of this level of qualification, it is necessary to increase the annual race volume at the maximum speed at the sections of from 100 to 300 meters to 25.5 kilometers, the race at the sections of from 100 to 300 meters at the submaximum speed up to 27.7 kilometers, and the race at the sections of more than 300 meters at a speed of less than 80 % out of the best possible result to 129.2 kilometers. The listed exercises volumes grew in comparison with the previous training stage by 12.3%, 22.6% and 10.1%, respectively. To develop strength, the sprinters of the considered qualification group must use the weight exercises in the volume of 93.2 t. for the annual training cycle, which makes up almost 47.2% of the growth out of the training plane of the 2nd grade athletes. Apart from the listed training loads, it is necessary to use the jump exercises in quantity of 10000 jumps-off during the year, which exceeds the training load of the same purpose of the athletes of the previous qualification group by 12.7%.

When considering the training load structure for the 1st grade sprinters, it may be noted that the main goal of the training process determines the improvement of the technical skills and physical capacities for qualitative covering of the competitive distance as the priority aspect. The general training tasks consist in the locomotive system development through the jump work and an increased volume of the combined developing exercises. The special training tasks are the technical skills improvement, the increase in average speed of covering the competitive distance, and the speed endurance improvement. The training priorities are as follows: physical and technical training; special race training to increase the race speed and the speed endurance; formation of the athletes' ability to perform the instantaneous tension with the quickest possible relaxation of muscles during the race.

The training loads in the 1st grade sprinter training structure must have the following ratios: general physical training – 20%, technical training – 20%, exercises for developing the locomotive system for the maximum-intensity race – 25%, exercises for improving the general endurance – 20%, special race training – 15% out of the amount of time spent for the training over a year.

Thus, the training load structure for the 1st grade runners is mainly aimed at improving the special skills of covering the competitive distance. This stage of the sporting improvement comprises the in-depth specialization beginning (Anthony *et al.*, 2012)29].

The training load structure of candidates for master of sports acquires specific features for the qualified athletes (see Table 4.)

**Table 4.** Ratio of training loads for candidates for master of sports

Training loads	Annual volume of the training loads for the candidates for master of sports (in units of the total volume)
Less than 80-meters race at a speed of 96-100% (out of max.)	19.6±3.5
100-300-meters race at a speed of 91-100% (out of max.)	28.2±4.3
100-300-meters race at a speed of 81-90 % (out of max.)	32.7±4.5
More than 300-meters race at a speed of 80% (out of max.)	141±6.1
Weight exercises (t)	123±8.5
Jump exercises (out of * 100%)	11200±161

Source: The table is drawn up by the authors according to the research results

The training load structure of the candidates for master of sports acquires specific features of the qualified athletes. It is characterized by the fact that the maximum-intensity race volume growth at the sections of up to 80 meters made up 1.6 kilometers, which is 9.8%. Further increase in this kind of a load loses its sense, since the training process goal is changed. For the athletes with this qualification, it is necessary to increase the annual race volume at the maximum speed at the sections of from 100 to 300 meters in comparison with the previous stage load by 2.7 kilometers, the race at the sections of from 100 to 300 meters at the submaximum speed – by 5 kilometers, and the race at the sections of more than 300 meters at a speed of less than 80 % out of the best possible result – by 11.8 kilometers. The listed exercises volumes increased by 10.5%, 18.1% and 9.1%, respectively. To develop strength, the sprinters of the considered qualification group must use the weight exercises in the volume of 123 t for the annual training cycle, which makes up 32% of growth out of the training plan of the 1st grade athletes. Apart from the listed training loads, it is necessary to use the jump exercises in quantity of 11200 jumps-off over a year, which exceeds the training load of the same purpose of athletes of the previous qualification group by 12% (Sarabia, 2017).

When analyzing the data received, some peculiarities may be noted. Firstly, the training process is aimed at improving the technical skills and functional capacities for enhancing the maximum result at the competitive distance. The general training tasks are to build up the functional potential of the locomotive system. The special training tasks are to improve the technical skills, to increase the average speed of covering the competitive distance and to improve the speed endurance. The training priorities are the in-depth specialization in a selected kind of the sprint.

The training loads in the springer program of the candidates for master of sports must have the following ratios: general physical training – 15%, technical training – 20%, exercises for developing the locomotive system capacities for the maximum-intensity race – 25%, exercises for improving the general endurance – 10%, special race training – 25% out of the amount of time spent for the training over a year.

Thus, the training load structure for the runners-candidates for master of sports is mainly aimed at deepening the specialization in all the training spheres, on which the competitive distance result depends (see Table 5).

*Table 5. Ratio of training loads for masters of sports*

Training loads	Annual volume of the training loads for the masters of sports (in units of the total volume)
Less than 80-meters race at a speed of 96-100% (out of max.)	21.2±4.1
100-300-meters race at a speed of 91-100% (out of max.)	30.9±4.8
100-300-meters race at a speed of 81-90 % (out of max.)	37.7±5.2
More than 300-meters race at a speed of 80% (out of max.)	152.8±7.1
Weight exercises (t)	168.8±10.3
Jump exercises (out of * 100%)	12400±179

Source: The table is drawn up by the authors according to the research results

The training load structure of the highly qualified athletes is characterized by the fact that the maximum-intensity race volume growth at the distances of up to 80 meters in comparison with the structure of candidates for master of sports made up 8%. For the athletes with this qualification, the annual race volume at the maximum speed at the sections of from 100 to 300 meters must make up 30.9 kilometers. This figure is by 2.7 kilometers more than planned at the previous stage of the sporting improvement. The annual race volume at the sections of from 100 to 300 meters at the submaximum speed increases by 5 kilometers, and the race at the sections of more than 300 meters at a speed of less than 80% - by 11.8 kilometers. The listed race exercises volumes increased in comparison with the previous training stage by 9.6%, 15.3% and 8.4%, respectively. To develop strength, the sprinters of the considered qualification group must use the weight exercises in the volume of 168.8 t for the annual training cycle, which makes up almost 37% of the growth out of the training plan of the candidates for master of sports. Apart from the race and the strength load, it is necessary to use the jump exercises in the volume of 12400 jumps-off during the year, which exceeds the training load of the athletes of the previous qualification group by 10.7%.

When analyzing the data, which was received during the research, it is possible to say that the training process is aimed at preserving the quality of sporting results during the optimum period of time

until the signs of destructive phenomena in the organism appear. According to the results of the research conducted, it is possible to recommend the following training load structure in the multi-year system of the highly qualified sprinters training (see Table 6).

**Table 6.** Structure of multi-year training loads of sprinters of different qualification

Training loads	Grades			Candidate for Master of Sports	Master of Sports
	3	2	1		
Less than 80-meters race at a speed of 96-100% (out of max.)	14.8	16.4	18	19.6	21.2
100-300-meters race at a speed of 91-100% (out of max.)	20.0	22.7	25.5	28.2	30.9
100-300-meters race at a speed of 81-90 % (out of max.)	17.6	22.6	27.7	32.7	37.7
More than 300-meters race at a speed of 80% (out of max.)	105.6	117.4	129.2	141	152.8
Weight exercises (t)	33.5	63.3	93.2	123	168.8
Jump exercises (out of * 100%)	7700	8870	10000	11200	12400

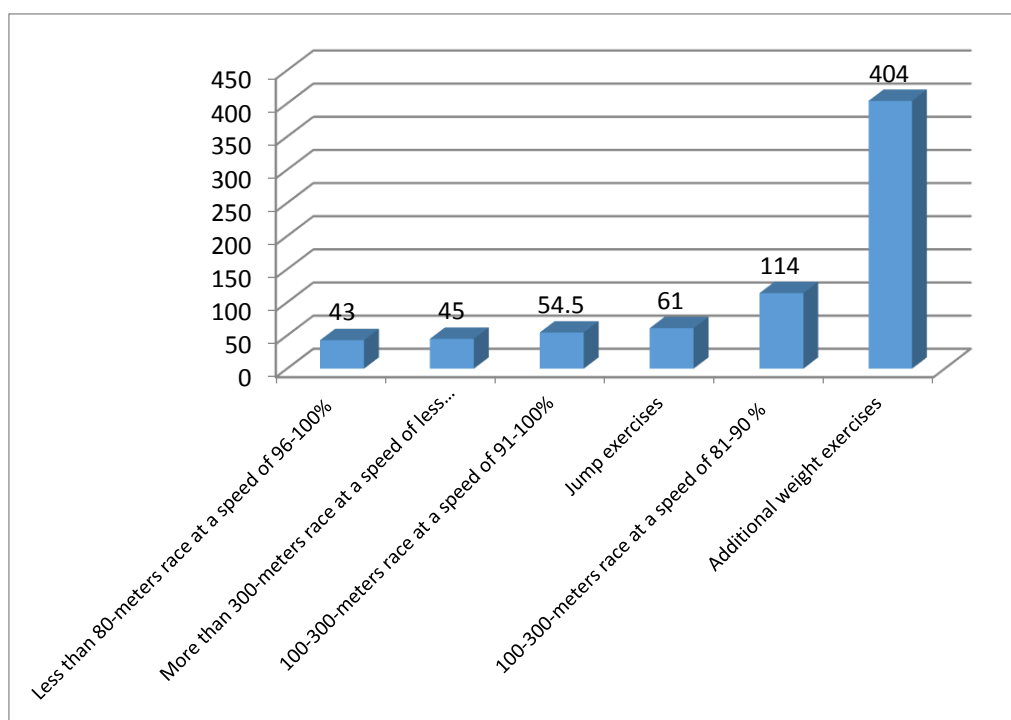
Source: The table is drawn up by the authors according to the research results.

The training tasks of the multi-year sprinter training system are to preserve the achieved magnitude of the maximum speed on the whole competitive distance. The training priorities are to extend the sporting career time; to gradually reduce the training process tension; to finish the competition performances reasonably (Daley *et al.*, 2007; Ross *et al.*, 2001).

### Discussion and Conclusion

Discussion of the research results according to peculiarities of changing the trading load volume of different purposes in the multi-year training structure of sprinters

In the final research part "discussion of the results", it is necessary to pay attention to the dynamics by kinds of the training loads in the multi-year sprinter training system. The data is represented in Figure 1.



**Figure 1.** Dynamics of kinds of the training loads of the beginner and the qualified sprinter in the multi-year training system (in %)

### **Peculiarities of distributing the strength exercises in the multi-year structure of the training loads of sprinters with different qualifications**

The first thing that must be noted is significant increase in a volume of the weight exercises performed by athletes from the beginners to the qualified sprinters. For the whole multi-year cycle of the sporting improvement, this kind of a load increased by 404 %. Such a tendency is quite justified. The sprint effectiveness depends in large part on the quality and quantity of the strength work. If at the beginning of the sporting career the race results at the competitive distance were worse than the results of the general physical and technical training, then at the peak of the sportsmanship, it is necessary to use the strength exercises in sufficient quantity to preserve the dynamics of the results improvement.

When analyzing the research results, it is possible to list the training tasks that are solved by means of the weight exercises: to increase the sprinters' strength potential; to redistribute the functional capacities with emphasis, in the first instance, on developing the muscle groups, on which the race technique efficiency and the distance motion speed depend; to optimize the runner's muscle bulk to a required magnitude in proportion with the basic anthropometric indicators.

Thus, the strength exercises are one of the main training loads. It is necessary to pay particular attention to this kind of a load while planning the training process, since the adequate use of weight exercises preserves a dynamics of the growth of the sporting results during the multi-year sprinters training, including the sportsmanship stage. That's why the strength load is built up in a greater degree than a volume of exercises of another purpose.

### **Peculiarities of distributing the jump exercises in the multi-year structure of training loads**

Let's consider the peculiarities of using the jump exercises in the multi-year structure of training the sprinters. This training load increases from the beginner to the qualified athlete by 114%. The annual stage-to-stage growth has a significant magnitude. The jump exercises volume increases in the same quantity as the majority of training loads do. The listed peculiarities show that the beat exercises are not dominating. Their application is justified only to solve a task for adapting the locomotive system to specificity of the maximum-intensity race. On the basis of the received data analysis, it is possible to designate a list of tasks for the jump loads: functional training of the locomotive system for the maximum-intensity race; the strength potential transformation to an ability to make an explosive effort for the shortest possible time during the maximum-intensity race; development of some technical elements that the sprinters need.

Thus, the jump exercises in the represented training loads structure are auxiliary exercises. The main task is to train the athletes' ligamentous and muscular system for the high-intensity race loads. The jump load growth for athletes from the beginner to the qualified sprinter is at a level of average indicators of all the loads used in the sprinters training.

### **Peculiarities of distributing the technical training loads in the multi-year training load structure**

The technical training is an indispensable element of the training load structure. This kind of training at all the stages from the beginner to the qualified athlete is used in significant volumes. By the way, the time spent for the technical training increases twofold in the multi-year structure. 80 hours at the initial training stage increase to 160 hours for the qualified athletes. This peculiarity is explained by the fact that the sprint's rational technique is one of the leading factors of improving the sporting result. Apart from that, permanent improvement of technique of the start, the distance race and the finishing is driven by several circumstances. Firstly, the sporting results growth makes the sprinters form many technical race elements, since the available skills lose their efficiency as the distance motion speed increases. Secondly, the scientists develop new technical approaches in order to optimize the athletes' efforts, which, in its turn, creates favorable conditions for renewing the records. During the sprinters training, the technique exercises solve several training tasks: to rationalize the sporting activities for improving the competitive result; to improve the special skills for performing the competitive exercises within the existing rules; to develop the myesthesia for timely tension and relaxation in performing the running step; to change the biomechanical indicators that determine the peculiarities of interaction between the foot and the support at the moment of contact, and the athlete body weight transfer to the jump-off phase. The technical skills influence the hands work quality during the race, the flight time and a position of various body parts during the start and the finishing burst. Good or bad technical skills can improve or worsen the athletes' efficiency. Irrational technique requires the additional physical efforts for performing the training tasks. At the tensest race moments, the irrational

technique can cause the traumatization.

Thus, the technical training significance in the training loads system cannot be overestimated. A lot of hours are driven by importance of this kind of the training work. The main task, which is solved by the technical training, is to rationalize the motions in order to improve the sporting result, to preserve the efficiency, and to perform the competitive exercise according to the established rules.

### **Peculiarities of distributing the general training loads in the multi-year training load structure**

The general physical training is an integral part of the whole multi-year training load structure. The general physical training is planned in sufficient volume, from 80 to 160 hours per year, for the beginners and for the qualified athletes. A great deal of time, which is spent for the general physical training, is driven by the necessity to lay down the foundations of a subsequent special load. Availability of the necessary and sufficient volume of this kind of exercises is an indispensable condition of adequacy of the training load structure not only at separate stages of the athletes training, but also in the multi-year structure of the sprinters training.

The use of the general physical exercises volume, which is offered in this paper, will help to solve the following training tasks: to strengthen and develop the locomotive system, the cardiovascular and respiratory systems; to create a rational relation of the strength qualities and the general endurance; to ensure the implementation of the basic functions of an organism at a qualitative level; to remove the prerequisites for the forced development of qualities that are specific for the sprinters; to create condition for increasing the sporting career duration with full-fledged implementation of the available talents and faculty through the rational volumes of the general physical training at all the training process stages.

Thus, the general physical training is represented in the multi-year training load structure in considerable volumes. This kind of training work solves the most important tasks that supply the sprinters with fundamental qualities for using the high-intensity special loads.

### **Peculiarities of distributing the maximum-intensity race volume at the sections of less than 80 meters in the multi-year training load structure**

Let's consider a group of special race loads that are the necessary part of the sprinters' training process. The most outstanding representative of these loads is the maximum-intensity race at the sections of up to 80 meters. The Figure shows that a growth of this exercise from the initial training stage to the master of sports makes up 6.4 kilometers (43 %). Increase in this kind of the training load in comparison with other exercises has the least magnitude. This is explained by the fact that the maximum-intensity race at the section of up to 80 meters is getting less important as the sprinters' sportsmanship increases. At the beginning of the sporting career, the high-intensity race at very short sections solves a task of improving the quickness and the maximum speed at the 60 meters distance. The qualified sprinters orientate themselves at distances of 100 meters and more. That's why the short section race does not have a sufficient training potential. While considering a load in the maximum-intensity race at the sections of up to 80 meters, it is possible to list the tasks that can be solved during the training of less qualified athletes: to improve the motion quickness; to teach the crouch start technique; to overcome a speed barrier at a short section of the sprinter distance; to improve the maximum-intensity race technique; to use a tonic impulse for mobilizing the physical and psychic capacities before a responsible start or the most important training load; to learn and improve a technique of passing the baton in the maximum-intensity race; to improve a technique of braking after the maximum-intensity race as a short section of the running track beyond the finish line.

Thus, the maximum-intensity race at the less than 80 meters sections has the lowest growth indicator in a system of the multi-year sprinters training. This training load is important at the first stages of the sprinters' sporting career. As the athletes' qualification is improved, the maximum-intensity race at the short sections becomes less significant.

### **Peculiarities of distributing the race volume at the 100-300 meters sections at a speed of 91 - 100 % in the multi-year training load structure**

This kind of the training load is used during the whole period of training the sprinters from the beginner to the master of sports. A growth of this kind of race in the multi-year structure makes up 54.5%. As the qualification is raised, this training load is getting more significant. This is explained by the fact that the 100 and 200 meters race distances are the main sprinter distances of the qualified athletes. For the

sprinter-beginners, the listed distances are important too, but in the event if a level of their physical development and functional readiness allows them to cope with an extreme load at the top of capacities of their locomotive system.

The use of the submaximum and maximum-intensity race at the 100 – 300 meters sections solve the following training tasks: to implement the accumulated potential of the strength capacities at a competitive distance in the preparatory period; to develop and improve the speed endurance; to improve various technique elements in the submaximum and maximum speed race at a competitive distance; to control the quality of preliminary training and efficiency of the used structure of training loads; to improve the biomechanical characteristics during the race at a competitive distance, such as the contact time, the flight time, efficiency of interaction of the muscles tension and relaxation phase, the hands motion quality, and the trunk and head position in the space; to adapt all the organism systems ensuring the maximum-intensity race to the coordinated interaction in order to optimize the distance motion.

Thus, the submaximum and maximum-intensity race at the sections of from 100 to 300 meters is the most important part of the training structure. This kind of a load is the most specific for the sprinters and has the special purpose. This race becomes the most significant as the sportsmanship increases. It may be said that for the sprinters, the results at the listed distances are the sporting career culmination. The planning of the considered training load at the stages of the initial sprinter training does not prevail, since the maximum and submaximum speed race at the 100 – 300 meters sections can be used only by the athletes who have the sufficient and necessary physical and functional capacities.

#### **Peculiarities of distributing the race volume at the 100 – 300 meters sections at a speed of 81 – 90 % in the multi-year training load structure**

This kind of a load has the greatest growth from the beginner to the master of sports among the race exercises of other duration and intensity. Its increase in the multi-year structure can reach 100 and more percent. This peculiarity is explained by the fact that this kind of a load is the main training load for the qualified athletes and the least necessary for the beginners. The 100 – 300 meters distance race at a speed of 81–90% at the height of the sporting career is important for several reasons. Firstly, this is the optimum load alternative for designing the competitive distance at a special preparatory stage. Secondly, the race in this mode comprises solution to many training tasks, for example: to develop a feeling of the competitive distance; to improve the tactics of covering the competitive distance; to implement the physical potential accumulated in the preparatory period, at the moment of covering the competitive distance; to develop and improve the speed endurance; an initial stage of improving a technique of the race at a distance which is equal to the competitive distance in terms of length; to coordinate functions of the organism's various systems that, in the first instance, ensure the results at the competitive distance; to develop the stable reflex to the peculiarities that the sprint has. This training load helps to experiment in order to choose the most rational strategy of training the athlete for the best possible result.

Thus, the 100 – 300 meters race with an intensity of 81–90% is the most needed training load for all the sprinters except for the beginners. This exercise potential favors the development and improvement of the physical capacities, technical elements and the tactical and strategic developments.

#### **Peculiarities of distributing the race volume at the section of more than 300 meters at a speed of less than 80 % in the multi-year training load structure**

This kind of a training load does not lay claim to great significance among other exercises represented in the multi-year structure of training the sprinters. A growth from a stage of training the beginners to a stage of the sportsmanship is possible within 50%. The use of this kind of the race load is likely to be of greater importance at the beginning of the sporting career than in the middle or at the end. The race at a moderate speed at the sections of more than 300 meters is used to solve the following training tasks: to develop and improve the general endurance; to build up the race practice in the moderate motion mode; to improve the race technique; to implement the strength capacities in the race.

Thus, the race at the sections of more than 300 meters at intensity of less than 80 % cannot be considered as the main training load. This load is important to solve the secondary training tasks. This kind of the race becomes less significant, as the athletes become more qualified. At the initial training stage, the use of this kind of a load solves the task of developing the general endurance and of adapting the athletes' locomotive system to peculiarities of motion at the competitive distance.



## Conclusion

1. The training load structure at the first stage of the sporting improvement mainly solves the tasks of the technical and general physical training. The specialized exercises are used in the minimum quantity. The represented ratio of exercises of different purposes excludes the possibility of using forced loads.

2. The training load structure for the 2<sup>nd</sup> grade athletes mainly solves the training tasks of the technical and general physical training with the initial elements of specialization. The ratio of the training means of different purposes makes it possible to rationally use the athletes' physical potential to come to the next stage of the sporting specialization.

3. Building of the training loads structure for the 1<sup>st</sup> grade runners has its peculiarity. The main goal of this system is a priority of improving the special sprinter skills making it possible to cover the competitive distance in the optimum mode in term of the technique and functioning of the organism systems, on which the result depends in the first instance. This stage of the sporting improvement comprises the in-depth specialization beginning.

4. The training load structure of the sprinters-candidates for the master of sports is mainly aimed at deepening the specialization in all the training spheres, on which the competitive distance result depends.

5. The training load structure of the masters of sports is supposed to ensure the achievement of the training process goal that consists in preserving the sporting results quality during the optimum period of time until the signs of destructive phenomena in the organism appear. The training priorities are to increase the sporting carrier time; to decrease the training process tension gradually; to finish the competition performances reasonably.

6. The integrated use of the experiments results, which are represented in the scientific literature, made it possible to build the multi-year training load structure for the sprinters. This structure is developed on the basis of the "gradualness and succession" principle.

The multi-year planning of training loads on the basis of the gradualness principle makes it possible to increase the strength exercises volume from the beginner to the master of sports by 400%, the jump exercises volume - by 61%. Quantity of the race at the sections of 100-300 meters and at the sections of less than 80 meters at the maximum speed can increase by 54.5% and by 43%, respectively.

The research results, which are represented in the paper, make it possible to switch over to the building of a rational structure of the training mesocycles that will make the content of the annual training stage, for each qualification group of athletes separately.

7. The strength exercises are the priority facility of training the qualified sprinters. Adequate use of the weight exercises will preserve a dynamics of the sporting results growth during the multi-year sprinters training. That's why the strength load is built up in a greater degree than the exercises volume of another purpose.

8. The jump exercises in the training load structure are an auxiliary load. The main task is to train the athletes' ligamentous and muscular system for the high-intensity race loads.

9. The maximum-intensity race at the sections of less than 80 meters has the lowest growth indicator in a system of the multi-year sprinters training. It is reasonable to use this training load at the first stages of the sprinters' sporting career. As the athletes' qualification is raised, the maximum-intensity race at the short sections becomes less significant.

10. The load in the race at the 100-300 meters distances at the intensity of 81-90% is the most necessary training load for all the sprinters except for the beginners. This exercise potential favors the development and improvement of the physical capacities, the technical elements, and the tactical and strategic developments.

11. The submaximum and maximum-intensity race at the sections of from 100 to 300 meters is the most important part of the training structure. The planning of the considered kind of a training load at the stages of the initial sprinter training does not prevail, since the race at the maximum and submaximum speed at the 100 - 300 meters sections can be used only by the athletes who have the sufficient and necessary physical and functional capacities.

12. The race at the sections of more than 300 meters at the less than 80% intensity cannot be considered as the main training load. The load is important for solving the secondary training tasks. This kind of race becomes less important as the athletes become more qualified. At the initial training stage, the use of this load solves a task of developing the general endurance and adapting the athletes' locomotive system to

peculiarities of the motion at the competitive distance.

As a result of the practical application of the recommendations, which are represented in the paper, several important tasks for the youth sports were solved and can be solved during the further application. These tasks are to use the special loads of permissible volume and intensity; to use the necessary and maximum permissible quantity of general physical exercises; to abolish an idea of the forced training.

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# Analysis of Consumer Preferences for Construction and Repair of Residential Buildings and Apartments in the Context of the Covid-19 Pandemic

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## Abstract

The article analyzes the dynamics of consumer spending on construction and repair of residential buildings and apartments during the COVID-19 pandemic. In the context of the pandemic the author comes to the conclusion that the population of our country needs both to invest money and to solve urgent problems related to the implementation of the following plans – to organize the repair of their own apartments or the construction of houses or summer cottages on their land plots. In this regard, it can be concluded that the owners of apartments and houses plan to spend significant funds to achieve this goal. It comes from the desire of people to save money from inflation and currency exchange rate growth, as well as an attempt to improve their own land plot in order to receive plant and animal products during its operation, which will reduce food costs. Accordingly, the analysis showed that with the growing demand for the services of construction teams, as well as the significant costs of the population for repairs and building during the pandemic, the volume of expenditures of Russian citizens in the construction industry tends to increase.

**Keywords:** pandemic, COVID-19, construction and repair of residential buildings, apartments, consumer costs.

## Introduction

In modern conditions, there is a rather serious epidemiological situation due to the spread of a serious infectious disease, called COVID-19. The disease started in China and spread around the world within a short period of time. The rapid course of this disease often leads to death. In March 2010 the World Health Organization recognized the disease as a pandemic, and governments around the world began to impose various restrictions on their citizens in order to preserve their lives and health. The measures that counteract the spread of COVID-19 was the introduction of a self-isolation regime in most countries for citizens over 65 years of age, the temporary closure of enterprises, the introduction of distance learning in schools and universities, the transfer of employees to remote forms of work, etc.

In Russia, these restrictive measures were also taken. Most of the citizens were isolated in their apartments and houses for several weeks. Also, some citizens, especially residents of such megacities as Moscow and St. Petersburg, preferred to spend time in self-isolation in their summer cottages and country places.

The self-isolation regime has significantly changed the lifestyle of many Russians, influenced their preferences, and also made them think about the future: it is known that the forecasts associated with a decrease in tension in the spread of the COVID-19 pandemic aren't short-term, and it is assumed that this disease will cause a significant number of citizens to be unable to work every day for quite a long period. For this reason, today many residents of our country have begun to think about what they need. On the one hand the need to occupy themselves with something useful, and on the other hand, to prepare the ground for the opportunity to provide themselves with food that can be obtained on a personal subsidiary farm.

In addition, living in an individual home substantially protects citizens from the possibility of contracting infectious diseases, and this is another factor - why so many people during the pandemic began to think about the need to build or repair their personal private homes and cottages.

The purpose of the study is to determine the dynamics of demand for construction materials and services in the building sector by Russian citizens during the COVID-19 pandemic based on an analysis of their costs in this area.

## Materials and Methods

The study was conducted with the involvement of respondents-residents of Belgorod and the Belgorod region who own apartments, country houses or summer cottages, who in the period from 15.03.2020 to 01.09.2020 carried out construction and repair works of these objects. A total of 1,568 people took part in the survey. Data for the survey was obtained by:

- personal survey of research participants in large construction hypermarkets in Belgorod;
- a telephone survey of the authors of ads requesting services for the construction and repair of real estates, published in periodicals and on Internet resources of regional significance.

The data obtained were summarized, systematized and analyzed, and the corresponding conclusions were made. A graphical method was also used to demonstrate the data obtained.

## Results

Recently, researchers have come to the conclusion that the construction industry in Russia is developing in difficult conditions. So, there is an opinion that today it is necessary to talk about the need for large-scale systemic structural modernization of the construction industry, which causes the use of anti-crisis measures and mobilization mechanisms [1]. There is also a drop in the pace of construction of residential buildings on a monthly basis from March to August 2020 by an average of 0.1 % [2]. There is also an opinion that the construction market was negatively affected by the decline in consumer activity [3], which caused some unstable tendencies in the mortgage lending market [4].

According to the authors, the pandemic has led to stagnation in the national construction industry, which already leads to a decrease in the volume of housing commissioning and a reduction in the entry of new sites to the market, and along with a decrease in the purchasing power of the population, it will significantly reduce the profitability of the construction business [5]. The monetary income of the population has decreased, according to some authors, and there is no need to wait for a rapid recovery of the construction industry [6]. It is for this reason that companies working in the construction industry will not be able to fully implement the construction projects started before [7].

The socio-economic situation of the population also raised many questions for researchers [8]. This is due to the fact that a large number of residents of the country were out of work at such a difficult time [9]. This situation can have significant consequences for the economy of our country [10].

However, the market for construction of housing and communal services, as well as the volume of sales of construction materials, tends to grow. It was decided to study the trends in this market and draw appropriate conclusions. The reason for this research was the review of the construction services market in Belgorod and the Belgorod region. The beginning of the pandemic occurred at the beginning of spring, when traditionally all owners of suburban real estate and apartments in multistory buildings carry out repairs and construction work on their own properties. However, taking into account the closure of borders of neighboring countries, such as Ukraine, Uzbekistan, Tajikistan, etc., the city and region had a shortage of personnel in the field of construction: most of the teams that carried out construction work were unable to enter Russia. Accordingly, the demand for construction services provided by local specialists, both legal companies and individual entrepreneurs, and individuals, has significantly increased. In this regard, the employment of this category of workers increased several times during the period under review, and owners of apartments and houses who want to use their services had to wait for the release of construction teams for a considerable time.

Having identified the presence of a deficit in the construction services market, we assumed that the volume of construction and repair work in the Belgorod market still tends to grow, despite the absence of construction teams from neighboring countries. If we take into account that labor migrants officially registered in Russia and involved in construction work, in general, accounted for only 10% of the total number of specialists providing construction services in the city of Belgorod, then we could talk about an increase in the volume of construction and repair work in the studied market.

Taking into account the above, it was decided to study or analyze the amount of expenses in the context of individual items that residents of Belgorod and the region sent for the repair and construction of houses, apartments and suburban areas.

A total of 1,568 people took part in the survey, each of whom was the owner or co-owner of a separate property that was being renovated or under construction. Most of the respondents were men (80% or 1,254

people) and 314 were women. Accordingly, it can be said that the most active position in this area was occupied by men, and it was for them that this activity was important during the pandemic. At the same time, 1,280 people were interviewed on the territory of large construction hypermarkets and 288 people – by phone.

Respondents were asked to answer a number of questions:

1. Are you building a new house or cottage, completing existing buildings, or planning to make repairs in a finished house or apartment?
2. Why did you decide to carry out construction or repair work during this period?
3. Do you plan to carry out construction work by yourself or with the involvement of construction teams?
4. What is the average cost of services that you plan to pay for the services of builders?
5. How much money do you plan to spend on the purchase of construction materials in general?
6. Do you plan to purchase construction materials using your own savings or make a purchase on credit?
7. Do you plan to ask for help in purchasing of construction materials from specialists with whom you sign a contract for construction or repair works?
8. You are planning to purchase building materials for economy class or rely on the acquisition of premium products of famous manufacturers?

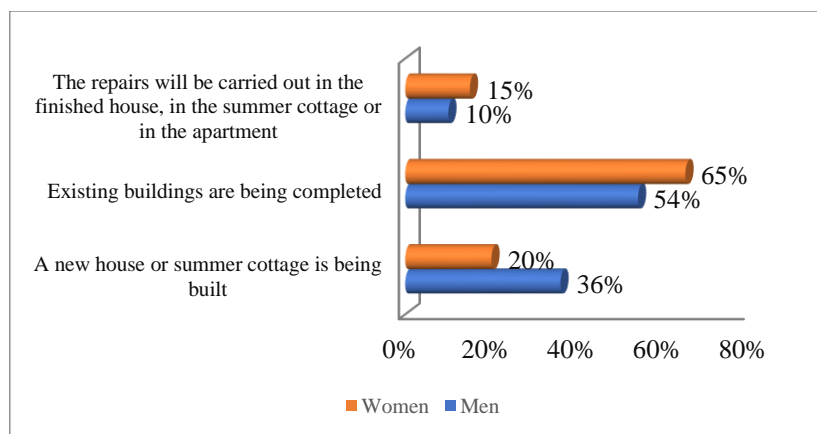
The respondents' answers were summarized in tables and analyzed. Let's look at the respondents' replies in more detail.

The results of the answer to the first question are shown in Table 1.

**Table 1.** Answers to the question "Are you building a new house or cottage, building existing buildings or planning to make repairs in a finished house or apartment?"

Respondents	A new house or summer cottage is in the process of building	Existing buildings are in the process of completing	The repairs will be carried out in the finished house, in the summer cottage or in the apartment
Men	36%	54%	10%
Women	20%	65%	15%

The survey results are shown in Chart 1.



**Chart 1.** The results of answers to the question "Are you building a new house or summer cottage, completing existing buildings or planning to make repairs in a finished house or apartment?"

According to the data obtained as a result of the answer to this question, it can be concluded that 36% of men and 20% of women planned to build new houses or cottages. At the same time, 54% and 65% of men and women, respectively, planned to carry out work as part of the completion of the already started construction. 10% and 15% of men and women, respectively, planned to spend money on repairs. Thus, we

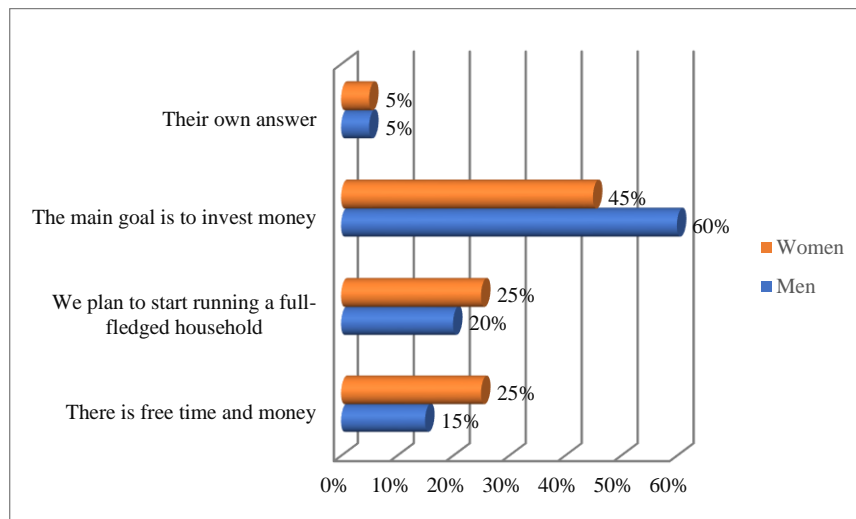
can say that the majority of respondents have an unfinished house or cottage and planned to carry out work that will allow them to finish the property and put it into operation.

The respondents' reasons for starting construction or repair work are shown in Table 2.

**Table 2.** Answers to the question "Why did you decide to carry out construction or repair work during this period?"

Respondents	There is free time and money	We plan to start running a full-fledged household	The main goal is to invest money	Their own answer
Men	15%	20%	60%	5%
Women	25%	25%	45%	5%

The survey results are shown in Chart 2.



**Chart 2.** Results of the answers to the question "Why did you decide to carry out construction or repair work in the current period?"

Based on the results of the study, the following conclusions were made. The main purpose of a greater number of respondents was the investment of funds. This answer was chosen by 60% of men and 45% of women. Accordingly, fearing the results of the pandemic, which had a negative impact on currency exchange rates and devalued the Russian ruble, respondents determined that the best investment of available funds should be to carry out repairs or construction.

Full-fledged household management is the second option in terms of the number of positive responses. Accordingly, the respondents who chose it considered that the organization of providing their family with crop and livestock products from their own plot would help preserve the health of family members and reduce food costs.

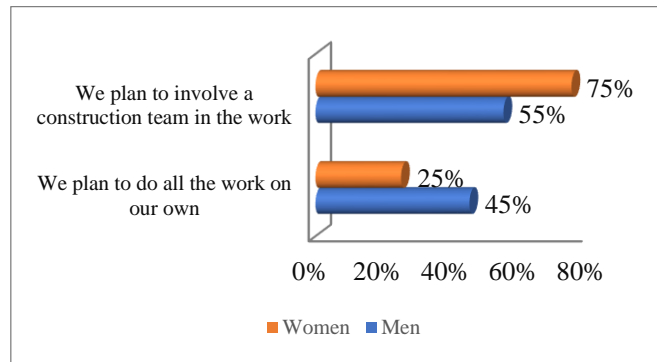
Among their response options were the following: "We have been planning for a long time and at last we've decided", "Children need to move to their own homes», etc.

The results of the answer to the third question are shown in Table 3.

**Table 3.** Answers to the question "Do you plan to perform construction work independently or with the involvement of construction teams?"

Respondents	We plan to do all the work on our own	We plan to involve a construction team in the work
Men	45%	55%
Women	25%	75%

The survey results are shown in Chart 3.



**Chart 3.** Results of the answers to the question "Do you plan to perform construction work independently or with the involvement of construction teams?"

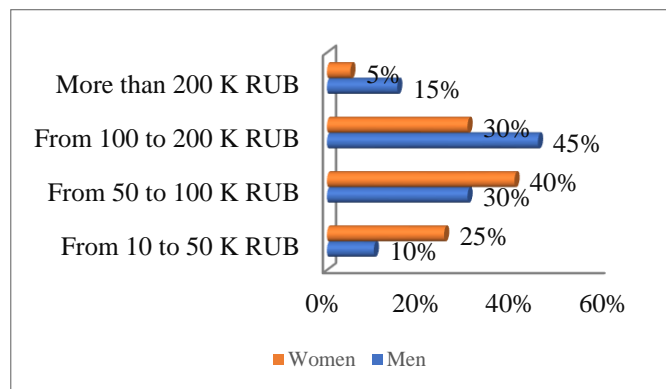
According to the responses of respondents, more than half of both men and women plan to hire specialists, and only 25% of women and 45% of men plan to perform work independently. Consequently, this figure reflects the increased demand for construction professionals in Belgorod and the Belgorod region.

The respondents were also asked about the average cost of services provided by construction teams involved in the work. This question was asked to those respondents who planned to attract hired labor to perform repair and construction work. The results of the responses to this question are shown in Table 4.

**Table 4.** Answers to the question "What is the average cost of services that you plan to pay for the services of builders?"

Respondents	From 10 to 50 K RUB	From 50 to 100 K RUB	From 100 to 200 K RUB	More than 200 K RUB
Men	10%	30%	45%	15%
Women	25%	40%	30%	5%

Graphically, the data in the Table 4 is shown in Chart 4.



**Chart 4.** Results of answers to the question "What is the average cost of services that you plan to pay for the services of builders?"

Thus, we can conclude the following: most of the respondents planned to spend between 100 and 200 thousand rubles to pay for construction services. this was indicated by 45% of men and 30% of women. The lowest percentage of respondents determined that they will send more than 200 thousand rubles to pay for construction services – 15% (men) and 5% (women)

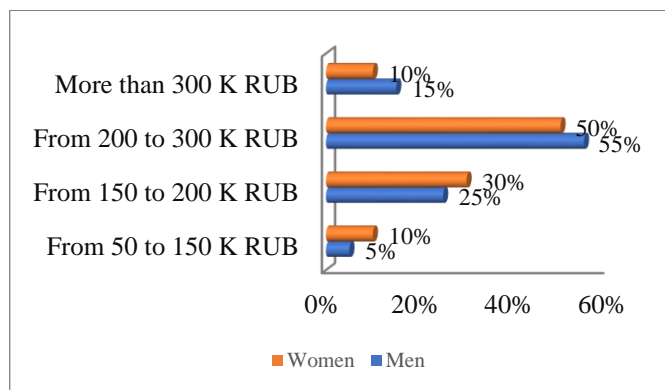
The next question was: "How much money do you plan to spend on purchasing construction materials in General?" The answers to this question are shown in Table 5.



**Table 5.** Answers to the question "How much money do you plan to spend on purchasing construction materials in General?"

Респонденты	От 50 до 150 тыс. руб.	От 150 до 200 тыс. руб.	От 200 до 300 тыс. руб.	Свыше 300 тыс. руб.
Мужчины	5%	25%	55%	15%
Женщины	10%	30%	50%	10%

The survey results are shown in Chart 5.

**Chart 5.** Results of answers to the question "How much money do you plan to spend on purchasing construction materials in General?"

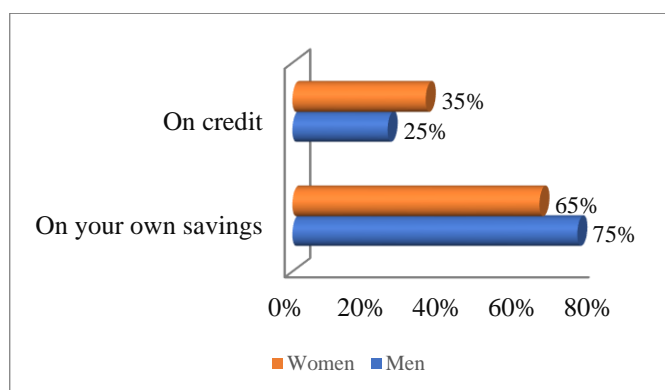
According to the data obtained from the survey, it can be concluded that most of the respondents (55% of men and 50% of women) plan to spend from 200 to 300 thousand rubles on the purchase of construction materials.

Also, during the survey, we found out how respondents plan to purchase construction materials – with their own savings or on credit. The results of the survey are shown in Table 6.

**Table 6.** Answers to the question "Do you plan to Purchase construction materials with your own savings or make a purchase on credit?"

Respondents	On your own savings	On credit
Men	75%	25%
Women	65%	35%

The survey results are shown in Chart 6.

**Chart 6.** Results of the answers to the question "Do you plan to Purchase construction materials with your own savings or make a purchase on credit?"

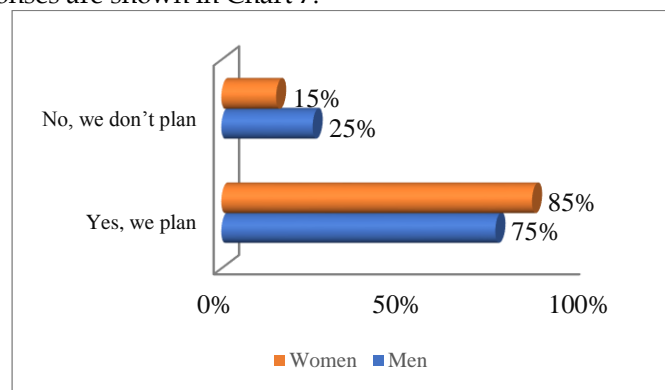
Accordingly, most of the respondents plan to purchase construction materials using their personal savings.

We also found out whether respondents plan to ask for help in purchasing construction materials from specialists with whom you sign a contract for construction or repair. The results of the responses are shown in Table 7.

**Table 7.** Answers to the question: "Do you plan to ask for help in purchasing construction materials from specialists with whom you sign a contract for construction or repair"

Respondents	Yes, we plan	No, we don't plan
Men	75%	25%
Women	85%	15%

The results of the responses are shown in Chart 7.



**Chart 7.** Results of answers to the question "Do you Plan to ask for help in purchasing construction materials from specialists with whom you sign a contract for construction or repair"

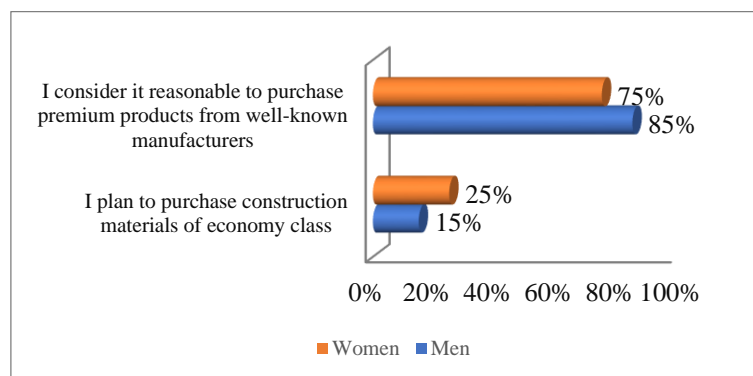
The data indicate that the majority of respondents plan to seek help in purchasing materials from specialists with whom they conclude a contract for construction or repair. This is due to the fact that such specialists usually have the opportunity to get a discount in those stores where they regularly purchase construction materials. Therefore, the cost of building materials will be cheaper.

Consumers were also asked a question: "Are you planning to purchase economy-class construction materials or are you planning to purchase premium-class products from well-known manufacturers?" The results of the response are included in Table 8.

**Table 8.** Answers to the question "Are you planning to purchase economy-class construction materials or are you planning to purchase premium-class products from well-known manufacturers?"

Respondents	I plan to purchase construction materials of economy class	I consider it reasonable to purchase premium products from well-known manufacturers
Men	15%	85%
Women	25%	75%

The results of the responses are shown in Chart 8.



**Chart 8.** Results of the answer to the question “Are you planning to purchase economy-class construction materials or are you planning to purchase premium-class products from well-known manufacturers?”

According to the data obtained, a significant part of the respondents plans to purchase premium construction materials for construction or repair.

### Discussion

The results of the survey showed that most of the residents of Belgorod and the Belgorod region who plan to carry out repair or construction work are men. At the same time, most of the work will be carried out by respondents on their own savings, which indicates that the population has free funds and a desire to invest them in real estate.

The amount that respondents plan to spend on repairs or construction is, on average, from 100 to 200 thousand to pay for the work of builders and from 200 to 300 thousand-for the purchase of construction materials. Accordingly, judging by the volume of expenditures, respondents do not plan to carry out a small amount of repair or construction work, but to make full-fledged investments in the construction or repair of a real estate object. This fact is confirmed by the fact that the majority of respondents choose premium construction materials, not economy, as well as the fact that most consumers plan to attract professionals to perform construction work.

However, the approach to purchasing construction materials from respondents still has its own specifics: most of them plan to apply for this service to construction teams involved in construction or repair in order to get a discount when purchasing. This indicates that consumers still want to save money. Accordingly, all of the above confirms the respondents' response to the question that their main goal in carrying out repairs or construction is to invest money that is constantly devalued due to inflation and currency exchange rate growth.

### Conclusion







In the context of the pandemic, the population of our country needs both to invest money and to solve urgent problems related to the implementation of certain plans – to organize the repair of their own apartments or the construction of houses or country houses on their land plots. In this regard, it can be concluded that the owners of apartments and houses plan to spend significant funds to achieve this goal. This is due to the desire of people to save money from inflation and currency exchange rate growth, as well as an attempt to improve their own land plot in order to receive plant and animal products during its operation, which will reduce food costs. Accordingly, the analysis showed that given the growing demand for the services of construction teams, as well as the significant costs of the population for repairs and construction during the pandemic, the volume of expenditures of citizens of our country in the construction industry tends to increase.

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## The Cost- Effectiveness Analysis Aimed at Paying the Fitness Training for the Staff of a Modern Company

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### Abstract

The article analyzes the effectiveness of expenses aimed at paying for fitness training for employees of a modern company. It was determined that fitness in modern conditions is quite in demand by people of different ages, since sports activities allow you to keep in shape, avoid the development of various diseases, and also contribute to weight loss. However, in the leading fitness clubs, the cost of an annual pass is quite high, which does not allow most employees of modern enterprises to attend classes in such clubs. In this regard, most modern companies include in the motivational package for their employees' payment for the cost of attending fitness classes.

In addition to the motivational component, this event also has a significant economic effect for companies: for example, the organization has the opportunity to increase the level of efficiency of its own activities by reimbursing the cost of fitness services to its employees. So, the analysis showed that employees who are engaged in fitness are less susceptible to disease, which allows them to perform their official duties more effectively. As a result, there is an increase in the company's revenue and a decrease in the value of the absenteeism coefficient. All this testifies to the expediency of carrying these costs by the company and the positive effect of this motivational event.

**Keywords:** fitness training, cost-effectiveness of companies, employees of enterprises.

### Introduction

As you know, the success and effectiveness of the organization as a whole are directly dependent on the professionalism, experience and personal qualities of individual employees. In turn, all these qualities depend on the health of employees.

In modern conditions of stress, psychophysiological load contributes to the occurrence of a whole complex of chronic diseases in employees. To maintain the ability of people to work, new forms of recovery of working capacity and human health are required [1].

Regular physical activity contributes to the reduction of General and professional morbidity. In addition, it also reduces the impact of psycho-emotional and physiological loads, which, in turn, has a beneficial effect on people's health [2].

At the same time, physical activity increases the efficiency of people, which cannot positively affect the efficiency of the companies in which they work.

The purpose of the research is to analyze the effectiveness of expenses aimed at paying for fitness training for employees of a modern company

Materials and methods. In this study, we applied the analytical method of calculation and graphic method, method of analysis of literature.

### Results

In modern conditions, according to D. S. Zasenkov, physical activity is given great importance: they can be used as basic, fundamental elements of corporate culture, and become the basis for forming a corporate image. Thus, the organization of regular staff fitness classes, at the expense of the company, is increasingly becoming an important part of corporate policy [3].



It should be noted that the state, along with employers, is also interested in ensuring that its citizens are healthy. In Russia, a state program is being developed in which businesses will be offered benefits for the fitness of employees. This motivates employers to pay employees for fitness classes [4].

V. M. Guskov believes that it is advisable to develop corporate fitness programs to improve the health of employees. When developing corporate fitness programs, keep in mind that the amount and quality of physical activity applied to a person depends on the age and specifics of the job. Their practical application will enable the company to protect its employees and reduce the risks of diseases such as obesity, stroke, cancer, hypertension, depression, and diabetes [5].

In order to determine the interests of employees in the field of what kind of corporate sports they would like to engage in, it is best to conduct a survey by internal email. This allows you to save time and effort on making a final decision [6].

International organizations also attach great importance to corporate fitness. Corporate fitness improves the well-being of employees, their mood and, as a result, increases their performance [7].

The introduction of sports in an international organization contributes to the creation of its image and a high level of corporate culture. For example, Gmail offers its employees who spend time in a sitting position to stretch out in the fitness center under the supervision of a fitness trainer [8].

Corporate fitness is currently in demand. It has a significant advantage for employees and the company itself, increasing the level of health, profit and image of the organization [9].

Thus, we can say that regular physical education and sports activities benefit not only individual employees, but also the corporation, the professional community, and society as a whole.

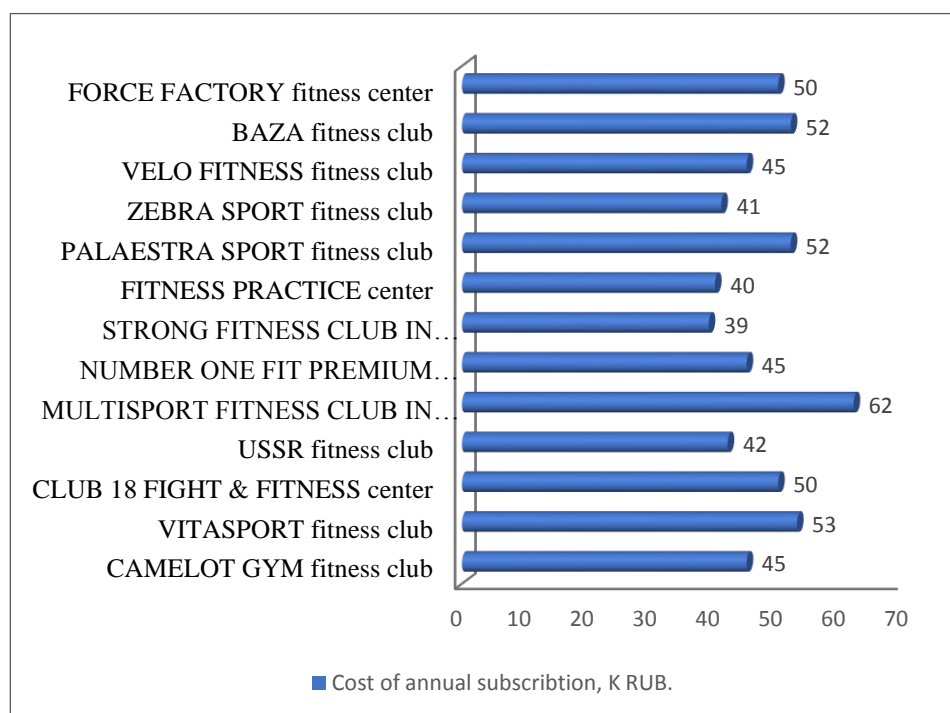
In this regard, we will analyze the effectiveness of expenses aimed at paying for fitness training for employees of a modern company on the example of the organization N\*, which operates in Moscow. The company's field of activity is sales of pet food. The total staff of the company is 145 people.

According to the company's motivational policy, employees are reimbursed annually for the cost of purchasing a subscription to fitness clubs. An analysis was conducted of the cost of annual subscriptions to the fitness clubs that acquired employees of the company and the cost of which was reimbursed by the employer. The cost of annual subscriptions to such clubs (gym centers) is shown in table 1.

**Table 1.** The cost of annual passes to fitness clubs purchased by employees of the organization N\* (Moscow)

Name of the fitness club (gym)	Cost of annual passes, RUB
CAMELOT GYM fitness club	45000
VITASPORT fitness club	53000
CLUB 18 FIGHT & FITNESS center	50000
USSR fitness club	42000
MULTISPORT FITNESS CLUB IN KHAMOVNIKI center	62000
NUMBER ONE FIT PREMIUM FITNESS CLUB ON LUKHMANOVSKAYA METRO STATION center	45000
STRONG FITNESS CLUB IN OCHAKOVO-MATVEEVSKOE center	39000
FITNESS PRACTICE center	40000
PALAESTRA SPORT fitness club	52000
ZEBRA SPORT fitness club	41000
VELO FITNESS fitness club	45000
BAZA fitness club	52000
FORCE FACTORY fitness center	50000

Figure 1 shows an analysis of the cost of season tickets in the context of certain fitness clubs (figure 1.)



**Fig. 1.** Cost of annual fitness club (gym) subscription purchased by employees of organization N\* (Moscow)

According to the presented data, we can conclude that the highest cost of a pass is noted in such clubs as the Multisport fitness club in Khamovniki, the Palestra Sport fitness club, and the BAZA Fitness Club.

The General calculation of the company's expenses for paying for fitness club subscriptions is presented in table 2.

**Table 2.** General calculation of the company's expenses for paying for fitness club (gym) subscriptions

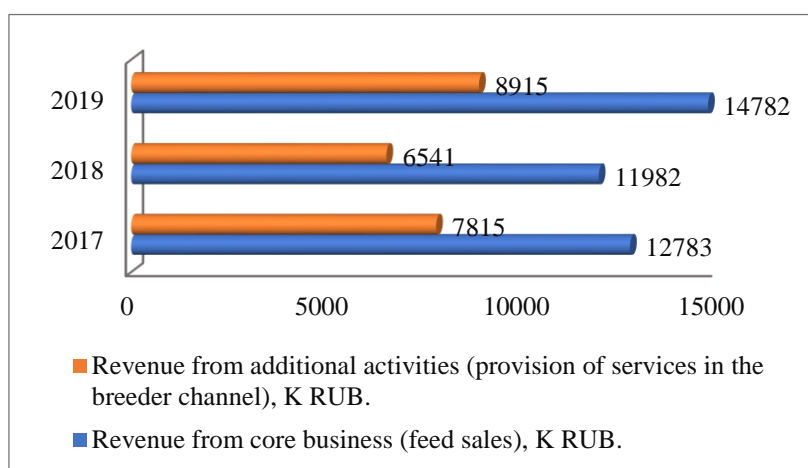
Name of the fitness club (gym)	The cost of an annual subscription, RUB.	Number of employees who purchased a subscription	Cost amount, RUB.
CAMELOT GYM fitness club	45000	10	450000
VITASPORT fitness club	53000	12	636000
CLUB 18 FIGHT & FITNESS center	50000	5	250000
USSR fitness club	42000	12	504000
MULTISPORT FITNESS CLUB IN KHAMOVNIKI center	62000	10	620000
NUMBER ONE FIT PREMIUM FITNESS CLUB ON LUKHMANOVSKAYA METRO STATION center	45000	24	1080000
STRONG FITNESS CLUB IN OCHAKOVO-MATVEEVSKOE center	39000	1	39000
FITNESS PRACTICE center	40000	6	240000
PALAESTRA SPORT fitness club	52000	11	572000
ZEBRA SPORT fitness club	41000	9	369000
VELO FITNESS fitness club	45000	12	540000
BAZA fitness club	52000	14	728000
FORCE FACTORY fitness center	50000	19	950000
Total	-	145	6978000

Thus, it was determined that the total amount of expenses per year for paying subscriptions to fitness clubs was 6 978 K RUB.

To determine the economic efficiency of these costs, it is necessary to calculate the dynamics of the company's revenue at the first stage. N\* company introduced a motivational program for paying for fitness club subscriptions in 2019. Let's analyze the company's revenue in dynamics for three full years-for 2017,2018 and 2019 (table 3).

**Table 3.** Analysis of company N\* revenue for 2017,2018 and 2019 K RUB

Parameter	2017	2018	2019	Alterations, +/-		Growth rate, %	
				2018 to 2017	2019 to 2018	2018 to 2017	2019 to 2018
Revenue from core business (feed sales)	12783	11982	14782	-801	2800	93,73	123,36
Revenue from additional activities (provision of services in the breeder channel)	7815	6541	8915	-1274	2374	83,69	136,29



**Fig. 2.** Analysis of company n's revenue for 2017,2018 and 2019, K RUB.

According to the presented data, the company's revenue in 2018 decreased by 801 thousand rubles compared to 2017 or up to 93.73% of the total. According to the head of the sales department, this was due to a decrease in sales to the retail channel due to the fact that there was a high seasonal morbidity among employees, and control of sales and shipments to Moscow and regional retail companies was reduced.

In 2019, the sales volume increased significantly: its growth left 2800 thousand rubles or 23.36%. According to data from the company's management, the absence of employees from work due to illness during this period decreased, which allowed us to properly organize work in the retail channel and increase sales.

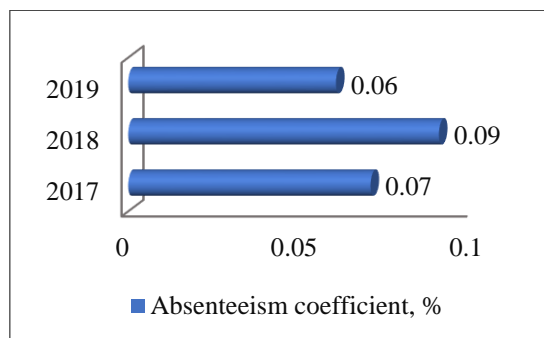
We will analyze the absenteeism indicators for the company to either confirm or deny the data obtained.



**Table 3.** Dynamics of the absenteeism coefficient of the company N\* for 2017-2019

Parameters	2017	2018	2019	Alterations, +/-	
				2018 г. к 2017 г.	2019 г. к 2018 г.
Number of days missed	448	694	480	246	-214
Fund of working time of persons/ days	6500	7540	8060	1040	520
The ratio of absenteeism, %	0,07	0,09	0,06	0,02	-0,03

The dynamics of the absenteeism coefficient is shown in Fig. 3.

**Figure 3.** Dynamics of the absenteeism coefficient of the company N\* for 2017-2019.

Data from the analysis of the absenteeism coefficient, that is, the coefficient reflecting the dynamics of the company's employees' morbidity, suggest a decrease in this indicator.

### Discussion

These studies suggest that the company has the opportunity to increase the level of efficiency of its own activities by reimbursing the cost of fitness services to its employees. So, the analysis showed that employees who are engaged in fitness are less susceptible to disease, which allows them to perform their official duties more effectively. As a result, there is an increase in the company's revenue and a decrease in the value of the absenteeism coefficient. All of this testifies to the expediency of carrying these costs by the company and the positive effect of this motivational event.

### Conclusions





Therefore, we can conclude the following. Improving the health of the body and maintaining a healthy lifestyle has a positive effect on the production performance of modern companies' employees [10]. In this regard, it is quite important to introduce such a motivational component as compensation for employees for the cost of training in a fitness club in most enterprises. Based on a practical example, it was demonstrated that after the organization's employees began to attend sports classes *en masse*, their incidence decreased, which positively affected the company's production results and profits.

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## Comparing the Views of Young Football Players and Their Coaches on Leading Behavior Characteristics

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### Abstract

In the research, the opinions of young footballers were analyzed regarding to the educative and supportive, democratic, social support, autocratic and positive feedback leader behaviors received from their coaches. The demographic characteristics of footballers and coaches were examined. Leader behavior characteristics experienced by coaches were determined and included in the study, also the relationship between the demographic characteristics of football players and leader behavior characteristics experienced by coaches was studied. The data includes the TRNC A2 Super League footballers (total 126) and coaches from 7 different teams located in Nicosia.

In the research, mixed method which includes both quantitative and qualitative methods was used. In the quantitative part of the study, a survey method was applied to determine the leading behavior characteristics of football players from their coaches. In the qualitative part of the study, a semi-structured interview form was prepared and applied to determine the opinions of the coaches about the leading behavior characteristics.

According to the results obtained; the leader's behavioral characteristics that the footballers experienced from their coaches and the opinions of the trainers about their leader behaviors coincide. A significant difference was found between the educational status and football playing time of football players and also their social support behaviors from their coaches. In addition, a significant difference was determined again between the working times of football players with the same coach.

**Keywords:** Leadership, Leader behavior characteristics, Football, Footballer, Coach.

### Introduction

Sport, is the focus of attention amongst people in society (Konter, E. 2016). The concept of competition has become apparent within big communities with football. With the industrial increase of football, expectations within clubs have also increased. People who have invested in clubs expect success. Otherwise, as it has been seen in many situations a tense atmosphere occurs (Singh ve Lamba 2019). In such situations there is an excessive amount of stress and pressure upon football players. Therefore, playing football with this amount of stress and pressure is not easy for each individual player. Considering the level reached in football, being physical sufficient or good is not enough to increase the sportive performance alone. The player's psychological state is as important as their physical state. If a player is insufficient because of their psychological state, even if they are physically ready, they will not be able to reach their target. Consequently, to be able to increase their performance, players need to be ready psychologically. In such circumstances it is more the role of the trainer than the player to resolve the situation.

A trainer needs to have the characteristic of being a leader, to be able to motivate their players not only physically but mentally. This will lead to the achievement of the club's previously determined target. Being a leader is not only for A Team League footballers, it is an important concept for the lower leagues too. A leader, brings a team together to achieve a predetermined target, with use of knowledge and skills that drives the team to be a whole (Fındıkçı, 2009).

Children who are going through adolescent may be very competent physically yet they may not be ready mentally for the A Team League. They may be skillful but lacking in the infrastructure in education leads to the loss of a player without being able to move onto a higher level (Zastrow ve Kirst-Ashman, 2015).

The infrastructure consists of training, alongside mental support to equip players. A player who reaches the A Team league, must know what they will be faced with. Hence the trainer will show their leadership and coaching skills through this process (Özsarı, 2010).



A trainer should be technically equipped with their speech, so they set a good example with their speech, crisis management, and their stance. It has been observed that players with a good infrastructure education in the lower league, are more successful in higher leagues (Akkoyun, 2014).

### Method

Mixed research method was used; it is a study which examines behavioral differences of the trainer leadership characteristics provided towards players, and the trainers leadership skills received by the players. Therefore, both quantitative and qualitative semi structured questions have been used to be able to ensure that the necessary details and reliable data be collected. For this reason, mixed methods of both qualitative and quantitative research methods were used to be able to analysis the techniques within the study. A survey (questionnaire) technique was used to collect the quantitative measurement of the research, in regards to the qualitative measurement a case study was used with the use of face to face interviews with semi-structure questions. Case study is a method widely used in qualitative research (Merriam, 2015). The mixed method is used a source of data collection to be able to analysis data and it is quite common in similar studies (Gürbüz ve Şahin, 2016).

### System and Sampling

This research has been applied to football players in 7 teams aged between 15-19 and their trainers in the Central region of Nicosia in the TRNC Football Super League. The study was conducted with a total of 133 people, 126 football players and 7 trainers, selected with the use of Stratified Sampling method. With the use of mixed method "the Comparison of Young Footballers and Their Coaches' Views on Leader Behavior Characteristics" have been researched. Stratified sampling is a selection technique that allows the subgroups in the system to be identified and be used in sampling with equal proportions (Gay, 2003).

### Data Collection Tools

In the quantitative phase of the study, "Chelladurai and Saleh (1980) Sports Leadership Scale and football players satisfaction questionnaire" (Leadership Scale and Leadership for Sport Scale - LSS) were applied to the football players in order to examine the leadership behavior characteristics that young football players received from their trainers.

In the qualitative part of the study, the semi-structured interview form, which was created to evaluate the opinions of the trainers on leadership behavior, contains 5 open-ended interview questions to determine the educational and supportiveness, democratic, autocratic, social support and positive feedback leadership behavior characteristics which the trainer give to the football players.

### Data Analysis

The quantitative data was evaluated using the SPSS (Statistical Package for Social Sciences; Version 24.0) 24.0 Statistical Package Program. The quantitative data; the calculation mean ( $\bar{x}$ ), standard deviation (S), medium and minimum-maximum values were determined. The quantitative data obtained are shown as numbers and percentages. All descriptive statistics are shown in tables and texts within the study. The significance level for the study was calculated and accepted as 0.05. T-Test and one-way ANOVA analyzes were used for the comparative analyzes. A TUKEY test was applied to the comparisons for the significant difference and the significant difference emerged and was determined.

Qualitative data was used to support the validity and reliability of the quantitative data obtained in the study. In the classification of the qualitative data obtained, NVivo 10 program was used and the data obtained was analyzed by the use of descriptive and systematic analysis. In addition, the division of the answers received in these interviews being classified into different groupings were also used (Gürbüz & Şahin, 2016).

### Findings

The findings obtained from the football players regarding their perceptions on their trainer's leadership behavioral characteristics can be seen in the table below.

**Table 1. Educational and Supportive Behavior**

Educational and Supportive Behavior	X	SS
The football player works to the best of their capacity.	1.34	0.62
Explains techniques and tactics related to the sport to each footballer.	1.50	0.80
Pays special attention to correcting the mistakes of football players.	1.46	0.76
Ensures that the function in the team is understood by the football players.	1.69	0.85
Shows the necessary skills of the sport needed to each football player individually.	1.62	0.70
Pre-plans what needs to be done and plans accordingly.	1.37	0.70
Explains to each individual athlete what to do and what not to do.	1.59	0.81
Expects every football player to fulfill their mission, down to the very last detail.	1.69	0.99
The trainer is aware of each football players strengthens and weakness.	1.65	0.98
The trainer provides specific training to each footballer according their situation.	1.86	1.07
The trainer is aware of each footballer's efforts and gives importance to their interconnectedness.	1.83	0.92
The trainer explains how each individual footballer contributes to the end result.	2.19	1.30
The trainer specifics in detail what is expected from the footballer.	1.68	1.00

The data on football players regarding their trainers' educational and supportive behavioral characteristics can be seen in Table 1, on average the response is that the trainers always provide educational and supportive leadership behavior with a high frequency response of "always" and some participants responded as "often".

According to the findings trainers, being aware of football players capacity ( $X=1.34$ ,  $SS=0.62$ ) and pre-calculating in advance, and according to that determines an appropriate plan ( $X=1.37$ ,  $SS=0.70$ ). The response football players provided is that trainers frequently explains to each football player how each individual player contributes to the end result ( $X=2.19$ ,  $SS=1.30$ ). Another finding that is made apparent is that, trainers give importance to each football player's interconnectedness ( $X=1.83$ ,  $SS=0.92$ ). It can also be perceived that most trainers provide each football player with specific training according to each situation ( $X=1.86$ ,  $SS=1.07$ ).

**Table 2. Democratic Behavior**

Democratic Behavior	X	SS
The trainer ask football players for their personal opinions on strategies to be followed during the match.	1.90	1.06
Before making important decisions the trainer receives a team consent from football players on important matters.	2.16	1.30
The trainer consults and gets football players opinions while making a decision.	2.16	0.98
The trainer encourages its football players to make recommendations regarding the way training will be implemented.	1.92	0.98
The trainer allows its football players to set their own goals.	1.57	0.75
The trainer allows football players to try their own way, even if they make mistakes.	2.05	0.85
The trainer takes the opinion of football players regarding important coaching issues.	2.42	1.19
The trainer allows its football players to work to the extent of their own capacity.	2.00	0.99
The trainer allows its football players to participate in making a decision on tactics to be used in a competition.	1.77	1.19

In Table 2 the results regarding football players perceptions on their trainer's democratic behavioral characteristics is apparent as the trainer often samples democratic behavioral characteristics.

The responses regarding the trainer are as most of the time "always" or most of the time "often". The findings on the trainers are, the football players are permitted to set their own targets ( $X=1.57$ ,  $SS=0.75$ ) and the players are able to contribute to the decision and tactics to be used during the match as ( $X=1.77$ ,  $SS=1.19$ ). The responses which the football players provided regarding the trainer consulting and taking on their

opinions on important issues related to coaching were as often ( $X=2.42$ ,  $SS=1.19$ ). According to the research one thing that is comprehensible is that trainers acquire the ideas of their athletes for the strategies to be followed in certain competitions ( $X=1.90$ ,  $SS=1.06$ ). Hence most trainers, allow for football players to try out their own way even if it is believed that there is a miscalculation ( $X=2.05$ ,  $SS=0.85$ ).

*Table 3. Social Support Behavior*

<b>Social Support</b>	<b>X</b>	<b>SS</b>
The trainers helps their players with their personal problems.	1.47	1.00
The trainers helps resolve conflict amongst the team members.	1.93	1.17
The trainer wants their player to be personally good in every aspect.	1.42	0.79
The trainer provides personal support to their players.	1.64	0.82
The trainers expresses their feelings towards their players.	1.96	1.10
The trainer encourages their players to trust and believe in themselves.	1.81	1.03
The trainer has a close and informal relationship with their players.	2.00	1.12
The trainer is encouraging.		
The trainer invites players to their home.	3.01	1.59

The responses of the football players regarding the social support behavioral characteristics they received from their trainers is apparent in Table 3 there is an indication that the trainers frequently practice social support leading behaviors towards their players.

The answers given in this section on average are, that most of the trainers are at the "often" and some of them are at "always". According to the findings obtained from the study, it was determined that the trainers wanted the football players to be good in every aspect ( $X = 1.42$ ,  $SS = 0.79$ ) and support the players with their personal problems ( $X = 1.47$ ,  $SD = 1.00$ ). With the responses provided, the football players stated that their trainers provided personal assistance and support to their football players. ( $X = 1.64$ ,  $SS = 0.82$ ). One of the results found in this study is that trainers often encourage football players to have close and informal relationships ( $X = 2.00$ ,  $SD = 1.12$ ). However, it can be seen that a small sum of the trainers invite their football players to their homes. ( $X = 3.01$ ,  $SS = 1.59$ ).

*Table 4. Autocratic Behavior*

<b>Autocratic Behavior</b>	<b>X</b>	<b>SS</b>
The trainer makes plans relatively independent of their players.	2.51	1.20
The trainer does not provide an explanation to their players about their behavior.	2.42	1.31
The trainer does not argue with their players about issues which they have already decided on.	2.24	1.39
The trainer has a distant between them and the players.	3.33	1.47
The trainer speaks in a competently manner which prevents players form asking questions.	3.08	1.80

In Table 4, the responses provided by the football players to the autocratic behavioral characteristics they received from their trainers indicate that the trainers frequently practice autocratic leading behaviors.

When analyzing the answers provided in this section, on averaged it can be seen that most of the trainers received a response of "often" and some of them "occasionally". The findings obtained from the research show that some of the trainers keep at a distance from their football players ( $X = 3.33$ ,  $SD = 1.47$ ) and it shows that they speak competently too prevent players to ask questions or have any kind of requests ( $X = 3.08$ ,  $SS = 1.80$ ). With the replies players delivered, the football players stated that they did not argue again about issues that their trainers had already decided. ( $X = 2.24$ ,  $SS = 1.39$ ). A result obtained from this study is that the trainers do not give explanations to their players about their behavior ( $X = 2.24$ ,  $SS = 1.39$ ).

**Table 5. Positive Behavioral Feedback**

Positive Behavioral Feedback	X	SS
The trainer praises a player in front of others for their good performance.	1.89	0.97
The trainer informs the player when they have done a good job.	1.47	0.76
The trainer takes care to reward the player for their good performance.	1.93	0.94
The trainer appreciates when a player has performed well.	1.46	0.83
The trainer praises a player when deserved at the given time and place.	1.76	1.08

In Table 5, the responses of the football players regarding positive feedback characteristics which they received from their trainers is indicated as, the trainers always practice positive feedback towards positive behaviors. When the responses are observed in this section on are averaged, it is seen that most of the trainers are at the "always" and a large part of them at "often". The findings from the study show that trainers appreciate when a football player performs well ( $X = 1.46$ ,  $SD = 0.83$ ) and it also shows that when the player does a good job, they are informed ( $X = 1.47$ ,  $SD = 0.76$ ). With the players responses, the football players stated that their trainers showed their players the praise they deserved at the given time and place ( $X = 1.76$ ,  $SD = 1.08$ ). A result found in this research is that the trainers praise their players in front of others for their good performance. ( $X = 1.89$ ,  $SS = 0.97$ ).

*When looking at the Comparison of Football Player Demographic Information and Coach Leader Behavior Characteristics*, to sum up the responses provided by football players a significant difference was observed between the educational status and the sub-dimensions of the questionnaire between the "Social Support Behavior" ( $P = 0.043$ ,  $P < 0.05$ ) that the football players received from their trainers. Thus according to the findings; social support behaviors perceived by university students from their trainers were found to be more positive than those of high school students.

The answers provided in the measurement by the football players were collected and the relationship between their ages and sub-dimensions of the questionnaire was checked and no significant difference was found between these sections.

The relationship between football players playing time and sub-dimensions of the questionnaire was checked. According to this; a significant difference was determined in the "Social Support Behavior" ( $P = 0.017$ ,  $P < 0.05$ ) section in respect to social support behavior that football players received from their trainers, and no significant relationship was found in other sub-dimensions. According to the analysis results, it was determined that among the responses presented by the football players who played football for 4-6 years and 10-12 years, the athletes who played football for 10-12 years saw more social support behavior from their trainers ( $MD = .46$ ).

The responses provided by the football players were collated and the relationship between work with current trainers of players and the sub-dimensions of the questionnaire was checked. According to this; a significant difference was found in the "Autocratic Behavior" ( $P = 0.001$ ,  $P < 0.05$ ) and "Positive Feedback Behavior" ( $P = 0.049$ ,  $P < 0.050$ ) measurements regarding football players and their trainers. When the duration of working with the same trainer and the autocratic behavior sub-dimension of the football players were examined, it was found that among players who worked with the same trainer for 0-1 years and 4 years or more ( $MD = .72$ ) and between players who worked 2-3 years and 4 years or more ( $MD = .64$ ) a significant difference was determined. According to this, autocratic behavior perceptions of players who worked with the same trainer for 4 years or more are more positive. In addition to this, a significant difference was determined between football players who worked with the same trainer for 0-1 years and over 4 years ( $MD = .28$ ). Consequently, positive feedback behavior perceptions of players who worked with the same trainer for 4 years or more were found to be positive.

### Examining the Perceptions of Coaches on Leader Behavior Features

During the interview the reposes submitted by trainers and the findings are in the tables below.

*Table 6. Educational and Supportive Behavior*

Educational and Supportive Behavior (n=7)	F
The techniques and tactics related to the sport were explained.	6
Tries to correct player's mistakes.	7
Shows players individually their sportive skills	5
Determines the duties of the players and ensures their fulfillment.	5
Calculates and plans what is to be done.	7
Knows the strengths and weaknesses of players.	7
Provides special training for players about what to do in every situation.	5
Explains each player's contribution to the result.	5
Explains in detail expectations from players.	6

In Table 6, it was revealed that all of the trainers' responses regarding educational and supportive behaviors trying to correct the inaccuracies of players, calculating what could happen in the trainings or matches to be held and were planned, and also trainers were aware of the strengths and weaknesses of players. It was observed that five of the trainers demonstrated their sports skills to each player individually, provided players with support to fulfill their duties successfully after determining and thoroughly conveying their duties, and also explained the positive or negative contributions that players had to the result, and in every case they gave special training to their players about what to do. Six trainers stated that they explained the techniques and tactics related to football to their players, they tried to make them act accordingly and explained their expectations from players in detail.

*Table 7. Democratic Behavior*

Democratic Behavior (n=7)	F
Ideas and strategies are received from her players before the competition.	6
Decisions are made with players.	6
Ideas about the implementation of training are asked for from athletes.	1
Players are allowed to set individual targets.	6
Ideas about the trainers coaching style is asked for from players.	6

In Table 7, the findings show that in the responses of the trainers about democratic behavior, six of them allowed their athletes to set their individual goals, and also received ideas from their players about their coaching style. Six of the trainers stated that they received ideas from their players on strategic matters before the competition and made decisions together with their players, while a trainer stated that they received ideas from their athletes about training practices.

*Table 8. Social Behavioral Support*

Social Behavioral Support (n=7)	F
Helps player's with their personal problems.	7
Solves conflicts within the team.	7
Provides personal assistance to their players.	5
Is open with their feelings towards their players.	5
Ensures that their players trust them.	7
Invites players to their home.	2

In Table 8, the findings show that all of the trainers responses regarding social behavioral support helped football players with their personal problems, made efforts to resolve conflicts within the team, and did what was necessary to gain the trust of the players. Five of the coaches stated that they provided personal assistance to their footballers and at the same time they were open about their feelings about the



football player. Two coaches stated that they met with their football players outside the field and invited them to their homes.

**Table 9.** *Autocratic Behavior*

Autocratic Behavior (n=7)	F
Makes plans independent of their players.	4
Does not provide an explanation to their players regarding their behavior.	4
Once a decision is made, it is not discussed.	6
Keeps at a distance with their players.	4
The coach is the only decision-making body.	4

In Table 9, in the findings, it is perceived that in the answers given by the trainers about autocratic behavior are, four of them stated that they did their plans independently from their players and did not explain their behaviors to their players. It was observed that four of the trainers kept their distance with their players and stated that they were the only decision-making body during the decision making stage. Furthermore, six trainers stated that they did not allow the decision to be discussed within the team after a decision was made.

**Table 10.** *Positive Behavioral Feedback*

Positive Behavioral Feedback (n=7)	F
Praises their players for their good performance.	7
The player is told when they have achieved something good.	7
The player is shown appreciation at the given time and place.	5

In Table 10, the findings show that in the responses of the trainers regarding positive feedback behavior, all of them praise the players for their good performance and tell them when the player has achieved something good. Five of the trainers stated that they appreciate the footballers when they achieve something at that specific moment and place.

## Discussions and Results

In this section, the results obtained based on the discussion and the findings of the research will be examined.

When the democratic behavioral characteristics which football players received from their coaches were examined, the result was again high. It is seen that democratic behaviors within the team and individually have benefits in success and personal development (Benziz, 2016).

The responses given by the football players regarding the educational and supportive behavioral characteristics which they received from their coaches are averaged. The findings demonstration that a great majority of the trainers respond as "always" and a small part of them as "often". Subsequently, it is seen that most of the trainers give specific training to each player regarding what to do in every situation.

The social support behavior results were found to be high in the leadership behavior traits perceived by the trainers. Along the lines, it has been determined that there are player's trainer who contributes to both the player's social life as well as their football life. When the leadership behavior characteristics of football players received from their coaches were examined, it was discovered that the trainers' educational and supportive behavior characteristics were high. This contributes positively to the development of football players at this age (Donuk, 2007).

When the autocratic behavioral characteristics which trainers provided to their football players were examined, it was found that the trainers displayed moderate autocratic behavioral characteristics. This shows that coaches sometimes adopt a leadership approach that does not take into account strict discipline and emotional needs.

When the data obtained from the football players were examined, the positive feedback measurement of the trainers were found to be high. This displays that the trainers exhibit rewarding and admirable attitudes.

In the light of the qualitative information obtained from the trainers, it was determined that the educational and supportive leader behavior characteristics measurement applied to football players were high. Accordingly, it was revealed that the trainers tried to correct the inaccuracies of their players, calculating what could happen during trainings or matches that were to be held and were planned, and they knew the strengths and weaknesses of their players. When the responses given here are compared with the responses provided by the players, it is apparent that the results overlap with each other.

In line with the qualitative information obtained from the trainers, the democratic behavioral characteristics they apply to the football players show a variation. It is comprehensible that most coaches allow football players to set their individual targets and ensure their own development. With the exception of a single trainer, it was observed that particular trainer planned their training on their own without consulting their footballers. When the answers given here are compared with the answers given by the players, it is seen that the results overlap with each other.

All things considered, the qualitative information attained from the trainers, the responses given by the trainers about autocratic leader behaviors and the responses given by the football players intersect. According to the average of the data obtained from the trainers; it appears that the trainers maintained distance with the players. It was determined that the trainers made the plans independently and did not discuss these decisions within the team once a decision was made on a particular issue. This shows us that the decision making body in the team is the coach.

When looking at the social support behavioral responses received from the trainers, it is obvious that all of them helped the football players with their personal problems, made an effort to resolve the conflicts in the group, and did what is necessary to gain the trust of the football players. The answers given here and the answers given by the football players overlap. It is known that praising and supporting football players is an important issue for success (Özsarı, 2010).

When analyzing the positive feedback behaviors received from the trainers, the average measurement was found to be high. It has been established that trainers praise their footballer for their good performance and tell him when the player has achieved something well. This increases the motivation of the football player and enables him to make more effort with the set goal (Bakan, 2013).

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# North Cyprus Leagues Soccer Players Evaluation on Coaching Behaviors

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## Abstract

The aim of this study is to determine how the players of different criteria in the Northern Cyprus evaluate their coaching behaviors. 300 licensed soccer players who played in soccer teams in North Cyprus participated in the study. In the study, Coach Behavior Assessment Scale developed by Yapar and İnce (2014) was used to determine the opinions of soccer players about coach behaviors. As a result of the analysis, Cronbach Alpha value was found to be 0.949 and it was found that the scale could be used at an excellent level.

SPSS 25.0 software was used for statistical analysis of the obtained data. Descriptive statistics of the data are given as percentage, frequency, average and standard deviation. The compliance of the data to the normal distribution was determined by Kolmogorov-Smirnov test, QQ graph and kurtosis-skewness values and it was found that it conforms to the normal distribution. Parametric hypothesis tests were used to compare the scores obtained from the scale. The independent sample t test was used if the independent variable was in two groups, and variance analysis (ANOVA) was applied if it consisted of more than two groups and Tukey test was used as post-hoc test. Significance levels were determined as  $p < 0.05$ .

As a result of the statistical analysis, age group, education level, marital status, league played, team played, number of times in the first 11, ranking of the team, time in the team, time worked with the coach and the region variables with the physical training and Planning, Technical Skills, Mental Preparation, Goal Setting, Competition Strategy, Positive Trainer Behavior, Negative Trainer Behavior sub-dimensions were found to be significant at  $p < 0.05$  level, while working status, position variable and 7 sub-dimensions of the scale were not significantly different. was determined.

As a result of this study, it was found that the coaches in the North Cyprus Super League and First League scored the lowest score from the players especially in terms of physical training and planning and need to develop themselves and train in this direction

**Keywords:** Soccer, soccer player, coach, coach behavior, North Cyprus.

## Introduction

Coaches are intelligent leaders directing the players to the common purpose (Tatar, 2009) Also, by using the training methodology, coaches are educated individuals to develop physical, psychological, mental, emotional and social characteristics and prepare the soccer players for competition (Konter 1996).

Coaching seems to be the most primary factor that has an influence area in soccer for any time (Martens 1990). Coaches are essential for the player's physical and psychological development and motivation (Abakay and Kuru 2013). Coaches also should emphasize and allow time to develop mental skills besides physical and physiological features. While doing these, they should have a good communication relationship with players and show leadership characteristics (Konter 2006).

Coaching is a primary factor in becoming successful in many sports in the present day. Coaches play a significant in either team sports or individuals sports. Professionally they are responsible for talent identification and development in soccer as being the most popular sports in the world (Lobinger and Musculus, 2018).

In Larousse coach defined as a person that prepare athletes, swimmers, boxers individuals or team for competitions or races. Turkish Language Institution defines a coach as a person who develops the athletes. According to this, the coach should be an educator who can be a good organizer, effective manager, and motivator. They should also help athletes to gain independence and proficiency (Sevim et al., 2001).

Coaches are responsible for increasing the performances of the athletes. Coaches already have abilities to impress the soccer players, and should prepare them for competitions by increasing the motivation levels through developmental practices. Coaches have a significant role and should have excellent communication with athletes to be successful in this issue (Ulukan, 2006). Coaches can be divided into six groups according

to their characteristics. These are disciplined and authoritarian, flexible and good character, tense and dynamic, liberal, diligent, cooperative and agreeable (Kasap and Erdem, 2009)

This research aims to investigate the evaluation of soccer players from various criteria about coaches' behaviors and to study the diversity according to their demographic characteristics like age group, position, education level, marital status, profession, league, club, playing in starting team, the position of the team in the league standing, playtime, the amount time working with the coach and region.

## Methods

### *Research Model*

The study is quantitative research, which is descriptive screening methods used to identify the relationship between the soccer players and their coaches.

### *Population and Research Sample*

The population of the study consists of soccer players who are playing in 16 Super League and 1. division clubs' first team and U21 teams, which are under Cyprus Turkish Football Federation. (Total 1152 Licenced soccer players). The sample of the study is the soccer players of 6 Super League clubs first and U21 teams from 6 regions and the players of 1. division clubs first and U21 teams from 4 different regions. (Total 300 Licenced players)

### *Data Collection Tool*

Scale form consists of two parts used in data collection. Personal Information: The questions for determining characteristics like players' social-demographical features, game positions, and their teams were in the first part of the scale form.

Coaching Behavior Evaluation Scale for Athletes: In this study, The scale form Coaching Behavior Evaluation Scale for Athletes translated by Yapar and Ince 2014 in the Turkish language of the Coaching Behavior Assessment System scale form developed by Smith, Smoll, and Hunt 1997 to determine the soccer player's opinions about coaches' behavior used in this study. The Coaching Behavior Evaluation Scale for Athletes consists of 47 items prepared by using 7 Likert types and 7 sub-items. The items in the scale graded from 1-7 (1 never, 7 always). The total variance was calculated as % 68.29. Confirmatory factor analysis results ( $F2/sd = 3.630$ ,  $NFI = 0.90$ ,  $RMSEA = 0.071$ ,  $CFI = 0.98$  and  $IFI = 0.92$ ,  $GFI = 0.91$ ) indicated that there was an acceptable fit index values between 7 factor model. Cronbach's alpha value of the 7 dimensions of the scale was between .79 and .87. The results of the study showed that the Turkish version of the CBS-S has good internal consistency and construct validity to use in related studies. Cronbach Alfa test used to examine the internal consistency of data collected in this study. The Cronbach Alpha coefficient regarding sub-items found between 0,831 and 0,913

## Procedure

### *Collection of the Data*

The subject of the study and detailed information about the fulfilling process of the scale form explained to coaches. Scale forms completed by the players before and after the training session collected on the same day. The study was done in February and January 2019 during the 2018-19 soccer season of the Cyprus Turkish soccer Federation.

### *Data Analysis*

SPSS 25.0 statistical package program used to analyze the data of the study. The player's socio-demographical, playing positions and their team characteristic's distribution determined by using the frequency analysis

Descriptive statistics are given to scores taken from soccer player's coaches' behavior scale.

The Cronbach Alpha coefficient is .949 obtained by the Cronbach Alpha test used for measuring the reliability of the results of the soccer player's coaches' behavior scale.

Kolmogorov-Smirnov test, QQ graphics, and skewness-kurtosis values examined for determining the normal distribution compatibility of the scores taken by the Coaching Behavior Evaluation Scale for Athletes scale of soccer players who participated in this study. Normal distribution detected in this study.



Due to the compatibility of the normal distribution of the scale scores, the parametrical hypothesis tests were used for comparison of scores from the Coaching Behavior Evaluation Scale for Athletes scale according to soccer players' sociodemographic characteristics, positions of players and their teams. Independent t-test for two groups independent variables, variance analysis (ANOVA) for more than two group variables applied, and for advance analysis Tukey test used as (post-goc) test.

## Findings

*Table 1. soccer Players Socio-demographical Characteristics Distribution (n=300)*

	Number (n)	Percentage(%)
<u>Age Group</u>		
Age 18 and Under	110	36,67
Age 19-23	100	33,33
Age 24 and Over	90	30,00
<u>Educational Status</u>		
Elemenary/High School	146	48,67
Undergraduate/Master Degree	154	51,33
<u>Marital Status</u>		
Married	39	13,00
Single	261	87,00
<u>Proffesion</u>		
Employed	163	54,33
Unemployed	137	45,67

Table 1 shows the distribution of sociodemographic characteristics of the soccer players who participated in this study. It can be seen from Table 1 that soccer players' age groups are %36,67 18 years and under, %33,33 19-23 years old and %30 24 years and older. Their education levels are %48,67 Elementary or High School and %51,33 undergraduate or master's degree graduates. %13,0 of the players are married, and %87,0 single and finally, %54,33 are employed while %45,67 is not working in any job.

*Table 2. soccer Player's Positions and Clubs Characteristics Distribution (n=300)*

	Number (n)	Percentage(%)
<u>Position</u>		
Defence	86	28,67
Central Midfield	73	24,33
Wing	66	22,00
Forward	39	13,00
Goalkeeper	36	12,00
<u>League</u>		
Super League	178	59,33
1. Division	122	40,67
<u>Team</u>		
First Team (Seniors)	150	50,00
U 21. Division (Juniors)	150	50,00
<u>Being in Starting team for the games</u>		
Under 4	100	33,33

Between 5-10	67	22,33
Over 11	133	44,33
<u>The position of the team in Standings in 1.period of the season</u>		
Between 1-3	79	26,33
Between 4-10	135	45,00
Over 11	86	28,67
<u>The amount of time period being in the team</u>		
1 year and under	95	31,67
2-3 years	99	33,00
4 years and over	106	35,33
<u>The amount of time period of working with the coach</u>		
1 year	183	61,00
2 year	85	28,33
3 year and over	32	10,67
<u>The region of the club</u>		
Nicosia	59	19,67
Kyrenia	60	20,00
Güzelyurt	60	20,00
Famagusta	62	20,67
İskele	29	9,67
Lefke	30	10,00

**Table 3.** The scores of layers' responses for Coaching Behavior Evaluation Scale for Athletes (n=300)

	n	$\bar{x}$	s	Min	Max
Physical Training and Preparation	300	5,00	1,08	1,86	7,00
Technical Skills	300	5,12	1,26	1,25	7,00
Mental Preparation	300	5,19	1,23	1,00	7,00
Goal Setting	300	5,09	1,24	1,00	7,00
Competition Strategy	300	5,77	1,04	2,29	7,00
Positive Coaching Behaviors	300	5,63	1,12	1,83	7,00
Negative Coaching Behaviors	300	3,13	1,43	1,00	7,00

**Table 4.** The comparison of the scores of soccer players' responses for Coaching Behavior Evaluation Scale for Athletes according to their league of the teams. (n=300)

	League	n	$\bar{x}$	S	T	p
<b>Physical Training and Preparation</b>	Super League	178	4,71	1,07	-6,073	0,000*
	1. Divison	122	5,44	0,95		
<b>Technical Skills</b>	Super League	178	4,77	1,32	-6,217	0,000*
	1. Divison	122	5,64	0,97		
<b>Mental Preparation</b>	Super League	178	4,91	1,34	-4,842	0,000*
	1. Divison	122	5,59	0,93		
<b>Goal Setting</b>	Super League	178	4,76	1,30	-5,866	0,000*
	1. Divison	122	5,57	0,96		
<b>Competition Strategy</b>	Super League	178	5,53	1,11	-5,024	0,000*

	1. Divison	122	6,12	0,80		
Positive Coaching Behaviors	Super League	178	5,34	1,20	-5,686	0,000*
	1. Divison	122	6,05	0,82		
Negative Coaching Behaviors	Super League	178	3,13	1,21	0,082	0,935
	1. Divison	122	3,12	1,72		

\* $p < 0,05$ 

**Tablo 5.** The comparison of the scores of soccer players' responses for Coaching Behavior Evaluation Scale for Athletes according to their teams (1.Team Seniors or Under 21 Years old Juniors (n=300))

	Takım	n	$\bar{x}$	S	t	p
Physical Training and Preparation	1. Team	150	5,17	1,06	2,769	0,006*
	Under 21	150	4,83	1,08		
Technical Skills	1. Team	150	5,26	1,26	1,862	0,064
	Under 21	150	4,99	1,26		
Mental Preparation	1. Team	150	5,34	1,27	2,087	0,038*
	Under 21	150	5,04	1,19		
Goal Setting	1. Team	150	5,26	1,23	2,419	0,016*
	Under 21	150	4,92	1,23		
Competition Strategy	1. Team	150	5,86	0,98	1,428	0,154
	Under 21	150	5,69	1,09		
Positive Coaching Behaviors	1. Team	150	5,74	1,03	1,626	0,105
	Under 21	150	5,53	1,19		
Negative Coaching Behaviors	1. Team	150	3,04	1,50	-1,011	0,313
	Under 21	150	3,21	1,36		

\* $p < 0,05$ 

**Tablo 6.** The comparison of the scores of soccer players' responses for Coaching Behavior Evaluation Scale for Athletes according to their education level (Elementary/High School or Undergraduate/Master degree) (n=300)

	Eğitim Durumu	n	$\bar{x}$	S	t	P
Physical Training and Preparation	Elementary/High School	146	4,86	1,15	-2,251	0,025*
	Undergraduate/Master degree	154	5,14	1,00		
Technical Skills	Elementary/High School	146	5,15	1,29	0,400	0,689
	Undergraduate/Master degree	154	5,10	1,24		
Mental Preparation	Elementary/High School	146	5,22	1,22	0,500	0,617
	Undergraduate/Master degree	154	5,15	1,25		
Goal Setting	Elementary/High School	146	5,09	1,24	-0,082	0,935
	Undergraduate/Master degree	154	5,10	1,24		
Competition Strategy	Elementary/High School	146	5,71	1,05	-1,034	0,302
	Undergraduate/Master degree	154	5,83	1,02		
Positive Coaching Behaviors	Elementary/High School	146	5,62	1,15	-0,153	0,879
	Undergraduate/Master degree	154	5,64	1,08		
Negative Coaching Behaviors	Elementary/High School	146	3,31	1,42	2,193	0,029*
	Undergraduate/Master degree	154	2,95	1,43		

\* $p < 0,05$



## Discussion

The scores from the Physical Training and Planning subscale of the soccer players Coach Behavior Evaluation Scale is  $5,00 \pm 1,08$  points; the technical skills sub-dimension is  $5,12 \pm 1,26$  points, the mental preparation sub-dimension is  $5,19 \pm 1,23$  points, from the goal-setting sub-dimension is  $5,09 \pm 1,24$  points, from the competition strategy sub-dimension is  $5,77 \pm 1,04$  points, from the positive coaching behavior sub-dimension is  $5,63 \pm 1,12$  points. Finally, from the negative coaching behavior, sub-dimension is  $3,13 \pm 1,43$  points (Table 3). In the field of physical training and planning, where soccer players give the lowest score on the scale of evaluating coaching behaviors for athletes, they may think that their coaches do not have the exact equipment, interest, and practice and in this field compared to other areas. It may be assumed that they looked at their trainers more negatively on this issue. In this case, we can believe that coaches may need the training to get players to train physically challenging and satisfying. On the other hand, the field of competitive strategy with tactical elements appears as the most successful behavior set. Soccer players may think that their coaches are tactically sufficient and successful and look at them more positively. There were statistically significant differences ( $p < 0,05$ ) between the scores obtained from the Physical Training and Planning, Technical Skills, Mental Preparation, Goal Setting, Competition Strategy, and Positive Coaching Behaviors sub-dimensions according to the League where the soccer players played (Table 4). The scores of the players who played in the 1st League in the Physical Training and Planning, Technical Skills, Mental Preparation, Goal Setting, Competition Strategy, and Positive Coaching Behavior sub-dimensions were found higher than the players in the Super League. In this case, the players playing in the Super League can be thought to approach the coaches with a more critical perspective. Soccer players in the super League may think that their coaches do not have sufficient equipment, training, knowledge, and experience compared to the players in the 1st League. Because, it has been revealed that Super League soccer players give negative opinions from the trainers' planning, physical training, technical skill training, mental preparation exercises, helping them set goals and creating a competitive strategy. Soccer players in the 1st League think more positively towards their coaches and talk about them with an optimistic point of view. There is no statistically significant difference between the Negative Coaching Behavior sub-dimension scores according to the League where the soccer players are playing (Table 4) It was determined that there were statistically significant differences between the scores obtained from the Physical Training and Planning, Mental Preparation, and Goal Setting sub-dimensions in the Coach Behavior Evaluation Scale according to the team played by the soccer players ( $p < 0,05$ ). The Physical Training and Planning, Mental Preparation, and Goal Setting scores of the players playing in the A team are higher than those playing in the U21 League. It was determined that there were no statistically significant differences between the scores obtained from Technical Skill, Competition Strategy, Positive Coaching Behaviors, and Negative Coaching Behavior sub-dimensions (Table 5). It can be thought that this result is since the players of team A work with a more intense schedule than the players playing in the U 21 league. It can also be thought that young team coaches do not have the potential and knowledge to physically train their players, the experience that will prepare them mentally, and the capacity to help them set goals.

Dilek (2017) found in her studies that as the sports experience age of the participants increased, they evaluated the behavior of the coaches as positive at a higher level. These findings obtained in the studies are similar to the findings of this study. It was determined that there are statistically significant differences between the scores of the soccer players from the physical training and planning sub-dimension and the negative coach behavior sub-dimension according to their educational status ( $p < 0,05$ ). The results of the soccer players with an undergraduate / graduate level of education got higher scores from the physical training and planning sub-dimension than the players with secondary / high school education, and lower scores from the negative coach behavior sub-dimension. It was determined that the difference between the sub-dimensions of technical Skills, mental preparation, goal setting, competition strategy, and positive trainer behaviors was not statistically significant (Table 6). Players who have undergraduate and postgraduate education think that their coaches are more successful in the field of physical training and planning than footballers with secondary and high school education, and they think that their training is more beneficial and satisfactory in this direction. It reveals that those with postgraduate education give lower scores on negative coaching behavior compared to middle school and high school graduates and they think more positively on this issue. This shows us that footballers with secondary and high school education are more critical of their coaches (Table 6).

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