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Original Article

Effectiveness of sports-oriented physical education of students using basketball

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Abstract:
The search for ways to optimize PE classes for students, to improve their physical health, is an urgent problem of modern pedagogical science. *Research aim*. To improve the level of physical fitness, a program of training sessions for young students' physical education using basketball with a competitive orientation has to be developed and tested. ***Materials and methods***. The research project was conducted among 79 students of the Technical University of Irkutsk (Russia), who were randomly assigned to CG (n= 56) and EG (n=23). PE classes for all young men were held 2 times a week for 90 minutes during the school year. CG students performed physical activities according to the generally accepted curriculum for universities. Sports-oriented training sessions of EG students using basketball were divided into two macrocycles of 17 weeks each, corresponding to semesters of study. Each macrocycle consisted of a preparatory period, which included working stages lasting from two to nine weeks of basketball training sessions. At the beginning and at the end of the research project, boundary testing of physical fitness of young men of both observation groups was carried out using motor tests, and students' motivation for physical activity was studied using a questionnaire. ***Results***. It was found that at the end of the project, a significantly meaningful increase in indicators in all motor tests was registered in EG boys, where sports technology was used in physical education compared to CG boys, where the traditional curriculum was used. In the experimental group of young men, a significant increase in motivation for physical education and independent motor activity was noted. ***Conclusions*.** The obtained data of the research project expand knowledge about sports-oriented physical education of students using basketball and allow them to be recommended in other educational institutions to increase the level of physical fitness and motivation for young people's physical activity.
Key Words*:* **physical education, motivation, sports integration, basketball, physical training**

Introduction

Students' physical education is aimed at strengthening their physical, somatic and mental health (Görner, & Reineke, 2020). An important role in physical education is also given to increasing motivation for regular physical activity (Sawicki, 2018), mastering theoretical knowledge of the subject and teaching the basics of a healthy lifestyle (Nesterchuk et al., 2020).

Despite significant progress in the field of physical culture in educational institutions means and methods modernization, the health indicators of the younger generation in many countries of the world continue to be low (Tortella, et al., 2021; Drenowatz, 2021; Tomás Reyes-Amigo, 2021). There is a low motivation of students to physical activity (Bano et al., 2020).

According to the authors, one of the reasons for this is the manifestation of excessive academic studies (Tuan, 2019) and the limited possibility of choosing the type of physical activity in PE classes (Kuśnierz et al., 2020). Therefore, students' physical education needs constant modernization, both in terms of content and technology (Andrieieva et al., 2020).

In recent decades, an innovative direction of young people's PE educational process modernization has been actively developed in educational institutions. One of them is called sportization of physical education (Mischenko, et al., 2021a). It implies the use of sports training technologies in the educational process of mastering physical culture (Balsevich, & Lubysheva, 2003). According to the authors, the sportization of students' physical education can be considered as the integration of sports training into the main PE classes or as an additional education of a sports and wellness orientation. In the first case, we are talking about sports-oriented physical education, in the second case - about young people's additional physical education to improve the level

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of physical health and functional characteristics of young people's engaged body (Kolokoltsev et al., 2022; Golovin, & Romanova, 2017). Currently, sport is mandatory in a number of physical education programs in many countries of the world (Barba-Martín et al., 2020) and is considered as an innovative form of studying sports training in physical culture (Harvey et al., 2018).

For the educational and training process in students' physical education, various sports activities are used, which are popular with young people (Baidiuk et al., 2019; Viktorov et al., 2020). The results of the effective use of game sports technologies in the educational process of physical education are presented in the modern scientific literature (Montesano, 2018). Unlike performing traditional physical exercises, in game sports, there are more significant positive morphofunctional changes in the human cerebral cortex cells (Berger et al., 2020), which contributes to the appearance of satisfaction and the development of motivation for physical activity of a gaming orientation (Biino et al., 2020; Mischenko et al., 2021b). The positive effect of sports games is associated with the production of dopamine, which motivates a person to physical activity.

It is known that from sports games basketball, as a sport, is recognized as one of the best means of improving the body, strengthening health, increasing psychophysical fitness and cognitive abilities of a person (Griban et al., 2018). It is very popular in many countries in the world (Gomelski, 2015). Scientific studies on the use of club basketball models with a high positive result in the educational process of physical education are presented (Tuan Tran Minh, & Cuong Tran Ngoc, 2022).

Despite the information available in the scientific literature on the use of basketball in the educational process of young people's physical education, it remains relevant to conduct research related to the issues of long-term observations of an intervention experiment results (Silva et al., 2021). The scientific literature does not sufficiently present methodological materials for conducting university students' PE training sessions using basketball with a competitive orientation, especially at the initial stage of sports training. In our opinion, the study of these issues will improve the indicators of students' physical fitness and increase their motivation for physical activity.

Research aim. To improve the level of physical fitness, a program of training sessions for young students' physical education using basketball with a competitive orientation has to be developed and tested.

Material & methods

The research project was conducted at the Department of Physical Culture and Sports of the Technical University of Irkutsk (Russia) from September 2022 to May 2023. 79 students participated in the project, who were randomly assigned to CG (n= 56) and EG (n=23).

PE classes for CG and EG boys were conducted 2 times a week for 90 minutes during two academic semesters. CG students performed physical activities according to the generally accepted curriculum for universities. The Federal Standard of sports training for the sport of basketball, Russia (2022), upgraded by us, was used as the basis for sports-oriented training sessions of EG students. Due to the lack of skills, knowledge and skills in basketball, EG students were considered by us as a group of initial sports training.

The methodological support modernization for the EG students' sports training was due to the lack of methodological support for the organization of physical education using basketball with a competitive orientation. The upgraded training program provided for theoretical, methodological and practical, training, competitive and control sections of training.

EG students' educational and training process of physical education was divided into two macrocycles of 17 weeks each, corresponding to semesters of study at the university. Each macrocycle consisted of a preparatory period, which included working stages lasting from two to nine training weeks (Table 1).

Table 1. Working periods and the training process stages in the I and II semesters

Macrocycle (semester)	I			II		
Период	Preparatory			Preparatory		
Stage	Involving	First basic	Control and competitive	Second basic	Sports form development	Control and competitive
Duration, weeks	7	8	2	6	9	2
Duration, hours	14	16	4	12	18	4
Total hours	34			34		

The educational and training process of the involving stage (7 weeks) in the first semester and the basic stage (6 weeks) of the second semester were aimed at: increasing the cardiorespiratory system tolerance to physical activity, increasing general physical fitness, learning and improving the students' technical readiness in basketball, developing speed-strength qualities and coordination abilities. At this stage, running exercises with and without accelerations, jumping exercises and loads with weights, exercises for flexibility and coordination of

movement, mastering techniques and tactics of playing basketball (throws, catching and passing the ball) were used, control testing of physical fitness was carried out.

At the basic stage (8 weeks) of the first semester and the second one (9 weeks) and at the stage of sports form development (9 weeks), we set the following tasks: further increase of physical activity for special endurance development, expanded the means for the development of speed-strength, coordination qualities, flexibility, improved technical and tactical and psycho-emotional data from students. In the second semester, at the stage of sports form development (9 weeks), in addition to training loads, we used high-intensity physical activity approaching the competitive level. The competitive stage of the training program included the participation of EG students in competitions with other amateur basketball teams of other universities. At this stage, repeated testing of students' physical fitness was carried out.

At the beginning and at the end of the research project, all students of both groups answered questions from a questionnaire, characterizing their motivation for physical activity. The questionnaire we proposed contained 6 questions describing attitudes to physical education and independent forms of it, the mood for training sessions, the approximate weekly level of physical activity, and more.

CG and EG students' physical fitness testing was carried out using control tests at the beginning and at the end of the research project. To do this, we used a battery of tests for basic motor qualities (speed, strength, endurance, flexibility and coordination) development. Systolic and diastolic blood pressure, mmHg, heart rate at rest and after exercise in the form of 20 squats in 30 seconds, bpm, muscle strength of the right and left hand, kg was determined from functional indicators. Robinson index, characterizing the reserve capabilities of the cardiovascular system in conventional units and the strength index of the hands of both hands was calculated using formulas.

All CG and EG students agreed to participate voluntarily in the experiment before the start of the research project. The completed research project does not violate the principles of the Helsinki Declaration of 2008, imposed on medical and biological scientific observations.

The obtained digital data were processed statistically using licensed computer programs STATISTICA 10.0, MS Exsel 2010. Parametric methods were used to calculate the arithmetic mean, its error and the reliability of the difference in the values of the indicators according to the Student's t-criterion ($p < 0.05$ was considered the reliable difference in the values of the indicators).

Results

It was found that at the beginning of the research project, students of both observation groups had a low level of motivation for independent physical activity and PE classes. 21.4% of CG boys and 17.4% of EG ones independently perform physical activities by visiting various sports sections, fitness centers and other sports facilities. 44.6% and 43.5% of students like PE classes at the university, respectively.

Regular physical exercises cause significant changes in the characteristics of the young men's main physiological systems functional indicators. A comparative analysis of the cardiovascular and muscular systems values of young men in CG and EG at the beginning and end of the research project is presented in Table 2.

Table 2. High-stakes values of the young men's physiological systems indicators (M±m)

Functional indicators		CG (n=56)		EG (n=23)	
		At the beginning of the project	At the end of the project	At the beginning of the project	At the end of the project
Cardiovascular system					
Heart rate, bpm	At rest	73.5±3.12	72.2±3.0	74.4±3.23	66.2±2.64*
	After load in the form of 20 squats in 30 seconds	118.9±5.63	115.8±4.32	119.8±5.41	96.2±3.73*
Pulse recovery duration after load of 20 squats, seconds		59.2±3.46	43.2±2.25*	60.0±3.42	37.1±3.33*
Blood pressure, mmHg	Systolic	122.1±1.54	124.3±1.91	125.7±1.43	120.2±2.91
	Diastolic	72.1±1.94	69.7±0.91	64.5±0.93	70.1±1.58*
Robinson index. CU		128.0±2.43	127.8±2.83	124.8±4.62	106.2±3.91*
Muscular system					
Muscles strength, kg	Left hand	36.8±0.91	37.2±0.92	37.1±0.73	46.2±1.24*
	Right hand	46.6±1.03	48.3±0.93	45.2±1.26	51.9±1.076*
Strength index, %	Left arm	52.5 ±1.34	53.0±1.52	49.5±1.81	61.7±2.22*
	Right arm	66.5±1.73	68.9±2.21	60.3±2.65	69.3±3.12*

*Note. * significant difference in the values of the test scores at the end of the pedagogical experiment ($p<0.05$)*

It was found that the values of the physiological parameters of the cardiovascular and muscular systems at the beginning of the research project were approximately the same in young men in CG and EG, $p > 0.05$. At the end of the research project, positive changes in the values of physiological characteristics were registered.

The young men of both groups showed a slowdown in the heart rate at rest and after physical exertion in the form of 20 squats in 30 seconds, the duration of pulse recovery after such exertion, a decrease in the Robinson index. At the end of the project, an increase in the strength of the muscles of the hands of both hands and the strength index was registered. These changes indicate an increase in the tolerance of the young men's body of both groups to physical exertion. In CG boys, a significant change in the values of physiological indicators was found only in one parameter (the duration of pulse recovery after exercise). In EG boys, a significant improvement in the values of indicators was found in all the cardiovascular and muscular systems parameters (with the exception of systolic blood pressure), $p < 0.05$. The percentage of increase in the values of the cardiovascular and muscular systems is shown in Figure 1.

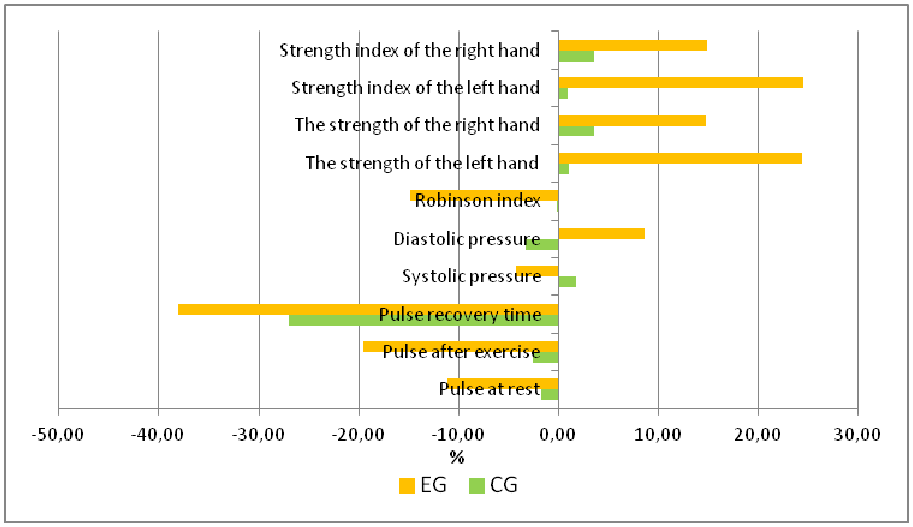

Fig. 1. The increase in the physiological indicators values in young men at the end of the research project

The largest change in the cardiovascular system values was recorded in the sample «duration of pulse recovery after exercise in the form of 20 squats in 30 seconds». This indicator decreased by 27.0% in CG boys and by 38.2% in EG ones. The greatest increase in the strength of the both hands muscles and the strength indices of the right and left arms was registered in young men EG. The use of a modernized sports-oriented basketball program with a competitive orientation in the educational and training process of physical education led to a change in the students' physical fitness, Table 3.

Table 3. High-stakes testing of EG and CG students' physical fitness (M±m)

No	Test	Monitoring group	At the beginning of the project	At the end of the project	p
1	Shuttle run 10x5, s	EG	17.83±0.22	17.13±0.37	**< 0.05**
		CG	17.78±0.22	17.66±0.10	> 0.05
2	Run 100 m, s	EG	13.96±0.24	13.34±0.26	**< 0.05**
		CG	13.93±0.23	13.74±0.17	> 0.05
3	Run 1000 m, m/s	EG	3.87±0.17	3.55±0.11	**< 0.05**
		CG	3.88±0.19	3.82±0.13	> 0.05
4	Pull-ups, number of times	EG	9.52±0.99	13.52±1.24	**< 0.05**
		CG	9.83±0.44	10.47±0.36	> 0.05
5	Abdominal crunch for 60 s, number of times	EG	37.29±1.45	42.41±1.51	**< 0.05**
		CG	38.45±1.66	40.29±0.59	> 0.05
6	Bend forward, cm	EG	6.11±0.14	8.64±0.19	**< 0.05**
		CG	6.19±0.16	7.60±0.58	**< 0.05**
7	Standing long jump, cm	EG	225.47±4.04	237.58±4.34	**< 0.05**
		CG	224.9±4.24	225.29±4.86	> 0.05

At the beginning of the research project, we did not establish reliable differences in the values of physical fitness indicators between young men in CG and EG, $p > 0.05$, which indicates approximately the same level of their motor qualities development.

At the end of the project, an improvement in the young men's in both observation groups physical fitness was noted. A significant increase in the values of all indicators of testing the development of motor qualities was noted at the end of the project in EG boys, where the training process of physical education had a

sports orientation using basketball, $p < 0.05$. In CG boys, a significant increase is recorded in only one test characterizing the motor quality «flexibility». The data given in Table 3 indicate a more significant increase in the values of indicators in the motor tests of the boys of the experimental group, compared with the increase in testing in the boys of the control one. Figure 2 illustrates the percentage increase in motor skills in CG and EG boys at the end of the research project.

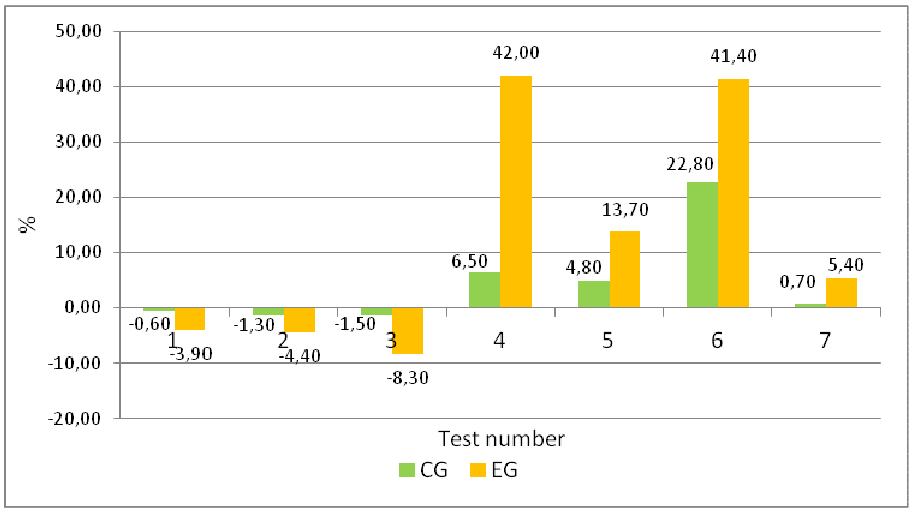

Fig. 2. The increase in the indicators values in motor tests in young men at the end of the research project

Figure 2 shows that the percentage of increase in motor tests in EG boys was greater than in CG ones. These data indicate the high efficiency of the training program proposed by us with the use of sports-oriented PE classes using basketball, compared with the traditional curriculum for higher education institutions.

It was found that at the end of the research project, the students of the experimental group significantly increased their motivation for physical activity. 86.9% of students began to use independent forms of physical activity, which turned out to be 4.9 times more than at the beginning of the project. The interest in training sessions among these young men increased 2.2 times. In the control group at the end of the experiment, we did not establish positive dynamics of the state of students' motivation for independent physical activity and interest in traditional PE classes.

Dicussion

To increase the effectiveness of physical fitness and students' motivation to physical activity, the educational process of physical education should be accompanied by continuous improvement using sports training technologies (Barba-Martín et al., 2020). This form of the traditional system of physical culture modernization is considered by researchers as an innovative direction of young people's physical education (Balsevich, & Lubysheva, 2003; Harvey et al., 2018). For these purposes, various sports are used, which are popular with young people (Stolbov, & Plastinina, 2019). The use of basketball during one semester in the physical education of female students at Saigon University allowed to improve some of the girls' motor qualities and increase interest in physical education (Tuan Tran Minh, & Cuong Tran Ngoc, 2022). At the same time, according to the authors (Silva et al., 2021), it is of scientific and practical interest to conduct such observations with a longer time interval, which makes it possible to determine more significant changes in the body of those involved. Therefore, we conducted a research project during one academic year.

By the end of the research project, positive changes in the physiological parameters of the body were revealed in the young men we examined. This is indicated by the end of the experiment by significantly high values of indicators of the cardiovascular and muscular systems in young men of the experimental group, where basketball with a competitive orientation was used in the training sessions of physical culture. The sports-oriented orientation of physical education using basketball led to a significantly greater increase in the tolerance of the young men's body in the EG to physical exertion, compared with the results obtained in the control group of students, where the traditional curriculum of physical culture was used.

According to our data, the competitive orientation of the physical education training sessions allowed to significantly increase the interest, activity and gambling of those engaged in physical culture in comparison with the young men of the control group, where an increase in motivation by the end of the project was not registered. Our data on increasing motivation to study are consistent with the opinion of other authors who observed a similar pattern among young men involved in football (Wilder Geovanny Valencia Sánchez, & Elkin Alberto Arias, 2021). Studies by other authors (Tuan, 2019; Kuśnierz et al., 2020) indicate low motivation of students engaged in a traditional physical education program.

The high motivational orientation of the educational and training process of physical education using basketball, an increase in the reserve capabilities of the cardiovascular and muscular systems led to a significant increase in the motor tests values. According to our data, by the end of the project, the boys of the experimental group had a significant increase in all motor qualities compared to the control group, where only one indicator «flexibility» significantly increased. The data obtained by us on the young men's in EG physical fitness differ somewhat from the results obtained by Tuan Tran Minh, Cuong Tran Ngoc (2022), which did not establish an improvement in the results in tests for the explosive strength of the lower extremities muscles and the muscles of the body. We believe this is due to the short time the authors conducted the experiment, which is the reason for the differences obtained from our research results, which were conducted throughout the academic year.

The obtained results of the use of university students' sports-oriented physical education using competitive basketball proved to be more effective in increasing physical fitness and motivation for physical activity than traditional training.

Conclusions

A modernized sports-oriented training program of physical education of students using competitive basketball technology is proposed. The program consists of two macrocycles, each of which includes three stages of preparation. The program is aimed at developing the reserve capabilities of the cardiovascular and muscular systems for physical activity, increasing the level of students' general physical, technical and tactical readiness and motivation for physical activity.

At the end of the research project, a significant increase in the values of the indicators of cardiovascular and muscular systems tolerance to physical activity and all motor qualities was found in the students of the experimental group, compared with the control one, where the traditional curriculum of physical education of university students was used. In the experimental group, there was a significant increase in the interest of young men in PE classes and independent motor activity.

The modernized sports-oriented program of physical education of students can be used in other educational institutions to increase the level of physical fitness and motivation for students' physical activity.

Conflicts of interest. The authors declare no conflict of interest.

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