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ОСНОВИ СПОРТИВНОГО ТРЕНУВАННЯ

LEFT-HANDED AND RIGHT-HANDED FENCERS IN THE INTERNATIONAL SPORTS ARENA: SPECIFICS OF THEIR COMPETITIVE ACTIVITY AND FEATURES OF IDENTIFICATION

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Abstract

Research purpose: To study the features of left-handed and right-handed fencers' competitive activity, to justify the tendency of increasing the representation of left-handed fencers in the international sports arena and to substantiate the need to take into account the functional asymmetry of fencers in the initial stages of sports training.

Material and Methods. 54 international competitions and 2,395 athletes were studied. The survey was attended by 25 coaches. The study of individual profiles of asymmetry involved 9 qualified fencers. During the research, the following methods were used: analysis of scientific and methodological literature and materials from the Internet, analysis of competition protocols and video analysis, sociological methods of research, pedagogical observation, pedagogical testing, methods of mathematical statistics.

Results. Among the features of competitive activity of fencers with different leading extremities are: increase in the number of various attacks and counterattacks of the right-handed athletes and widespread use of complex and more varied technical and tactical actions, while the speed of performing techniques and actions can be reduced due to the lack of competitive practice with left-handed athletes; left-handed athletes' widespread use of simple attacks without transference with high speed.

The number of left-handed fencers from 2002-2003 to 2016-2017 sports seasons increased by 48 athletes. Today, they are between 12 and 42% in the first 50 world rankings. The largest number is in teams of Russia, Italy, the USA, and China. Of the 146 left-handed athletes, 45% (66 people) represent Russia, Italy, the USA, and China in the top ten.

Cases of incorrect orientation of fencers' training were identified. This determines the relevance of accounting for functional asymmetry at the initial stages of training.

Conclusions. The features of duel between the fencers with dominant right and left extremities, tendency to increase the number of left-handed fencers in the international sports arena from 2002 to 2017 were determined. Fencers' individual profiles of asymmetry were studied, cases of incorrect orientation of athletes' training were identified.

Keywords: fencing, right-handed fencers, left-handed fencers, asymmetry.

Introduction

Fencers' competitive activity is characterized by rapid change in combat situations. This requires fencers to be extremely focused and quick to make decisions that determine the outcome of the match (Ulan, 2016). Today in modern fencing preference is given to left-handed athletes who are uncomfortable and unusual rivals. They demonstrate high competitive performance, and their percentage among winners in international fencing competitions is increasing annually (Shynkaruk, & Ulan, 2016).

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According to scientists (Oldfield, 1971; Kabanov, 2009), about 10-15% of athletes in the world are left-handed, but in fencing they are about 25%. The increase in their number is explained by the specificity of sports selection and orientation, which is implemented in some countries. This approach of selection and orientation is based on the choice of "uncomfortable" left-handed athletes, or even the re-training of right-handed fencers to possess a subdominant limb from nature (Kudriashova, Berdichevskaia, & Martynenko, 2015).

The identification of athletes with a left motor profile in the initial stages of training significantly increases the efficiency of the sports selection's and orientation's process of young athletes' training (Shynkaruk, 2012; 2013). The effectiveness of the process of long-term training in sports largely depends on the detected athletes' inclinations, including genetically determined propensity to possess one of the extremities (Fedorchuk, Lysenko, & Shynkaruk, 2019). It can be assumed that this tendency to increase the number of left-handed fencers in the international arena will continue in the future (Shynkaruk, & Ulan, 2016).

Scientists' works (Sologub, & Taimazov, 2000; Moskvin, & Moskvina, 2010; Sanchis-Moysi, Idoate, Olmedillas, Guadalupe-Grau, Alayón, Carreras, Dorado, & Calbet, 2010) are devoted to the problem of left-handed and right-handed athletes' training. In particular, some studies concern the construction of training and methods for managing motor asymmetry in complex-coordination sports, sports games (Korobova, & Shulpina, 2013; Kostiukevych, Shchepotina, Shynkaruk, Kulchytska, Borysova, Dutchak, Vozniuk, Yakovliv, Denysova, Konnova, Khurtenko, Perepelytsia, Polishchuk, & Shevchyk, 2019). The features of the styles of duels by athletes with different profiles of asymmetry, the psychophysiological characteristics of left-handed and right-handed fencers were studied by specialists in fencing (Kabanov, 2009; Rydnik, 2011; Ulan, 2016). However, to date, the issues have not covered the quantitative ratio of left-handed and right-handed athletes specialized in fencing in different types of weapons; their analysis in terms of representation on the international sports arena; research of the features of left-handed and right-handed fencers' competitive activity. The foregoing suggests that the study is relevant and timely.

Research purpose – to study the features of left-handed and right-handed fencers' competitive activity in different types of weapons, to justify the tendency of increasing the representation of left-handed fencers on the international sports arena and to substantiate the need to take into account the functional asymmetry of fencers in the initial stages of sports training.

Material and methods

Research participants

2395 athletes were studied: 1200 athletes ftom the international rankings (the first 50 seats in each weapon category in two age categories – seniors and juniors by result of two sports seasons), 1195 athletes from Russia, Italy, the USA and China who are in the international ranking rating (age category – seniors, based on the results of two sports seasons). The survey was attended by 25 respondents – first and highest category coaches of Russia, Ukraine and China. Nine qualified fencers – members of national teams of Ukraine participated in the study of individual asymmetry profiles.

Organization of research

During the research methods were used: analysis of scientific and methodological literature and materials of the Internet, analysis of competition protocols and video analysis, sociological methods of research, pedagogical observation, pedagogical testing, methods of mathematical statistics.

The materials of the official site of the International Fencing Federation made it possible to carry out a statistical analysis of right-handed and left-handed fencers in the world ranking according to several sports seasons. In total, 54 international competitions were analyzed: 2002-2003 – 18 competitions, 2014-2015 – 18 competitions, 2016-2017 – 18 competitions.

The analysis of competition protocols and video analysis was conducted to determine the characteristics of the fights of athletes with different manual asymmetries.

The sociological methods of the survey used the method of questioning, which allowed to determine the features and difficulties of the fight between the right-handed and left-handed fencers, the opinions of coaches, based on their own practical experience, about the representation of left-handed athletes in international fencing competitions (Byshevets, Denysova, Shynkaruk, Serhiyenko, Usychenko, Stepanenko, & Syvash, 2019; Kostyukevich, & Shynkaruk, 2019).

To determine individual asymmetry profiles, tests were used to identify the leading arm ("Grip of fingers", "Pose of Napoleon", "Shoulder test", "Drawing blind", "Hand used in drawing"), leading leg ("Foot to foot", "One-foot bouncing", "Chair climbing", "Step forward"), leading eye (Rosenbach test, Dolman method, "Aim", "Spyglass") and leading ear ("Handset", "Clock ticking"). After performing the tests and collecting data, the K_{as} was determined:

$$K_{as} = ((E_r - E_l)/E_r + E_l + E_\alpha))\times 100$$

where K_{as} – coefficient of asymmetry; E_r – number of right-dominated tests; E_l – number of tests with dominance of the left side; E_α – number of tests without one party's dominance.

Positive value of the K_{as} showed a right domination, negative – about the left domination, the value of 0 – symmetry (ambidexterity) (Ulan, 2018).

Statistical analysis

Statistical processing of the data was performed using the Excel 2010 spreadsheet editor (Microsoft, USA, 2010), the average was used.

Results

Analysis of qualified fencers' competitive activities, the results of coaches' survey allowed to establish that the fight between the right-handed and left-handed fencers is characterized by complicated combat (Gamalii, Bakum, Shevchuk, & Khabinetc, 2017). The "unusual" battle between right-handed and left-handed fencers and between left-handed and the left-hander fencers, the lack of competitive practice with this category of athletes in most cases becomes a limiting factor to achieving a high result of the competition. The "mirror

position" on the fencing track makes the left-handed athlete an uncomfortable rival for the right-hander, which stimulates the left-handed athlete to continually shift toward the more likely hit the left-handed fencer's surface of body (Fig. 1).

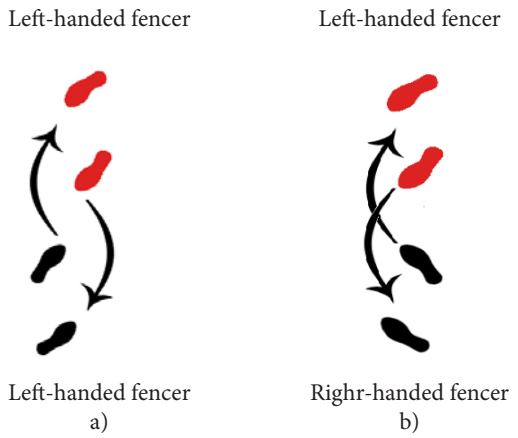


Fig. 1. Scheme of the location of athletes with different manual asymmetry on the fencing track: a) schematic representation of a duel of two fencers with left-hand manual asymmetry, b) schematic representation of a duel of left-handed and righr-handed fencers

Were identified and substantiated the specific features of duel with left-handed athlete (Ulan, 2016). These include increasing the number of attacks and counterattacks by a right-handed athlete in line with changes of the opponent's surface of body. Left-handed athletes prefer simple attacks without translations, which are characterized by high speed of execution. Right-handers are more likely to use complicated and more diverse technical and tactical actions, and their speed may be reduced due to the lack of competitive practices with left-handed athletes (Fig. 2).

The percentage of athletes who fence with their left hand was determined by the results of their performances during 2002-2003, 2014-2015 and 2016-2017. Among the first 50 athletes in the World Fencing Federation World Ranking, the number of fencers in different weapons varies from year to year. According to the results of 2002-2003, the number of left-handed fencers on the international arena was 104 athletes, their percentage ranged from 10 to 24%. Until 2014-2015, the dynamics of the number of left-handed fencers in the direction of increase (149 athletes) is observed, their percentage compared to right-handed fencers ranged from 16 to 40%, which averaged 25.3%. In 2016-2017, the number of left-handed fencers amounted to 152 athletes (from 12 to 42%, which averaged 24.2% of the total number of athletes) (Fig. 3) (International fencing federation, 2018).

The largest number of left-handed athletes in teams of countries such as Russia, Italy, USA, China, Korea, Hungary, Japan, Germany, Poland and France. Russia, Italy, the USA and China also occupy leading positions among other countries in international fencing competitions (Fig. 4).

The analysis of the number of left-handed and right-handed fencers of the high-ranking leading countries (Russia, China, USA and Italy) in different types of weapons and presented in the world rankings (age category – seniors) showed that the number of left-handed athletes of the two sports seasons are increases. According to the 2012-2013 sports season, the number of left-handed fencers (men and women) in Russia, Italy, the USA and China, who are represented in the international rankings by three weapons (epee, foil and sabre) in the age category "senior", amounted to 121 athletes. Over the course of 3 years, their number has increased by 27 athletes and in the 2016 – 2017 sports season was 148 athletes (Fig. 5).

In Russia, the number of left-handed athletes has increased by 8 athletes, in Italy – by two athletes, in the USA – by 16 athletes and in China – by one fencer. The analysis

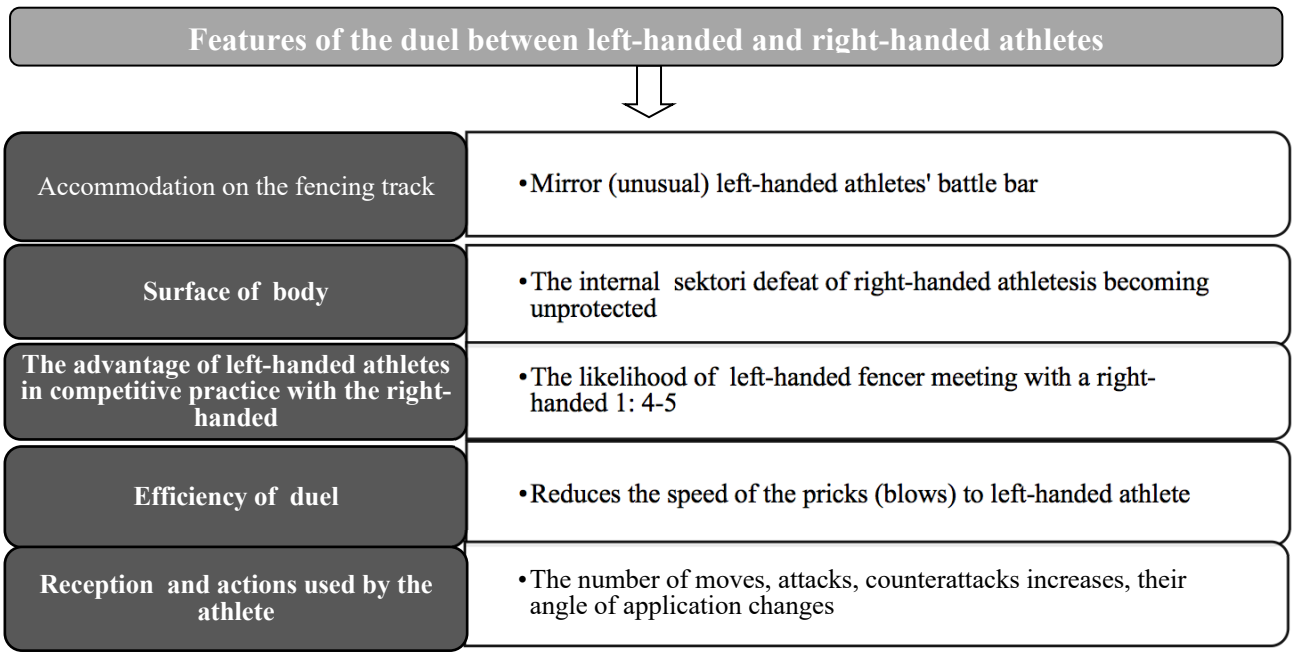
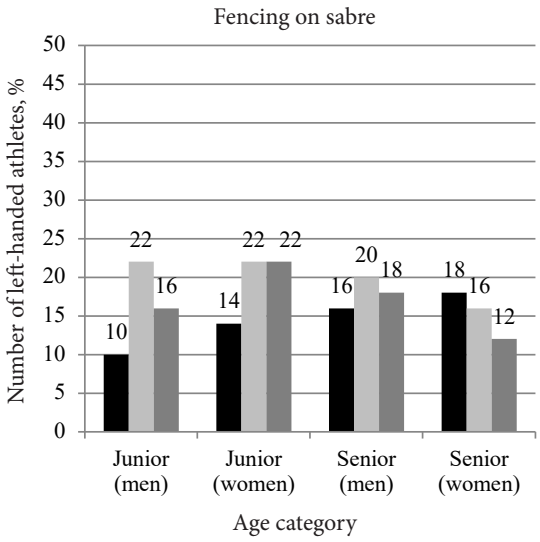
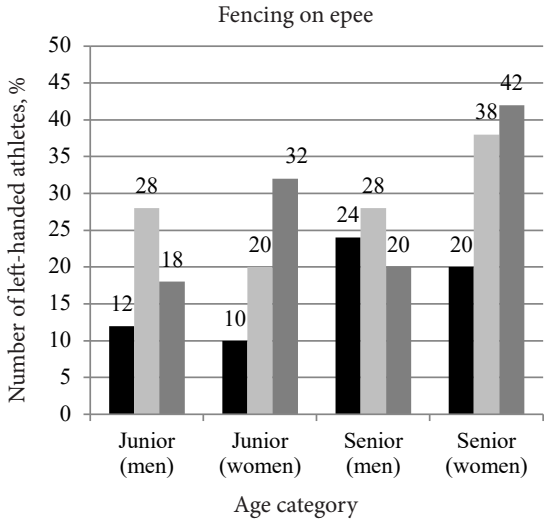


Fig. 2. Specific features of the duel between left-handed and right-handed athletes





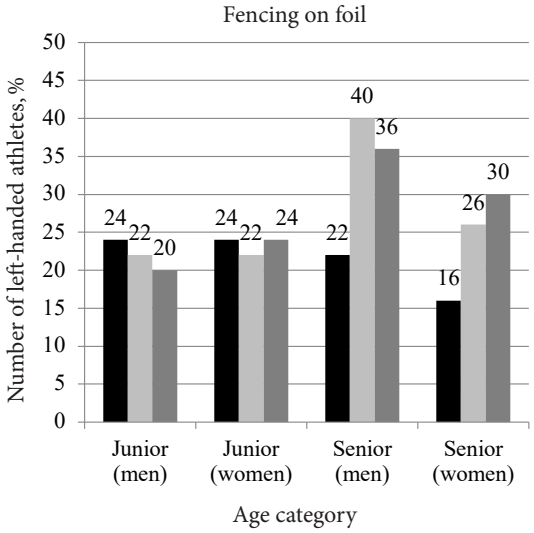


Fig. 3. The ratio of left-handed athletes in fencing on different weapons in to age categories: seniors (men and women) and juniors (men and women) in the world by the results of three sports seasons, n = 1800: ■ – 2002-2003; ■ – 2014-2015; ■ – 2016-2017

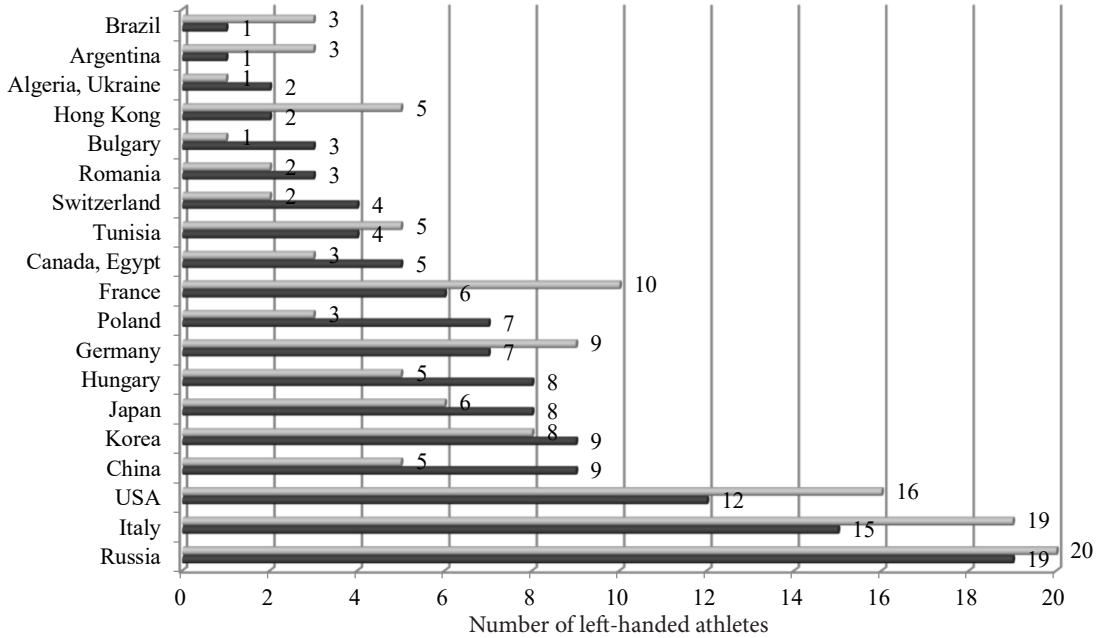


Fig. 4. The number of left-handed fencers represented in the FIE rating based on the 2014 – 2015, 2016 – 2017 seasons (n=301): ■ – 2014-2015; ■ – 2016-2017

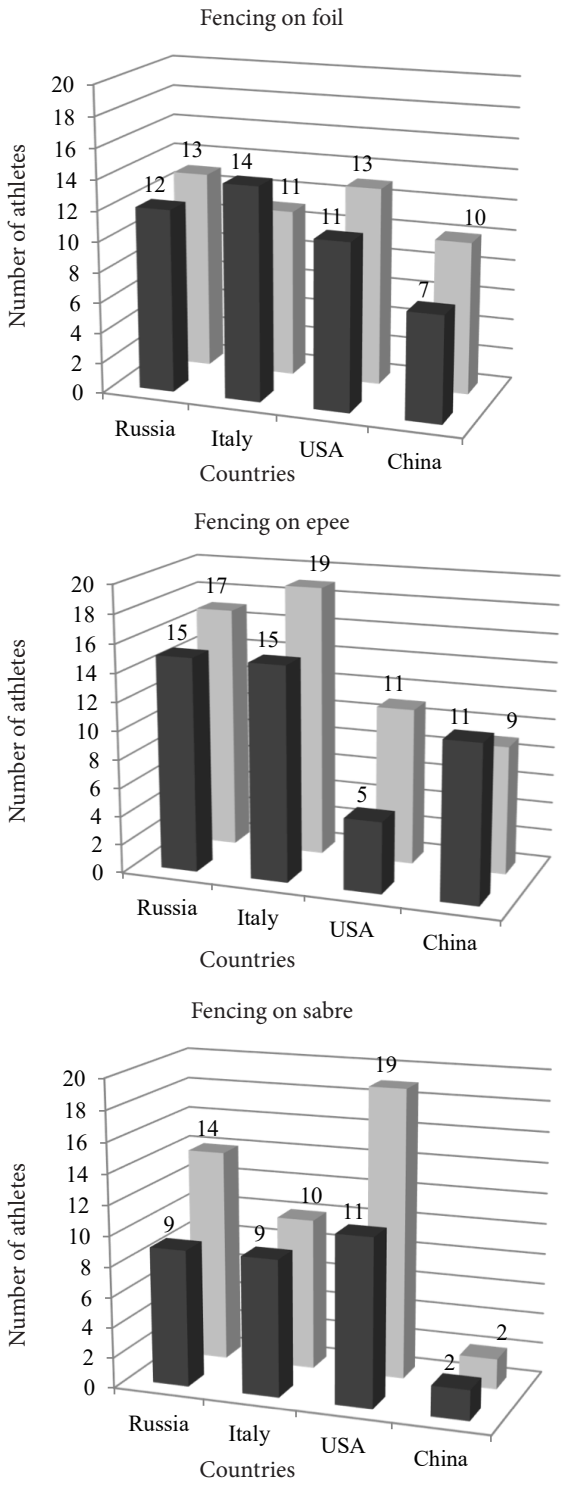


Fig. 5. Number of left-handed athletes representing the leading fencing countries: Russia, Italy, USA and China according to the two sports seasons 2012-2013 and 2016-2017 (n=269): ■ – 2012-2013; ▭ – 2016-2017

of practical experience and the survey of foreign coaches allowed to find out that in Russia, during the selection of athletes, the coaches prefer the left-handers, as evidenced by the tendency to increase their number on the international arena, presented in our study. At the same time, coaches and athletes claim that at major international competitions, almost half of athletes are fencing with their left hand. Among them there are those who are retrained to fence with their left-hand.

Left-handed athletes specializing in fencing in different weapons also occupy leading positions in rating and competitions (Fig. 6).

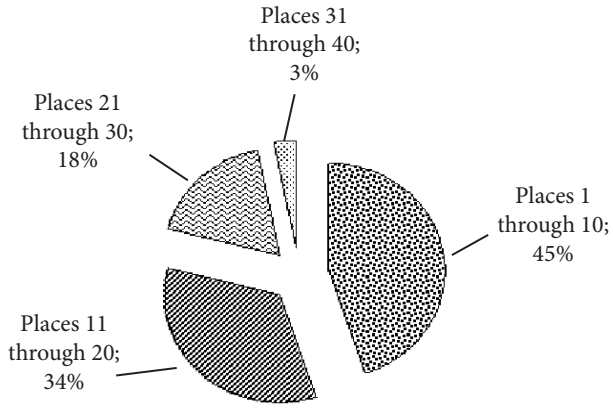


Fig. 6. Percentage of left-handed athletes specializing in fencing in different weapons according to the places they rank in the FIE World Ranking (n = 146): ▭ – places 1 through 10; ▨ – places 11 through 20; ▨ – places 21 through 30; ▭ – places 31 through 40

Among 146 left-handed athletes (among the top 50 athletes in the ranking), specializing in fencing in different weapons, 45% of fencers (66 people) ranked 1 to 10. 34% (50 people) of athletes are ranked 11-20 in the world rankings. 18% (26 people) of left-handed fencers are ranked 21 to 30 in the ranking and about 3% (4 people) are in the 31-40 positions.

The analysis of the international ranking also revealed data on the distribution of left-handed athletes who ranked 1 to 10 in the international FIE ranking, depending on the countries they represent on the international arena and the type of weapons in which they specialize (Fig.7).

The largest percentage of left-handed male athletes who hold the leading positions in the ranking, compared to other representatives of the leading countries, in sabre fencing (57%), and women in epee fencing (100%) have representatives of Russia. Among the left-handed athletes of China, the highest ranking representatives of fencing on epee (83%) and foil (80%). The same number among female athletes of China and Italy in fencing on foil – 50%.

The largest percentage of left-handed female athletes – representatives of Italy is observed in women's fencing on sabre (75%). Left-handed fencers – USA representatives rank in the rankings from 1 to 10 and make up 25-60%.

The successful performance of left-handed fencers in competitions determines the need for identification of this category of athletes.

However, studies (Gronskaia, 2012) have shown cases of planing of sports training for fencers without taking into account the predisposition of athletes to own one or another limb. In the course of the study, individual asymmetry profiles of nine qualified fencers from Ukraine were determined on the basis of the study of motor and sensory asymmetries (Ulan, 2018) (Tab. 1).

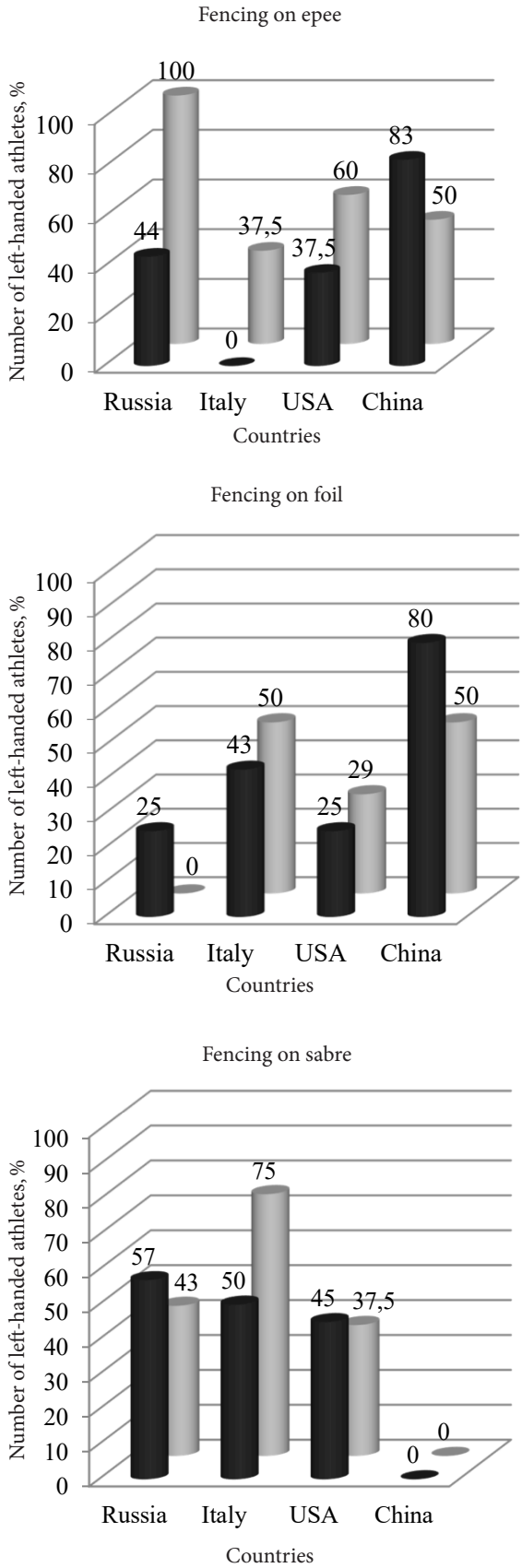


Fig. 7. Percentage of left-handed fencers among leading fencing countries – Russia, Italy, the USA and China (n=66): ■ – senior (men), ▭ – senior (women)

Table 1. Individual asymmetry profiles of qualified fencers (n=9)

№	Athlete	Type of asymmetry				IPA
		manual asymmetry	asymmetry of the lower extremities	visual asymmetry	auditory asymmetry	
1.	A-k	L	L	L	L	LLLL
2.	B-ko*	R	R	R	L	RRRL
3.	B-va	L	L	L	L	LLLL
4.	B-k*	R	R	R	R	RRRR
5.	S-kov*	R	R	R	R	RRRR
6.	S-ko*	R	R	R	L	RRRL
7.	H-va*	L	R	R	R	LRRR
8.	Z-ta*	L	R	R	R	LRRR
9	Sh-va*	L	L	L	L	LLLL

Note: IPA – individual asymmetry profile, L – dominance of left signs, R – dominance of right signs, LLLL – absolute left-handed people, RRRL – mostly right-handed people, RRRR – absolute right-handed people, LRRR – hidden left-handed people or left-handed right-handed people, * – athletes, who fence with the right hand

As can be seen from the table, the athletes numbered 7, 8 show hidden signs of left-handedness. According to the results of the study, the athlete at number 9 turned out to be "absolute left-handed". At the same time, the mentioned athletes are fencing with their right hand and have never practiced fencing with the opposite left hand in their sports activities, which indicates the incorrect orientation of their sports training, based on knowledge about the asymmetry of the upper limbs.

Discussion

Sologub and Taimazov (2000) suggest that the left-handed athlete is an inconvenient rival for the right-handed because of the features of his postures and movements performed by him in the course of competitive activity. Scientists (Taimazov, & Bakulev, 2006; Moskvin, & Moskvina, 2010) say that left-handed athletes win about 40% of the medals at international competitions, despite the fact that their share in the world is only 10% of the total population.

In the own research, new data have revealed the features of fencing duels of athletes with different manual asymmetry. In particular, such a fight is characterized by a "mirror" (unusual for the right-handed athlete) battle bar, a decrease in the speed and angle of pricks (blows), opening the right-handed fencer's internal sektori defeat of the surface of body, increasing the number of movements and counterattack. First of all, such a duel is characterized by a small experience of competing between athletes with different motor profiles.

The results of our own studies confirm the data of the authors (Kabanov, 2009) regarding the increase in the number of left-handed athletes on the international arena and their success compared to right-handed fencers. The study first identi-

fied and described data on the representation of left-handed and right-handed athletes on the international arena. There is a tendency for an increase in the number of left-handed fencers from 2002 to 2017. For the first time, the ratio of left-handed and right-handed fencers representing the fencing leading countries (Russia, Italy, USA and China) and their representation in fencing on different weapons are analyzed.

It should be noted that experts say (Guchetl, 2012; Malazoniia, & Gronskaia, 2016), and the results of own studies confirm the need for comprehensive and timely identification of athletes' functional asymmetry. Specialists recommend studying asymmetry in a comprehensive way, with the construction of individual profiles of athletes asymmetry (Nikitiuk, 1985; Ilin, 2004; Moskvin, Moskvina, 2010). The results of our own studies confirm that there are cases where hidden (congenital) signs of asymmetry may differ from signs of asymmetry acquired in the course of sports activities, which requires the identification of athletes' asymmetry at the beginning of their training.

The prospect of further research is a comprehensive definition of functional asymmetry of young athletes, determination of their profiles of functional asymmetry; the construction of model characteristics of the competitive activity of fencers taking into account manual asymmetry, which can be used by coaches in the process of athletes' training.

Conclusions

The Features of duel between the fencers with dominant right and left extremities were determined: the unusual position of the left-handed opponent on the fencing track, which makes it difficult to fight; right-handed athlete performing techniques and actions in an unusual way reduces their speed and efficiency; the right-handed athlete uses more movements and techniques to make pricks or blows to the left-handed opponent.

Tendency to increase the number of left-handed fencers on the international sports arena from 2002 to 2017 were determined. Leading fencing countries – Russia, Italy, the USA and China – are characterized by a significant number of left-handed fencers in their teams. This is probably one of the main factors that allows these countries to hold a leading position in the fencing.

Left-handed fencers rank high in the world rankings and at international competitions. 45 % of left-handed athletes are in the top 10 in the world ranking.

Individual profiles of the asymmetry of fencers were studied, cases of incorrect orientation of the training of athletes on fence with non-dominant hand in their sports activities were identified. The need for taking into account the functional asymmetry of fencers at the initial stages of sports training was determined.

Conflict of interest

The authors state that there are no conflicts of interest.

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ЛІВОРУКІ І ПРАВОРУКІ ФЕХТУВАЛЬНИКИ НА МІЖНАРОДНІЙ СПОРТИВНІЙ АРЕНІ: СПЕЦИФІКА ЗМАГАЛЬНОЇ ДІЯЛЬНОСТІ ТА ОСОБЛИВОСТІ ЇХ ВИЯВЛЕННЯ

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 9 с., 1 табл., 7 рис., 26 джерел.

Мета дослідження – вивчити особливості змагальної діяльності праворуких і ліворуких спортсменів у фехтуванні на різних видах зброї, встановити тенденцію збільшення представництва ліворуких фехтувальників на міжнародній спортивній арені та обґрунтувати необхідність урахування функціональної асиметрії фехтувальників на початкових етапах спортивного тренування.

Матеріали і методи. Було проаналізовано 54 міжнародних змагання та вивчено 2395 спортсменів. В опитуванні прийняли участь 25 тренерів. У дослідженні індивідуальних профілів асиметрії брали участь 9 кваліфікованих фехтувальників. Під час досліджень використовувалися методи: аналіз науково-методичної літератури та матеріалів мережі Інтернет, аналіз протоколів змагань та відеоаналіз, соціологічні методи дослідження, педагогічне спостереження, педагогічне тестування, методи математичної статистики.

Результати. Серед особливостей поєдинку ліворукого і праворукого фехтувальників: збільшення кількості різ-

них атак і контратак праворуких спортсменів; широке використання ліворукими спортсменами простих атак без переведень з високою швидкістю їх виконання; широке використання праворукими фехтувальниками складних і більш різноманітних технічних і тактичних дій, при цьому швидкість їх виконання може знижуватися через відсутність змагальної практики з лівшами.

Кількість ліворуких спортсменів за період з 2002-2003 по 2016-2017 роки збільшилася на 48 спортсменів. Сьогодні вона становить від 12 до 42% від загальної кількості спортсменів, представлених у першій 50-ці світового рейтингу. Найбільша кількість ліворуких фехтувальників – в командах Росії, Італії, США та Китаю. Зі 146 ліворуких спортсменів 45% (66 осіб) представляють Росію, Італію, США і Китай у першій десятці. В той же час жоден ліворукий спортсмен не представлений в рейтингу на 41-50 місцях. У процесі дослідження індивідуальних профілів асиметрії були виявлені випадки використання фехтувальниками під час ведення поєдинку не домінуючої руки, що свідчить про неправильну орієнтацію підготовки спортсменів.

Висновки. Визначено особливості поєдинку між фехтувальниками з домінуючими правими і лівими кінцівками. Виявлена тенденція до збільшення кількості ліворуких фехтувальників на міжнародній спортивній арені з 2002 по 2017 рік. Вивчено індивідуальні профілі асиметрії фехтувальників, виявлені випадки неправильної орієнтації тренування спортсменів на фехтування субдомінантною рукою.

Ключові слова: фехтування, праворукі фехтувальники, ліворукі фехтувальники, асиметрія.

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MONITORING AND ANALYZING OF THE ATTACKS OF THE FOOTBALL TEAM

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Abstract

The aim of the research is to develop a methodology for monitoring and analyzing attacks of highly qualified football teams, taking into account various models of the game tactics.

Material and methodology. The competitive activity of the national football teams at the 2018 World Cup was studied. Research methodology: analysis and generalization of the literature sources, lesson observation, video analysis of competitive activities, methods of mathematical statistics.

Results. A protocol for registration attacks of the football team has been developed. The estimated scale of penetrating attacks and playing off of standard positions of the football team is identified. A different correlation of positional and fast attacks of national football teams, which used different tactical models of the game, has been established. In one half: for the tactical model "A", positional attacks were 32.3±4.35 (61.8%), fast attacks – 20.0±1.78 (38.2%); for the tactical model "B" – positional attacks – 25.2±4.32 (52.7%), fast attacks – 22.6±4.32 (47.3%); for the tactical model "C" – positional attacks – 32.5±3.49 (67.7%), fast attacks –15.5±3.96 (32.3%); for the tactical model "D" – positional attacks – 19.2±2.87 (41.9%), fast attacks – 26.6±2.87 (58.1%). At the 2018 world Cup, out of 169 goals, 111 (65.4%) were scored as a result of completing positional attacks, 35 (20.7%) – after playing off of the standard positions, and 23 (13.9%) – after implementing penalty kicks.

Conclusions. Monitoring and analyzing the attacks of a football team allows managing persistently the competitive activities of football players both at the operational level during a single game and at the current level during a competitive tournament.

Keywords: football team, 2018 FIFA World Cup, positional and fast attacks, tactical models of the game..

Introduction

Competitive activity in each kind of sport is the final stage of the entire system of training sportsmen. Monitoring and analyzing the competitive activity of sportsmen can improve the effectiveness of their training management (Shynkaruk, 2013; Kostiukevych, 2016). The most difficult is to control competitive activities in team sports. First of all, this is related to the multi-factor structure of competitive activity in these sports (Kostiukevych, 2006; Doroshenko, Sushko, Koryahin, Pityn, Tkalich, & Blavt, 2019; Mitova, 2016).

The analysis of literature sources leads to the conclusion that the problem of monitoring and analysis of competitive activities in team sports has been studied by many specialists in recent decades. In basketball, Zashchuk (2008) devoted his research to identifying the fast break models of highly qualified sportsmen in the game. The scientific research of Koryahin (2002), Bezmylova and Shynkaruk (2013) was devoted to the studying of the competitive performance indicators of high-class basketball teams. The structure of competitive activity of qualified volleyball players of different playing roles was specified by Doroshenko (2013), Imas et al. (2017), Kostiukevych et al. (2019). Solovey et al. (2020) analyzed the results of competitive activity of highly qualified handball teams to study the development trend of the game. In field hockey, the competitive activity of both players of different roles and in the team aspect was analyzed (Fedotova, 2007; Kostiukevych, 2007; Kostiukevych et al., 2019). The features of competitive activity of players and the team in general in mini-football were studied by Stasyuk (2017).

As for football, it should be noted that the problem of analyzing and monitoring of the competitive activity in this sport has been studied by rather a wide range of specialists. Quantitative and qualitative indicators of technical and tactical activity of qualified football players (Kostiukevych et al., 2019) and highly qualified football players (Lisenchuk, 2002; Godik, 2006; Kostiukevych, 2006; Tyulenkov, 2007; Shamardin, 2013) were outlined, as well as organizational aspects of building the game tactic of the football team (Bazilevich, 2011; Bangsbo, & Peitersen, 2000; Kostiukevych, 2020).

At the same time, the analysis of the literature confirmed the assumption that the problem of monitoring and analyz-

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ing of attacks of the football team has not been investigated enough, which defined the subject of scientific research, the results of which are presented in this article.

The aim of the research is to develop a methodology for monitoring and analyzing attacks of highly qualified football teams, taking into account various models of the game tactics.

Material and methodology

Participants

The competitive activities of the national teams that took part in the 2018 FIFA World Cup were studied. A total of 107 halves were analyzed, including 22 halves of matches of teams that used the tactical model "A", 33 halves – tactical model "B", 29 halves – tactical model "C", 23 halves – tactical model "D." The analysis of the competitive activity of the teams in one half is primarily due to the fact that a certain tactical model the team chooses, as a rule, for one half.

Methodology for monitoring the attacks of a football team

During the game, the attack carried out by the team during the match, which is divided into three types: penetrating, successful penetrating and goal-scoring.

In football, under attack should consider the actions of the team's players in the phase of possession of the ball, which are directly aimed at moving the ball in order to "take the goal" of the opposing team. Attacks in which a game situation is created for sharpening tactical move or a shot on the goal is considered penetrating. A successful attack is a penetrating attack, which ended with a kick on goal or giving a free-kick or a corner kick. A goal attack – a penetrating , which ended with a goal.

A long-term observations and analysis of the competitive activity in football allows us to come to the following conclusions:

1. As a rule, every attack in football consists of four phases (stages). The first stage is the transition of the ball to the team and the implementation of stable control of the ball. This phase can be called the stabilization phase. The stabilization stage begins after the selection or interception of the ball, as well as after the team has received the right for playing off of the standard positions. When selecting or intercepting a ball, the team must create a coalition of players to control the ball in a certain area of the field. Otherwise, the ball can very quickly pass under the control of the opposition.

A player coalition is a group of players in a team that interacts with each other in a certain playing area (zones) in order to solve a game problem.

Typically, such coalitions consist of a small number of players – from 2-3 to 4-6. In some cases, such coalitions may consist of 7-8 players. For example, for the combinations of a pass in pairs, a wall, a run, a pass through a third, a coalition of 2-3 players is necessary. Such game combinations as the transfer of the ball from flank to flank through the near, the square is held on the basis of coalitions, which consist of 4-6 players.

The main requirements for forming coalitions of players:

- the number of players in the coalition should be optimal in relation to the content and complexity of the game task;
- a coalition of players must be formed quickly enough, especially the coalition that is formed around the ball;
- coalition breaks up after it has completed its task, and the players who were in that coalition are eager to enter the new coalition;
- in each attack the number of coalitions depends on the stage of its organization and implementation: at the first stage (beginning) of the attack, usually, one coalition is created; at the second stage (attack development) – several coalitions (depending on the type of attack); 1-2 coalitions are created on the third (sharpening of the attack) and the fourth (completion of the attack).

The main rule for forming a coalition in the first stage is to form a "triangle" around the player who owns the ball. The second stage is the development of an attack with positional control of the ball (positional attacks) and fast movement of the ball in the direction of the opponent's goal (fast attacks). The third stage is the sharpening of the game situation. This stage occurs when a condition has been created for a sharpening tactical move. In other words, a penetrating attack is created. The fourth stage is the completion of the attack.

2. The third stage of the attack, that is, the stage of sharpening, can mainly take place on the following options: from the right flank; from the left flank; with the transfer of the ball into the cut between a wingback and a centre back. Conventionally, this tactical move can be defined as passing the ball to the "right pocket" and "left pocket"; the sharpening tactical move in the central part of the third zone of the field. In this case, a successful penetrating attack can be carried out by: the passing of the ball behind the back of the opponent's players; the interaction of the football players through the game combinations; the individual sharpening of the game situation. Long-range shots belong to the individual game.

The sharpening of the game situations after standard positions is registered separately (table 1).

The estimated scale of penetrating attacks is presented in the table 2.

In football, the result of a match does not always reflect the balance of power on the field. At the same time, a team that strives to organize and conduct more attacking actions and at the same time effectively counteract the attacking actions of opponents has real opportunities to achieve a common positive result. Therefore, monitoring and analyzing the attacks of the team and the opposite team allows, in certain degree, to evaluate the effectiveness of the game of the team.

Using the scorescale (see table 2) two informative indicators that characterize the effectiveness of the team's attacks are determined – the scoring ratio (SR, standard unit) and the effectiveness of the team's attacks (ETA, points).

$$SR = \frac{\sum_{i=1}^{n} GA}{\sum_{i=1}^{n} SA}, \quad (1)$$

where $\sum_{i=1}^{n} GA$ – a number of goal-scoring attacks;

$\sum_{i=1}^{n} SA$ – a number of successful attacks.

$$ETA = \sum_{i=1}^{n} points(PA + SA + GA), \quad (2)$$

Table 1. A protocol for registering attacks in football

Date ____ _____ team															
												_____ team			
Selection							1	2	3	∑	1	2	3	∑
Positional attacks															
Fast attacks															
Penetrating attacks	a right flank														
	a left flank														
	a right "pocket"														
	a left "pocket"														
	center	behind the back													
		combinations													
		an individual game													
Successful penetration attacks	a right flank		c												
			f												
			→												
	a left flank		c												
			f												
			→												
	a right "pocket"		c												
			f												
			→												
	a left "pocket"		c												
			f												
			→												
	center	behind the back	c												
			f												
			→												
		combinations	c												
			f												
			→												
		an individual game	c												
			f												
			→												
Standard positions	corner	near post													
		far post													
		playing off													
	Free kick	a direct kick													
		playing off													

Notes: c – corner-kick; f – free kick; → – shot on goal; 1, 2, 3 – field zone

where $\sum_{i=1}^{n} points$: PA – a number of penetrating attacks; SA – a number of successful attacks; GA – a number of goal-scoring attacks.

It should be emphasized that the above method of identifying the effectiveness of the team's attacks in football is relatively easy to learn, but it is quite informative, especially for the coach when analyzing the game of the team.

Statistical analysis

In the mathematical treatment of the results of the study the descriptive statistics were used: the following values were defined: arithmetic mean, mean square deviation, standard error of the arithmetic mean. The mathematical processing of the results of the study was conducted using MS Excel software packages.

Research results

A focused observation of the competitive activities of highly qualified club and national teams allows us to come to the conclusion that in modern football, one or another team primarily uses certain tactics of the game. Every tactic in football is aimed at achieving a goal in a match, depending on the level of your team and the opposing team. In this regard, the coach usually solves three tasks before the game: the starting line-up for the game; the system of play and the method of play. In modern football, such systems of play are mainly used: 1-4-4-2; 1-4-5-1; 1-3-4-3; 1352 (1st digit – goalkeeper; 2nd – defense line players; 3rd – midfield line players; 4th – attack line players).

As for the method of play, it can be active, passive, or combined. The active method involves playing "first number", when the team is included in the selection of the ball immediately after it is lost in each zone of the playing field. The passive method, on the contrary, is characterized by the fact that the team concedes the initiative to the opponent when losing the ball, all the players move behind the ball line and organize a concentrated defense in the first zone of the game. The game using the combined method is primarily due to the fact that when selecting the ball, the first line of team players is located in the second zone of the field, which makes it possible to rationally switch from attacking to defensive actions or vice versa, depending on whether the team owns the ball or selects it. As a rule, this method is used when playing equal-level teams.

Each tactic of the game is based on the following components:

- the game system;
- the method of the game;
- the ratio of positional attacks;
- the ratio of quick attacks;
- the ratio of holding, developing and sharpening gears;
- the ratio of high, medium and low pressure;
- the ratio of technical and tactical actions performed in various modes of coordination complexity.

Based on these components, four main tactical models of the game of highly qualified football teams can be determined: model "A", model "B", model "C", model "D". Models "A" and "C" refer to the active method of playing the game, that is, to the "playmaking" method. Model "D" provides a game based on the passive method, and model "B" is used when the conditions of the combined method of playing are met.

One of the tasks of the research of competitive activity of national football teams at the 2018 world Cup was to

Table 2. A scorescale for organizing and conducting attacks by a team in football

Type of attacks and principles of their completion	Number of points per 1 attack	The team		Opposite team	
		number of attacks	point total	number of attacks	point total
Penetrating – losing the ball	1				
Penetrating – losing the ball, created a scoring chance	4				
Successful – a free-kick or a corner-kick	2				
Successful – a free-kick or a corner-kick, created a scoring chance.	5				
Successful – not an accurate shot on goal.	2				
Successful – not an accurate shot on goal, created a scoring chance.	5				
Successful – an accurate shot on goal.	5				
Successful – an accurate shot on goal, created a scoring chance.	8				
Successful – a free 11-meter kick.	8				
Successful – a goal.	10				
Standard position – a free kick or a corner kick (a passing, a direct kick, a playing off)	2				
Standard position – a free kick or a corner kick (a passing, a direct kick, a playing off). Created a scoring chance.	5				

determine the specifics of playing the game according to different tactical models. It was assumed that the analysis of competitive activity of highly qualified football players would confirm the previously obtained results of building the game by teams using tactical models "A", "B", "C", and "D".

It was also important to determine the indicators of penetrating attacks by football teams and in particular the aggravating stage of these attacks. During the last world Cup, the competitive activity of the leaders of national teams of different playing roles was studied. The results obtained will increase the level of knowledge of football specialists regarding the features of competitive activity of teams and players in the aspect of different tactical models, which, in turn, will increase the effectiveness of management of competitive activity of football teams.

Qualitative indicators of penetrating attacks of national football teams

Long-term monitoring of the competitive activity of highly qualified football players allows us to state that the aggravating stage of penetrating attacks mainly occurs in five variants (Fig. 1.): left flank; right flank; through the left "pocket" (the part of the field in the third zone that is located between the winger and the centre back); through the right "pocket"; through the center. When conducting the aggravating stage of penetrating attacks through the center, passes behind the back of the opponent's players, group combinations and individual play are most often used.

Indicators of penetrating attacks by national football teams are presented in table 3.

As can be seen from the table for all tactical models, the most characteristic is the conduct of sharpening stages of penetrating attacks through the flanks, for TM "A" these indicators are 20.0 points in one half (28.8 %), for TM "B" – 11.8 points (23.9 %) for TM "C" – 10.8 points (23.7 %) and for TM "D" – 11.0 points (31.4 %).

Most of the sharpening stages of penetrating attacks through the right and left "pocket" are observed when building a game on TM "A", respectively 3.5 points – 5.0% and 2.5 – 3.6 %. For TM "C", in addition to attacks through the flanks, it is typical to use sharpening tactical moves behind the defenders – 7.0 points (15.3 %). A similar tendency to conduct penetrating attacks is also typical for TM "D" – 7.9 points (15.8 %), which is primarily due to the predominant use of positional attacks of the first pace and fast attacks.

Of the five options for conducting penetrating attacks, the highest quality indicators were registered when attacking through the center. So successful were penetrating attacks through the center for tactical models: TM "A"– 25.8 points (37.1 %), TM "B"– 17.4 points (35.1 %), TM "C"– 14.8 points (32.4 %), TM "D" – 10.6 points (30.3 %).

During one half, the highest quality indicators of penetrating attacks are observed in teams that use the playmaking tactics of the "A" model – 69.4 points, of which 17.6 % is allocated to draws of standard positions. Indicators of other tactical models are characterized by significantly lower quality indicators. In particular, the average value of quality indicators of TM "B" is 49.5 points, which is 19.9 (28.6 %) less than in TM "A". For TM "C", the average value of qualitative indicators of penetration attacks is less than TM "A" by 23.7 points (34.1 %).

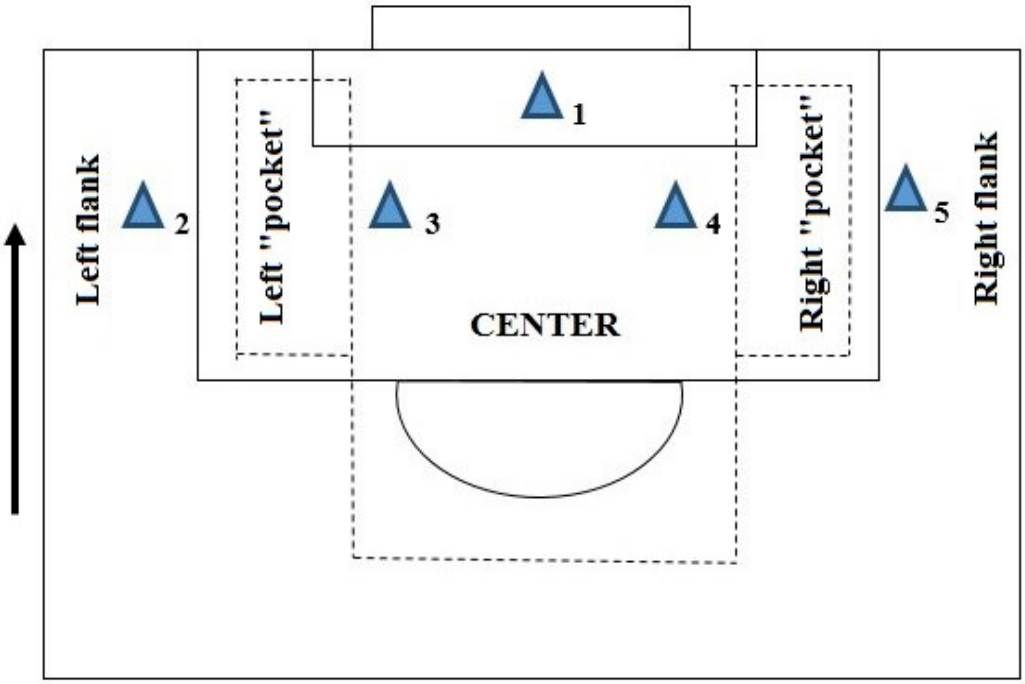

Fig. 1. Variants of the final stages of penetrating attacks in football

Table 3. Indicators of penetrating attacks by national football teams in one half at the 2018 world Cup (average values, points)

Types of attack			Tactical models				
			A	B	C	D	Average (X)
			n=20	n=32	n=34	n=22	27 halves
Penetrating attacks		Right flank	4.0 (5.8 %)	2.4 (4.8 %)	2.4 (5.3 %)	1.6 (4.6 %)	2.5 (5.0 %)
		Left flank	3.0 (4.3 %)	2.6 (5.3 %)	2.5 (5.5 %)	2.2 (6.3 %)	2.5 (5.2 %)
		Right "pocket"	1.6 (2.3 %)	1.0 (2.0 %)	0.7 (1.5 %)	0.3 (0.9 %)	0.9 (1.8 %)
		Left "pocket"	1.5 (2.9 %)	0.8 (1.0 %)	0.6 (1.3 %)	0.4 (1.1 %)	0.8 (1.6 %)
	Center	Behind the back	3.5 (5.0 %)	2.6 (5.3 %)	3.3 (7.2 %)	2.0 (5.7 %)	2.9 (5.8 %)
		Combinations	1.1 (1.6 %)	0.8 (1.6 %)	0.7 (1.5 %)	0.2 (0.6 %)	0.7 (1.4 %)
		Individual game	0.9 (1.3 %)	0.7 (1.4 %)	0.6 (1.3 %)	0.5 (1.4 %)	0.7 (1.4 %)
Successful penetration attacks		Right flank	5.8 (8.4 %)	3.5 (2.1 %)	3.2 (2.0 %)	4.0 (11.4 %)	4.1 (8.2 %)
		Left flank	7.2 (10.3 %)	3.3 (6.7 %)	2.7 (5.9 %)	3.2 (9.1 %)	4.1 (8.2 %)
		Right "pocket"	1.9 (2.2 %)	1.8 (3.6 %)	2.7 (5.9 %)	1.4 (4.0 %)	1.9 (3.8 %)
		Left "pocket"	1.0 (1.4 %)	1.2 (2.4 %)	1.6 (3.5 %)	1.4 (4.0 %)	1.3 (2.6 %)
	Center	Behind the back	5.7 (8.2 %)	5.3 (10.7 %)	3.7 (8.1 %)	5.1 (14.6 %)	5.0 (10.0 %)
		Combinations	16.4 (23.6 %)	7.4 (14.9 %)	8.7 (19.0 %)	3.5 (10.0 %)	9.0 (18.0 %)
		Individual game	3.7 (5.3 %)	4.7 (9.5 %)	2.4 (5.3 %)	2.0 (5.7 %)	3.2 (6.4 %)
	Standard position		12.1 (17.6 %)	11.2 (23.7 %)	9.9 (21.7 %)	7.2 (20.6 %)	10.2 (20.6 %)
	Total		69.4	49.5	45.7	35.0	49.9

As expected, the lowest quality performance of penetrating attacks was observed in national teams that used a counter-attacking style of play. These teams built the game on TM "D". On average, for one half-time, the qualitative indicators of TM "D" during penetrating attacks are 35.0 points, which is 34.4 points (49.6%) less than TM "A", 14.5 points (29.3%) less than TM "B" and 10.7 points (23.4%) less than TM "C".

When studying the competitive activity of football national teams at the 2018 World Cup, the indicators of positional and fast attacks were analyzed (Table 4). The most attacks were performed by teams using TM "A" – 52.3±2.56

Table 4. Indicators of positional and fast attacks of national football teams in one half at the 2018 world Cup

Attacks	Tactical model															
	"A"				"B"				"C"				"D"			
	n	X	S	%	n	X	S	%	n	X	S	%	n	X	S	%
Positional attacks																
Of the first rate	24	15.3	4.62	47.3	33	11.6	2.88	46.0	35	12.0	2.79	36.9	22	10.0	3.14	52.0
Of the second rate	24	11.7	2.56	36.2	33	8.9	2.16	35.3	35	10.3	1.86	31.6	22	6.9	2.35	35.9
Of the third rate	24	5.3	2.56	16.5	33	4.7	1.44	18.7	35	10.2	2.56	31.5	22	2.3	1.04	12.1
TOTAL	24	32.3	4.35	61.8	33	25.2	4.32	52.7	35	32.5	3.49	67.7	22	19.2	2.87	41.9
Fast attacks																
short	24	7.7	2.05	38.5	33	7.8	1.68	34.5	35	5.7	1.86	36.7	22	7.1	1.57	26.6
average	24	6.9	2.05	34.5	33	6.3	1.92	27.8	35	4.9	1.18	31.6	22	6.5	1.57	24.4
long	24	5.4	1.79	27.0	33	8.5	2.40	37.7	35	4.9	1.63	31.7	22	13.0	2.09	49.0
TOTAL	24	20.0	1.78	38.2	33	22.6	4.32	47.3	35	15.5	3.96	32.3	22	26.6	2.87	58.1

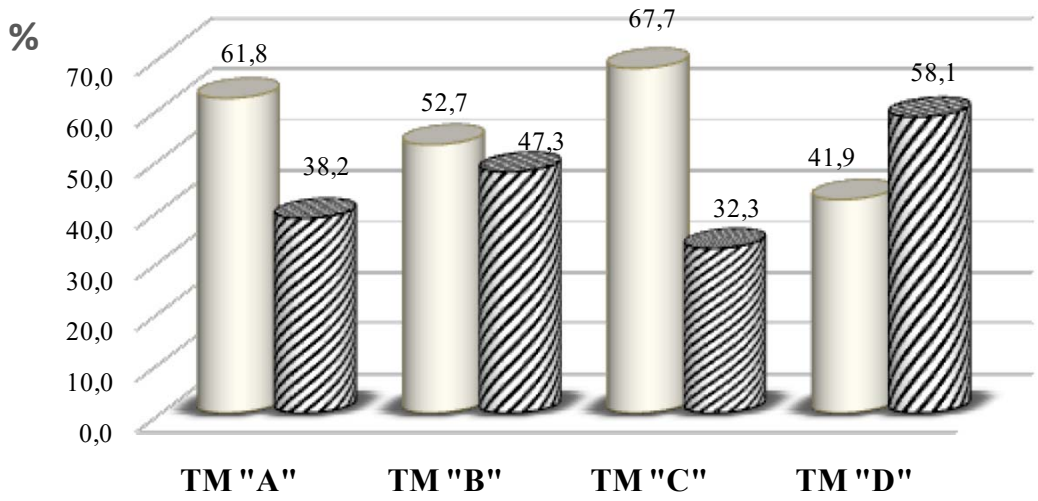

Fig. 2. Distribution of positional and fast attacks depending on different tactical models of the game of national teams at the 2018 world Cup: – positional attacks; – fast attacks

attacks per one half. The teams that built the game on the basis of TM "B" and "C" have a slightly lower indicator, respectively – 47.8±1.36 and 48.0±3.73 attacks.

Tactical models "A", "B" and "C" are characterized by the predominant execution of positional attacks in comparison with fast attacks (Fig. 2). Teams that played on "D" performed more fast (58.1%) than positional (41.8%) attacks. The greatest difference between positional and fast attacks was observed in the game of teams on TM "C"– 35.4% and TM "A" – 23.6%.

Indicators of the distribution of positional attacks on attacks of the first, second and third rates and fast attacks on short, medium and long (see table. 4) to a certain extent characterize the style of play of teams. Thus, TM "A" is characterized by preferential execution of positional attacks of the first (47.3 %) and second (36.2 %) rates and fast short (38.5 %) and medium (34.5 %) attacks. For TM "C", the distributions of positional attacks of the first, second and third rates are approximately the same, respectively, 36.9, 31.6 and 31.5 %. Fast attacks are also distributed for this TM: short – 36.7 %, medium – 31.6 %, and long – 31.7 %. To a certain extent, TM "C" can be described as the most balanced tactical model of the game. It is confirmed by the construction of the game of the world's leading national teams: Spain, Germany, Argentina, and Brazil, which build the game to the greatest extent on the basis of TM "C". As can be seen from table 4, the indicators of positional and fast attacks of TM "B" are intermediate between TM "A" and TM "C". As a rule, TM "B" is used by equal teams.

Unlike the first three tactical models of the game, which are characterized by the use of playmaking tactics, TM "D" is counter-attacking. With this TM, the most performed po-

sitional attacks of the first (52.0 %) and second (35.9 %) rates and fast long (49.0 %) as well.

Thus, the indicators of positional attacks, depending on the different options for the implementation of the sharpening stages of these attacks, allow to more targeted management of the competitive activities of highly qualified football teams.

Discussion

Managing a football team during a competition is one of the most difficult problems of coaching.

First of all, this is due to the complexity of operational control, which must be carried out directly during the match. For this purpose, the coach must receive urgent objective information about the quantitative and qualitative indicators of competitive activity of both his team and the opposing team.

The proposed methodological approach to monitoring the analysis of attacks of a football team allows the coaching staff to make managerial corrections regarding:

- number of penetrating attacks;
- methods of sharpening stages of game combinations;
- quality indicators of game combinations (situations that result in a goal being scored).

Based on the data obtained, the coaching staff not only corrects the tactics of the game during the match, but also makes the necessary changes to the training program.

Therefore, our research, in addition to theoretical, is also of practical significance.

The results of our research complement the results of previous scientific searches (Godik, 2006; Kostiukevych, 2006, 2010; Shamardin, 2013; Kostiukevych, al. 2017).

At the same time, our study has provided new results on the quantitative and qualitative indicators of the tactics of football teams. For the first time, we have proposed five options for conducting the sharpening stages of penetrating attacks.

This study is a continuation of the previous scientific search for various models of tactics of football teams (Kostiukevych, 2019).

Of course, the different results in the study relate only to the first phase of the football team's tactics – the possession phase. Equally important is the second phase of the football team's game – the phase of ball selection. Research on the tactics of the team's game in the ball selection phase is very relevant and can be the subject of further scientific research.

Conclusions

Monitoring and analysis of competitive activity of athletes is the main link in the system of their training.

Modern football is characterized by a multi-factor structure of tactical interactions of players during the match. One of the key components in this structure is game combinations, in which special importance is given to penetrating attacks. The sharpening stage of these attacks is carried out in five ways: from the right flank; from the left flank; through the right "pocket"; through the left "pocket"; through the center.

The developed methodology for monitoring and analyzing the attacks of a football team is quite informative and can improve the efficiency of operational and current management decisions in the process of competitive activity.

The analysis of goals scored at the 2018 FIFA World Cup allows us to state that out of 169 goals: 25 (14.8%) were scored after sharpening passes from the right and left flanks; 20 (11.8%) – after combinations through the right and left "pocket"; 66 (38.9%) – after combinations conducted through the center of the penalty area; 20 (11.8%) – after drawing corner kicks; 15 (8.8%) – after drawing free kicks; 23 (13.9%) – after implementing penalty kicks.

The prospect of further research of the problem under study may be due to the scientific search for the development of an integrated assessment of monitoring and analysis of the tactics of the football team.

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Conflict of interests

The authors state that there is no conflict of interests.

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КОНТРОЛЬ І АНАЛІЗ АТАК ФУТБОЛЬНОЇ КОМАНДИ

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 9 с., 1 табл., 7 рис., 26 джерел.

У статті викладено методичний підхід до контролю й аналізу атак футбольної команди високої кваліфікації.

Мета дослідження – з урахуванням різних моделей тактики гри розробити методику контролю й аналізу атак футбольних команд високої кваліфікації.

Матеріал і методи. Досліджувалася змагальна діяльність національних збірних команд з футболу на чемпіонаті світу 2018 року. Методи дослідження: аналіз і узагальнення літературних джерел, педагогічне спостереження, відеоаналіз змагальної діяльності, методи математичної статистики.

Результати. Розроблено протокол реєстрації атак футбольної команди. Визначено оціночну шкалу проникаючих атак і розіграшів стандартних положень футбольної команди. Встановлено різне співвідношення позиційних і швидких атак національних збірних команд з футболу, які застосовували різні тактичні моделі гри. В одному таймі: для тактичної моделі «A» позиційні атаки становили 32,3 ± 4,35 (61,8 %), швидкі атаки – 20,0 ± 1,78 (38,2 %); для тактичної моделі «B» – позиційні атаки – 25,2 ± 4,32 (52,7 %), швидкі атаки – 22,6 ± 4,32 (47,3 %); для тактичної моделі «C» – позиційні атаки – 32,5 ± 3,49 (67,7 %), швидкі атаки – 15,5 ± 3,96 (32,3 %); для тактичної моделі «D» – позиційні атаки – 19,2 ± 2,87 (41,9 %), швидкі атаки – 26,6 ± 2,87 (58,1 %). З 169 голів на чемпіонаті світу 2018 року, 111 (65,4 %) було забито в результаті завершення позиційних атак, 35 (20,7 %) – після розіграшу стандартних положень і 23 (13,9 %) – при реалізації 11-метрових штрафних ударів.

Висновки. Контроль і аналіз атак футбольної команди дозволяє цілеспрямовано керувати змагальною діяльністю футболістів як на оперативному рівні в процесі однієї гри, так і на поточному, протягом змагального турніру.

Ключові слова: футбольна команда, чемпіонат світу з футболу 2018 року, позиційні і швидкі атаки, моделі тактики гри.

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ФІЗКУЛЬТУРНА ОСВІТА

GLOBAL COMMUNICATION COMPETENCE: A FRAMEWORK OF INTERCULTURAL SKILLS DEVELOPMENT IN SPORT AND TOURISM HIGHER EDUCATION

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Abstract

Purpose. The research aims at multi-faceted study of global communication competence, which is a vital soft skill for professional development of students, acquiring their degrees in sport and tourism.

Materials and methods. Qualitative research methods applied in the research include theoretical analysis of relevant scientific findings, synthesis and modelling, pedagogical observation and evaluation. Quantitative analysis relates to questioning and data processing, in particular, 50-question Intercultural Quiz, conducted among 352 students of NUUPES and NUFT.

Results. The conducted research of global communication competence of the first and fifth year university sport and tourism students shows clear correlation between the level of education and gained global communication expertise, presented by the communicative skills of critical thinking and cooperation. The analysis of statistic data has proved that along with improved self-awareness, disciplines more than doubled students' global communication competence within five academic years. In addition to quantitative improvement, the quality of the intercultural communication is enhanced, as essential professional skills are gained in the sphere of students' future occupation. Professional orientation of global communication competence outlines sportive and medical inclination of NUUPES students' higher education, and tourism and hospitality focus of NUFT students' training.

Conclusions. The results of the study have proven that contemporary university students who get degrees in the fields of sport and tourism perceive culturally-bound information when attending their on-line and off-line academic courses and participating in various multicultural events in and outside university setting. In this way they acquire attitudes and values of self-awareness and recognition of ethnical diversity. Established values transform into production and result in implementation of culturally aware behaviour, represented by a high level of self-evaluation and persuasion abilities directed to effective, yet tolerant way of problem solving and shared responsibility.

Keywords: global communication competence, intercultural attitudes and values, perception, production.

Introduction

Global communication competence is a set of interpersonal skills essentially required for contemporary sport and tourism students, living in the era of globalization, when the world they live in is no more than a global village and social contacts with representatives of other countries are commonplace. Identifying themselves as individual cultural representatives, seeing others as belonging to their culturally diverse groups promotes shared respect and tolerance in the world of sport and tourism and assists in achieving academic and professional goals.

Educational establishments are directed at preparing their students to interact in culturally diverse environment both in Ukraine and outside, establishing connections with people from various cultural backgrounds, thus fulfilling multiple models of global communication in academic and professional domains (Berardo & Deardorff, 2012; Lázár, 2012). High communication competence, especially skills of cross-cultural understating and cooperation, guarantees both sport and tourism students better employability and varied job opportunities.

The aim of research is to define global communication competence as an integral element of professional development among students that gain their degrees in sport and tourism. It involves completion of the following tasks: 1) de-

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fining communication-based attitudes and values, which affect ethical behaviour and skills; 2) outlining multi-faceted and behaviourally determined nature of global communication competence; 3) establishing effective ways of gaining this competence via perception and production.

Material & methods

The research is the authors' vision on how global communication competence is developed among students of National University of Ukraine on Physical Education and Sport (NUUPES), Kyiv, Ukraine, and National Food Technologies University (NUFT), Kyiv, Ukraine, based on 10-year teaching experience in these educational establishments. To achieve the objectives of this study the following qualitative research methods were used, i.e. theoretical analysis of relevant scientific findings, synthesis and modelling, as well as pedagogical observation and evaluation. Quantitative analysis included questioning and data processing.

Participants and organization of the research

In order to assess level of self-awareness and knowledge about other countries, as well as evaluate changes in the level of global communicative values among sport and tourism students within their university time (Doscher, 2012), we have conducted 50-question Intercultural Quiz, which contained questions both about Ukrainian and other world cultures. Questions examined knowledge about history, ethical behaviour, appropriate greeting, cultural norms and taboos in various societies. The total number of participants was 352 students, including the first (140, 77) and fifth (103, 32) year students of NUUPES and NUFT respectively.

Statistical analysis

The obtained results of the questionnaire were further processed using the methods of mathematical and descriptive statistics (Morais, & Ogden, 2011; Mahon, & Cushner, 2014). We used MS Excel (Microsoft USA), Statistica 8.0 (StatSoft, USA). For this the total scope of 50 questions were split into 2 major categories of self-awareness and cultural diversity recognition. Then the obtained empirical data were systemised in accordance to outlined components of global communication competence (i.e. attitudes/values, behaviour and skills) and analysed to form conclusions (Fantini, 2009); the results are shown further in Fig. 1.

Results

The result of the quiz has revealed that the first year students of both Universities have quite high level of self-awareness, corresponding to 70 %; however, they are rather badly-informed about cultural diversities of other countries, as they gave only around 40 % of correct answers regarding world cultures. Moreover, knowledge that the first year students possess is general and theoretical, as more specific questions answering which required special research or intentional study were mostly incorrect.

Nevertheless, the fifth year students revealed higher global communication values, showing growth of both self-

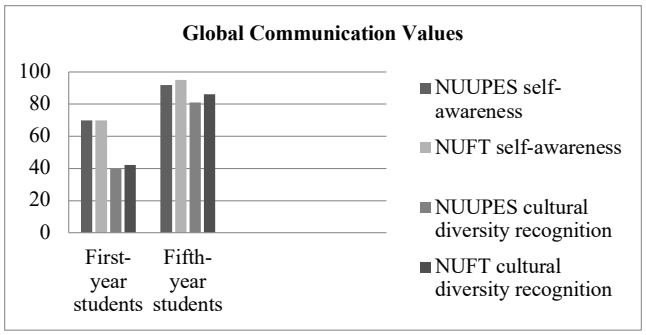

Fig. 1. Correlation of global communication values between the first and the fifth year NUUPES and NUFT students

awareness and recognition of cultural diversity. They are more that 20% better informed about own country, and their global competence has more than doubled, reaching 81% and 87% for NUUPES and NUFT respectively. Significant quantitative and qualitative increase of global communication attitude and values appeared as a result of acquisition of professional knowledge through various academic activities, including attending lectures connected with International policies, theoretical study of countries geopolitics, economics, culture, traditions and customs, sports, writing reports and preparing projects about different nations, thus establishing clear correlation between gaining global attitudes and getting higher education in the fields of sport and tourisms.

Global communication competence of students is based on three fundamental interconnected attributes, namely attitudes and values, behaviour and skills, which were first introduced as part of Byram's ethno-relativism theory (Hoff, et al., 2014) of Multidimensional Model of Intercultural Competence.

However, over the last few decades, constant growth of online and offline flow of international communication has significantly affected dichotomy of human-world interrelation, proving great influence of individuals on society and vice versa (Bender, Wright, & Lopatto, D., 2009). Thus, in our research global communication competence is manifested both on the level of *internal perception* and *external production,* i.e. are seen as self-understanding of a human and their acting in / as a group (Fig. 2).

It has been established that global communication competence as a triad of corresponding attitudes/values, behaviour and skills is achievable by students as a dichotomy of *perception* and *production*. According to psychological Activity Theory, developed by Vyhostkyi, Lieontiev, Rubinstein and further studies by Bartelsen and colleagues (Bertelsen, et al., 2003), these are so-called consciousness and activity, united in such a way that the letter determines the former. Thus, it is true to say that global communication competence is formed within person's actions and is revealed there as well. To be precise, the above-mentioned competence as a whole constitutes of two equally important parts, i.e. perception of culturally bound information and production of culturally aware behaviour. However, despite being joint and interdependent, they tend to be mutually exclusive. It means that perception does not equal production, but is rather its outcome and vice versa. We believe that students, gaining their degrees in sport and tourism, take professionally related actions in national

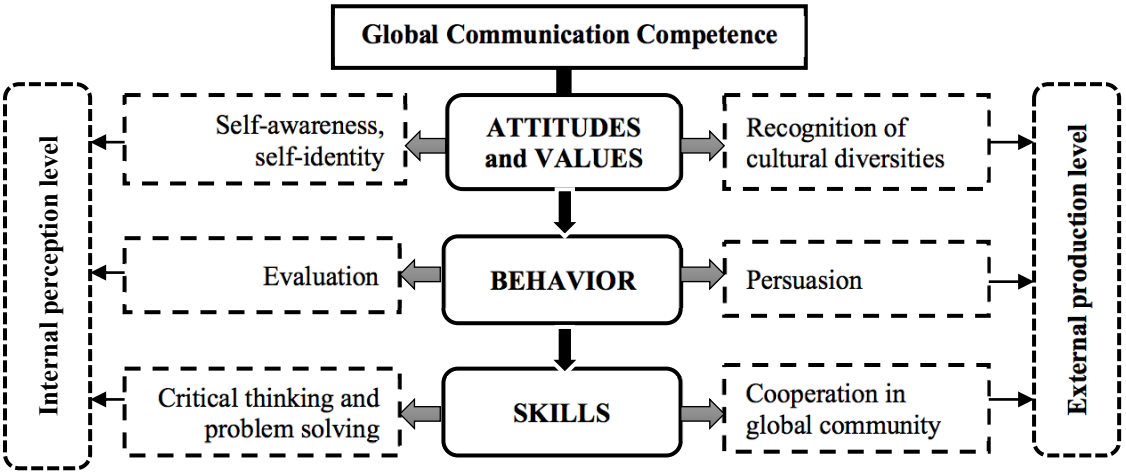

Fig. 2. Global communication competence structure

and international context that allows them to become interculturally aware specialists.

Attitudes and values denote the significance of cultural things and actions for a sport and tourism student and are mostly based on family and cultural background, social upbringing, academic competence and mass media. In other words, values are often inherited from family and then intensified by and shared within social groups (Deardorff, 2006). For instance, positive attitude to active lifestyle and doing sports, e.g. riding bicycle starting from the earliest possible age, or spending time hiking in the forest, is encouraged by positive image in children books, cartoons and family movies in Ukraine. Positive attitude to active and healthy lifestyle brought up in the family and social environment is then enhanced by values of respect and tolerance to other cultures, the latter appears as a result of perceiving positive intercultural relation in mass media (Fry, 2012; Whitehead, 2007). For example, the young learn to respect sport achievements and understand national identities when they watch broadcasts of Olympic Games or World Championships, where people of different nationalities compete on equal terms, thus developing values of global cultural competence.

According to 2013 UNESCO and 2018 OECD programs key values that are fostered through school and university education system worldwide are empathy and sympathy, solidarity, self-respect, sense of social responsibility and belonging, commitment to learning, sustainability. In addition to developing all above-mentioned values, we believe that special attention is to be paid to enhancing fundamental key internal value for each sport and tourism student, namely *self-awareness,* i.e. self-identification, knowledge about own culture, understanding national mentality strengths and weaknesses, traditions, socially acceptable behaviour, moral norms, family values (Baeva, 2005). Knowing cultural background not only lets a student identify themselves as a member of ethnic group, but also provides ground for comparison with other nations and leading to external attitudes.

Key external value for a sport and tourism student is *recognition of cultural diversity* of other ethnic groups. Acquisition of this value by universities students is usually fulfilled by identifying own cultural similarities and differences with other nations. Having got first on hand experience talking to foreigners on professional topics (for instance, during conferences, workshops, guided tours, excursions, competitions), students become aware of common and shared values in international academic environment, namely diligence, attention and devotion to learning, politeness, dignity and self-respect. At the same time some evident cultural discrepancies (i.e. greeting traditions, manner of speech, attitude to other generations) may not come unnoticed, raising questions which require further research.

Behaviour. Positive global attitudes and values of sport and tourism students develop into constant socially-acceptable behaviour, which later transforms from amateur level games or hobbies to professional activities, such as doing sports in specialized educational establishments, participation in competitions and Olympiads, hiking and camping using professional tools and equipment, organizing international cultural fairs, etc. (Dennis, 2010). Thus, global communication behaviour, being determined by attitudes and values, on internal perception level develops into self-evaluation, and on external production level transforms in persuasion.

Internal behaviour of sport and tourism students develops from cultural self-awareness to *self-evaluation* (Boix Mansilla, 2016). The top priority now is personal achievements and assessment of student's own actions. As students spend more time studying and practicing in academic environment, enlarging amount of intercultural communication, they start noticing correlation between time spent on self-development and level of professional achievements. The higher scores they get, the more medals they win, the more cities/countries they visit, the more confident their behaviour becomes. Consequently, quantity of knowledge changes into quality of communication, moving to the level of external behaviour, understood as persuasion, i.e. expressing own thoughts and beliefs in the process of communication in intercultural environment (Fig. 3).

Global external behaviour of *persuasion* is realized by the students' wish to share knowledge and encourage discourse within and outside international academic circle. The young learn not only to clearly express and openly share their ideas, but also to prove and promote own points of view in a friendly academic manner. Such academic behaviour is known to be *emotion-oriented,* as the purpose is to share responsibil-

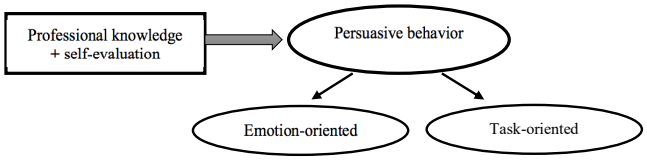

Fig. 3. Transformation of students' professional knowledge into persuasive behaviour

ity and run project to the successful outcome by mean of global communication. With this aim, sport and tourism students take part in online and offline conferences, discussions, meetings, tours, festivals, fairs, where they have opportunity to communicate with representatives from other countries. Their task is to persuade others and create positive communication environment as they learn to work in the teams.

However, some academic activities directed to global communication may require *task-oriented* behaviour, when the priority is to reach the target, e.g. win a competition at individual sports, or complete an individual research, e.g. defend own scientific project about particular recreation area. Persuasion in this case is a bit devalued, being substituted by determination and accuracy, leading to the process of continuous learning (Laal, et al., 2014), which goes further and beyond formal educational environment (Willingham, 2007). The valuable skill of an experienced teacher in enhancing high-quality global communication competence through emotion and task-oriented behaviour is to educate sport and tourism students to form their opinions and build conclusions on exploration and sufficient evidence, and communicate them clearly and tolerantly.

Skills. Acquired attitudes and well worked out communication behaviour create solid background for students' global communication skills, which are represented by critical thinking on internal level and cooperation on the external one.

Critical thinking and *problem solving* are the essential internal skills of providing complex intellectual reasoning, which include a bunch of students' mental abilities namely, deduction, induction, analysis, evaluation and inference (Garrett, et al., 2017), gained both as a result of doing academic research tasks and strengthening body, willpower and endurance. By thinking critically, the young generation gets understanding of deeper aspects of tourism and sport industry (Hakman, Medved, Moseychuk, & Muzhychok, 2017), demonstrates awareness of ethical and ecological issues. In addition, they are taught to construct and articulate fair moral judgements regarding ethnic, race, gender, age, disability, culture minorities issues, as they participate in relating debates and discussions, contact with representatives of various countries in and outside academic setting.

Skills of communicative *cooperation,* which represent external production level of global communication competence, are directed to creating social and effective outcomes (Siedenton, et al., 2000) and embodied in students' abilities of active listening and effective oral and written presentation. Not only students are able to self-express and perceive ideas of others, but they can also exercise empathy and solidarity. Consequently, contemporary students are well-equipped with employable skills, suitable for junior and senior managerial positions in the fields of sport and tourism.

In terms of our research, the dichotomy of *perception* and *production* has been split further. Firstly, perception is regarded as the process of acquiring high-level knowledge or expertise and developing professional skills by students within years of their study. Taking into account the way of gaining information, on-line and off-line modes are distinguished (Fig. 4).

In Ukrainian educational tradition the main activity domain for university students is class-room learning, which presupposes attending lectures, participating in seminars and practical classes. Here perception prevails over production regarding development of global communication competence, as far as cultural information is exposed for them to be analyzed and discussed in academic setting. Curricula of both universities' disciplines include intercultural competence as an integral part of professional education. For example, at NUUPES syllabuses of History of Physical Culture, Biomechanics, Statistics, Hygiene, Sport Medicine, Treatment of Sport Injuries and Massage etc. disciplines all require covering findings of foreign scientists in relevant fields, thus, letting undergraduates familiarize with international sport science achievements of past and present. The same is relevant for NUFT, where tourism and hospitality development is studied not only in chronological, but also economic and geographical perspectives in the courses of World and National Cultural Heritage, Tourism Geography, Recreation and Resort Business. Therefore, students' perception of culturally bound information in the sphere of their expertise makes their knowledge applicable in any cultural background. Moreover, having a dual diploma of a local university and a foreign partner one gives them legal opportunity to apply their professional skills worldwide.

Current shift from face-to-face learning to self-study aims at encouraging students to gain knowledge independently, but turn it into hard skills in cooperation with others through collaborative project work. It proves that global communication competence is also likely to emerge in the process of student's self-education as kind of additional soft skills in understanding cultural diversity (Gay, 2015). Take for instance, completion of Bachelor's scientific research works and writing diploma papers. This task requires reading and/or watching scientific, yet culture specific information, its deep analysis and further usage to offer their vision of changing the phenomenon under research. It should be added that a problem-solving task that students face here makes them activate comparative and creative thinking, the former – to study how different cultures deal with analysed phenomenon and the letter – to come up with a new effective solution (Edwards, 2017). Even though perception still prevails over production here, as far as students have quite little social influence to insist on immediate implementation of their own findings, this type of works develops their professional intercultural competence via critical thinking, applied during research. Actually, any topic of students' scientific papers illustrates intercultural aspect of their research, as they are almost all built by the same principle, i.e. analysed phenomenon in Ukraine + the one in (an)other country(s) + new strategy/vision for its improvement. For instance, "Leadership at the World Games and factors behind it (on the example of Italy and Ukraine)" or "Improvement of common business practices of running a boutique hotel in Ukraine

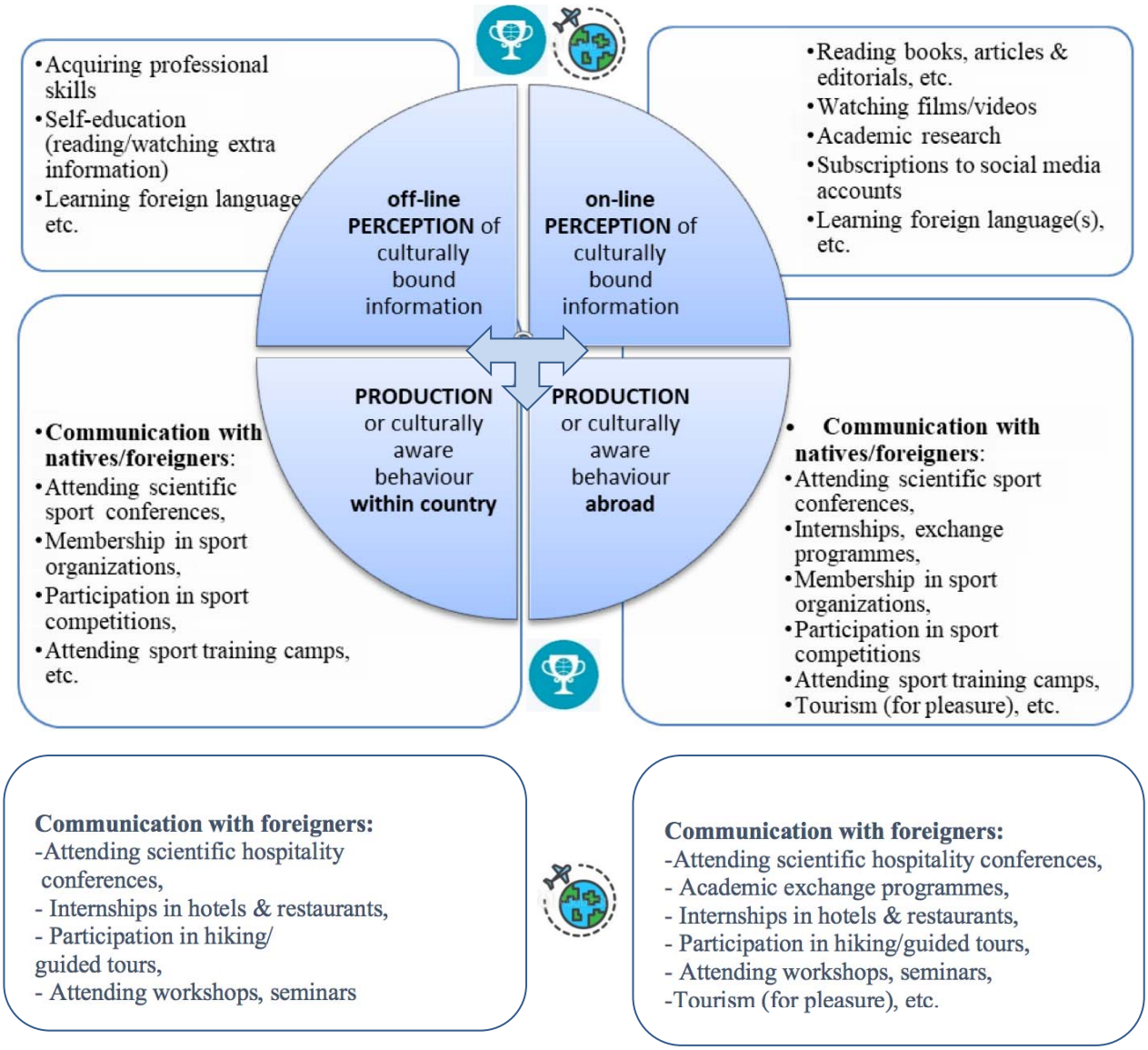

Fig. 4. Global communication competence acquisition in dichotomy of perception and production

and France". We believe that such an approach to scientific projects is the most efficient for students to generalize their own national experience in the field of study and get involved in global professional sphere.

Off-line perception of culturally-bound information would be quite limited not to say distorted if it was only possible via Ukrainian and/Russian-speaking sources. True global communication competence is formed in the process of foreign language(s) acquisition. In this respect the triad of language – culture – identity should be mentioned, as speech is regarded as a social culturally-determined behaviour of a person. According to classical hypothesis of linguistic relativity (See the Sapir–Whorf hypothesis) as well as W. Humboldt's philosophy of language, human culture is embodied in language (Hadis, 2005). Thus, while learning foreign language students automatically gain both linguistic and cultural skills of self-expression. They enrich own inter/cultural awareness comparing cultural specifics of native and non-native speech, derived from different historical and social economic parameters of language development.

Contemporary lifestyle is determined by overwhelming globalization trend, driven by rapid advance in IT. So, university students as an integral group of modern society are greatly influenced by global networking opportunities. On-line perception of information becomes predominant for them; continuous Internet surfing is actually becoming their daily routine (Zuckerman, 2013). All the studying activities that used to be performed off-line are now available on-line, including reading articles, editorials, books, watching films/videos, following social media posts, conducting on-line academic research, etc. Audio-visual mode of information perception is similar to that of off-line mode of knowledge acquisition; however, the significant difference here lies in the scope of information available. Great variety of Internet resources provides students of both specialisations with informational choice which they could probably lack before.

Moreover, it gives them more freedom of action, encourages working independently of tutors, and thinking critically (Ritchhart, 2011). No doubt that in such a way they develop global communication competence naturally as a result of analytical work.

Learning foreign language(s) with the help of IT turns to be beneficial as well. Despite numerous contemporary claims of languages becoming global lingua franca with the same set of basic concepts and additional connotations, our English language teaching experience shows that cultural aspects here matter greatly. In professional sphere leaning a foreign language means that students should not only distinguish key concepts, notions and terms in the language they acquire, but also compare them to the ones in their mother tongue. Undergraduates of both NUUPES and NUFT perceive a lot of professionally-related information in non-native language(s) first during their language classes and then in other disciplines (Karaman, & Tochon, 2007). However, surfing the Internet they develop their perceptive communicative skills in reading and listening along with productive skills of speaking and writing, which together comprise global communication competence.

Taking into consideration the above-described combination of professional and linguistic skills that students develop when they do their university studies and perform their individual work either on-line or off-line, it should be stated that they become inter-culturally aware in the sphere of their future occupation. While NUUPES students mainly concentrate on sportive and medical achievements of humanity, NUFT students are obviously more focused on tourism and hospitality principles and trends. Anyway, this professional specialisation does not mean that their global communication competence is restricted to their university major. On the contrary, their primary professional orientation gives them deeper insight into other spheres of human activity through their ability of meaningful international communication in the field of their expertise.

Production or students' culturally aware behaviour is based on their ability to implement professional and communicative skills into practice via cooperation with others. In this paper we do not distinguish communicative styles and culturally-specific behaviour of undergraduates during interaction with natives and foreigners; however, we differentiate their chances to show their global communication competence in Ukraine and abroad. In the context of discourse analysis, that analyses speech and behaviour in relation to real life situations (Fritz, et al., 2002), it is established that not only pragmatic aim of interlocutors in each individual interaction determines their professional style of communication, but also various social and cultural settings may influence their professional behaviour.

Students of both NUUPES and NUFT can introduce their scientific findings during international conferences, held annually. Even though their focus is either sport or tourism oriented (compare "Sport and Modern Society", "Sustainable Development and Heredity in Sport", etc. and "Quality and Safety of Food Products", "Innovative Technologies in Hospitality Business", etc.), the general idea is to highlight achievements of Ukrainian scholars in both spheres. On the contrary, similar meetings, held abroad, are likely to shift their perspective to global cooperative principles of professional interaction. Thus, participation in such events gives students a chance to broaden their general cultural and professional vision on current trends and phenomena. The same is true to mention about practical kinds of activity, i.e. attending sport training camps or conducting hiking/guided tours, attending seminars and workshops, which can further lead to making first steps in their career development (Blynova, 2018). For example, participation in sport competitions and/or internships in hotels, restaurants, travel agencies, etc. is the real action students can take to use their professional knowledge and skills of international cooperative behaviour. Consequently, it is evident that the latter is the ultimate goal for students to achieve during the years of their studies.

Discussion

Regarding high speed of globalisation processes in the world and increased number of intercultural contacts in both academic and professional areas, the necessity of acquiring global communication competence is obvious to sport and tourism students. The role of universities is significant here, as they should strive to primarily provide students with practical ways of international interaction. Both NUUPES and NUFT have a wide network of international partners among other specialised educational institutions, organisations and enterprises abroad. For more detail check the web-sites of both universities. The only thing that should be underlined is that a great number of current international programs, reasonable academic requirements and sufficient practical conditions make it possible for all those who will to participate in them. No doubt, real life professional communication both in Ukraine and abroad positively affects their values and attitudes within global communication competence. Moreover, if it is accompanied by individually organised trips abroad either for pleasure or for educational/professional purposes, the effect of cultural awareness will be much bigger.

Nevertheless, development of global communication competence is conducted not only via Universities initiative and academic teachers-designed tasks at universities, but also through students' self-development, personal trips and intercultural experience acquired outside scholastic setting, thus should be highly encouraged.

Conclusions

Overall, during this research the issue of global communication competence has been studied regarding its acquisition and/or development by students of sport and tourism specialities. It has been established that this competence constitutes of three interdependent components, i.e. attitudes/values, behaviour and skills. The first is a cultural background of students, enhanced by their inner personal qualities and outer vision on contemporary lifestyle. According to conducted quantitative analysis it shows the proportion of 70%/40% of the first-year students' self-awareness and cultural diversity recognition respectively. Therefore, it serves as a fundamental basis of broadening their intercultural worldview during university studies.

The triad of global communication competence elements let us differentiate the level of internal perception and external production, or in other words, perception of cultur-

ally-related information and production of culturally-aware behaviour. While perceptual level is all about gaining expertise and developing professional skills either in the sphere of sport or tourism, the production presupposes students' persuasive behaviour aimed at reaching cooperative goals of professional communication. Both levels of behaviour and skills development are culturally-determined, as can take place in intercultural setting and/or with reference to internationally acknowledged academic achievements. They serve to improve students' communicative skills of critical thinking and cooperation on the global arena.

While gaining a degree in sport or tourist students of NUUPES and NUFT have a chance of meaningful international communication in the field of their expertise, which gives them deeper insight into other areas of human life. During the years of studies, they develop their global communication competence to the level of 80-90%, regarding their self-awareness and cultural diversity recognition. This is a great change of their worldview that gives them many chances of career development and professional recognition worldwide.

Although various factors may contribute to global communication competence development, the role of university education is significant, as during these formative years, students of both NUUPES and NUFT get opportunity to acquire professional knowledge and apply it in intercultural context. Production of culturally aware behaviour and global communication skills, thus, becomes one of integral components of students' professionalism regardless of their specialisation, which lets them develop career in global perspective.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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ГЛОБАЛЬНА КОМУНІКАТИВНА КОМПЕТЕНТНІСТЬ: ОСНОВА РОЗВИТКУ МІЖКУЛЬТУРНИХ НАВИЧОК У СТУДЕНТІВ ГАЛУЗІ СПОРТУ І ТУРИЗМУ

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 9 с., 4 рис., 30 джерел.

Мета дослідження – вивчення глобальної комунікативної компетентності як важливої навички у професійному розвитку студентів, які здобувають вищу освіту в галузі спорту та туризму.

Матеріали та методи. Якісні методи, що застосовуються в дослідженні, включають теоретичний аналіз наукових джерел, синтез та моделювання, педагогічне спостереження та оцінку навчальних дій студентів. Кількісний аналіз передбачає опитування та обробку даних, зокрема тесту на з'ясування міжкультурної компетенції студентів, проведеного серед 352 студентів НУФВСУ та НУХТ, Київ.

Результати. Проведене дослідження глобальної комунікативної компетентності студентів першого та п'ятого курсу університетів спортивного та туристичного профілів показує чіткий взаємозв'язок між рівнем освіти студентів та набутою глобальною комунікативною обізнаністю, представленою комунікативними навичками критичного мислення та співпраці. Аналіз статистичних даних довів, що поряд з покращенням самосвідомості вивчення професійно-орієнтованих дисциплін більш ніж удвічі збільшує глобальну комунікативну компетентність студентів протягом п'яти навчальних років. Окрім кількісного вдосконалення, покращується якість міжкультурної комунікації, оскільки набуваються основні професійні навички у сфері майбутнього працевлаштування студентів. Професійна спрямованість глобальної комунікативної компетенції охоплює спортивну та медичну направленість вищої освіти серед студентів НУФВСУ та фокусується на міжкультурних за-

садах туризму та готельно-ресторанного бізнесу для студентів НУХТ.

Висновки. Результати дослідження довели, що сучасні студенти університетів, які здобувають вищу освіту у галузі спорту та туризму, сприймають культурно пов'язану інформацію під час відвідування он-лайн та офлайн-академічних курсів та участі у різних мультикультурних заходах в університетах та поза ними. Таким чином, вони розвивають свою самосвідомість, визнаючи цінність етнічної різноманітності. Встановлені цінності переходять на рівень продукування та призводять до реалізації культурно усвідомленої професійної поведінки, представленої високим рівнем здатності до самооцінки та переконання, спрямованих на ефективний, але толерантний спосіб вирішення проблем та спільну відповідальність.

Ключові слова: глобальна комунікативна компетентність, міжкультурна позиція та цінності, сприйняття, продукування.

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ФІЗИЧНЕ ВИХОВАННЯ РІЗНИХ ГРУП НАСЕЛЕННЯ

SOCIAL INTEGRATION OF HEARING-IMPAIRED STUDENTS BY MEANS OF HEALTH-ENHANCING AND RECREATIONAL ACTIVITIES

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Abstract
Purpose: To substantiate and develop a program of health-enhancing and recreational physical activity for the social integration of students with hearing impairments in a higher education institution environment.
Materials and Methods. The study involved 65 students with hearing impairments 17–18 years of age (30 males and 35 females). Theoretical analysis and generalization of special scientific and methodological literature, pedagogical experiment, anthropometric measurements of the hearing-impaired, Apanasenko's method, methods of mathematical statistics were used.
Results. The structure and content of the program of health-enhancing and recreational physical activity for students with hearing impairments were scientifically substantiated and developed. The program takes into account the factors, principles, objectives, tasks, methods, organizational and socio-pedagogical conditions for its effective implementation in higher education institutions. The program includes a system for monitoring the results of its implementation and performance criteria. The effectiveness criteria for the health-enhancing and recreational physical activity program were identified as follows: social integration of hearing-impaired students, restoring their psycho-emotional state, and involvement of the young people in regular physical activity.
Conclusions. The results of the study confirmed the effectiveness of the developed program of health-enhancing and recreational physical activity in a higher education institution for the social integration of hearing-impaired students.
Keywords: health-enhancing and recreational physical activity, social integration, students, hearing impairments, program, higher education institution.

Introduction

The number of young people with disabilities is an important indicator of a nation's health for the country (Kohut, 2015). Democratization of social life, humanization of relationships between different social groups require improvement of conditions for socialization of youth with disabilities (Adyrhaiev, 2013).This requires a change in the focus of higher education institutions. The problem of providing educational services to this group of youth is addressed in the works of Ukrainian researchers (Talanchuk & Konoplytska, 2001). Over the last 15 years, the number of higher education students in Ukraine has doubled to 12.33 thousand. Nevertheless, 53% of persons with disabilities remain outside the educational system (Talanchuk & Konoplytska, 2001). For most hearing impaired young people, entering higher education can be an effective step towards social, educational and cultural integration (Talanchuk & Konoplytska, 2001). A characteristic feature of this age period is the actualization of the need for affiliation (Lytovchenko, 2005). These include: determining one's place in the social relations system, self-affirmation, building self-esteem and enhancing conscious motives underlying behaviors, purposefulness, determination, perseverance, and initiative (Iliin, 2000).The changes occur in circadian rhythms of activity, in daily patterns of work, rest, and sleep; the level of physical activity decreases, while the level of mental load increases (Kashuba, Kolos, Rudnytskyi, Yaremenko, Shandrygos, Dudko, & Andrieieva,

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2017). The result is a disturbed development of a full-fledged, well-rounded, self-realized person (Gorovoy, 2013).One of the ways to satisfy the social needs of the above mentioned group of youth is specially organized health-enhancing and recreational activity (Dutchak, 2015). Therefore, the studies on theoretical and methodological foundations and practical implementation of health-enhancing and recreational physical activity in higher education institutions are of particular relevance (Andrieieva & Kateryna, 2014).

The problem of organizational and methodological approaches to adaptive physical education of students with hearing impairment has been addressed in the scientific literature (Rychok, 2018). Previous studies have shown the effectiveness of using recreational activities to develop physical abilities of children with hearing impairment (Demchuk & Vypasnyak, 2016; Demirel, 2018). Correction of physical and psychological states and motor disorders of children and young people with hearing impairment by means of adaptive physical culture has been described in the studies (Solish Perry & Minnes, 2018; Palmer, 2018). Adaptive physical recreation as a means of enhancing social adaptation of children and young people with disabilities has been discussed in scientific works (Orekhovskaya & Spesyvykh, 2018; Kurková & Maertin, 2014). However, the issues of social integration of hearing impaired students by means of health-enhancing and recreational physical activity are still insufficiently studied (Joseph Winnick, 2011; Shields & Madelyn, 2017).The problem outlined needs further investigation.

The objective of the study was to substantiate and to develop a program of health-enhancing and recreational physical activities for social integration of students with hearing impairment in the settings of higher education institution.

Materials and methods

Sample and research methodology

Sample. The study involved 65 students with hearing impairment 17–18 years of age (30 males and 35 females). The protocols of experiments were approved by the ethics commission of the National University of Physical Education and Sport of Ukraine. According to ethical standards, all participants voluntarily provided written informed consent for participation in all stages of the pedagogical experiment, for further analysis and disclosure of their personal data during interpretation and publication of the results of the study.

Research methodology. The study was conducted at the Poltava Institute of Economics and Law of the Open international University of Human Development "Ukraine" (Ukraine).

Theoretical analysis and generalization of special scientific and methodological literature were carried out with the aim of studying in detail the problem of designing health-enhancing and recreational activities for students with hearing impairments. The basic forms of leisure organization and major types of leisure time use were classified. Theoretical analysis and generalization of modern practical experience allowed us to identify the relevance, clarify and specify the purpose, objectives and the focus of the study.

One of the main research methods was the pedagogical experiment. The study consisted of ascertaining (the first stage) and transformative (the second stage) experiments. The ascertaining experiment involved assessing physical and psycho-emotional states, the level of physical activity, the value orientations, needs, priorities, and motivation for health-enhancing and recreational physical activity of students with hearing impairment. Anthropometric measurements of hearing impaired students were taken using standard equipment and uniform test procedures (International Standards for Anthropometric Assessment, 2017). The level of physical health was assessed by the Apanasenko's method (Apanasenko & Popova, 2011). The following parameters were measured: strength index, vitality capacity (mL/kg), Robinson index, body mass index, and heart rate recovery time after 20 squats for 30 s. The physical performance was evaluated using the Ruffier functional test. The quality of life was assessed using the self-administered questionnaire Medical Outcomes Study-Short Form (SF-36) (36-Item Short Form Survey (SF-36), 2018). The questionnaire items were used to construct eight scales focused on the evaluation of various health aspects. The scales were grouped to derive two component scores: the Physical Health Component Score and the Mental Health Component Score. Self-assessment of the students was studied using the technique described in (Pashukova, Dopira & Diakonov, 1996). The technique involved the evaluation of self-assessment of the students, their assessment of own abilities, qualities and place among other people. The score values ranged from 0 to 0.65 indicates low self-esteem, from 0.65 to 0.85 is adequate self-esteem, and above 0.85 corresponds to high self-esteem. The daily physical activity level was measured using the Framingham Physical Activity Index (Davidenko & Masaud, 1999). The index was calculated on the basis of average time spent at each activity level during the day. Sociological research methods were used to assess students' attitudes toward physical recreation activities, determine motivational priorities in the choice of types of physical activity, duration, frequency, and forms of sessions. The questionnaire consisted of 20 questions. Assessment of the maturity level of the value orientations was carried out according to the Rokeach's approach (Rokeach Milton, 1973). The respondent was presented with two lists of values (18 items each) placed in alphabetical order on two sheets of paper. The subject assigns a rank number to each of the values in the lists. The most important value was placed on top of the rank at first position and the least important was placed at the bottom at rank 18 in the list. First a set of terminal and then a set of instrumental values were presented.

An expert evaluation of the reasons that impede the effective organization of health-enhancing and recreational physical activities for students with hearing impairment in higher education institutions was performed by the method of preference (ranking). The number of experts was 12. The experts included higher education academic personal in physical education and leading experts in adaptive physical education. The transformative pedagogical experiment was conducted to evaluate the effectiveness of the developed program of health-enhancing and recreational physical activities for students with hearing impairment. The experiment lasted for one academic year. The structure and content of the program of health-enhancing and recreational physical activity for students with hearing impairment were developed and substantiated. The goal of the program is to increase the level of social integration of students with hearing impairment through the increase in their level of physical activity and

improvement in their physical and psycho-emotional states. In order to effectively implement the program, the basic principles of adaptive physical education, leisure, and health-enhancing and recreational activity were taken into account. Creating an atmosphere of trust and goodwill in relationships, availability of the necessary equipment, and physical exercise in the form of game helped to increase the effectiveness of the program. The program consisted of the following stages: diagnostic, organizational, methodological, and corrective. The diagnostic stage (36 academic hours) involved the assessment of the level of physical and psycho-emotional states and the level of physical activity along with the evaluation of the needs, motivation, and the value orientations of students with hearing impairment. The organizational stage (54 academic hours) was focused on generating the interest in the classes. This stage was based on the following principles: adjustable schedule, creativity, visual support, partnerships, and creating a sense of worth. This stage involved the development of an individual trajectory of social integration, adaptation, socialization, with taking into account the psychological characteristics, abilities, and interests of students with hearing impairment. Constant psychological and pedagogical support was provided during the classes.

The methodological stage (120 academic hours) included implementing the program of health-enhancing and recreational physical activities for students with hearing impairment into a higher education institution environment. The classes lasted for 80 minutes and were done three times a week. The sessions were designed as group and small group lessons. Time spent during lessons on physical activity (motor density) ranged from 50 to 60 %. The intensity of general physical exercise was 40-65% of the maximum heart rate. The developed program involves the use of the following organizational forms of activities: sports holidays and competitions, festivals, spartakiades, recreational outdoor games, and entertainment with animation elements. The use of game methodology involved corrective active games, relay races, sports games with simplified rules, and play-based tasks. Specific features of the lessons included the use of posters, tables, instructions, task cards; sports equipment; light, sound, and sign language signals, pointers, boards, and reference marks. The classes were aimed at improving the psycho-emotional state, forming understanding of the effects of physical exercises, increasing the level of physical activity, developing a positive attitude to physical exercise, promoting rational organization of recreational health-enhancing and recreational activities of students in the free time, and creating conditions for socialization of an individual. The corrective stage (30 academic hours) included evaluation of the effectiveness of the program of health-enhancing and recreational physical activities for students with hearing impairment. At each stage of the program, adequate methods of pedagogical monitoring were applied.

Statistical analysis

Systematization and primary analysis of the data were performed with Microsoft Excel 2010 spreadsheets. Known methods of transforming data were used to analyze empirical questionnaire survey results (Paniotto & Maksimenko, 2003).

Results

A questionnaire survey was conducted to study the needs, interests, and motivation of hearing impaired students for various types, forms, and means of physical activity in the free time. The majority of students (43.08%) were partially satisfied with the organization of health-enhancing and recreational activities in higher education institution. A quarter of students (23.07%) did not like this activity at all. Only 33.85% of hearing impaired students were completely satisfied with the organization of health-enhancing and recreational activities in higher education institution. External and internal factors influencing participation of students with hearing impairments in health-enhancing and recreational activities were identified. The main purposes of the classes identified by the surveyed students were health-enhancing and communicative and educational. The health-enhancing purpose includes normalization of body weight; correction of figure and posture; increasing muscle mass; reducing stress and depression; and improving mental and physical performance. The communicative and educational purpose includes expanding the circle of communication, establishing new social contacts, and emotional self-organization. Priority types of physical activity of hearing impaired students were: dance, gymnastics, swimming, active games and sports games, table tennis, outdoor sports.

Physical and mental health as well as financial wellness and love were the most important terminal values of hearing impaired students (Fig. 1).

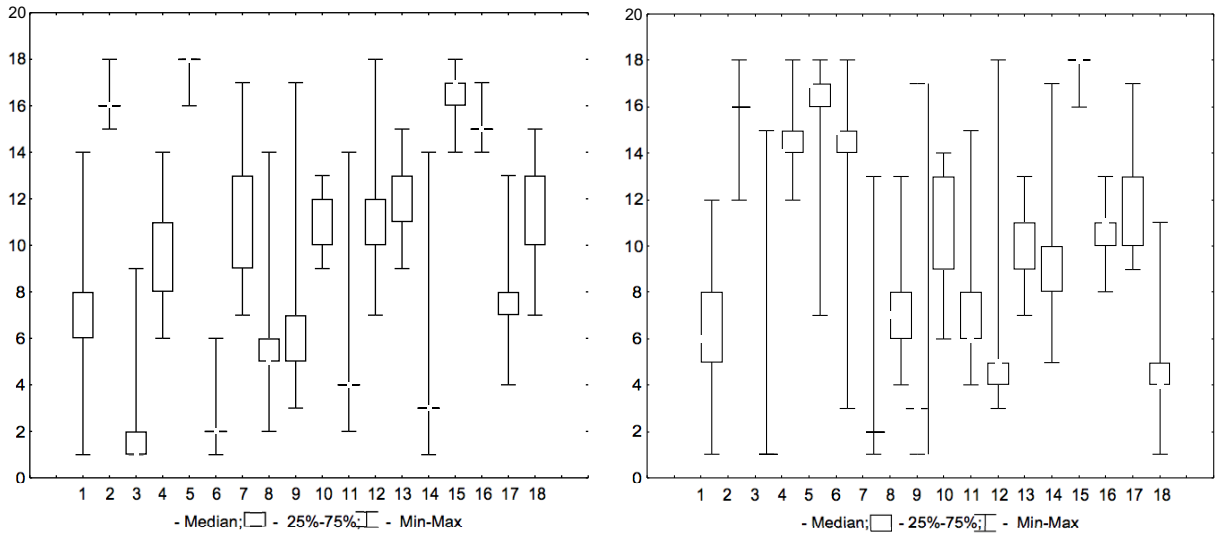
Physical activity of the students involved in the study was measured. The daily physical activity index averaged 29.52 points for males and 29.69 points for females. The sedentary-level activity was the prevalent type of activity. Students devoted more time to study, personal hygiene, home work, and passive rest. Students spent twice as much time traveling by transport than walking.

The results of the rapid assessment of the student's physical health indicators are presented in Table 1. There is a general tendency for the prevalence of male and female students with below average and low levels of health status. There are no persons with the safe level of physical health among the hearing impaired students. Ignoring the basics of a healthy lifestyle has serious consequences for students as this significantly affects their health status.

For the subjective assessment of the health status of students with hearing impairment, the questionnaire survey with Medical Outcomes Study-Short Form (SF-36) was used.

Table 1. The data of physical health assessment in students with hearing impairment (n = 65)

Parameter	Males, n = 30	Females, n = 35
	X ± s	X ± s
HR recovery time after 20 squats in 30 s, min	2.50 ± 0.92	2.11 ± 0.84
Body Mass Index, kg·m-2	23.41 ± 0.93	22.34 ± 1.70
Vitality capacity, mL·kg-1	58.50 ± 6.34	44.14 ± 4.46
Strength index, %	67.13 ± 6.83	47.59 ± 4.66
Robinson index, arb. units	81.94 ± 7.54	91.44 ± 10.81



a b

Fig. 1. The predominant focus of students' terminal values (a – males; b – females): 1 – an exciting life; 2 – wisdom; 3 – inner harmony; 4 – a sense of accomplishment; 5 – a world of beauty; 6 – mature love; 7 – a comfortable life; 8 – true friendship; 9 – social recognition; 10 – cognitive development; 11 – productive life; 12 – development;13 – freedom; 14 –family security; 15 – happiness; 16 – creativeness; 17 – self-confidence; 18 – pleasure.

The answers of the male students to the question about the health status were as follows: very good – 6.67% (n = 2); good – 53.33 (n = 16); and fair – 40.00 % (n = 12).

Among the female students, 54.29 % (n = 19) of the respondents thought their health status is good; 40.00 % (n = 14) reported fair health; and 5.71 % (n = 2) replied they had poor health.

The well-being of the respondents over the last four weeks was also analysed depending on gender. The survey participants felt themselves good enough, but were often nervous, sometimes downhearted and worn out, and often tired. Males were less prone to negative self-evaluation of their psycho-emotional state. Over the last four weeks, physical health or emotional problems quite a bit interfered with normal social activities in 6.67% and 2.86%, moderately in 80.00% and 71.43%, and slightly in 13.33% and 25.71% of hearing impaired males and females, respectively. The results of the study indicate the low level of physical condition of the students. This requires the formation, maintenance, and enhancement of their health.

A significant proportion of hearing impaired students had a lowered self-esteem. Their idea of an ideal person does not match their self-concept. There is no statistically significant relationship ($p > 0.05$) between the student's self-esteem and his/her idea of an ideal person. There were 6.19% more females who had sufficient self-esteem than males. Nevertheless, 28.57% (n = 10) of female students had a lowered self-esteem (Table 2). Only 16.67% (n = 5) of male students were found to have a a low level of anxiety. Male and female students with hearing impairment said sometimes feel lonely.

The results of the pedagogical experiment were used as a basis for development of a program of health-enhancing and recreational physical activity for hearing impaired students. The program implementation in a higher education institution environment allowed to achieve the following outcomes:

Table 2. Distribution of students with hearing impairment by their level of self-esteem (n = 65)

Level	Participants of the study			
	Males, n = 30		Females, n = 35	
	%	n	%	n
Sufficient	16.67	5	22.86	8
Insufficient	83.33	25	48.57	17
Critical	–	–	28.57	10

- the level of students' satisfaction with the organization of health-enhancing and recreational activities in the higher education institution was changed. The number of completely satisfied students increased by 12.85%;
- physical and psycho-emotional states of hearing impaired students significantly improved ($p < 0.05$). After the experiment, the proportion of male students with higher than the average and the average level of physical health increased by 10.0% and 15.0%, respectively. The proportion of female students with the higher than the average level of physical health increased by 8.0%;
- the positive changes occurred in indicators of emotional well-being, self-esteem, and general well-being;
- the physical activity index of males and of females increased by 12.1% and 9.1%, respectively.
- positive changes were observed in terminal and instrumental values of hearing impaired students. Students had a higher rating of instrumental values from the cluster of self-affirmation values. There

was a tendency towards a reorientation towards individualistic personal-significant values;
- the ambitions of students with hearing impairment for social activity, self-affirmation, desire to be self-determined and recognized by others were observed.

Discussion

Physical education lessons involving the means of health-enhancing and recreational physical activity are essential to involve young people with hearing impairments in regular exercise, to promote their socialization, and to meet their social needs (Boyko, 2014; Yarmak, Galan, Hakman, Dotsyu & Teslitskyi, 2017). Health-enhancing and and recreational activities have the following general functions: developmental, health-enhancing, teaching, educational, and social (Andrieieva, 2014). Health-enhancing and recreational physical activities promote the formation of a community of people based on the common needs, interests, motives, exchange of social experience between people, and development of communicative capabilities of a person (Kateryna, 2016). Organization of PE lessons based on health-enhancing and recreational activities for higher education students has been the focus of research by many scientists (Zaitsev, Yermakov & Prusik, 2011; Sadovsky & Kyrychenko, 2016). Nevertheless, the use of existing approaches for healthy young people in the lessons for hearing impaired students is inappropriate for the following reasons: differences in motivation, differences in physical and emotional state, the contrast of the objective and tasks of the lessons, the variety of limiting reasons and factors, limited means used, etc. (Buckworth, & Nigg, 2010).

The success of social integration is linked to the need to take into account the significant psychological patterns of development of hearing impaired students (Jessica, Schultz, Lauren, Lieberman, Kathleen & Linda, 2013). They have a lot of intellectual, psychological, and physical abilities. Therefore, the potential of this group of students for social integration must be determined on the basis of the age, physical and psychological development, and health status (Yarmak, Galan, Nakonechnyi, Hakman, Filak & Blahii, 2017). In this context, particular attention should be given to the problem of determining the psychological preparedness of hearing impaired students for social life. Addressing the problem will contribute to timely vocational orientation, as well as help to avoid learning difficulties and ensure the student's successful social integration (Khrypko & Kyrychenko, 2017).

According to the researchers, physical recreation activities contribute to the formation of the following personality traits: sociability, strong goal orientation, and concentration (Andrieieva, 2014). Physical recreation helps to optimize the physical, mental, and social state of a person. This approach makes it possible to find the best means of enhancing the abilities of hearing impaired students and their effective use in health-enhancing and recreational activities.

Difficulties of social integration of hearing impaired students are due to the mismatch of the functional capabilities of the body to modern requirements. Decreased hearing function significantly impairs the quality of life of young people, by limiting their viability and fitness. The leading motives for the health-enhancing and recreational physical activity of hearing impaired female students are the following: communication and increasing the chances to meet new friends (88.57%); improvement of appearance, figure, and posture (82.85%); health maintenance and promotion (74.28%); and increasing the functional state of the body (60%). Among the male students, the following are the priorities: improving physical performance, achieving a high level of physical fitness (86.66%); improving appearance (80%); enhancing communication (70%); and health maintenance and promotion (66.66%). These data indicate the similarity in motives of hearing impaired students of both genders. The data we obtained are consistent with the results of the studies on higher education students without sensory disabilities (Kateryna, 2016).We have confirmed the results of the study of students' motivation to engage in health-enhancing and recreational physical activity (Sadovsky & Kyrychenko, 2016). The factors of 'negative motivation' were identified: lack of free time, lack of material and financial conditions for recreational activity, inconvenient location, and unfavorable health conditions.

The study confirms a significant decrease in the level of physical activity of people with hearing impairment compared to visually healthy peers (Al-Rahamneh, Dababseh & Eston 2013). Low physical activity of students with hearing impairment has led to a decrease in their emotional well-being. The students were found to have a low level of self-esteem and increased levels of anxiety and personal disharmony. All this does not contribute to their self-actualization, socialization, and integration into society. The distribution of female students by health status was as follows: 68.6% of them had the low, 20% – the lower than average, and 11.4% – the average levels of health. The male students had the better health status: 36.7% of them had the low, 30% – the lower than average, and 33.3% – the average levels of health. According to Apanasenko's studies, only average and high levels of physical health are considered as safe. No students were found who had the safe level of health. A similar situation is typical for young people without hearing impairment (Iliin, 2000; Andrieieva & Kateryna, 2014). However, today, in the light of altering the approaches in the special education system, a more correct, tolerant approach seems to be to compare the data of young people with congenital or acquired impairments in accordance with the standards of the World Health Organization, rather than comparing them to the characteristics of healthy peers.

We confirmed the published data on prioritized types of physical activity (Mueller & Ackley-Holbrook, 2016; Kurkova, 2015). Hearing impaired female students were primarily interested in the following types of physical activity: female students preferred dance classes (80.00%); table tennis (68.57%); swimming (60.00%); and health-enhancing fitness classes (54.28%). Male students with hearing impairments preferred football (83.33%), volleyball (70.00%); table tennis (66.66%); swimming (43.33%); outdoor activities (60.00%); and strength training (53.33%). Researchers point out the potential of using active games to improve physical fitness and enhance the health of hearing impaired students. Preferred types of physical activity are identical for hearing impaired students and healthy youth. Most students have a positive attitude towards health-enhancing and recreational physical activities (Kurkova & Nemecek, 2018). However, most students' leisure is passive, and sometimes destructive. Our study confirmed the data of previous studies that the stu-

dents' leisure time activities is insufficiently organized and they lack developed skills necessary for productive spending of leisure time in a healthy way (Kurkova, & Nemecek, 2016). We further corroborate the results of the studies on organization of students' leisure time that have shown the low level of their recreational activity (Gorovoy, 2013). Students with hearing impairments do not realize the importance of systematic physical activity. The daily physical activity index averaged 29.52 points for males and 29.69 points for females. The sedentary-level activity was the prevalent type of activity. Our study supports the findings of earlier research revealing the low level of physical activity of higher education students (Andrieieva, 2014). Furthermore, the study provides further understanding of the factors that influence the participation of hearing impaired students in recreational activities (Imas, Dutchak, Andrieieva, Kashuba, Kensytska & Sadovskyi, 2018). Students with hearing impairments are influenced by their friends, acquaintances, classmates, and the media. They do not trust the advice of teachers, coaches and parents on this issue.

The results of the research on the value orientations of modern student youth are further enhanced by our study (Sadovsky & Kyrychenko, 2016; Imas, Dutchak, Andrieieva, Kashuba, Kensytska & Sadovskyi, 2018). The primary terminal values of male students include ambition, freedom, and intellect. Those of female students include ambition, courage, and intellect. In the hierarchy of instrumental values, the male students give the highest priority to responsibility, education, honesty, cleanliness, politeness, self-control, independence, strong will, and cheerfulness. Female students prioritize education, cheerfulness, responsibility, politeness, honesty, independence, broad-mindedness, cleanliness, and logic. Value orientations of hearing impaired students significantly differed from the priorities of healthy students (Nemcek, 2017).The most important terminal values of hearing impaired students are physical and mental health as well as financial wellness and love. Female students with hearing impairment give a higher priority to the subjective-personal values (politeness, education, honesty, accuracy, etc.), while, for male students, utilitarian and pragmatic values such as health, true friendship, close emotional relationships with family, and family security are more important. The study of the rating of instrumental values confirms the absence of value priorities related to an active life position in the majority of hearing impaired students. Health-enhancing and recreational activities can contribute to the formation of an active life position, abilities and skills to meet basic needs, meaningful filling of the free time with a focus on healthy lifestyles, realization of life potential, and improvement of quality of life. We have studied self-esteem of students with hearing impairment. A significant proportion of hearing impaired students was found to have a lowered self-esteem. Their idea of an ideal person does not match their self-concept. Similar data were obtained by other authors for school students and higher eduction students with hearing, vision, and musculoskeletal impairments and other nosology's (Demirel, 2018; Nemcek, 2017). This calls for these provisions to be taken into account when designing a training program. The study provides further support for the earlier research on social integration of persons with disabilities into society by means of specially organized physical activity (Kohut, 2015; Adyrhaiev, 2013).

The amount of scientifically sound data on the features of designing physical recreation programs for hearing impaired students is insufficient. There are no substantiated recommendations on the alternative content of health-enhancing and recreational activities. The technology of implementing recreational activities into the physical education process that will take into account the socio-pedagogical characteristics of the lessons is not developed. Recommendations to increase the amount and quality of physical activity for social integration of hearing impaired students generally lack substantiation.

To develop the program of PE lessons using the means of health-enhancing and recreational physical activity, we followed a number of general scientific principles and approaches. When designing the program, the main ontogenetic patterns of the body development were considered along with the data on the nature of the body adaptation to physical load and the peculiarities of taking this information into account during practical implementation of various corrective and restorative programs (Andrieieva, 2014).

We have expanded the data available regarding the use of physical activity to improve higher education students' physical and psycho-emotional status (Khrypko & Kyrychenko, 2017). Our data confirmed the authors' conclusions about the appropriateness of this organizational structure for designing program of physical activities for higher education students. The reasonableness and necessity of using innovative means of physical activity and forms of organization of extracurricular activities in designing of such programs were proved. This significantly influences the motivation of young people to participate in such programs. The study expanded and enhanced existing knowledge concerning the relevance of the use of interactive methods of increasing the level of theoretical knowledge (Kashuba, Futornyj, & Golovanova, 2011). A low level of theoretical knowledge of health maintenance has a significant impact on participation in health-enhancing programs. Increasing the students' knowledge in this area contributed to the increase in the number of hearing impaired students involved in health-enhancing and recreational physical activity and to the formation of sustainable motivation for participation in such activities.

Conclusions

The results of the study confirmed the effectiveness of the developed program of health-enhancing and recreational physical activities for social integration of students with hearing impairment in the settings of higher education institution. This provides a reason to recommend the program for use in the process of physical education of hearing impaired students in the curricular and extracurricular activities of higher education institutions.

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Conflict of Interest.

All the authors declare to have no conflict of interest.

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СОЦІАЛЬНА ІНТЕГРАЦІЯ СТУДЕНТСЬКОЇ МОЛОДІ З ВАДАМИ СЛУХУ ЗАСОБАМИ ОЗДОРОВЧО-РЕКРЕАЦІЙНОЇ РУХОВОЇ АКТИВНОСТІ

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Реферат. Стаття: 9 с., 2 табл., 1 рис., 48 джерел.

Мета дослідження – обґрунтувати та розробити програму оздоровчо-рекреаційної рухової активності в умовах закладу вищої освіти для соціальної інтеграції студентів з вадами слуху.

Матеріали і методи. В експерименті брали участь 65 студентів з вадами слуху 17–18 років (30 – юнаків і 35 – дівчат).

Результат. Науково обґрунтовано, розкрито структуру і зміст програми оздоровчо-рекреаційної рухової активності студентської молоді з вадами слуху. Програма враховує чинники, принципи, мету, завдання, методи, організаційні і соціально-педагогічні умови її ефективної реалізації в умовах закладу вищої освіти. Вона включає систему контролю за результатами її застосування та критерії ефективності. Критеріями ефективності програми оздоровчо-рекреаційної рухової активності визначено соціальну інтеграцію студентів з вадами слуху, відновлення їх психоемоційного стану, залучення молоді до регулярної рухової активності.

Висновки. Результати дослідження підтвердили ефективність розробленої програми оздоровчо-рекреаційної рухової активності в умовах закладу вищої освіти для соціальної інтеграції студентів з вадами слуху.

Ключові слова: оздоровчо-рекреаційна рухова активність, соціальна інтеграція, студенти, вади слуху, програма, заклад вищої освіти.

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TRANS-SEASON RELIABILITY OF PHYSICAL FITNESS TESTING IN STUDENTS OF "TOURISM" SPECIALITY

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Abstract

The **study purpose** was to prepare a model of the trans-season reliability of physical fitness testing on the example of "Tourism" speciality students.

Material and Methods. A total of 50 university first year bachelor's students studying "Tourism" as a business service were involved in the physical fitness testing: 20 males with body mass 67.3±9.5 kg (M±SD) and body length 174.6±5.6 cm; and 30 females (body mass 59.6±7.3 kg, body length 163.9±5.2 cm). Monthly testing was conducted seven times from September to March using a complex test KONTREKS–2. Trans-season mean score reliability was evaluated within the intraclass correlation model.

Results. Approximately 86% of the students were found to be on the average and higher levels and only nearly 5% – on the low level. Males showed significantly better state of the physical fitness than females (16.6%, $p < 0.002$) with 96.3% similarity of trends in scores between males and females during the trans-season study. A great variation within these samples was noticed, too; a corresponding part in the total variation was derived as 93.6%. A strong and high level significant correlation ($r > 0.80$, $p < 0.001$) was determined between all the seven monthly test-retest trans-season trials. Significant trans-season reliability on the excellent level was found for each of two gender samples (ICC > 0.95, $p < 0.001$). Deviations from mean values for seven monthly tests undertaken during the study period were not significant (chi-squared = 13.939, $p = 0.834$).

Conclusions. A model of the trans-season reliability of physical fitness testing created on the example of the first year bachelor's students of "Tourism" speciality showed its effectiveness and could be recommended for physical education of high school students.

Keywords: physical education, students, tourism, testing, reliability, modelling.

Introduction

Recently health and physical readiness of children and youth have sharply deteriorated (Sahoo K., Sahoo B., Choudhury, Sofi, Kumar & Bhadoria, 2015). In particular, this is due to the crisis in the national physical education system, which does not meet modern requirements. Physical training sessions do not provide the volume of motor activity necessary for a young person; they are insufficiently taken into account individual interests and needs of students (Al-Khudairy, Loveman, Colquitt, Mead, Johnson & Fraser, 2017; Liposek, Planinsec, Leskosek & Pajtler, 2019).

Problems of physical education of student youth were studied by many scientists. It was noted that a serious obstacle to physical improvement of the student youth is the fall of interest in the traditional forms of physical education. Therefore, the organization and content of physical education in higher educational schools need to be updated (Mcdavid, McDonough, Wong, Snyder, Ruiz & Blankenship, 2019).

Due to the expansion of the market of educational services and emergence of new specializations, increase a number of students who differ from the majority by the small volume of motor activity, arose the question about the study of an optimal system of educational activities that takes into account the features of different groups of students (Kharchenko, Khomenko, Krasilov & Rybalko, 2019, p. 194).

The theme of the use of sport and health tourism as a component of physical education of student's youth was disclosed in research works. However, not enough attention is paid to the formation of a system of perennial sport and health tourism during the whole period of study at higher education schools. Only integrated use of sports and health tourism as a component of physical education can positively influence the solution of the problem of strengthening of health, optimization of volumes of motive activity, formation of positive motivations to the tourism activities, after graduation etc. (Kukhtiy & Labartkava, 2011).

Skaliy A., Skaliy T., Muszkieta, Kalosza and Żukow (2009) showed that hiking tourism has positive influence on the physical fitness of young people. They studied physical

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conditions of students in the course of increased physical activity in the mountain hiking tourism. The dynamics of the physical state of students during many days hiking made possible to accept the research hypothesis regarding significant improvement of the physical readiness. For the comprehensive assessment of the functional capacity of the cardiovascular system and physical qualities of the examined in the tourism practice, the test-complexes KONTREKS as scoring systems were useful (Dushanin, Pirogova & Ivashchenko, 1985). KONTREKS–2 is a complex diagnostic system, which is recommended for current hospital and pedagogical control. It can help to determine not only the level but also the structure of physical training. It is characterized by simplicity and reliability; it can be used for individual and inter-control during the independent activities of physical exercises.

A quantitative measure of the test re-test reliability is intraclass correlation coefficient used effectively in different fields of sciences. Though much research and attention has been directed at assessing the correlation coefficient under range restriction, the assessment of reliability under range restriction has been largely ignored. This article uses item response theory to simulate dichotomous item-level data to assess the robustness of test-retest under varying selection ratios (Fife, Mendoza & Terry, 2012, p. 862).

Almehrizi (2013, p. 438) presented a general form of ICC and extends its use to estimate internal consistency reliability for nonlinear scale scores (used for relative decisions). He also examines this estimator of reliability using different score scales with real data sets of both dichotomously scored and polytomously scored items. Different score scales show different estimates of reliability. The effects of transformation functions on reliability of different score scales were also explored. Fitness testing is used frequently in many areas of physical activity, but the reliability of these measurements under real-world, practical conditions is unknown. Therefore, it is necessary to evaluate the reliability of specific fitness tests using the methods and different time periods used in the context of real-world sport and occupational management (Burnstein, Steele & Shrier, 2011, p. 505; Ishii, Shibata, Adachi, Nanoue & Oka, 2015). A special interest is focused on the long period of time regarding test reliability in the physical education area because trans-seasons terms and academic years.

Research hypothesis. The intraclass test score reliability model could be valid in the trans-season testing of the physical fitness of the first year bachelors of "Tourism" speciality.

Purpose. The aim of this research was to create a model of the trans-season reliability of the physical fitness testing on the example of the first year bachelors of "Tourism" speciality.

Material and Methods

Study participants

Totally 50 university first year bachelors studying "Tourism" as a business service were involved into the physical fitness testing. They were 20 males with body mass 67.3±9.5 kg (M±SD) and body length 174.6±5.6 cm; and 30 females (body mass 59.6±7.3 kg, body length 163.9±5.2 cm). All the students were in good physical shape, and they participated in the university lessons of physical fitness according the program of Lviv State University of Physical Culture (Academic program, 2016). This study was approved in advance by Ethical Committee of Lviv State University of Physical Culture. All the participants voluntarily provided written informed consent before participating. The procedures followed were in accordance with the ethical standards of the Ethical Committee on human experimentation.

Procedure

Monthly testing was conducted seven times from September to March using a complex test KONTREKS–2. The scoring system consists of eleven indicators: five of them are biomedical: age, body weight, blood pressure, heart rate, reducing pulse; a six – motor: flexibility, speed, dynamic power, speed, power and overall endurance. Negative scores of indicators were replaced with zeros. Levels of the physical fitness were evaluated regarding a sum score of all the indicators using the scale as follows (Table 1).

Table 1. Evaluation scale of the physical fitness (Viktorov, 1990)

Physical fitness level	Definition	Score
1	Low	≤ 50
2	Lower than average	51 – 90
3	Average	91 – 160
4	Higher than average	161 – 250
5	High	> 250

The testing was conducted afternoon on the first week of month at the sport venue of Lviv State University of Physical Culture.

Statistical analysis

Distribution of scores in the samples was determined in the frames of statistical hypothesis by Shapiro – Wilk method (Shapiro & Wilk, 1965). Dynamics of changing of test-retest results during the study period was evaluated using relative parameters of the total score:

$$\xi = \frac{x}{\bar{x}} \quad , \qquad \text{(Eq. 1)}$$

where x is a total test score of a sample, $\bar{x}$ – an average total score during the study period (Zanevskyy & Zanevska, 2016).

A difference in score dynamics between males and females was calculated with formula as follows:

$$\delta\xi = \frac{1}{N}\sum_{i=1}^{N}\left|\xi_i^M - \xi_i^F\right|, \qquad \text{(Eq. 2)}$$

where ξ_i^M and ξ_i^F are relative parameters of the total scores correspondingly for males and females, N = 7 is a number of test-retest treaties. Because $\frac{1}{N}\sum_{i=N}^{N}\xi_i^M = \frac{1}{N}\sum_{i=N}^{N}\xi_i^F = 1$, $\delta\xi$ is a difference relative to one (or 100%). A quantity measure

of similarity between male and female samples regarding dynamics of results was determined with the expression as follows:

$$(1-\delta\xi)100\% . \qquad \text{(Eq. 3)}$$

A quantitative measure of difference between males and females physical fitness levels was determined using the coefficient of difference calculated by the formula as follows (Zanevskyy & Zanevska, 2019):

$$\delta x = \frac{\bar{x}^M - \bar{x}^F}{\bar{x}^M + \bar{x}^F} 200\% . \qquad \text{(Eq. 4)}$$

Two-ways ANOVA was used to determine differences between male and female samples. One-way ANOVA with repeated measures was used to evaluate differences in results between means of monthly testing and relative parts of variation between subjects and interaction between test-retest and interpersonal variation. This one-way ANOVA design was realised in three problems, i.e. for the male sample, for the female sample, and for the united sample. Pearson correlation between test-retest scores was applied with a purpose to substantiate ANOVA with repeated measures (Zanevskyy & Zanevska, 2017). Trans-season correlation was studied using Pearson pared linear coefficient (r), and corresponding significance of this correlation was determined using t-Student statistics as follows:

$$t = |r|\sqrt{(n-2)/(1-r^2)} . \qquad \text{(Eq. 5)}$$

Variation of scores in the samples was evaluated using the coefficient of variation (Suni, Oja, Laukkanen, Miilunpalo, Pasanen, Vuori et al., 1996):

$$V = 100\frac{SD}{M}100\% , \qquad \text{(Eq. 6)}$$

where *SD:* standard deviation, *M:* arithmetic mean. If $V < 10\%$, variation is small, 10-20% – moderate, and $V > 20\%$ – great.

Trans-season mean score reliability was evaluated in the frames of the intraclass correlation coefficient using the formula by Shrout and Fleiss (1979):

$$ICC(1,k) = \frac{MS_B - MS_W}{MS_B} , \qquad \text{(Eq. 7)}$$

where k is a number of trials (seven months), MS_B is mean square of scores between persons (students' samples), and MS_W – within persons. The evaluation scale was used with levels as follow: ICC>0.95 (excellent reliability), 0.91-0.95 (good), 0.81-0.90 (moderate), 0.71-0.80 (acceptable), 0.61-0.70 (questionable), and 0.60 or smaller (unacceptable).

Calculations were done using Statistica software package analysis (Dell Inc., 2017).

Results

Because the hypothesis regarding normality of test results was accepted (SW–W = 0.947-0.981, p = 0.169-0.593), parametric statistics was used for treating of score results (Table 2).

A character of changing of the test scores during this seven months period for males and females was rather similar between them (Figure 1). During the first four months (September – December) the results of the male and female groups remained approximately constant. In January test results felt down near a quarter, and during February – March they returned up near to the autumn level. All the time, males had greater results than females about 20%. Variation of the

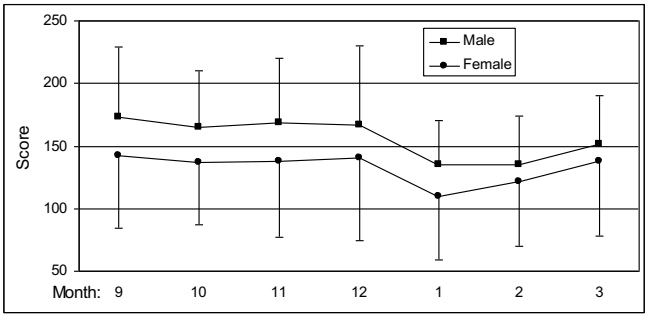

Fig. 1. Graphs of the test scores during seven months: males (M + SD) and females (M – SD)

Table 2. Statistics of the test-retest scores in male (upper, n_M = 20) and female (lower, n_F = 30) samples

Statistics*	September	October	November	December	January	February	March
M	173.3 142.5	165.4 136.6	168.6 138.1	166.6 140.5	134.7 109.3	135.0 121.8	151.4 137.7
SD	56.2 58.0	45.1 49.8	51.3 61.0	63.6 66.2	36.0 50.0	38.5 52.0	39.3 60.1
Max	267.0 224.2	234.2 288.3	231.1 286.6	236.6 236.3	192.2 229.1	202.3 243.9	217.8 296.3
Min	93.9 94.0	87.1 94.9	85.7 71.0	74.8 67.1	64.7 51.0	60.6 60.7	94.7 61.7
SW-W	0.967 0.972	0.948 0.967	0.953 0.981	0.959 0.970	0.966 0.949	0.962 0.977	0.947 0.968
p	0.485 0.504	0.172 0.485	0.233 0.593	0.243 0.501	0.483 0.171	0.391 0.511	0.169 0.490
V%	32.4 40.7	27.3 36.5	30.4 44.2	38.2 47.1	26.7 45.8	28.5 42.7	25.9 43.6

* Note: M – arithmetic mean, SD – standard deviation, Max – maximal, Min – minimal, SW-W – Shapiro – Wilk parameter, p – significance, V% – coefficient of variance.

Table 3. Two-ways ANOVA results

Source of variation	SS	df	MS	F	p	$F_{(0.05, df)}$	Q,%
Gender	28306.8	1	28306.8	10.174	0.0017	3.893	2.9
Test-retest	32095.6	6	5349.3	1.922	0.0794	2.149	3.3
Interaction	2376.1	6	396.0	0.142	0.9903	2.149	0.2
Within samples	915597.6	329	2783.0				93.6
Total	978376.1	342	2860.8				100.0

Table 4. Pearson correlation coefficient \ t-Student statistics*

Month	9	10	11	12	1	2	3
9	–	14.046	11.236	11.338	7.285	7.386	9.151
10	0.940	–	11.577	13.542	8.272	9.174	10.654
11	0.911	0.915	–	12.255	10.082	8.442	10.797
12	0.912	0.936	0.923	–	6.943	7.291	10.188
1	0.819	0.851	0.892	0.806	–	10.192	10.521
2	0.823	0.874	0.856	0.819	0.894	–	18.860
3	0.874	0.902	0.904	0.894	0.900	0.965	–

* Note: t(0.001,48) = 3.505

Table 5. Intraclass correlation analysis results

Gender	MS_B	MS_W	ICC	Q%	p
Male	13793.2	633.1	0.954	77.1	<0.001
Female	20737.5	463.0	0.978	81.4	<0.001

results insight the male and the female samples was rather high (V = 26-47%).

Significant differences between male and female samples was noticed: 16.6% (Eq. 4), p = 0.0017. A great variation within these samples was noticed too; corresponding part in the total variation was derived as 93.6% (Table 3). Similarity of trends in scores between males and females during the study was determined by the coefficient of changes in dynamics equal 96.3% (Eq. 3).

Strong and a high level significant correlation (r = 0.806 -0.965, p < 0.001) was noticed between all the seven months test-retest trans-season trials (Table 4).

Because strong correlation was found between this monthly testing, one-way ANOVA of repeated measures was applied for study a trans-season reliability of the physical fitness testing (Table 5). Taking into account significant differences regarding gender, the investigation of trans-season reliability was undertaken separately in the male and female samples.

Significant trans-season reliability on the excellent level was found for each of two gender samples (ICC > 0.95, p < 0.001). So, and males, and females showed very high trans-season reliability during the seven months of testing.

The results of testing were evaluated on five levels of the physical fitness (see Table 1). Relative numbers of the

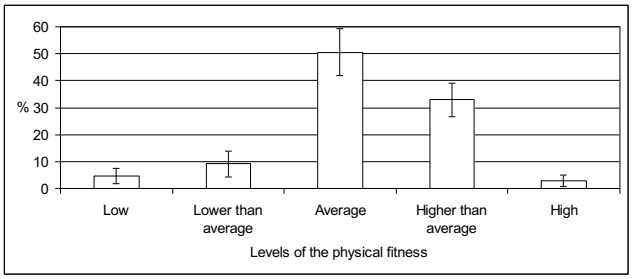

Fig. 2. Distribution of subjects on the levels of the physical fitness during the study period

subjects were graphed vs. corresponding levels (Figure 2). Approximately 86% of subjects appeared on the average and higher levels and only near 5% – on the low level.

Trans-season reliability was evaluated regarding trends in numbers of subjects on the physical fitness levels. With a purpose to meet mathematical conditions of the chi-squared method regarding a minimum numbers of subjects in cells of the research table, a number of levels were reduced from five to three. Low and lover than average levels were united into one, as well as high and higher than high were united, too.

Deviations from mean values in three new levels were calculated for seven tests taken during the study period with (3x7–1)(2–1) degree of freedom: chi-squared = 13.939, p = 0.834.

Discussion

The study of long time periods reliability for the physical fitness was a reasonable problem of the modern state of the theory and methods of physical education. While short-term high intensity functional training (HIFT) effects have been established, fitness improvements from program participation exceeding 16 weeks are unknown. Cosgrove, Crawford, and Heinrich (2019) examined the effectiveness of participation in HIFT through CrossFit. During 2013–2014, fitness performance testing was incorporated into an ongoing university CrossFit program with 0–27 months of HIFT experience (grouped into 0–6 months and 7+ months). Participants completed three separate days of assessments across 10 fitness domains before and after participating in the program for six months that was near seven months period of the present research.

The purpose of the research (to create a model of trans-season reliability of the physical fitness testing), was undertaken on the example of the first year bachelors studying "Tourism" speciality. This approach was conveniently agreed

with results of the analysis of the student's body physical conditions in the course of increased physical activity during mountain hiking tourist undertaken by Skaliy A., Skaliy T., Muszkieta, Kalosza, and Żukow (2009).

As a key method of achieving the aim of this research was a complex test Kontreks-2, which was used for evaluation the physical fitness of the tourist students. The results appeared with good accordance with results of previous studies taken by Tymoshenko and Labartkava (2011). Sport and health tourism is a promising and generally accessible means of physical education of a youth. It is considered an important factor in comprehensive development of student youth, moral and physical rehabilitation, education of national consciousness and involvement in systematic activities of physical exercises.

Advances of the complex test Kontreks-2 in evaluation of physical fitness of students have age restrictions regarding adolescents younger than nineteen years old. Then, another specialised for teenagers test should be used, e.g. "Field-based fitness assessment in young people: the ALPHA health-related fitness test battery for children and adolescents". The battery include selected fitness tests: the 20 m shuttle run test to assess cardio respiratory fitness; the handgrip strength and standing broad jump to assess musculoskeletal fitness, and body mass index, skin fold thickness and waist circumference to assess body composition (Ortega, Cadenas-Sanchez, Sanchez-Delgado, Mora-Gonzalez, Martinez-Tellez, Artero et al., 2015; Ruiz, Castro-Pinero, Espana-Romero, Artero, Ortega, Cuenca, et al., 2011; Ortega, Artero, Ruiz, Vicente-Rodríguez, Bergman, Hagstromer et al., 2005).

Accurate measures of youth fitness require researchers and practitioners. Evidence of validity and reliability are essential before results of youth fitness tests can be used to make sound decisions. Mahar and Rowe (2008) proposed practical guidelines for valid and reliable youth fitness testing. They described a three-stage paradigm for validation research and provided guidance for conducting and understanding norm-referenced and criterion-referenced validity and reliability research. Advice is provided on how to administer fitness tests and how to use fitness test results in ways that promote reliability and validity in practice. Users of fitness tests are cautioned that interpretation and use of fitness tests involve important educational, pedagogical, and psychological consequences. Confidence in youth fitness test results and the decisions that are made based on these scores depend upon careful test design and administration that incorporate a sound understanding of the principles of validity and reliability (Trost, Pate, Sallis, Freedson, Taylor, Dowda et al., 2002; Haddock, Poston, Heinrich, Jahnke & Jitnarin, 2016).

In addition, most of reliability tests are conducted over a short period of time, but the reliability properties may be very different over the months to years in which they are routinely used in the field. Therefore, the purpose of our study was to evaluate some typical fitness tests for reliability within the environment and using the methods and timeframe that will be used in the field. Reliability was acceptable (ICC > 0.6) over an 18-month time period for all pairwise comparisons and all time points together for the push-up, vertical jump, and pull-up assessments. The Harvard step test and 60-second jump test had poor reliability (ICC < 0.6) between baseline and other time points. When we excluded the baseline data and calculated the ICC for 6-month, 12-month, and 18-month time points, both the Harvard step test and 60-second jump test demonstrated acceptable reliability. Dynamic balance was unreliable in all contexts. Limit-of-agreement analysis demonstrated considerable intraindividual variability for some tests and a learning effect by administrators on others (Falk & Kennedy, 2019). The trans-season test Kontreks-2 in this research showed rather good reliability (ICC>0.95) relatively other tests used for the evaluation of the physical fitness (Petersen, Thieschafer, Ploutz-Snyder, Damann & Mester, 2015).

Conclusions

A model of the trans-season reliability of the physical fitness testing created on the example of the first year bachelors of "Tourism" speciality showed its effectiveness and could be accepted for the practice of physical education in high school. Overall, approximately 86% of students appeared on the average and higher levels and only near 5% – on the low level.

Males showed significant better state of the physical fitness than females (16.6%, $p < 0.002$) with 96.3% similarity of trends in scores between males and females during the trans-season study. A great variation within these samples was noticed too; corresponding part in the total variation was derived as 93.6%. Strong and a high level significant correlation ($r > 0.80$, $p < 0.001$) was noticed between all the seven months test-retest trans-season trials. Significant trans-season reliability on the excellent level was found for each of two gender samples (ICC > 0.95, $p < 0.001$). Deviations from mean values for seven monthly tests undertaken during the study period with was not significant (chi-squared = 13.939, $p = 0.834$).

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Conflict of Interest

The authors declare that there is no conflict of interest regarding this research.

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ТРАНС-СЕЗОННА НАДІЙНІСТЬ ТЕСТУВАННЯ ФІЗИЧНОЇ ПРИДАТНОСТІ СТУДЕНТІВ СПЕЦІАЛЬНОСТІ «ТУРИЗМ»

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 7 с., 5 табл., 2 рис., 48 джерел.

Мета дослідження – розробити модель транс-сезонної надійності тестування фізичної придатності на прикладі студентів спеціальності «Туризм».

Матеріал і методи. Загалом 50 студентів першого курсу університету спеціальності «Туризм», як бізнесу послуг, було охоплено тестуванням фізичної придатності: 20 чоловіків із масою тіла 67,3±9,5 кг (M±SD) і довжиною тіла 174,6±5,6 см; 30 жінок із масою тіла 59,6±7,3 кг, і довжиною тіла 163,9±5,2 см. Щомісячні тестування проводилися сім разів від вересня до березня із застосуванням комплексу тестів КОНТРЕКС–2. Транс-сезонна надійність середніх результатів оцінювалася у рамках моделі внутрікласової кореляції.

Результати дослідження. Приблизно 86% студентів опинилися на середньому й вищих рівнях і тільки 5% – на низькому рівні. Чоловіки показали істотно кращу фізичну придатність, ніж жінки (16,6%; $p < 0{,}002$) із 96,3% подібності між ними за характером зміни протягом транс-сезонного тестування. Також було виявлено велику варіацію результатів в середині груп, частка якої від загальної варіації склала 93,6%. Було зафіксовано сильну й високо істотну кореляцію між результатами всіх повторюваних тестувань ($r > 0{,}80$; $p < 0{,}001$). В обох гендерних групах було визначено відмінну й статистично істотну транс-сезонну надійність тестування (ICC > 0,95; $p < 0{,}001$). Відхилення від середнього рівня результатів тесту протягом семи місяців досліджень були статистично неістотні (хі-квадрат = 13,939; $p = 0{,}834$).

Висновки. Модель транс-сезонної надійності тестування фізичної придатності, розроблена на прикладі студентів першого курсу спеціальності «Туризм», показала свою ефективність й може бути рекомендована для застосування у фізичному виховання студентів вищої школи.

Ключові слова: фізичне виховання, студенти, туризм, тестування, надійність, моделювання.

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DIDACTIC OPPORTUNITIES OF INFORMATION-COMMUNICATION TECHNOLOGIES IN THE CONTROL OF PHYSICAL EDUCATION

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Abstract
The study objective is to justify and implement information and communication technologies in the test control of the development level of the frequency of movements, as a manifestation of speed qualities in the process of physical education.
Materials and Methods. To solve the research tasks, the study used the methods of comparing and contrasting, analysis, synthesis, abstraction, formalization and technical modeling.
Results. An electronic device for the exercise controlling the movement frequency of the hands to evaluate speed qualities was developed for the research purpose. The device is designed on the basis of capacitive type proximity sensors. The signal received by the sensors is processed in the microcontroller unit during the test and transmitted to the personal computer via the communication interface. On a personal computer, using the developed software, they control the time of completion of the test task.
Conclusions. The developed information and communication technologies based on electronic monitoring device embodies a new approach to addressing the challenge of improving the performance of speed control in physical education by ensuring that objective and reliable test data are obtained promptly.
Key words: physical education, control, testing, information and communication technologies, speed and power abilities, sensor device.

Introduction

Problem statement. Effective functioning of control in physical education is considered as a key factor in solving its goals and objectives (Bassett, 2000; Koryahin, Blavt, & Ponomaryov, 2019). Therefore, methodological support of the control process is of particular importance, since its effectiveness depends on the quality, timeliness and content of the information received (Lauber, & Keller, 2014). In this context, the introduction of new innovative tendencies, which at the present stage of scientific and technological progress, are characterized by strong evolutionary changes in all fields of knowledge, is of particular relevance (Gonzalo-Skok, Sánchez-Sabaté, Izquierdo-Lupón, & Sáez de Villarreal, 2019; Koryahin, & Blavt, 2018).

The importance of finding and implementing innovative approaches to controlling physical education and improving the technological foundations of this process is dictated by time (Koryahin, Mukan, Blavt, & Virt, 2019). In the conditions of globalization, rapid spread and intensive introduction of information and communication technologies (ICT), using the potential of modernization in the modern scientific space, it is possible to significantly increase the informatization of physical training through the use of ICT (Strohrmann, Harms, Kappeler-Setz, & Troster, 2012).

Considering the possibility of introducing new controls to improve the efficiency of physical education, to bring this process closer to world standards, to ensure high quality of physical training, to explore the possibilities of implementing productive ideas of integrating ICT in the control of physical education, is updating further scientific research in this direction.

Analysis of recent research and publications. The problem of ensuring the efficiency of physical education is constantly analyzed by scientists, experts, and specialists of the field. The works (Alfrey, & Gard, 2014; Di Tore, Schiavo, D'isanto, 2016) substantiate the basic reasons for the imperfection of the existing system of control in physical education, indicate the testing methodology (Jrgensen, Andersen, Froberg, Maeder, Smith, & Aadahl, 2009; Koryagin, & Blavt, 2019). Its disadvantages are pointed out, in particular: its dependence on a human factor (Geoffrey, Power, Handrigan, Basset, 2012; Koryahin, Blavt, & Ponomaryov, 2019); low level of reliabil-

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ity and consistency of test methods (Alfrey, & Gard, 2014; Bassett, 2000; Gonzalo-Skok, Tous-Fajardo, Suarez-Arrones, Arjol-Serrano, Casajus, & Mendez-Villanueva, 2015); ensuring the reliability of information (Matiegka, 1991; Silverman, Keating, & Phillips, 2008); lack of a single network of observations (Reiman, & Manske, 2009); obsolete technical and methodological support for observations (Magill, 2007; Koryahin, Mukan, Blavt, & Virt, 2019).

In this aspect, the increased attention of specialists is now being paid to the problem of physical education development based on innovations. The successful implementation of this process is believed to ensure the full utilization of the scientific potential of the latest information and communication technologies (ICT) (Capobianco, Almuklass, & Enoka, 2018; Chow, Chung, Ma, Macfarlane, & Shirley, 2017; Gonzalo-Skok, Sánchez-Sabaté, Izquierdo-Lupón, & Sáez de Villarreal, 2019), increases the efficiency of learning (Estivalet, & Springer, 2009; Kok, Komen, Capelleveen, & Kamp, 2020; Strohrmann, Harms, Kappeler-Setz, & Troster, 2012).

The scientific advances of intelligence on the modernization of control procedures are quite widespread (Alfrey, & Gard, 2014; Clarys, & Cabri, 1993; Reiman, & Manske, 2009). It is determined (Preatoni, Hamill, Harrison, Hayes, Van Emmerik, Wilson, & Rodano, 2013), that ensuring the effectiveness of this process through the modernization of the means of implementation of control is, of course, an important and urgent task. A number of studies have been devoted to the use of innovative ICT in the practice of physical education (Chow, Chung, Ma, Macfarlane, & Shirley, 2017; Estivalet, & Springer, 2009), its didactic and methodological aspects (Koryahin, & Blavt, 2018; Preatoni, Hamill, Harrison, Hayes, Van Emmerik, Wilson, & Rodano, 2013).

The works justify the indisputable need to introduce innovations, fundamentally new approaches to the implementation of control in physical education (Lauber, & Keller, 2014; Silverman, Keating, Phillips, 2008). In recent years, the topic of electronic methods and means of test measurements has been consistently among the scientific priorities (Haake, 1996; Hotra, Mahlovanyy, Mykytyuk, Ivakh, & Politanskyi, 2019). The use of ICT in test control of physical education is regarded as one of the resources that have a significant impact on the quality of testing procedures, which implies a new level of quality and effectiveness (Estivalet, & Springer, 2009; Strohrmann, Harms, Kappeler-Setz, & Troster, 2012). The integration of ICT creates the prerequisites for a radical renewal of both the content-based and technological aspects of control, which is manifested in the enrichment of the system of didactic techniques and tools (Koryahin, Mukan, Blavt, & Virt, 2019).

However, despite the fact that the topic of innovation in the current scientific literature is quite well discussed, there is limited research on the modernization of control procedures in physical education based on the introduction of ICT.

The purpose of the article is to justify and implement ICT in the test control of the level of development of the frequency of movements, as a manifestation of speed qualities in the process of physical education.

Materials and methods

The methodological framework based on research has been formed based on the bases of the correlation of general to specific, the unity of theory and practice, the provisions of regularities on processes. The research strategy is focused on the integration of information resources of modern ICTs to ensure the effectiveness of control in the process of physical education. The pilot study aimed to eliminate a number of problematic factors and to ensure promptness, objectivity of ICT testing.

The authors highlight the literature review and methods used in the study theory: synthesis, induction and deduction, correlation, comparison and critical reflection, logical method, structural and systemic method, method of systematization and generalization.

To solve the research tasks used the methods of technical modeling. A method of modeling based on a comprehensive approach (synthesis of analytical and simulation modeling) was proposed, which allowed us to gain new knowledge about the object of scientific research. Technical simulation was used to create a device to be studied: the use of technical means gave the simulation an experimental character. This method provided the definition of the properties of the modeled detailing of the model and the level of detail of its representation by means of images. A comprehensive approach allowed to capture a qualitatively new presentation of the research results.

Results

First of all, in order to conduct research in a certain direction, we consider it necessary to specify that we are investing in the concept of "speed qualities". We are impressed by the fact that speed qualities are manifested in the ability to perform movements in the shortest possible time. There are so-called elementary and complex forms of expression of speed qualities (Stroot, 2014).

Speed qualities are very specific. There is either no dependency between the various forms of their manifestation, or the dependence is quite small. Therefore, in assessing the overall level of development of these qualities, it is necessary to use several speed indicators (Wulf, & Lewthwaite, 2009).

One of the components of complex speed characteristics is the frequency of unladen movements, which is extremely important in cyclic motions and in the rapid repetition of acyclic motions. Now the assessment of the level of development of the frequency of movements is to perform the specialized test exercise "Test of the speed of the movements of the hands" (Alme, & Mylvaganam, 2006; Reiman, & Manske, 2009).

However, in this way, which involves moving the hands and alternately touching the two areas with a comfortable hand with the maximum possible speed and fixing the time of execution of 25 cycles, there is a certain dependence of the subjective assessment of the perception of the evaluator. Subjective perception is the standardization of compliance with the necessary requirements of the test exercise: the correctness of alternately touching the hands, which set visually. At the same time, there is a likelihood of a large error in fixing the time of correctly completed test exercise cycles. All of the above makes it impossible to obtain the relevant test results, so they can not objectively indicate the level of development of speed. The use of such a test exercise does not provide objectively reliable indicators of control over the level of devel-

opment of speed and because of the average level of reliability and consistency of the test.

An electronic test device for controlling the frequency of hand movements was developed for the purpose of the study. The device is designed on the basis of capacitive-type proximity sensors whose action is based on changing the gap between the plates and their dielectric constant (Bracke, Puers, & Van Hoof, 2007).

Modern sensor technologies allow you to create sensory devices that are devoid of traditional problems of the past: complexity in development, low reliability and instability in work. The sensors used in this device are extremely reliable, long-life devices. At the same time, these sensors are not susceptible to all kinds of obstacles, characterized by maximum accuracy and reliability. Capacitive sensors are insensitive to changes in temperatures and vibrations and are highly resistant to electromagnetic effects (Hotra, Mahlovanyy, Mykytyuk, Ivakh, & Politanskyi, 2019; Olmos, Primicia, & Fernandez Marron, 2007).

In the developed control device, a capacitive control resistor is built into the capacitive sensor to adjust the sensitivity. For this purpose, a unique algorithm is used, which, due to the increased signal strength, reduces the noise interference by eight times compared to the usual one.

Information from capacitive sensors is transmitted not by cable but by light waves, which can vary in intensity, phase, color or geometric distribution in space.

The device is designed on the basis of capacitive-type proximity sensors, which are made on insulating material (fiberglass) in the form of two planar electrodes that can be recognized with up to ten simultaneous touches with jewelry. The sensitive elements of such capacitive sensors are the capacitor matrix with modulated external factors between the electrode electrical capacitance. In the general case, the structure of the capacitive sensors can be divided by the change: the area of he inter-electrode overlap, the inter-electrode distance, the parameters of the inter-electrode dielectric and the influence of environmental objects.

The capacitive sensors are placed in the test disks (Fig. 1), which are located on both sides of the support platform and which, when performing the test, the control subject touches with his hands. Capacitive type sensors are made on insulating material (fiberglass) in the form of two planar electrodes. These electrodes, through a two-wire line, connect to the analog inputs of the microprocessor system (in this case PSoC) to measure the capacitance. The capacitive sensors used to create the device of the capacitive sensors include programmable PSoC systems (CapSense crystal C78C21x34 and C78C24x94) In essence, they are a microcontroller for the joint processing of analog and digital signals. Unlike traditional microcontrollers and their electronic signal conversion systems, the PSoC concept not only provides the ability to program modes of digital and analog system nodes, but also configures the structure of these nodes and their interconnections (CapSenseTM, 2006 Bracke, Puers, & Van Hoof, 2007).

The capacitive sensor, in addition to the primary converter (User Interface) with which the control subject's hands interacts, contains a signal converter. The structure of the signal converter used includes:

- CapSence Controller with Haptics controller, which measures capacitor array capacities, generates Touch Signal, and hand touch recognition;

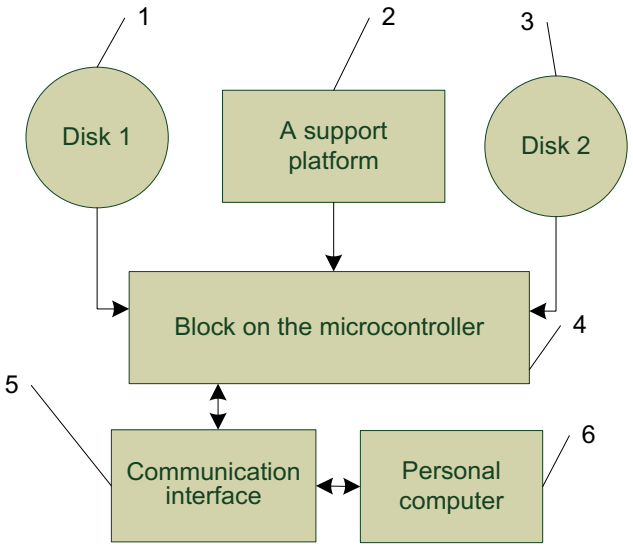

Fig. 1. Structural diagram of the electronic part of the device: 1 – disk 1; 2 – a support platform; 3 – disk 2; 4 – block of the microcontroller; 5 – communication interface; 6 – personal computer

- Host Controller, which provides further signal conversion and processing of digital data;
- Amplifier amplifier and Actuator actuator to provide feedback;
- Tactile Feedback Actuation, which improves the accuracy and noise immunity of the measurement process.

After starting the device, the controller determines the value of the capacity in the absence of a hand on test disc 1 and test disc 2 and fixes the optocoupler with the presence of a hand on the support platform and then signals to the personal computer about the readiness to perform the test task.

The number of hand movements performed by the subject of control is calculated by changing the amount of sensor capacity at the time of touching the test disks. One movement is recorded as a sequence of changes in the amount of capacity on the first and second sensors, which are located in the disks. In the absence of one signal (from disk 1 or disk 2), such motion is not counted. Counting is also suspended in the absence of the control entity's hand at the support site. In the event of such situations, the display of the personal computer displays a message about the violation of the methodological requirements for performing the test exercise and indicate its cause. The sensors received in the test disks receive signals promptly to the microcontroller unit, which generates information about the time of 25 cycles of exercise. The results are transmitted via the communication interface to the personal computer. The indication of the end of the test is the lack of change in the capacity of the sensors, which are placed in the disks for 2-3 seconds, or the absence of a signal from the reference pad. The operation of the device is determined by the firmware algorithm and the application software of the personal computer. The information recorded by the electronic control unit is displayed on the digital display and stored in files that are stored on the disk and are available for further processing.

The structure we developed uses a personal computer, but it is also possible to use a mobile telecommunication sys-

tem that has a high-speed interface subsystem and in which the received signal is processed on a real-time scale. In addition to promptly displaying the results, the device makes it possible to store their values in the internal memory or transfer these values to the control unit for further analysis and visualization.

A way of assessing the level of development of speed attributes, according to which exercise time control is, is that the test subject stands in front of the table, puts the brush of the left (for right-handed) hands on the support platform. Supporting pad (10x20 cm), located between test disk 1 and test disk 2, placed horizontally on the table (distance between the centers of the disks - 60 cm) at an equal distance from each. The right hand is on the left disk. Capacitive-type sensors, which are located under the disks and the support platform, fix with the help of an optocoupler the presence of a hand on the support platform and one of the disks. According to the signal, the test subject alternately touches the disks with the hand brush (right-handed, left-handed), moving the right-hand brush from disc 1 to disc 2 so that it moves over the left hand brush during movement. The task is performed at the maximum possible rate until the number of hand transfers from one disk to another is 25 cycles. The developed electronic control device records the moment of the beginning of the movement of hands and calculates the number of movements by changing the size of the sensor capacity. The signal received by the sensors is processed in the microcontroller unit, which generates information about the time and number of completed test cycles. Further, the signal processed through the communication interface is transmitted by wireless infrared devices to a personal computer. On a personal computer, using the developed software, they control the time of completion of the test task. The results obtained are compared with the evaluation standards and the value of which concludes the level of development of speed qualities. The result is displayed on a personal computer display.

It is known that the maximum effect from the use of ICT is achieved in a complex approach, when different information systems interact (Hotra, Mahlovanyy, Mykytyuk, Ivakh, & Politanskyi, 2019). This is the approach we use in our development as software infrastructure. Software has been developed to automate the process of maintaining registration information and performing control and automated information processing. The function of this assurance is to filter

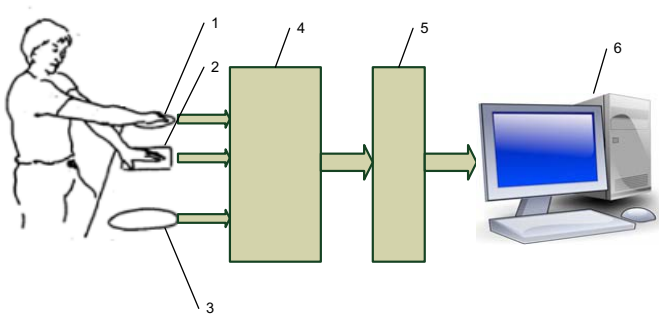

Fig. 2. Block diagram of a method of controlling the level of development of speed qualities: 1 – disk 1; 2 – a support platform; 3 – disk 2; 4 – block of the microcontroller; 5 – communication interface; 6 – personal computer

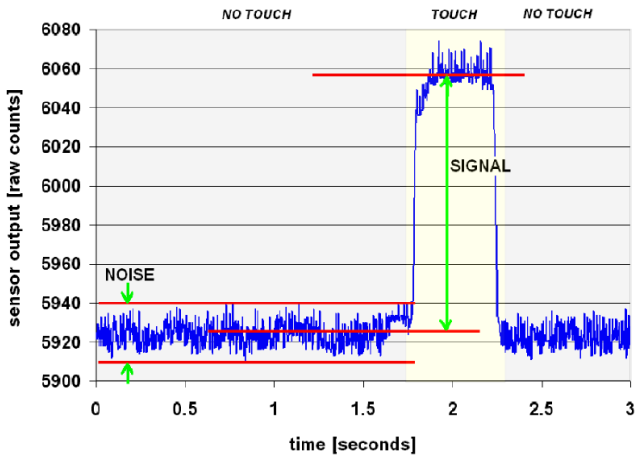

Fig. 3. The process of filtering and correction of signals

and correct the signals received from the electronic control instrument and to visualize the test results. When the exercise is completed, the result is displayed on the screen, which is then stored in the integrated test control database. This database facilitates their replication, processing and interactive analysis using statistical and mathematical methods and algorithms. This is how we accumulate, update, correct, and multifaceted use of a large array of test data. Used interface provides a high level of ergonomic properties of the electronic control device and the ability of professionals to work effectively with the test data. Further archiving takes place in and accessible to each of the control entities in the storage and data center infrastructure in a personal text format. The application of the software allows simultaneous analysis of the results of testing of a group of control subjects without loss of information.

The main indicators that characterize the effectiveness of the use of the tool to control the development of the frequency of movements developed using ICT are:

- testing simplification and automation;
- ensuring accuracy, objectivity, reliability of test results;
- ease of use and compactness of the device: miniature, autonomy, compactness and portability;
- urgency of control, consisting of the time of receipt of information (usually within 60 s), the time of viewing the received data and analysis of results;
- ensuring long-term follow-up during training sessions to update processing results;
- automatic retrieval of results of multiple tests, ease of viewing the structure of obtained results and their dynamics;
- rapid execution of complex calculations with the presentation of results in digital or graphical form;
- saving the results of the test control in the database in the format of hypertext arrays.

Discussion

The conducted research complements the available information that intensive development of scientific and technical process, strengthening its influence in modern science necessitates a significant improvement of the quality of scien-

tific research (Armour, 2014; Asadi, Arazi, Young, & Saez de Villarreal, 2016; Clarys, & Cabri, 1993) and implementation of radical changes in the organization (Chow, Chung, Ma, Macfarlane, & Shirley, 2017; Gonzalo-Skok, Sánchez-Sabaté, Izquierdo-Lupón, & Sáez de Villarreal, 2019) and examination of the results of physical education (Kok, Komen, van Capelleveen, & van der Kamp, 2020; Strohrmann, Harms, Kappeler-Setz, & Troster, 2012).

We support scientific approaches to the need for effective physical education control to improve physical education (Alfrey, & Gard, 2014; Bassett, 2000; Crocker, & Algina, 2015), which is a complex and multifaceted task (Di Tore, Schiavo, D'isanto, 2016; Ivashchenko, 2016; Ivashchenko, & Khudolii, 2016).

Our study supplements data on the unreliability of control information using valid test methods (Alfrey, & Gard, 2014; Edwards, 2010; Koryahin, & Blavt, 2019; Power, Handrigan, & Basset, 2012). We propose a new approach to the study of control in this area of knowledge. The novelty of the presented development is to harness the potential of modern ICT, which, given its prospects, is of particular interest to researchers today.

We coordinate the study according to the ideas of the need for retrofitting, updating, upgrading and intensification of test control in physical education (Clarys, & Cabri, 1993; Capobianco, Almuklass, & Enoka, 2018). We support scientific approaches to the implementation and use of modern ICT in this process, which will help to solve the problems of test control (Chow, Chung, Ma, Macfarlane, & Shirley, 2017; Koryahin, Blavt, & Ponomaryov, 2019).

According to the results of the research, scientific ideas on operational control of physical qualities in real time with the use of ICT have been further developed (Estivalet, & Springer, 2009; Hotra, Mahlovanyy, Mykytyuk, Ivakh, & Politanskyi, 2019; Koryahin, Mukan, Blavt, & Virt, 2019). Utilizing the potential of modernization in today's scientific space, it is possible to significantly enhance the informatization of physical fitness through the use of ICT (Koryahin, & Blavt, 2018; Preatoni, Hamill, Harrison, Hayes, Van Emmerik, Wilson, & Rodano, 2013; Shepard, & Janky, 2008).

Conclusions

The urgent need to integrate all fields of knowledge into the world of educational space requires a major modernization of the content of the theory and methodology of physical education. After all, the modern system should reflect the movement towards the information society, undergo continuous improvement due to the use of own advanced ideas of intensive use of modern ICT tools by domestic researchers.

Introduced electronic device for performing the test of the frequency of hand movements, developed using modern electronic technologies and software, is proposed for the first time and has significant advantages over the existing method of testing the quality of speed. The use of in-house development ensures that objective, reliable test results are obtained promptly.

The use of ICT capabilities as a tool for solving control tasks based on the modernization of this process, provides a qualitatively new technological advance in the methods and didactics, organization and practical implementation of speed control in physical education.

The main methodological result of the study is that the use of the proposed electronic test device to control the frequency of movements of the hands allows to intensify the testing process during physical education. In turn, it allows to solve in a comprehensive manner the issues of timely introduction of adjustments to the training program in accordance with the obtained results.

Conflict of interest

The authors state no conflict of interest.

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ДИДАКТИЧНІ МОЖЛИВОСТІ ІНФОРМАЦІЙНО-КОМУНІКАТИВНИХ ТЕХНОЛОГІЙ У КОНТРОЛІ ФІЗИЧНОГО ВИХОВАННЯ

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Мета дослідження – обґрунтування та реалізація інформаційно-комунікативних технологій у тестовому контролі рівня розвитку частоти рухів, як прояву швидкісних якостей в процесі фізичного виховання.

Матеріали та методи. Представлено методи, використані у дослідженні, серед яких теоретичний аналіз наукової літератури, аналіз і синтез, індукція та дедукція, співставлення, порівняння та рефлексія, метод систематизації та узагальнення. Для вирішення дослідницьких завдань використано методи технічного моделювання.

Результати. Для реалізації мети дослідження розроблено електронний пристрій контролю виконання тестової вправи: частоти рухів рук для оцінки швидкісних якостей. Пристрій сконструйований на основі сенсорів наближення ємнісного типу. Сигнал, отриманий сенсорами, при виконанні тесту обробляють у блоці мікроконтролера та через інтерфейс зв'язку, передають на персональний комп'ютер. У персональному комп'ютері з використанням розробленого програмного забезпечення реалізують контроль часу виконання тестового завдання.

Висновки. Електронний пристрій, розроблений на основі інформаційно-комунікативних технологій, втілює новий підхід до вирішення проблеми підвищення ефективності контролю швидкісних якостей у фізичному вихованні та забезпечує термінове отримання об'єктивних та надійних даних тестування.

Ключові слова: фізичне виховання, тестування, контроль, інформаційно-комунікативні технології, частота рухів, швидкісні якості, пристрій.

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ФІЗИЧНА КУЛЬТУРА В ШКОЛІ

STRENGTH ABILITIES: IMMEDIATE AND DELAYED TRAINING EFFECTS OF ORTHOGONAL MODES OF STRENGTH TRAINING IN BOYS AGED 8 YEARS

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Abstract

The study purpose was to determine the dynamics of training effects of orthogonal modes of strength training in boys aged 8 years.

Materials and methods. The study participants were 48 boys aged 8 years. The experiment was performed using a 2^2 factorial design. The study materials were processed using the IBM SPSS 22 statistical analysis program. Discriminant analysis was performed. The study examined the impact of four variants of strength training loads on the immediate (ITE) and delayed (DTE) training effects of orthogonal modes of strength exercises and rest intervals in 8-year-old boys.

Results. In the first variant of strength training, the largest contribution to the dynamics of training effects is made by the work performed at the first place "exercises to strengthen arm and shoulder muscles"; in the second variant, the largest contribution to the dynamics of training effects is made by the work performed at the third place "exercises to strengthen back muscles"; in the third variant, the largest contribution to the dynamics of training effects is made by the work performed at the first "exercises to strengthen arm and shoulder muscles" and the third "exercises to strengthen back muscles" places; in the fourth variant, the largest contribution to the dynamics of ITE is made by the work performed at the first "exercises to strengthen arm and shoulder muscles" and the third "exercises to strengthen back muscles" places. The most significant changes in the DTE are associated with the fourth place's work "exercises to strengthen leg muscles".

Conclusions. The response to strength training load includes immediate and delayed training effects. Thus it can be argued that training effects can be classified using the given battery of tests based on discriminant analysis. The efficiency of discriminant analysis increases when using 2^k FFE active experiments.

Keywords: boys aged 8 years, immediate training effect, delayed training effect, strength training loads, discriminant analysis.

Introduction

The low physical activity level of schoolchildren is the main reason for their health deterioration and requires the development of methodological approaches to physical education in educational institutions (Krutsevych, & Chervotoka, 2019; Bahinska, 2015; Garkusha, 2013). The regulation of physical loads in physical education lessons is one of the factors that ensure the effectiveness of schoolchildren's physical education (Ivashchenko, Khudolii, Iermakov, Veremeenko, & Lopatiev, 2018; Veremeenko, Khudolii, & Ivashchenko, 2019).

The effective use of loads in physical education goes hand in hand with control and targeted regulation of rest intervals between exercises, their repetition and training in general, as well as with management of training effects of exercises (Ivashchenko, 2016; Bosenko, 2016; Veremeenko, 2019). The importance of studying rest intervals between strength exercises is indicated in papers by Arazi, Mirzaei, Sangdevini, and Abadi (2012), Ratamess, Chiarello, Sacco, Hoffman, Faigenbaum, Ross, and Kang (2012), Miranda, Simão, DosSantos-Vigário, DeSalles, Pacheco, and Willardson (2010).

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Studies on schoolchildren's physical education focus on the development of strength and coordination skills and on technological approaches to the assessment of training effects of strength training loads in schoolchildren. (Cieślicka, & Ivashchenko, 2017; Ivashchenko, Khudolii, Iermakov, & Prykhodko, 2018).

Technological approaches to the assessment of training effects of strength training loads, pedagogical control of the level of motor fitness in primary school pupils have been studied in a number of works (Ivashchenko, Khudolii, Iermakov, & Harkusha, 2017; Ivashchenko, Khudolii, Iermakov, Chernenko, & Honcharenko, 2018; Ivashchenko, 2016). One of the technological approaches is the use of pattern recognition methods (Neimark, & Teklina, 2007, 2012; Ivashchenko, Khudolii, Iermakov, Veremeenko, & Lopatiev, 2018). In research on the effectiveness of strength development, there is an issue of studying single-factor and multi-factor impacts on the formation of immediate and delayed training effects. An aspect of research is studying the laws of regulating strength exercises which result in immediate and delayed training effects, and the obtained data represent time series at each step of discretization (link). A distinctive feature of pattern recognition is that it is a task with an active experiment, and the possibilities of the experiment are almost unlimited and do not require large time or material costs. The experiment planning involves choosing initial conditions, as well as its characteristics, such as a discretization step, duration and accuracy of calculation (Neimark, & Teklina, 2007, 2012). Full factorial experiments of a 2^k type are effective for studying the process of learning and motor abilities development in schoolchildren (Ivashchenko, 2016; Ivashchenko, Khudolii, Iermakov, Chernenko, & Honcharenko, 2018).

Therefore, the issue of assessing training effects and managing strength training of primary school pupils is relevant and requires further research.

The study purpose was to determine the dynamics of training effects of orthogonal modes of strength training in boys aged 8 years.

Materials and methods

Study participants

The study participants were boys aged 8 years (n = 48). The children and their parents were fully informed about all the features of the study and gave their consent to participate in the experiment.

Study organization

To solve the tasks set, theoretical and empirical methods were used: analysis and generalization of scientific and methodological literature; modeling, pedagogical observation and experiment, discriminant analysis.

To determine the dynamics of strength training effects in boys aged 8 years, the study carried out an experiment according to the plan given in Table 1. Variant I of the combined method was used to strengthen arm and shoulder muscles (place I), abdominal muscles (place II), back muscles (place III), and leg muscles (place IV). At each place, the following methods were used: dynamic effort method, maximal effort method, isometric effort method, repeated effort method. The modes of performance for each group, for the indicated places are given in Table 1.

Table 1. Factorial design in studying the influence of different modes of the combined method of strength development (variant I) in primary schoolchildren (X_1 – number of repetitions in a set; X_2 – rest interval, s)

No. of strength load variant	Method	X_1	X_2
I	Dynamic effort method	3-	30-
	Maximal effort method	1-	30-
	Isometric effort method	3-	30-
	Repeated effort method	6-	30-
II	Dynamic effort method	5+	30-
	Maximal effort method	3+	30-
	Isometric effort method	5+	30-
	Repeated effort method	12+	30-
III	Dynamic effort method	3-	60+
	Maximal effort method	1-	60+
	Isometric effort method	3-	60+
	Repeated effort method	6-	60+
IV	Dynamiceffort method	5+	60+
	Maximal effort method	3+	60+
	Isometric effort method	5+	60+
	Repeated effort method	12+	60+

During the experiment, the study recorded the results of the following tests: 1. Push-ups. 2. Speed push-ups, 3 times. 3. Sit-ups in 30 seconds. 4. Trunk lift in 10 seconds. 5. Standing long jump.

On the first day before the experiment, the study recorded the results of Test 2 "Speed push-ups, 3 times", Test 1 "Push-ups", Test 3 "Sit-ups in 30 seconds", Test 4 "Trunk lift in 10 seconds", Test 5 "Standing long jump". After performing the exercises at place I – Tests 2, 1; at place II – Test 3; at place III – Test 4; at place IV – Test 5. After the lesson – Tests 2, 1, 3, 4. Twenty-four hours after training – Tests 2, 1, 3, 4, 5. The dynamics of test results was determined as a percentage relative to the initial level.

Statistical analysis

The study materials were processed using the IBM SPSS 22 statistical analysis program. In the process of discriminant analysis, the researchers created a prognostic model for group membership. This model builds a discriminant function (or, when there are more than two groups – a set of discriminant functions) in the form of a linear combination of predictor variables, which ensures the best division of groups. These functions are built according to a set of observations, for which their group membership is known. These functions can continue to be used for new observations with known values of predictor variables and unknown group membership.

For each canonical discriminant function, the study calculated: eigenvalue, dispersion percentage, canonical correlation, Wilks' Lambda, Chi-square.

Results

The discriminant analysis made it possible to obtain information on the dynamics of the immediate (ITE) and delayed (DTE) training effects of strength exercises with different focus, taking into account their modes. So, after the first mode of strength exercises, the difference between the results of Tests 1, 2, 3, 5 is statistically significant ($p = 0.001$; $p = 0.015$). The dynamics of the results of Test 4 is statistically non-significant ($p = 0.06$). After the second mode of strength exercises, the results of Tests 1, 2, 3, 4 differ statistically significantly ($p = 0.002$; $p = 0.001$). The dynamics of the results of Test 5 is statistically non-significant ($p = 0.364$). After the third mode of strength exercises, the difference between the results of Tests 1, 3, 5 is statistically significant ($p = 0.001$; $p = 0.016$). The dynamics of the results of Tests 2 and 4 is statistically non-significant ($p = 0.058$; $p = 0.053$). After the fourth mode of strength exercises, the results of Tests 1, 3, 5 differ statistically significantly ($p = 0.001$; $p = 0.016$). The dynamics of the results of Tests 2 and 4 is statistically non-significant ($p = 0.058$; $p = 0.053$) (see Table 2).

Thus, there is a statistically significant difference in the effect of strength exercises in 8-year-old boys after the work at stations 1-4, after the class, and after 24 hours, relative to the initial level.

Tables 3-6 show the results of discriminant analysis for a set of data for four variants of strength exercises.

The following data were obtained for the first variant of strength exercises.

The first canonical function explains 97.9% of the variation of results, the second one – 1.3%, which indicates a high informativeness of the first canonical function ($r = 0.936$) (see Table 3, variant I).

The verification of the first function shows its high discriminative ability and value in interpretation with respect to the general population ($\lambda = 0.109$; $p = 0.001$; Table 4, variant I). The first function characterizes the impact of strength training load on the dynamics of test results after the work, after the class, and after 24 hours.

Structure coefficients indicate that the most significant changes in the ITE and DTE are associated with the work at the first place "exercises to strengthen arm and shoulder muscles" ($r = 0.847$, see Table 5, variant 1). During a discriminant analysis, it was found that 70,8% of cases were classified correctly. The analysis of group centroids for the first load variant shows that at the positive pole of the first function,

Table 2. The results of the impact of strength exercises modes on test results of boys aged 8 years (%)

Place	N	Indicators	Terms of recording	Variant I (n = 12)		Variant II (n = 12)		Variant III (n = 12)		Variant IV (n = 12)	
				X	s	X	s	X	s	X	s
Place I "Exercises for arm and shoulder muscles"	1.	Push-ups	before work	100.00							
			after work	84.98	4.737	92.91	7.784	89,25	6,419	93,31	2,104
			after class	84.85	2.190	90.53	6.283	89,25	6,419	86,53	1,765
			after 24 hours	96.57	3.615	94.37	7.551	101,39	3,244	94,81	4,273
			F; p	73.318; 0.001		5.773; 0.002		22.704; 0.001		22.704; 0.001	
	2.	Speed push-ups, 3 times	before work	100.00							
			after work	109.39	6.009	106.56	4.579	105,24	5,706	97,45	5,489
			after class	108.31	7.183	106.42	7.196	105,66	7,077	104,04	7,372
			after 24 hours	102.60	2.164	106.33	5.143	104,20	6,091	102,83	4,295
			F; p	10.667; 0.001		5.847; 0.002		2.691; 0.058		2.691; 0.058	
Place II "Exercises to strengthen abdominal muscles"	3.	Sit-ups in 30 seconds	before work	100.00							
			after work	89.63	6.103	90.46	4.515	92,77	0,857	98,15	2,735
			after class	89.78	3.587	89.10	5.277	95,55	3,301	9,236	2,581
			after 24 hours	95.46	2.141	95.83	2.813	95,55	3,301	9,481	4,273
			F; p	10.806; 0.001		25.181; 0.001		19.076; 0.001		19.076; 0.001	
Place III "Exercises to strengthen back muscles"	4.	Trunk lift in 10 seconds	before work	100.00							
			after work	92.03	6.271	91.94	6.170	94,02	7,074	97,78	3,282
			after class	91.28	6.575	91.54	4.237	93,68	4,785	95,00	3,761
			after 24 hours	97.68	3.460	97.79	3.643	94,64	8,972	94,81	4,273
			F; p	2.654; 0.060		14.469; 0.001		2.758; 0.053		2.758; 0.053	
Place IV "Exercises to strengthen leg muscles"	5.	Standing long jump	before work	100.00							
			after work	100.32	2.408	99.69	2.473	97,06	3,768	98,00	1,644
			after class	98.99	2.282	98.60	2.940	99,17	3,621	99,18	2,309
			after 24 hours	99.96	2.139	99.89	2.590	101,80	4,576	94,81	4,273
			F; p	3.862; 0.015		1.084; 0.364		3.848; 0.016		3.848; 0.016	

there are the centroids of state at the beginning of strength training and 24 hours after the class, at the negative pole – the centroids of training effects after strength training, after the class. Thus, in the response to strength training load, there are immediate and delayed training effects (see Table 6. Fig. 1).

Table 3. Eigenvalues. Boys aged 8 years

Variant	Function	Eigenvalue	% of Variation	Cumulative %	Canonical Correlation
I	1	6.959	97.9	97.9	.935
	2	.094	1.3	99.3	.293
	3	.053	.7	100.0	.223
II	1	2.292	92.1	92.1	.834
	2	.133	5.3	97.4	.343
	3	.065	2.6	100.0	.246
III	1	3.709	77.1	77.1	.887
	2	1.030	21.4	98.5	.712
	3	.074	1.5	100.0	.263
IV	1	21.874	91.4	91.4	.978
	2	1.548	6.5	97.9	.779
	3	.510	2.1	100.0	.581

Table 4. Test of function(s). Boys aged 8 years

Variant	Test of function(s)	Wilks' Lambda	Chi-square	df	Sig.
I	1 through 3	.109	94.143	15	.000
	2 through 3	.869	5.984	8	.649
	3	.950	2.175	3	.537
II	1 through 3	.252	69.633	15	.000
	2 through 3	.829	9.465	8	.305
	3	.939	3.159	3	.368
III	1 through 3	.097	98.978	15	.000
	2 through 3	.459	33.129	8	.000
	3	.931	3.046	3	.385
IV	1 through 3	.011	190.295	15	.000
	2 through 3	.260	57.271	8	.000
	3	.662	17.522	3	.001

The following data were obtained for the second variant of strength exercises.

The first canonical function explains 92.1 % of the variation of results, the second one – 5.3 %, which indicates a high informativeness of the first canonical function (r = 0.834) (see Table 3, variant II).

The verification of the first function shows its high discriminative ability and value in interpretation with respect to the general population (λ = 0.252; p = 0.001; Table 4, variant II). The first function characterizes the impact of strength load on the dynamics of test results after the work, after the class, and after 24 hours.

Structure coefficients indicate that the most significant changes in the ITE and DTE are associated with the work at the third place "exercises to strengthen back muscles" (r = 0.795, see Table 5, variant II). During a discriminant analysis, it was found that 67.9 % of cases were classified correctly. The analysis of group centroids for the first variant shows that at the positive pole of the first function, there are the centroids of state at the beginning of strength training and 24 hours after the class, at the negative pole – the centroids of training effects after strength training, after the

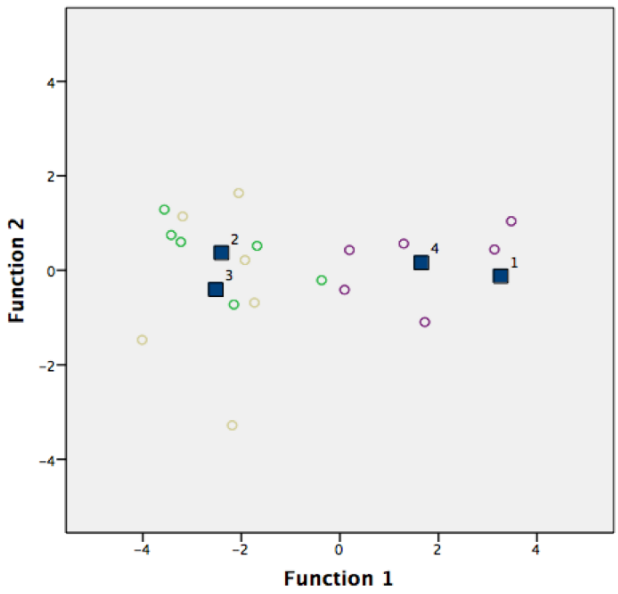

Fig. 1. Dynamics of test results of boys aged 8 years. Load variant I: 1 – before work, 2 – after work, 3 – after class, 4 – after 24 hours

Table 5. Structure matrix. Boys aged 8 years

Indicators	Variant I Function			Variant II Function			Variant III Function			Variant IV Function		
	1	2	3	1	2	3	1	2	3	1	2	3
Push-ups	.847	.058	-.469	.368	-.390	.186	.616	-.360	-.253	.388	.425	.808
Speed push-ups, 3 times	-.319	.307	.107	-.323	.808	.426	-.185	-.183	.542	-.037	-.393	.126
Trunk lift in 10 seconds	.300	.139	.059	.592	.438	-.318	.175	.224	-.549	.061	.398	.516
Standing long jump	.034	.771	.328	.129	.100	.595	.212	-.196	.875	-.065	.326	.873
Sit-ups in 30 seconds	.457	-.317	.710	.795	.122	-.144	.499	.595	.400	.151	.617	.409

Table 6. Functions at group centroids. Boys aged 8 years

Terms of recording	Load variants			
	I	II	III	IV
before work	3.266	2.101	2.254	3.818
after work	-2.403	-1.043	-2.184	-.780
after class	-2.518	-1.636	-1.404	-7.015
after 24 hours	1.655	.578	1.333	3.977

class. Thus, in the response to strength training load, there are immediate and delayed training effects (see Table 6. Fig. 2).

The following data were obtained for the third variant of strength exercises.

The first canonical function explains 77.1 % of the variation of results, the second one – 21.4 %, which indicates a high informativeness of the first and second canonical functions (r_1 = 0.887; r_2 = 0.712) (see Table 3, variant III).

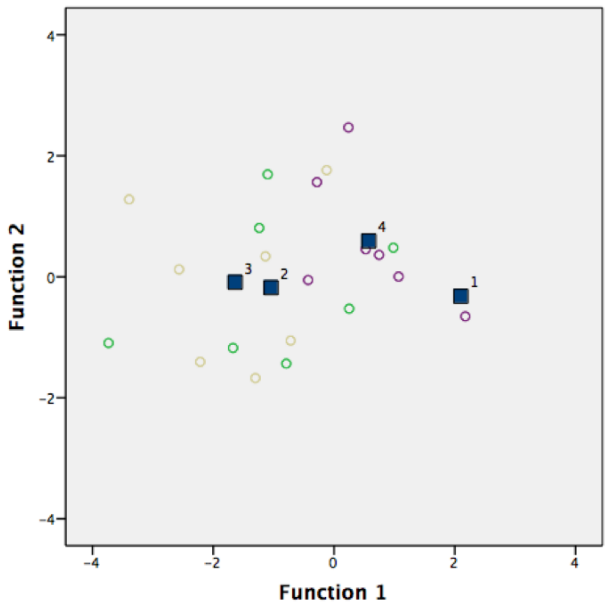

Fig. 2. Dynamics of test results of boys aged 8 years. Load variant II: 1 – before work, 2 – after work, 3 – after class, 4 – after 24 hours

The verification of the first and second functions shows their high discriminative ability and value in interpretation with respect to the general population (λ_1 = 0.097; λ_2 = 0.459; p = 0.001; Table 4, variant III). The first function characterizes the impact of strength training load on the dynamics of test results after the work, after the class, and after 24 hours, the second function – after the class and 24 hours after training.

Structure coefficients show that the most significant changes in the ITE and DTE are associated with the work at the first "exercises to strengthen arm and shoulder muscles" and the third "exercises to strengthen back muscles" places (r_1 = 0.616, r_2 = 0.595, see Table 5, variant III). During a discriminant analysis, it was found that 70.8 % of cases were classified correctly. The analysis of group centroids for the first load variant shows that at the positive pole of the first function, there are the centroids of state at the beginning of strength

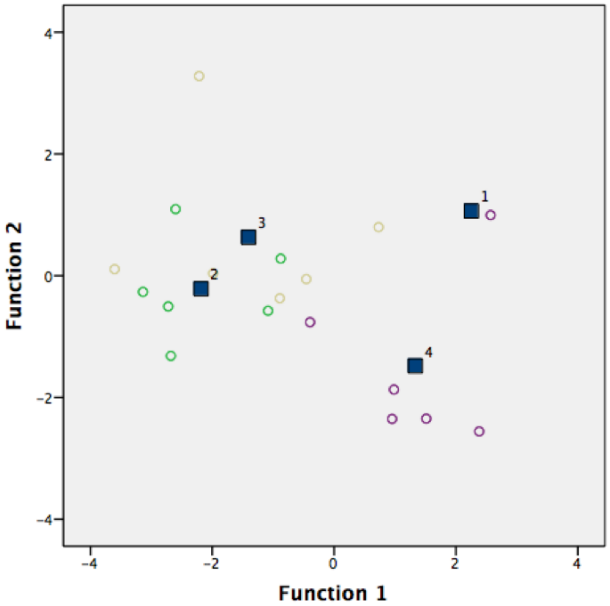

Fig. 3. Dynamics of test results of boys aged 8 years. Load variant III: 1 – before work, 2 – after work, 3 – after class, 4 – after 24 hours

training and 24 hours after the class, at the negative pole – the centroids of training effects after strength training, after the class. Thus, in the response to strength training load, there are immediate and delayed training effects (see Table 6. Fig. 3).

The following data were obtained for the fourth variant of strength exercises.

The first canonical function explains 91.4 % of the variation of results, the second one – 6.5 %, which indicates a high informativeness of the first and second canonical functions (r_1 = 0.978; r_2 = 0.779) (see Table 3, variant IV).

The verification of the first, second, and third functions shows their high discriminative ability and value in interpretation with respect to the general population (λ_1 = 0.011; λ_2 = 0.260; λ_3 = 0.662; p = 0.001; Table 4, variant IV). The first function characterizes the impact of strength training load on the dynamics of test results after the work, after the class, and after 24 hours, the second function – after the class and 24 hours after training, the third one – 24 hours after training.

Structure coefficients indicate that the most significant changes in the ITE and DTE are associated with the first place's "exercises to strengthen arm and shoulder muscles" and the third place's "exercises to strengthen back muscles" (r_1 = 0.616, r_2 = 0.595, see Table 5, variant IV). The most significant changes in the DTE are associated with the fourth place's work "exercises to strengthen leg muscles" (r_3 = 0.873, see Table 5, variant IV). During a discriminant analysis, it was found that 91.7 % of cases were classified correctly. The analysis of group centroids for the fourth variant of load shows that at the positive pole of the first function, there are the centroids of state at the beginning of strength training and 24 hours after the class, at the negative pole – the centroids of training effects after strength training, after the class. Thus, in the response to strength training load, there are immediate and delayed training effects (see Table 6. Fig. 4).

So each of the four load variants influences the formation of training effects of strength exercises. In the first variant, the largest contribution to the dynamics of training effects is

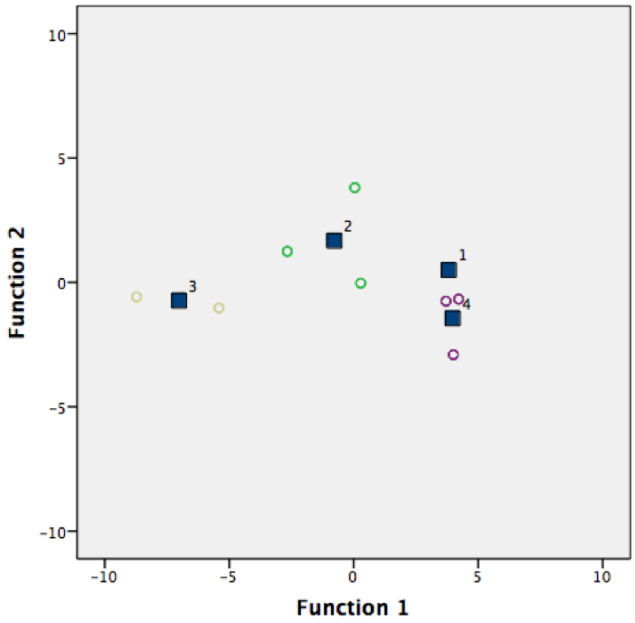

Fig. 4. Dynamics of test results of boys aged 8 years. Load variant IV: 1 – before work, 2 – after work, 3 – after class, 4 – after 24 hours

made by the work performed at the first place "exercises to strengthen arm and shoulder muscles"; in the second variant, the work performed at the third place "exercises to strengthen back muscles"; in the third variant, the work performed at the first place "exercises to strengthen arm and shoulder muscles" and the third place "exercises to strengthen back muscles"; in the fourth variant, the largest contribution to the dynamics of ITE is made by the work performed at the first "exercises to strengthen arm and shoulder muscles" and the third "exercises to strengthen back muscles" places, to the dynamics of DTE – the work at the fourth place "exercises to strengthen leg muscles".

Discussion

The paper assumed that the conditions of performing strength exercises during physical education classes influence the dynamics of ITE and DTE in boys aged 8 years. It was found that each of the four orthogonal variants of load influences the formation of immediate and delayed training effects of strength exercises.

The results of discriminant analysis specify the data of Ivashchenko (2016), Cieślicka, and Ivashchenko (2017) about the peculiarities of the dynamics of training effects in primary school pupils. The results corroborate the findings of Bosenko (2016), Ivashchenko (2016) about the need to consider the age and gender peculiarities of the development and response to physical load in schoolchildren aged 7-16.

The findings supplement the results of the study by Ivashchenko, Khudolii, Iermakov, Veremeenko, and Lopatiev (2018), Veremeenko, Khudolii, and Ivashchenko (2019), Veremeenko (2019) on the use of strength training in a physical education lesson.

The study specifies the data of Ivashchenko, Khudolii, Iermakov, Chernenko, and Honcharenko (2018), Ivashchenko, Khudolii, Iermakov, and Harkusha (2017), Iedynak, Galamandjuk, Dutchak, Balatska, Herasymchuk, and Mazur (2017) about the peculiarities of influence of different variants of performing physical exercises and rest intervals on schoolchildren's motor fitness.

The findings indicate that the ITE and DTE of strength exercises depend on the initial level of fitness and the total amount of strength training in a physical education lesson. This confirms the conclusion of researchers that primary school pupils' response to strength training load includes immediate, delayed, and cumulative training effects. (Ivashchenko, 2016; Cieślicka, & Ivashchenko, 2017; Balaban, 2018).

In contrast to Arazi, et al. (2012), Ratamess, et al. (2012), Miranda, et al. (2010), the study obtained data on the impact of orthogonal variants of alternation of strength exercises and rest intervals on the training effect of strength training loads. The paper confirmed that the efficiency of discriminant analysis increases when using 2^k FFE active experiments (Neimark, & Teklina, 2012; Correa, Grima, and Tort-Martorell, 2009, 2012; Ivashchenko, et al., 2018).

Conclusion

The response to strength training load includes immediate and delayed training effects. Thus it can be argued that training effects can be classified using the given battery of tests based on discriminant analysis. The efficiency of discriminant analysis increases when using 2^k FFE active experiments.

In the first variant of strength training, the largest contribution to the dynamics of training effects is made by the work performed at the first place "exercises to strengthen arm and shoulder muscles"; in the second variant, the largest contribution to the dynamics of training effects is made by the work performed at the third place "exercises to strengthen back muscles"; in the third variant, the largest contribution to the dynamics of training effects is made by the work performed at the first "exercises to strengthen arm and shoulder muscles" and the third "exercises to strengthen back muscles" places; in the fourth variant, the largest contribution to the dynamics of ITE is made by the work performed at the first "exercises to strengthen arm and shoulder muscles" and the third "exercises to strengthen back muscles" places. The most significant changes in the DTE are associated with the fourth place's work "exercises to strengthen leg muscles".

Conflict of interest

The authors state no conflict of interest.

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СИЛОВІ ЗДІБНОСТІ: ТЕРМІНОВИЙ І ВІДСТАВЛЕНИЙ ТРЕНУВАЛЬНИЙ ЕФЕКТ ОРТОГОНАЛЬНИХ РЕЖИМІВ СИЛОВИХ НАВАНТАЖЕНЬ У ХЛОПЦІВ 8 РОКІВ

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 8 с., 4 рис., 6 табл., 21 джерело.

Мета дослідження – визначити динаміку тренувальних ефектів ортогональних режимів силових навантажень у хлопців 8 років.

Матеріали і методи. У дослідженні прийняли участь 48 хлопців 8 років. Експеримент був проведений за планом факторного експерименту 2^2. Матеріали дослідження опрацьовані в програмі статистичного аналізу IBM SPSS 22. Здійснений дискримінантний аналіз. Вивчався вплив чотирьох варіантів силового навантаження на терміновий (ТТЕ) і відставлений (ВТЕ) тренувальний ефект ортогональних режимів виконання силових вправ та інтервалів відпочинку у хлопців 8 років.

Результати. У першому варіанті силового навантаження найбільший вклад у динаміку тренувальних ефектів має робота виконана на першому місці «вправи для розвитку сили м'язів рук і плечового поясу»; у другому варіанті найбільший вклад у динаміку тренувальних ефектів має робота виконана на третьому місці «вправи для розвитку сили м'язів спини»; у третьому варіанті найбільший вклад у динаміку тренувальних ефектів має робота виконана на першому «вправи для розвитку сили м'язів рук і плечового поясу» і третьому «вправи для розвитку сили м'язів спини» місцях; у четвертому варіанті найбільший вклад у динаміку ТТЕ має робота виконана на першому «вправи для розвитку сили м'язів рук і плечового поясу» і третьому «вправи для розвитку сили м'язів спини» місцях, найбільш значні зміни ВТЕ пов'язуються з роботою на четвертому місці «вправи для розвитку сили м'язів ніг».

Висновки. В реакції на силове навантаження виділяється терміновий і відставлений тренувальний ефект. Це дає можливість стверджувати, що класифікація тренувальних ефектів можлива за наведеною батареєю тестів на основі дискримінантного аналізу. Ефективність дискримінантного аналізу зростає в разі використання активних експериментів типу ПФЕ 2^k.

Ключові слова: хлопці 8 років, терміновий тренувальний ефект, відставлений тренувальний ефект, силові навантаження, дискримінантний аналіз.

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IMPACT OF UPDATED CURRICULUM CONTENT ON 6TH-7TH GRADERS' MOTIVATION IN PHYSICAL EDUCATION

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Abstract

The purpose of the study was to determine the impact of updated curriculum content on 6th-7th graders' motivation in physical education.

Materials and Methods. The study participants were 457 6th-7th graders from different regions of Ukraine (n = 230 girls and n = 227 boys). To determine the impact of curriculum content on school students' motivation in physical education, the study used methods of theoretical analysis, systematization, comparison, generalization, pedagogical observations, questionnaire, mathematical statistics.

Results. The study found that the content of 2012-2017 curricula has significant advantages in terms of developing school students' motivation for regular exercise. The impact results in a statistically significant increase in indicators of the school students' choice of learning motive (8.5% more; t = 2.24; $p \leq 0.05$-0.01), evaluation motive (5.0% more; t = 2,01; $p \leq 0.05$), play motive (6.3% more; t = 2.07; $p \leq 0.05$). The study determined an increase in the high level of learning motivation from 14 to 33 cases and in the above average level – from 21 to 48, as well as a decrease in the average level – from 59 to 56, the reduced level – from 21 to 17, and the low one – from 12 to 11 cases.

Conclusions. It was found that the result of the impact on school students' motivation in physical education is the inclusion of new components into curricula. It was defined that an increase in motivation is associated, first, with the inclusion of content lines "Environmental Safety and Sustainable Development", "Civil Responsibility", "Health and Safety"; secondly, sections "Theoretical and Methodological Knowledge" and "Expected Results of Educational and Cognitive Activity"; thirdly, a modular system of organizing the educational process; fourth, sections "Evaluation of Learning Achievements" and "Homework". The result of the impact of updated curriculum content is the enhancement of school students' motivation in physical education, first of all through educational (cognitive) and social motives.

Keywords: education, curriculum, lesson, motivation, school students.

Introduction

Studying the impact of physical education on the formation of a harmoniously developed personality and human health (Iermakova, 2014); conceptual ideas for modeling the processes of education and development of children's and adolescents' motivation in physical education (Khudolii, & Ivashchenko, 2013); factors that influence the effectiveness of teaching physical exercises and developing physical qualities, and therefore determine the interest in exercise (Khudolii, Ivashchenko, & Chernenko, 2013; Khudolii, & Titarenco, 2013) remain extremely relevant not only in Ukraine.

Researchers from Algeria (Kenioua, & Boumasjed, 2016) note the importance of developing schoolchildren's health by integrating them into entertainment and competitive activities, which will help to increase motivation in physical education. Radzimińska, Weber-Rajek, Lulińska-Kuklik, Kaźmierczak, and Moska (2016) focus on the implementation of health promotion programs for Polish school students, emphasizing the important role of an active lifestyle, habits

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and patterns of behavior as factors developing motivation for physical activity. In our study, we also relied on research papers analyzing the content of physical education curricula in different countries, including the physical education curriculum in Poland (Turchyk, Vatseba, & Biriuk, 2009), the content of physical education in educational institutions of the USA (Osadchaya, 2004), the peculiarities of physical education in Canada, Germany, the USA (Danylova, 2010; Sapargasimova, & Pluzhnov, 2017).

The Ministry of Education and Science of Ukraine developed the foundations of the Education Standard "New Ukrainian School" (Hrynevych, Lyashenko, Krutsevych, Shyyan, et al., 2016), in which, starting from the 2017-2018 academic year, Physical Education is taught according to an updated content (Physical Education Curriculum for 5th-9th Grades of General Education Schools, approved by the Order of the Ministry of Education and Science No. 1407 of October 23, 2017). An important factor in updating the curriculum content (updating the curriculum in accordance with the Order No. 52 of the Ministry of Education and Science of Ukraine of January 13, 2017 and the Order No. 201 of February 10, 2017) is its focus on developing and socializing school students' personality, shaping their national identity, general culture, worldview orientations, ecological style of thinking and behavior, creative abilities, exploratory and survival skills, ability for self-development and self-education in the conditions of global challenges, by means of physical education.

In our opinion, such a focus of the curriculum content can help increase motivation in physical education. We believe that it is not enough to carry out pedagogical correction of the motive, enhance its manifestations, but it is necessary to create a certain curriculum and organizational-methodological basis for its implementation. Only then the motive becomes strong and will help develop the need for physical activity in school students.

We failed to find data on the attempt to determine and scientifically substantiate the impact of a curriculum content on school students' motivation in physical education. After all, the formation of learning motivation is one of the main conditions for ensuring the quality of the educational process, including physical education, the relevance of which depends on updating the content of education.

The purpose of the study was to determine the impact of updated curriculum content on 6th-7th graders' motivation in physical education.

Materials and Methods

Study Participants

The respondents were 457 6th-7th graders (230 girls and 227 boys) from different regions of Ukraine (Kharkiv, Kyiv, Khmelnytsk, Donetsk, Luhansk, Chernihiv Regions).

Study Organization

To determine the impact of curriculum content on school students' motivation in physical education, we adapted and used M. Ginsburg's test "Research on Learning Motivation" (Zaniuk, 2002). The study determined the dominant motives of learning activity in physical education lessons (learning, social, positional, evaluation, play, external motives). The questionnaire included the following points: 1. "I try to learn better to…" (get a good grade, I like physical entertainments, know more about the effects of exercises on the body); 2. "Learning and knowledge are necessary for…" (self-development: to know and be able to, to be respected and appreciated, to win games and competitions); 3. "If I get a high grade…" (teacher and parents will be glad, I will understand the impact of exercises on the body); 4."I like being praised for…" (homework, correctly performed physical exercises, personal traits and positive emotions, teamwork); 5. "My goal is…" (good grades, teacher's praise, understanding the effects of exercises on the body); 6. "The most interesting thing is…" (learning new motor actions, communication with peers, teamwork, assessment of motor achievements, play activities); 7. "I study learning material well if…" (I try to improve my grade, I like it and understand the impact of exercises on the body, it will help improve health); 8. "I am more active if…" (I want to learn more about the impact of exercises on the body, it will help improve health, it is interesting, I will be a team member, teacher's praise); 9. "My success depends on…" (interest in a grade, attention to explanation, communication with peers, mood, manifestation of motor abilities); 10. "If learning material is not clear to me (difficult), I…" (remember the explanations in previous lessons, ask the teacher or peers for help, rest and try again).

The questionnaire results were interpreted as follows: learning motive – 5 points, social motive – 4 points, positional motive – 3 points, evaluation motive – 2 points, play motive – 1 point, external motive – 0 points. The sum of points on the questionnaire: 90-80 – a high level of learning motivation, 79-65 – above average, 64-40 – average (normal), 39-20 – reduced, 19 or less – low.

Statistical Analysis

The analysis and interpretation of the study results were carried out together (6th and 7th grade girls and boys) by calculating the reliability coefficient and the degree of probability of difference, using the Student's T-Test.

Results

This study conducted an analysis of physical education curricula for 5th-9th graders of general secondary education institutions at different stages of their improvement (first of all, 2012-2017), that is at a time when certain changes were made in the structure of curricula and their content was improved.

In this regard, we have reason to believe that the update of curricula content has had a positive impact on the development of school students' motivation. The analysis of the questionnaire results shows a certain dynamics in the school students' choice of priority motives under the influence of the curriculum content of 2012-2017 in comparison with that of 2008-2009 and earlier (Fig. 1).

The study found a statistically significant increase in indicators characterizing the choice of learning motive, evaluation motive, and play motive. In particular, 8.5%

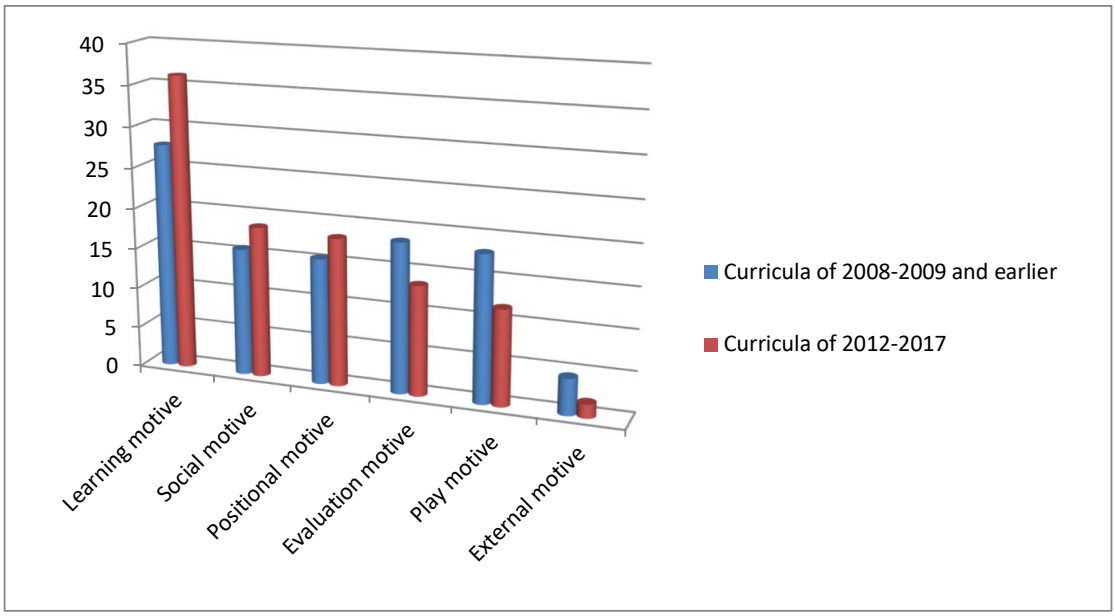

Fig. 1. Results of 6th-7th graders' choice of priority motives under the influence of the content of physical education curricula

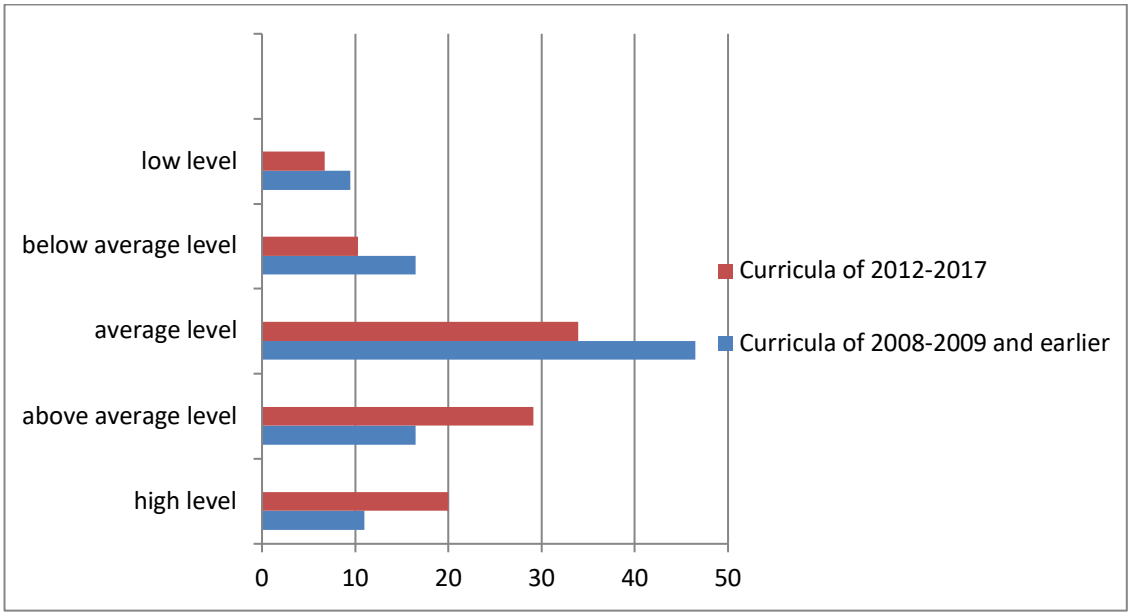

Fig. 2. Indicators of development of learning motive levels under the influence of Physical Education curricula of 2008-2009 (n = 127) and 2012-2017 (n = 165)

more students choose the learning motive and consider it a priority (t=2.24; p≤0.05-0.01), which we tend to explain by the development of cognitive interest in physical education (strive to study, learn new things about the impact of exercises on the body development, express the need to acquire knowledge, motor abilities and skills, etc.). The evaluation motive is chosen by 5.0% (t = 2.01; p≤0.05) and the play motive by 6.3% (t = 2.07; p≤0.05) more students. This is due to a change in approach to evaluating motor performance. Evaluation involves not only a quantitative result of the learning standard, but also a focus on the performance quality of an exercise, a motor task (evaluation is a criterion of self-awareness, honesty, diligence, not just a measurement of the performed task). The development of motives is also determined by the adequacy of students' ideas about the functions of physical education. Thus, the play motive (desire to participate in active and sports games, games with rules of fair play) encourages and boosts learning activity based on play and communication, helps to satisfy the need for physical activity, but not at the expense of learning quality.

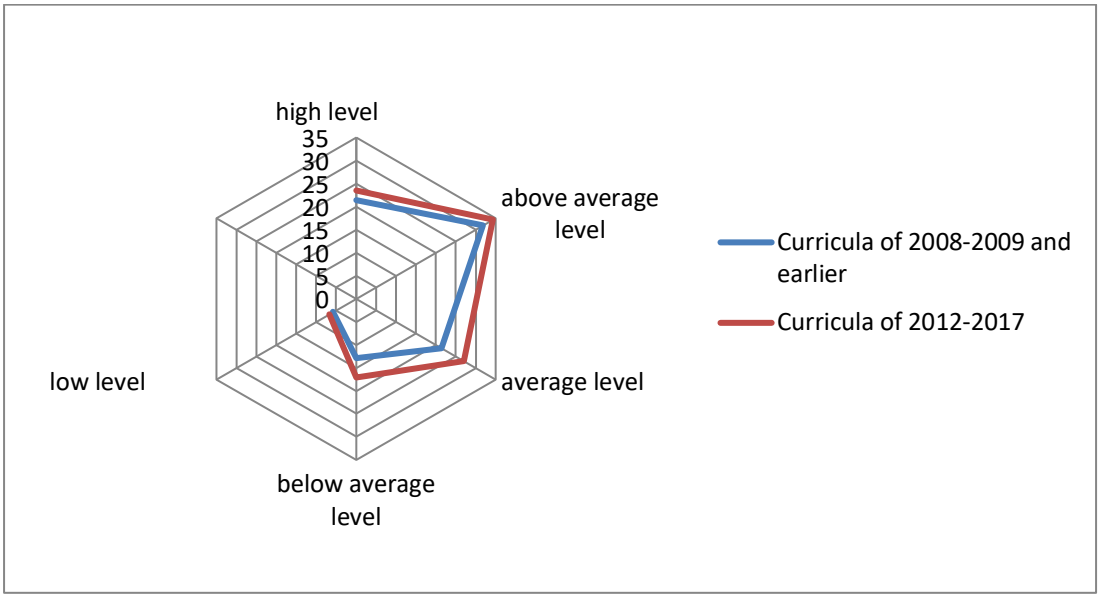

Fig. 3. Indicators of development of social motive levels under the influence of Physical Education curricula of 2008-2009 (n = 70) and those of 2012-2017 (n = 85)

A lower motivation in physical education is observed in the social (learning as a socially significant factor, awareness of the usefulness of learning), positional (increasing a social status, aiming for a corresponding social activity), and external (following established norms) motives. In our opinion, this is because school students are guided by situational factors and not necessarily conscious motives. Although, the social motive in combination with the learning (cognitive) one are crucial in ensuring the quality of education.

Characterizing the indicators of development of levels of students' motivation in physical education, we present the results of manifestation of the learning and social motives (Fig. 2, 3). It is the learning and social motives that are crucial in ensuring the quality of schoolchildren's physical education. An increase in the high level of learning motivation (90-80 points) is characterized by an increased number of choices from 14 to 33 (from 11.0 to 20.0%); the above average level (79-65 points) – from 21 to 48 choices (from 16.5 to 29.1%). Along with this, there was a decrease in the average level (64-40 points) from 59 to 56 choices (from 46.5 to 33.9%), the reduced level (39-20 points) – from 21 to 17 choices (from 16.5 to 10.3%), and the low one (19 or less points) – from 12 to 11 choices (from 9.5 to 6.7%).

A similar dynamics is observed in the development of levels of social motive of learning activity. The indicators of the high level increased from 15 to 20 choices (from 21.4 to 23.5%) of respondents, the above average level – from 24 to 27 (from 31.8 to 34.3%), the average level – from 15 to 23 (from 21.4 to 27.1%). At the same time, the indicators that characterize the reduced level of motivation decreased from 12 to 11 (from 12.9 to 17.1%) and the low level – from 5.8 to 4.7%.

A less pronounced dynamics is observed when comparing the levels of evaluation motive and play motive, which indicates, in our opinion, that 6th-7th grade students are not yet sufficiently aware of their importance in ensuring the quality of education, they are guided by situational factors, not necessarily conscious motives.

Discussion

The development of school students' motivation in physical education continues to be relevant in scientific discourse. Of particular interest are research findings of authors who consider the structure and content of physical education in the context of developing the motivational sphere of personality as a polymotivated concept of the functions of education.

The results of our study are consistent with scientific views of Richards, and Levesque-Bristol (2014) who emphasize the importance of structuring curricula so that they develop the need for lifelong learning. The authors consider it appropriate to create an educational environment that would contribute to the formation of a sense of one's own activity in implementing the tasks of education through meeting vital needs, strengthening internal motivation. At the same time, Hryban (2012); Nesterova, and Pavliuk (2014) note that the lack of school students' motor activity is mainly a social, not just a biological phenomenon. In this regard, motivation to exercise should also be determined by understanding the impact of motor activity on functional changes in the body on the basis of free choice of the kind of motor activity, which is provided by the updated curriculum content.

The necessity for updating the content and improving the structure of curricula is confirmed by studies of Uvarov, Belaid, and Yakhyavi (2016). Having analyzed the experience of organizing physical education in educational institutions of European countries, the researchers emphasize the need for a balanced impact of both motor and intellectual components of physical education.

The authors' scientific views are consistent with the findings of other authors' studies emphasizing that one of

the conditions for motivation development is increasing the amount and quality of knowledge in physical education, objectivity in assessing motor achievements, taking into account priorities (interest, enthusiasm) in choosing a kind of motor activity (Kondakov, Kopeikina, Balysheva, Usatov, & Skrug, 2015); using various interactive motor and health-developing technologies (Ha, Lonsdale, Lubans, & Ng, 2018), influence of parents' example on the formation of motivation for physical exercises (Sukys, Majauskienė, Cesnaitiene, & Karanauskiene, 2014).

Scientific views on overcoming certain psychological and pedagogical "barriers" that hinder the development of school students' motivation in physical education, especially in primary and secondary schools, are relevant in the context of our study. The authors note that they should be overcome by forming subject-subject relations, elective curricula, teachers' ability to reduce obstacles that hinder the development of motivation (Mowling, Brock, Eiler, & Rudisill, 2004). Mehmeti, and Halilaj (2018) point out the need to increase motivation for physical activity, suggesting that curricula should provide the implementation of measures promoting the development of both personal motor abilities and teamwork skills, the reduction of anxiety, fear of failure in mastering biomechanically difficult movements.

Thus, the findings showed that relatively low growth of students' motivation in physical education results from the structure and content of the curricula introduced into schoolchildren's physical education before 2012). These curricula practically did not take into account students' priorities, interests and desires regarding the kind of physical activity; individual features of physical development and motor fitness; objectivity and evaluation motive regarding the results of motor performance.

The factors that contributed to increasing school students' motivation in physical education include changes in the curricula implemented since 2012-2017.

The improvement of the curricula content is associated primarily with the introduction of sections "Theoretical and Methodological Knowledge" (knowledge, value, activity components), "Expected Results of Educational and Cognitive Activity of School Students" (student characterizes, gives examples, masters, follows rules, etc.), and "Organization of Educational Process". The implementation of these sections contributed to the formation of school students' abilities and skills to exercise independently; the differentiated approach taking into account the state of health, the level of physical development, motor fitness, gender; the development of interest in physical exercises; the expansion of organizational forms, means, methods and techniques of education and upbringing.

An important argument in increasing school students' motivation in physical education is the introduction of the "Homework" section for independent physical exercises aimed at increasing physical activity during leisure, achieving a recreational and health-improving effect.

In improving the content of curricula, an important role is played by the change of approaches to the "Evaluation of Learning Achievements", when taking into account personal achievements, level of activity and participation in sports competitions, physical education and health-improving events during a school year. Based on these indicators, the teacher can apply various systems of additional (bonus) points. At the same time, failure to meet the standards for reasons independent of the student (disproportionate physical development, missing classes for a valid excuse, etc.) is not a reason to reduce the final grade. Thus, a grade is a certain criterion of self-awareness, honesty, diligence, quality of exercise performance, and not just the achievement of a certain motor result, or control standard, "a grade for the sake of grade".

The 2017 curriculum takes into account students' acquisition of key life competencies, which, first of all, contributed to developing educational (cognitive) and social motives, which are a priority in ensuring the quality of the educational process, as well as through physical education. So, the content line "Environmental Safety and Sustainable Development" is aimed at forming students' social activity, responsibility and environmental awareness, willingness to participate in addressing issues of environmental protection and social development. The content line "Civil Responsibility" is aimed at forming a responsible subject of the community and society, who understands the principles and mechanisms of society's functioning. The content line "Health and Safety" envisages the formation of a student's personality as a spiritually, emotionally, socially and physically full-fledged member of society, who is able to lead a healthy life, to shape a safe living environment. Due to these competencies, school students should realize that physical education is an important factor in increasing a person's social activity, meeting moral, aesthetic and creative needs, the need for mutual communication; a factor of conscious attitude to one's own health and the health of others; a factor in developing the ability to communicate in different situations of physical education and sports activities, to reduce conflicts, to win, following the rules of fair play, etc.

Thus, improving the structure and updating the content of curricula positively influenced, above all, the development of socially significant physical education and health-improving motives expressed by a high level of goal setting (active life position, desire for conscious physical improvement, taking responsibility for one's actions, behavior, state of health, etc.).

Conclusions

It was found that the result of the impact on school students' motivation in physical education is the inclusion of new components into curricula. It was defined that an increase in motivation is associated, first, with the inclusion of content lines "Environmental Safety and Sustainable Development", "Civil Responsibility", "Health and Safety"; secondly, sections "Theoretical and Methodological Knowledge" and "Expected Results of Educational and Cognitive Activity"; thirdly, a modular system of organizing the educational process; fourth, sections "Evaluation of Learning Achievements" and "Homework". The result of the impact of updated curriculum content is the enhancement of school students' motivation in physical education, first of all through educational (cognitive) and social motives.

Conflict of interest

The authors declare no conflict of interest.

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ВПЛИВ ОНОВЛЕНОГО ЗМІСТУ НАВЧАЛЬНИХ ПРОГРАМ НА ВМОТИВОВАНІСТЬ УЧНІВ 6-7 КЛАСІВ ДО ЗАНЯТЬ ФІЗИЧНОЮ КУЛЬТУРОЮ

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 8 с., 3 рис., 24 джерело.

Мета дослідження – визначити вплив оновленого змісту програм на вмотивованість учнів 6-7 класів до занять фізичною культурою.

Матеріали і методи. У дослідженні брали участь учні 6-7 класів із різних регіонів України кількістю 457 осіб (n = 230 дівчат та n = 227 хлопців). Для визначення впливу змісту програм на вмотивованість учнів до занять фізичною культурою використано методи теоретичного аналізу, систематизації, порівняння, узагальнення, педагогічні спостереження, анкетування, математичної статистики.

Результати. З'ясовано, що зміст програм 2012-2017 рр. має суттєві переваги в контексті вироблення в учнів мотивації до систематичних занять. Результатом впливу є статистично достовірне зростання показників у виборі учнями навчального мотиву (на 8,5% більше; t = 2,24; $p \leq 0{,}05$-0,01), мотиву оцінки (на 5,0% більше; t = 2,01; $p \leq 0{,}05$), ігрового мотиву (на 6,3% більше; t = 2,07; $p \leq 0{,}05$). Визначено зростання високого рівня мотивації навчання з 14 до 33 випадків та вище середнього – з 21 до 48, а також зменшення середнього – з 59 до 56, зниженого – з 21 до 17 та низького – з 12 до 11 випадків.

Висновки. Встановлено, що результатом впливу на вмотивованість учнів до занять фізичною культурою є включення до навчальних програм нових компонентів. Визначено, що підвищення вмотивованості пов'язане, по-перше, із включенням змістовних ліній «Екологічна безпека та сталий розвиток», «Громадянська відповідальність», «Здоров'я і безпека»; по-друге, розділів «Теоретико-методичні знання» та «Очікувані результати навчально-пізнавальної діяльності»; по-третє, модульної системи організації навчально-виховного процесу; по-четверте, розділів «Оцінювання навчальних досягнень» та «Домашні завдання». Результатом впливу оновленого змісту програм є підвищення рівня вмотивованості учнів до занять фізичною культурою на засадах прояву, перш за все, навчального (пізнавального) та соціального мотивів.

Ключові слова: освіта, програма, урок, мотивація, учні.

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Керівництво для авторів

Редакція приймає до друку оригінальні експериментальні й оглядові статті з проблем фізичного виховання і спортивного тренування за напрямками:

- теорія та методика навчання рухам;
- фізичне виховання дітей та підлітків;
- спортивне тренування дітей та молоді;
- фізична культура в школі;
- фізична культура в профілактиці і лікуванні захворювань у дітей та підлітків;
- теорія і методика професійної підготовки учителя фізичної культури.

Обсяг оригінальної статті — до 3000 слів (окрім назви, рефератів, таблиць/рисунків, легенд рисунків, подяки, конфлікту інтересів та посилань), оглядових — до 6000 слів, коротких повідомлень — до 1000 слів. Мова статті — українська, російська, англійська.

Оригінальні статті пишуться за схемою:

- назва статті;
- автор (ім'я, прізвище);
- університет (інститут, академія);
- вступ (постановка проблеми, аналіз останніх досліджень і публікацій, гіпотеза дослідження, мета дослідження);
- матеріали і методи (учасники дослідження, організація дослідження, процедура тестування, статистичний аналіз; етичне схвалення до публікації експериментальних даних);
- результати дослідження;
- обговорення результатів дослідження;
- висновки;
- вдячності;
- конфлікт інтересів;
- список літератури;
- реферат статті (українською, російською та англійською мовою) за схемою: назва роботи, прізвище та ім'я автора (ів), назва установи, мета дослідження, матеріали і методи, головні результати дослідження, висновки, ключові слова. Обсяг — 200–300 слів.

Вимоги до розділів рукопису

Вступ

Постановка проблеми. Вказується основне протиріччя, яке буде досліджено в роботі.

Аналіз останніх досліджень і публікацій.

Аналізуються роботи вітчизняних дослідників з обраної теми:

- проблемою займалися ...
- у результаті дослідження встановлено ...

Аналізуються роботи іноземних дослідників за обраним напрямком дослідження:

- проблемою займалися ...
- у результаті дослідження встановлено ...

Вказується на доробок авторів за темою дослідження:

- у попередніх роботах було встановлено ...
- недослідженим залишається ...

Якщо вказується тема дослідження, то " У виконаних дослідженнях за темою "..." визначені: ...; встановлено: ...

Робиться висновок про актуальність теми дослідження.

- аналіз даних вітчизняних і закордонних вчених показав, що ... малодослідженою є ...
- або потребує уточнення ...
- або потребує додаткових досліджень ...

Формулюються гіпотеза і мета дослідження.

Матеріали і методи

Учасники дослідження. Вказується контингент досліджуваних.

Організація дослідження. Вказуються методи і з якою метою вони були використані; процедури дослідження і алгоритм проведення педагогічного експерименту.

Процедура тестування. Описуються тести і методика тестування.

Статистичний аналіз. Вказуються методи матстатистики і з якою метою вони були використані.

Етичне схвалення до публікації експериментальних даних. Дослідження повинно мати етичне схвалення відповідної установи з підписами комітету з питань етики. Для експериментів, проведених у галузі фізичного виховання та спорту, автор (и) повинен мати схвалення установи для публікації експериментальних даних.

Результати дослідження

Результати дослідження повинні бути представлені у таблицях і описані в логічній послідовності в тексті. В тексті посилання на таблиці обов'язкові.

Не слід повторювати в тексті всі дані з таблиць або графіків. Необхідно акцентувати увагу на статистично достовірних змінах результатів тестування та показати характерні тенденції динаміки. Слід обмежити кількість таблиць і малюнків (графіків) до трьох.

Дискусія

- огляд основної гіпотези;
- обговорення висновків: порівняння з даними публікацій, дотичними до теми статті наведеними у вступі рукопису;
- обґрунтування і коментарі щодо важливості викладених результатів дослідження;
- міркування щодо можливості практичного застосування результатів;
- висновок про перспективи подальших досліджень, який ґрунтується на матеріалах дискусії.

Висновки

Висновки повинні відображати результати і бути пов'язані з метою дослідження. Слід уникати висновків, які не підтверджуються отриманими даними.

Вдячності

Вказується тема дослідження за якою виконана робота, номер державної реєстрації.

Конфлікт інтересів

Наприклад:

Автори заявляють про відсутність конфлікту інтересів.

Література

Список посилань оформляється за стандартом APA.Кількість посилань — 30–70 джерел (не менше 30% посилань на публікації в журналах НМБ SCOPUS і WoS). Подається за алфавітом або у порядку цитування, не нумерується.

References

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