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PEDAGOGY & DIDACTICS

Gennadii Arziutov[1(ABCDEF)], Sergii Iermakov[(2ABCDEF)], Pavol Bartik[3(ACDEF)], Mykola Nosko[4(ACDEFG)], Wojciech J. Cynarski[5(ACDEF)]

[1]National Pedagogical Dragomanov University, Kyiv (Ukraine)
[2]Kharkiv National Pedagogical University, Kharkiv (Ukraine)
[3]Matej Bel University, Banska Bystrica (Slovakia)
[4]Chernigiv National T.G. Shevchenko Pedagogical University, Chernigiv (Ukraine)
[5] University of Rzeszow, Rzeszow (Poland)
Corresponding author: Pavol Bartik, e-mail: Pavol.Bartik@umb.sk

The use of didactic laws in the teaching of the physical elements involved in judo techniques

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Key words: judo, didactic, physical exercises, skills, abilities

Abstract

Purpose. The optimization of training judo practitioners in the techniques of the physical elements of judo based on the underlying principles and the informational-matrix training technology model, which was created to train sportspeople in motor skills.

Methods. Two groups of students participated in the research: the experimental group (young men aged 18-20, n=30) and a control group (young men aged 18-20, n=30). All the necessary procedures to verify the uniformity of the groups were conducted ($p<0.05$). The experiment was conducted from 2010 to 2014. We used statistical methods to determine the qualitative and quantitative indicators in the resulting research data of the research (X mean, t, p, s).

Results. We substantiated the use of didactic laws in the training of Judo techniques. Adequate usage of goal-setting structural elements in the training of motor actions for the mastery of physical exercises was accentuated. The principle of functional redundancy and reliability in the execution of the *Ura Nage* throw was demonstrated. The possibility of applying didactic laws to training in counter attack for example, was shown. It was noted that when there was a high level of fatigue there was a reduction in the variability of effort differentiation. This phenomenon is recommended for use as a methodic technique in training and in the perfection of movements to increase their stability and reliability. We determined the degree of motor exercise mastery, which met its required outcome. A minimum number of exercise and cycle repetitions was set at an 80% skillfulness level (189-504 repetitions and 3-8 cycles). Such an approach to mastering martial arts techniques reduced training time by between 2.97 and 7.96 times.

Conclusions. One of main factors in perfecting the training process is a consideration of didactic laws, the sports practitioner's individual features; his individual style. It is important to substantiate the optimal correlation of physical loads and a sports practitioner's rest intervals.

Introduction

Training in the elements of physical techniques is characterized the intensity and volume of training loads, which can result in positive or negative influences on mastering them. In this case the optimal correlation of different kinds of physical loads with the training stages, the sportsmen's age and abilities and their motivation for success is very important. The basis of the successful mastery of physical exercise is the adequate and reasonable application the goal-setting structural elements of motor action training theory.

In judo and other kinds of wrestling the general approaches of the theory of sports [Podrigalo *et al.* 2016; Yesentayev 2016] and the theory of motor action training [Kolot 2016] are used. Each of these branches implies the application of the definite means and methods, asused in pedagogic aims. In judo practice the knowledge, received by means of personal multiple repetitions (including the fulfillment of a technique in more and more complex conditions, on not resisting the opponent or on a training dummy) are supplemented by appropriate skills. In this case the skill is the ability to correctly (not automatically, with attention concentrated on details) fulfill a new action. In the course of multiple repetitions of the mastered technique in fights with different characteristics, the skill becomes automatic. It allows the practitioner to concentrate less on the purely technical elements of the move [Shulika *et al.* 2006].

Both methodological and general didactic approaches to the training of Judo's complex techniques are described in works by a range of different authors. It has been found that 17–19-year old Judo practitioners have specific and characteristic basic knowledge (throws). This allows their technical fitness to be determined. They have a high level of *koshi-waza* throw fulfillment and the lowest *ashi-waza* throws in the group [Jagiello, Dornowski, Wolska 2014]. Other work has found high organic response to training in special and power loads, comparing with speed-power load training. On this basis an algorithm of training load current correction by heart-beat rate indicators was worked out [Liu 2015]. The level of sports people's technical actions is pre-determined by a number of factors. Among them can be included: individual fighting style [Kozina, Jagiello, Jagiello 2015]; ability to mobilize all forces and skills, to be maximally active and ready for action in sudden situations [Beygul 2014; Gaurav, Gagandeep 2016]; level of strength [Podrigalo *et al.* 2015].

The optimization of physical loads can be a useful supplement in such cases [Khudolii, Iermakov, Ananchenko 2015], as can an assessment of motor fitness, the selection of age-appropriate pedagogic control methods [Zaporozhanov, Borachinski, Nosko 2015], and the substantiation of pedagogic approaches to the training of sportspeople and schoolchildren [Johnson, Ha 2015].

In our previous research we proposed training in Judo techniques with the help of a rectangular matrix of repetitions with the opponent's resistance and tempo of movement's regulated. The use of this theory of optimal training by rectangular matrix the time taken in the initial stage of training to be reduced 2.38 times [Iermakov, Arziutov, Jagiello 2016]. In this context it is very important to consider: principles of the theory of sports at stages over many years' training [Arziutov 1998, 2011], and the bio-mechanical laws of the construction of movement [Bernshtejn 1947]. The following is equally important: the application of technical aids in training; individual models of technical actions; adequate approaches to control over training loads [Cynarski *et al.* 2015]; optimal content of training material [Kozina, Iermakov 2015]; and determination of sports practitioners' response to physical loads [Podrigalo *et al.* 2015; Kozina *et al.* 2016].

However, as of today there is no single view by specialists on the planning of the training process for physical techniques. To large extent this is connected with the large number of repetitions of the physical exercises during one training session, one week or one month (or year). All these characterize the qualitative optimization of the training process for the technique. For a solution to this problem it is assumed that training in Judo techniques and the formation of motor experience have a scientific-theoretical and didactic foundation, which allows the qualitative parameters of the repetitions of the technique elements to be determined.

The purpose of the research: is the optimization of training in the techniques of the physical elements of Judo based on an information-matrix technology model of sports practitioners' training in motor skills, as well as didactic laws.

Material

Two groups of students participated in the research: an experimental group (young men aged 18-20, n=30) and a control group young men, aged 18-20, n=30). All the necessary procedures to verify the uniformity of the groups were conducted ($p<0.05$). The experiment was conducted from 2010 to 2014.

The content of the study was approved by the local Committee for Scientific Study Ethics.

In the experiment we used the “informational-matrix methodic” for the training of judo techniques [Arziutov 1998, 2011], which is built on the basis of a known linear algebraic object – a matrix. This matrix is written in the form of a rectangular table of field elements (for example, integers, or actual or complex numbers) and is a combination of lines and columns, with its elements located on the cross points. The number of lines and columns sets the size of the matrix. It is known that in the training process the students' volume of knowledge and skills increases. The number of tasks they solve also increases. The application of matrices is one of the directions taken for educational optimization in pedagogic research [Fedotova 2014]. For example, a matrix model was used to describe knowledge transformation in students' educational process It allows a knowledge vector to be calculated after a teaching period by using a previously- known knowledge vector [Komlev, Zhukov, Mizonov 2006].

Training matrix technology of was used. Training under rectangular matrices was conducted by using the triad principle “knowledge – ability – skill”, which sets out the tempo of the movements and the force of an adversary's resistance. In our case the rectangular training matrix is a structuralized enumeration of the fulfillment tempo and the resistance force of the partner (*Uke*). This enumeration contains knowledge, abilities and skills. Knowledge (space indicator), ability (space and tempo-rhythm indicator), and skill (space, tempo-rhythm and power indicators of movements) are built on the base of the rectangular matrix methodic of optimal training by depth of training.

The training in judo techniques (*O Soto Otoshi*, *De Ashi Barai*, *Tai Otoshi*) was conducted in the following methodic sequence:

1. Low tempo movement was set: 2 throws without resistance from the partner were completed executed (muscles) and finally with full resistance (using arm, leg and back muscles).

2. When the first practitioner was resting their partner undertook the same low tempo movement.

3. Average tempo movement was set: 3 throws without resistance from the partner were executed in turn, then with partial resistance (using leg and back muscles) and finally with full resistance using arm leg and back muscles).

4. When the first practitioner was resting their partner undertook the same low tempo movement.

5. High tempo movement was set: 2 throws without resistance from the partner were executed in turn, then with partial resistance (using leg and back muscles) and finally full using arm leg and back muscles).

6. When the first practitioner was resting their partner undertook the same low tempo movement.

By such a methodic initial training in three judo techniques was realized (see fig. 1).

We first started training in the *O Soto Otoshi* technique. Mastering the technique was organized by informational-matrix training technology, the sense of which is mastering in turn the following: knowledge (space indicator), ability (space and tempo-rhythm indicator) and skill (space, tempo-rhythm and power indicators of movements) (see fig. 1).

After this the partners started to master other blocks of motion using analogous systems. The method for mastering the two other throws is the same.

The generally accepted methodic techniques and training in their combinations in martial arts (judo, free-style wrestling, Greco-Rome wrestling and *sambo*) implies that a certain number of full repetitions of the first technique is trained fully followed by the same for the second technique. At the next training session the combination is fully trained. The number of repetitions incorporating the mastery of the combination with resistance, *O Soto Otoshi – O Goshi* (where *O Soto Otoshi* is the simulation of a throw and the athlete throws his partner with the *O Goshi* technique) is, according to our data, 500+500+500=1500 repetitions. In our research we offer respectively: 21 + 21 + 21 = 63 repetitions per matrix.

We used statistical methods to determine the qualitative and quantitative indicators for the results obtained by the research (X mean, t, p, s).

Results

The structure of mastering techniques by sports practitioners should envisage the application of the didactic laws of the training process [Arziutov 1998]:

1. The important inner connection between training phenomena;

2. Probable order of training phenomena, which has not achieved the level of a law;

3. Main initial principles of training, which determine the orientation of the training process and the coach's role in it;

4. Some requirements, which determine the character of both the coach and the practitioner's role and result in the realisation of principles.

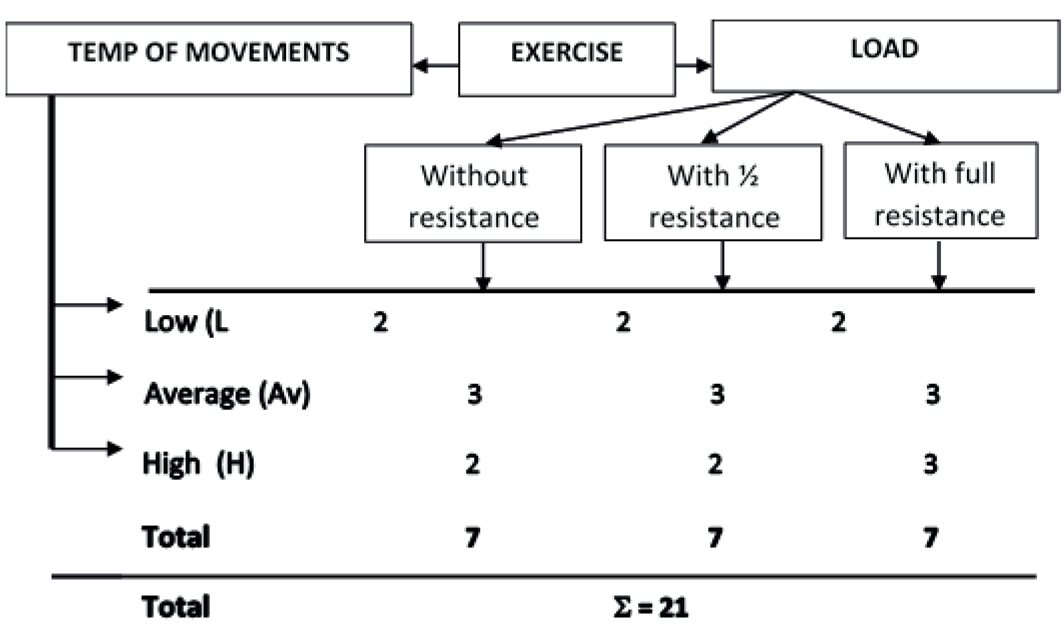

Fig. 1. Methodic techniques of mastering motor experience when training judo throws [Arziutov, 1998]: Notes: Σ –sum.

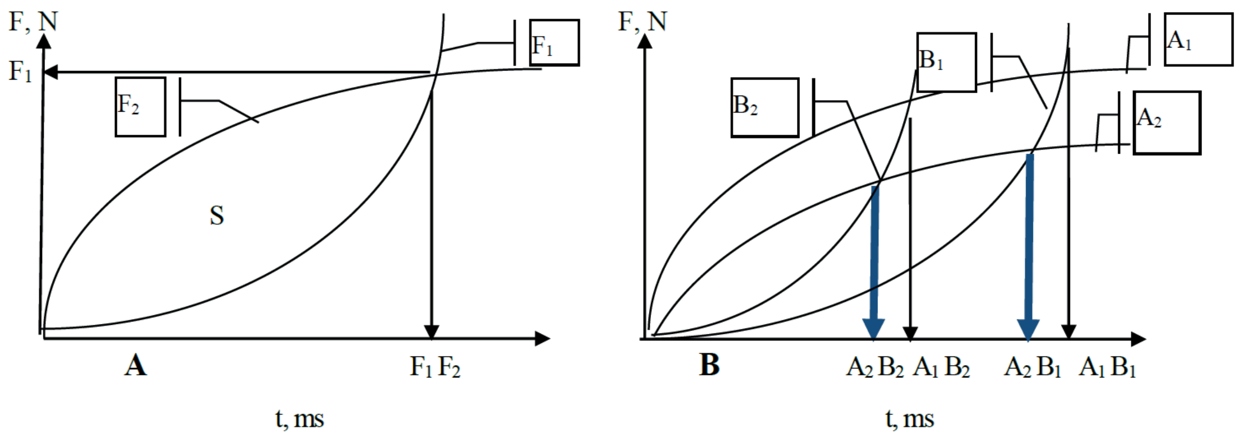

Fig. 2. Fulfillment of a counter attack against one opponent (variant A), against two opponents with different skills (variant B) [Arziutov 1998, 2011]:
t – time of throw fulfillment, ms;
F – force of opponent's resistance, N;
F_1 – force of sports practitioner's throw;
F_2 – strength, manifested by the opponent in resistance;
F_1 F_2 – point of opponent's losing support;
S – zone of stability;
A_1A_2 – resistance force of opponents with different level of speed-power fitness;
B_1B_2 – force of throw of sports practitioner with different level of speed-power fitness.

Didactic laws can be interpreted as a set of rules, which are the basis of the sports practitioner's training in motor actions. In this respect it is convenient to build a didactic model, for the optimization of the training process. Separate elements of this can be functionally interdependent. In this case certain values (functions) meet certain values of arguments.

The proof of such an approach is presented in our previous works, devoted to searching for optimal variants for training in strike movement techniques' in outdoor games [Iermakov 2001]. In respect of our task in our present work such an approach can be the following (using the example of a sports practitioner's counter attack in response to an attack by one opponent (A) by two opponents with different skill levels (B) (see fig. 2):

The next important elements of the training structure are the following principles:

Principles of training: the principle of the singularity of general and special training; the principle of continuity of training process; the cyclic character of the training process.

Methodological principles of sports selection: the principle of singularity of suitability; the principle of the singularity of sports and individual interests diagnostic of the training progress; the principle of consistency and selectivity; the singularity of the selection and education of sportspeople; preliminary preparation for selection; principle of reliability.

Didactic principles: correspondence of training programme in school sport to the age profile of enthusiasts; the principle of purposefulness; the principle of economy.

Principles of building movement: the principle of the multi-structural character of movement; progressive reconstruction of movement.

Principles of the rational use of force: principle of initial force and the addition of maximal force; optimal acceleration; coordination of specific impulses; principle of counter actions (counter movements); principle of conservation of kinetic momentum.

Principles of bio-mechanical waving movement: principle of economy (muscular forces, the holistic character of movement (participation of the whole body)); rhythm (muscular tension and relaxation in the expectation mode); principle of three-phase movement (initial phase, executive phase and damped phase); correct addition of forces (centrifugal transferation of forces).

Main principles of scientific control over generalized fitness: principle of the shortest way; effectiveness of prediction of sports practitioners' sports future; principle of advantage; application of prediction at every stage of training.

Principles of sporst future prediction: principle of the shortest way; principle of minimum training means for achieving maximum competition results.

Principles of brain work: stage-by-stage style of memorising information; principle of active isomorphism; principle of functional ring, principle of comparison; entropy principle; principle of prediction; minimisation of negative afferentation.

Prediction principles: systemic character of predictions; concordance of predictions; variability of predictions; continuity of predictions; verification of predictions; efficiency of predictions.

Principle of functional redundancy in fulfillment the execution of the *Ura Nage* throw is presented below as example (see fig. 3).

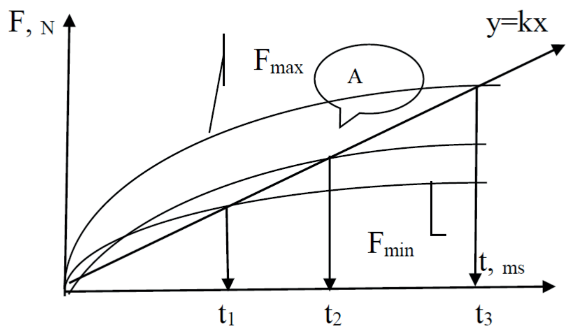

Fig. 3. Demonstration of the principle of functional redundancy in the execution of *Ura Nage* throw [Arziutov 1998, 2011]:
F –force, N;
t – time, ms;
Fmin – minimal force of opponent's resistance;
Fmax – maximal force of opponent's resistance;
y=kx – the law of force increase in the execution of the throw;
A – zone of redundancy and reliability (all ordinates higher y=kx);
t_1 – rising of opponent with minimal resistance;
t_2 – rising of opponent with mean statistic resistance;
t_3 – rising of opponent with maximal resistance.

The following rules are considered to be important elements in the training structure: the construction of training cycles; emergencies; training of skeletal muscles.

Didactic rules: efficiency of training: efficiency in mastering a pre-set volume of knowledge and skills; results of training. Results of training depend on the following: intellectual level; efficiency of mastering knowledge and skills; efficiency of trainees' creative thinking.

Pedagogic rules: efficiency of training; results of learning, strength of memorizing; quantity of repetitions; percentage of the learned material retention; effectiveness of learning material distribution; mental endurance; mental workability.

Cybernetic rules: effectiveness of training; efficiency of training; quality of knowledge; quality of training; effectiveness of management; coach's attitude to trainees.

Organizational rules: effectiveness of training; efficiency of training; results of training.

We have produced a methodical technique for training new motor actions, to demonstrate using didactic equipment. It is interesting to note that when practitioners reach a high degree of fatigue while using this new motor action training system the variability of force differentiation is reduced. This phenomenon can be used as a methodical technique for training and perfection of movements to increase their stability and reliability (see fig. 4).

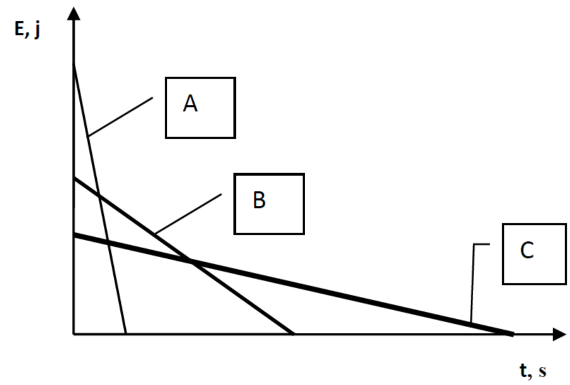

Fig. 4. Methodic technique of training and reinforcement of martial arts techniques depending on energetic level of the executed work [Arziutov 1998, 2011]: E – energy; j; t – time, s; A – the most inefficient method of execution of task (efficiency coefficient <1%) – glycolytic mode; B – the most common mode (efficiency coefficient <50%) – mixed mode; C – the most efficient mode of execution of task(efficiency coefficient >60%) – aerobic glycolytic mode.

In this case we use the principle that optimal control of the function of the central nervous system is considered to be a complex energy-informational criterion of optimality, with sufficient rigid and flexible systems correlation.

The concept of mastering the *Ura Nage* counter attack (mastering the speed-power parameter of movement) is shown in fig. 2B. Development of the didactic structure of the process, in the execution of a *Ura Nage* counter attack is characterised by the following:

Law: increase in efficiency of the execution of the throw;

Regularity: wrestlers with different speed-power fitness demonstrate different times for the opponent's separation from the mat;

Principle: functional redundancy and reliability (zone of efficient throws is located above the line of tension, manifested by practitioner in the execution of the throw);

Rule: when executing the technique, it is necessary to prevent the opponent's counter attack.

Thus, we show the potential of the didactic apparatus to describe the different facets of the studied problem.

The "informational-matrix technology of training" offered by us [Arziutov 1998, 2011] differs from those already known in pedagogy [Fedotova 2014] and includes two elements: informational provisioning of the process; method of executing the trained martial art technique, described in the matrix of training. The matrix of motor experience gain worked out by us (in the form of table 1) consists of lines (setting resistance level) and columns (setting the tempo of movement). The essence of the method is that for every degree of resistance 7 throws are f executed. With this system 2 throws are assigned low and high tempo movement and 3 throws an average. Then, using the training matrix we go to abilities, skills

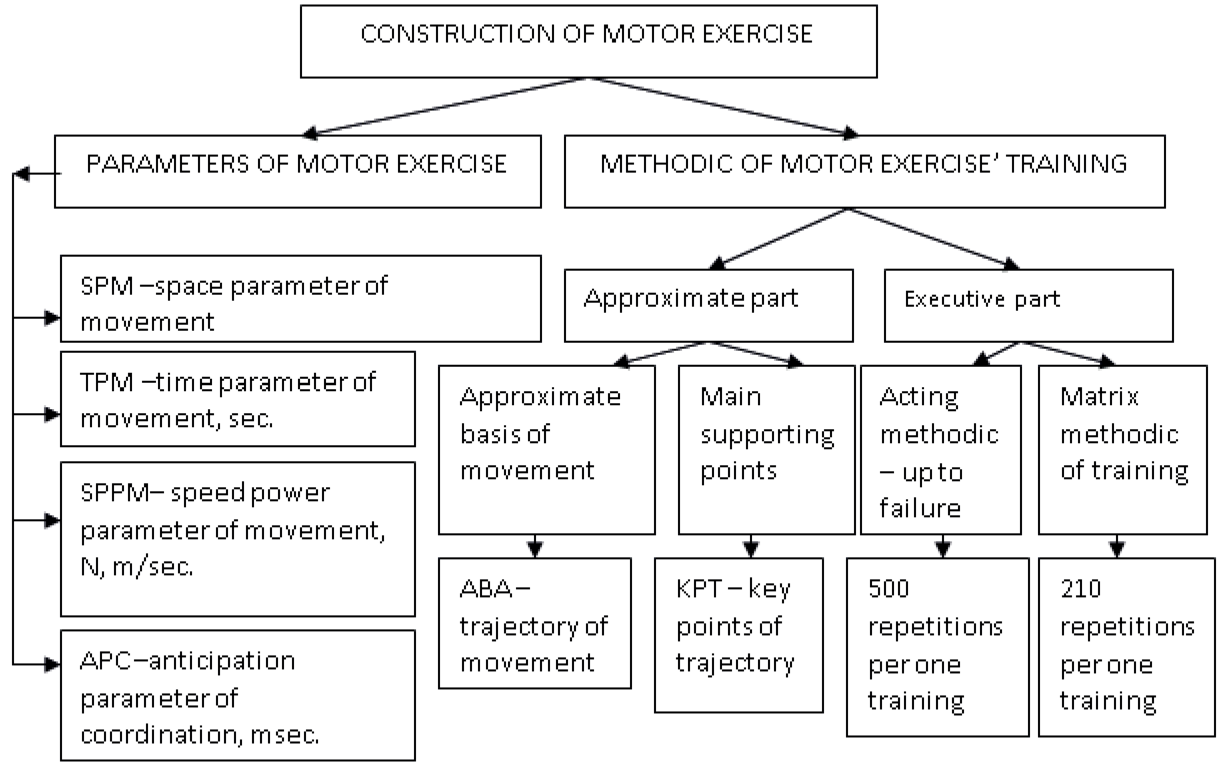

Fig. 5. Schema of the constructionof motor exercises in martial arts [Arziutov 1998].

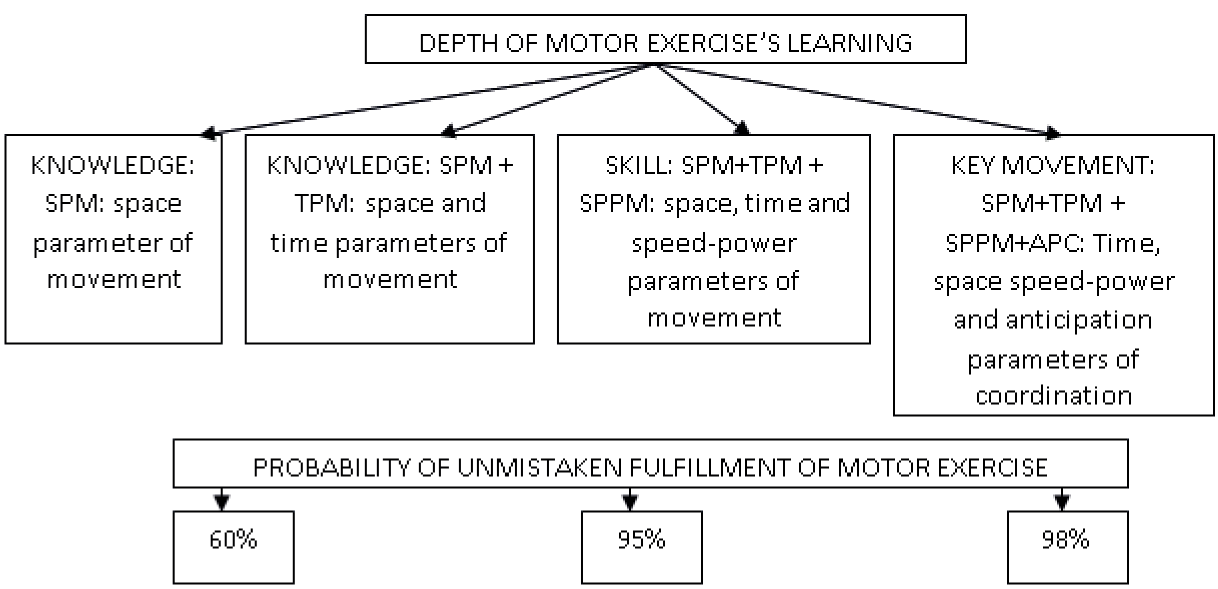

Fig. 6. Depth of motor exercise training [Arziutov 1998].

and knowledge. For elite sports people degree of resistance and tempo of movement will have other values in this rectangular matrix [Komlev *et al.* 2006].

Research on the effectiveness of matrix usage resulted in the following data.

Construction of motor exercises in compliance with the theory of training is shown in fig. 4. Objects of concentration of attention in the fulfillment of actions are presented in the form of main supporting points (MSP). Their combination forms an approximate basis of actions (ABA) [Bernshtejn 1947].

All training cycles depend on the number of hours allocated for mastering the motor exercise. This time determines the depth of motor exercise learning, which meets its required outcome.

In our previous researches we showed the technology for mastering motor exercises depended on its parameters to accelerate the training process we used the informational-matrix technology of training, with the help of matrices of repetitions in the elements of the training techniques [Iermakov *et al.* 2016].

Table 1. Technology of training in motor exercise depending on its parameters

№	Depth of learning the action		Parameter of movement		Number of repetitions (amount of training)		Successful execution of the action
1	KNOWLEDGE	→	SPM	→	Up to 300 repetitions	→	5%
2	ABILITIES	→	APM+TPM	→	Up to 1000-1200 repetitions (25-30 training sessions)	→	50%
3	SKILL	→	SPM + TPM + SPPM	→	Up to 5000-6000 repetitions (100-120 training session)	→	95%
4	KEY FULFILLMENT OF TECHNIQUE	→	SPM + TPM + SPPM + APC	→	Up to 120 000 repetitions (10 years of training)	→	98%

Notes: SPM –space parameter of movement; TPM – time parameter of movement; SPPM – speed power parameter of movement; APC – anticipation parameter of coordination.

Table 2. Calculation of number of executed motor actions (repetitions)

1). By traditional training methodic – up to failure (CG, n=30)					
O Soto Otoshi	+	Ura Nage	=	Combination of techniques Ura Nage against O Soto Otoshi	S, repetitions
500		500		500	1500
2). By informational-matrix training technology (EG, n=30), (3÷8) cycles					
O Soto Otoshi	+	Ura Nage	=	Combination of techniques: Ura Nage against O Soto Otoshi	S, repetitions
21		21		21	63

Notes: Σ – sum.

Table 3. Results of experts' assessment of mastery of Judo techniques after experiment

Student's number	**Student's number**	**De Ashi Barai**		**O Soto Otoshi**		**Tai Otoshi**	
CG	**EG**	**CG**	**EG**	**CG**	**EG**	**CG**	**EG**
1	1	3	10	7	10	7	10
2	2	5	7	7	10	3	10
3	3	5	10	7	10	7	10
4	4	3	10	7	10	7	10
5	5	3	10	7	10	7	7
6	6	5	7	7	7	7	7
7	7	5	10	7	10	3	7
8	8	3	10	7	7	7	10
…	…						
30	30	3	10	7	10	5	10
Mean value	X	3.6	9.1	6.4	9.1	5.8	9.25
Error	m	0.08	0.26	0.33	0.32	0.39	0.29
Standard deviation	σ	3.77	1.18	1.47	1.41	1.77	1.33
Quantity of students	n	30	30	30	30	30	30
t – criterion of Student	t	15.7			5.87		7.18
Probability	P	≤ 0.001			≤ 0.001		≤ 0.001

Notes: CG – control group; EG – experimental group.

Such an approach allowed us to find optimal training parameters: depth of learning the movement; number of repetitions (amount of training); successfulness of the execution of the action (see table 1).

Calculation of the number of motor actions, fulfilled in compliance with standard methods and with information-matrix training technology is give in table 2.

From table 2 it follows that with the application of our method the number of repetitions during 3-8 cycles is 189-504.

Below, the results of the statistic processing of the results obtained are presented (see table 3).

The methodic sequence of Judo technique training (*O Soto Otoshi, De Ashi Barai, Tai Otoshi*) is shown in sufficient detail in our previous research [Iermakov, Arziutov, Jagiello 2016: 19-20]. The time taken to master a technique up to 80% "ability" level, for students with high potential was 3 cycles. For students with average potential it was 8 cycles. Accordingly the number of exercise repetitions was 189 and 504. With such an approach mastering mastery of martial arts techniques using the suggested method shortens training time by between 2.97 and 7.96 times.

Discussion

The formation of motor skills is accompanied by the need to fulfill the main didactic rules of the training process. By considering sports practitioners’ individual features while training Judo techniques and by determining their aptitude for certain movements it can be assumed that the formation of motor skills can be accelerated. The results of our previous researches prove this.

In other research a demand for the substantiation of the assessment criteria for training quickness of complex coordination is noted. The authors stressed the qualitative and quantitative criteria for quickness of training complex coordination by indicators of training tempo in terms of operative, current and stage-by stage control. This allows the training process to be individualised. With this they note the point of flawless physical quality control in terms of a substantive assessment of the practitioner’s qualitative and quantitative condition in specific training conditions [Zaporozhanov *et al*. 2015].

In sports-pedagogic practice the objective assessment of trainees’ potential is regarded as one of the most important problems even at the initial stages of long-term training [Zaporozhanov *et al*. 2015]. Its main peculiarity is the technocratic paradigm, at the root of such an approach: man (his body and psych) is regarded as certain, meant for the solution of tasks, connected with one or other kinds of sport. The main target, in this case, is to scientifically substantiate ways, means and methods of realizing people’s sports ambition and, through sport realize humanistic principles and ideals [Bernshtejn 1947]. The correctness of our approach is confirmed by research in other sports. It is noted that the formation of steady motor skills is influenced by certain conditions for the execution of exercises. These sportspeople’s motor potential. In addition these conditions must ensure opportunities for control over the execution of exercises (exercises to perfect skills), which is likely to result in desirable competition results. Of not less importance is the application of adequate fighting styles in Judo [Adam *et al*. 2015], the working out of models to improve young sports practitioners’ health [Pujszo *et al*. 2013] and establishing to predict sporting success [Iermakov *et al*. 2016].

Such approaches to training raise the problem of statistically significant levels of motor skills, under the influence of physical exercise. For example, to develop special endurance practitioners should execute particular exercises: throws of the partner at maximum intensity (8-9 throws per 10 sec.); execution of 5 series, consisting of 5 spurts (maximum number of throws per 10 sec.) and execution of throws at moderate tempo (4-5 throws per 10 sec); training fights; fights with four participants (the fight lasts up to passing in lying position or up to a throw) [Alekseev *et al*. 2014]. In this respect it is very important to determine the specific features in the formation of motor skills and substantiation of the number of exercise repetitions at one attempt and the number of attempts. This has also been shown in other research [Ivashchenko, Yermakova 2015; Podrigalo *et al*. 2016]. The authors show ways to determine the optimal correlation of the number of attempts, the number of repetitions in one attempt, and rest intervals. This fact is well correlated with the results we obtained and proves our hypothesis. In our previous research we substantiated the optimal correlation of physical exercise repetitions the number of exercise series [Khudolii, Iermakov, Prusik 2015; Bliznevsky *et al*. 2016].

Thus, we can say that it is possible to accelerate training in Judo techniques, by considering sports practitioners’ potential and on the basis of objective assessment criteria for motor actions. Besides this, we can also state the following:

- we have significantly expanded the scientific concept of the theory of motor action training;
- the concept of depth of motor action training, depending on the number of exercise repetitions, has been supplemented;
- in our opinion, a reduction in complex technique training periods on the base of informational-matrix technologies, is quite a novelty.

Conclusions

The constructive character of our theory implies the possibility of verifying its main principles and laws, fulfilled by definite rules. All approaches in our research were based on the fact that one of the main factors in perfect training processes is the consideration of didactic training laws; the sports practitioner’s individual features and fighting style. It is also important to consider the optimal correlation of physical loads and rest intervals.

When mastering judo technique it is necessary to range all three movement indicators: space, time and speed-power. The space indicator plays a leading role just it is most important in our case; other indicators are in the background but come to the fore depending on the degree of deviation from the programme. With the critical value of the student’s t-criterion it becomes evident that the applied informational-matrix training technology confidently ($p \leq 0.001$) improves the speed of mastering judo techniques.

The model of students’ informational-matrix training is built on the foundation of a general theory of motor action training and is based on the main didactic definitions: MSP (main supporting points) and ABA (approximate basis of actions – movement trajectory). When the required knowledge and a full view are formed at each MSP, they become the key points of the trajectory (KPT), and the practical execution of the whole action based on full assimilation of the basis of actions (ABA) becomes possible.

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Prawa dydaktyczne w treningu ćwiczeń fizycznych techniki w judo

Słowa kluczowe: judo, dydaktyka, ćwiczenia fizyczne, umiejętności, zdolności

Abstrakt

Cel. Optymalizacja treningu techniki ćwiczeń fizycznych w judo na podstawie praw dydaktycznych i matrycy informacyjnej modelu technologii szkolenia, stworzonej do treningu zdolności motorycznych sportowców.

Metody. W badaniach uczestniczyły dwie grupy studentów: grupa eksperymentalna (chłopcy, w wieku 18-20, n = 30) oraz grupa kontrolna (chłopcy, w wieku 18-20, n = 30). Wszystkie wymagane procedury weryfikacji jednorodności grup zostały przeprowadzone ($p < 0,05$). Eksperyment odbył się w latach 2010-2014. Użyto metod statystycznych dla określenia jakościowych i ilościowych wskaźników otrzymanych wyników badań (średnia X, t, p, s).

Wyniki. Uzasadniono stosowanie praw dydaktycznych w treningu technik *judo*. Podkreślone zostało odpowiednie wykorzystanie elementów konstrukcyjnych przy wyznaczaniu celów szkolenia w ćwiczeniach fizycznych. Przedstawiona została zasada redundancji funkcjonalnej i niezawodności w wykonywaniu rzutu *Ura Nage,* a także możliwość zastosowania praw dydaktycznych w treningu na przykładzie kontrataku. Zauważono także, że przy wysokim stopniu zmęczenia zmienność różnicowania się wysiłku zostaje zmniejszona. Zjawisko to jest zalecane do stosowania, jako technika metodyczna w treningu i doskonaleniu ruchów w celu zwiększenia ich stabilności i wiarygodności. Autorzy stwierdzili stopień opanowania ćwiczeń motorycznych, które spełniły bezwarunkowo swoje zadanie. Ustalona została minimalna ilość ćwiczeń i cykli powtórzeń wymaganych by osiągnąć sprawność na poziomie 80% (189-504 powtórzeń i 3-8 cykli). Takie podejście do opanowania technik sztuk walki oszczędza czas treningu od 2,97 do 7,96 razy.

Wnioski. Jednym z głównych czynników procesu szkolenia doskonałości sportowej jest uwzględnienie przepisów dydaktycznych, indywidualnych cech sportowca i jego indywidualnego stylu. Ważne jest, aby uzasadnić optymalną korelację obciążeń fizycznych i przerw na odpoczynek dla sportowców.