ORIGINAL ARTICLE

Quick training of students to judo techniques

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Manuscript Preparation
E Funds Collection

Sergii Sidorovich Iermakov[1ABCD], Gennadii Nikolaevich Arziutov[2ABCD], Władysław Jagiełło[3ACDE]

[1]Kharkiv National Pedagogical University, Kharkiv, Ukraine
[2]National Pedagogical Dragomanov University, Kyiv, Ukraine
[3]Gdansk University of Physical Education and Sports, Faculty of Physical Education, Gdansk, Poland

Received: 17 November 2015; **Accepted:** 21 December 2015; **Published online:** 12 January 2016

AoBID: 10843

Abstract

Background & Study Aim: Main didactic principles of training to martial arts (combat sports) technique on the base of theory of optimal training with the help of rectangular matrixes have been elucidated. In this didactic system two approaches are used: profound training and training with the help of main principles motor action's construction. The purpose of the research is theoretical-scientific substantiation, working out and experimental verification of informational-matrix technology of students' training to motor experience.

Material & Methods: In the research two groups of students participated: experimental (n=30) and control (n=30). All required procedures for verification of groups' uniformity have been conducted ($p<0.05$). Experiment lasted during period from 2010 to 2014. We used statistical methods for determination of qualitative and quantitative indicators of the received results of the research (X mean, t, p, s). Matrix technology of training was used. Training by rectangular matrixes was conducted by triad principle "knowledge – ability – skill", which set dozing of movements' temp and forces of adversary's resistance.

Results: In existing methodic of training and mastering of judo technique main part of training session includes realization of technique up to full physical and psychic fatigue ("to failure"). In this case sportsman fulfils technical element up to full fatigue (in martial arts it is 500 repetitions of exercise 10 series with 50 repetitions in each). In case of two technical elements' combination sportsman fulfils 1500 repetitions of exercise. We offer approach to training of judo technical element with the help of rectangular matrix of repetitions with regulated partner's resistance and temp of exercise's fulfilment. In our case sportsman fulfils only 630 repetitions of exercise; respectively 10 series, 21 repetitions in each. On example of judo we elucidate mechanism and structure of martial arts training didactic system as per informational-matrix technologies (rectangular training matrixes). Basing on motor actions' rectangular matrix methodic of optimal training by profoundness is built: knowledge (space indicator), ability (space and temp-rhythm indicator), and skill (space, temp-rhythm and power indicators of movements).

Conclusions: Application of the offered theory of optimal training by rectangular matrix permits to shorten time at initial stage of martial arts technique's mastering 2.38 times. It is recommended to use the worked out structure of optimal training model with the help of rectangular matrix in martial arts training process.

Key words: combat sport • didactic system • "knowledge – ability – skill" • martial arts

Conflict of interest: Authors have declared that no competing interest exists

Ethical approval: The study was approved by the local Committee for Scientific Study Ethics

Provenance & peer review: Not commissioned; externally peer reviewed

Source of support: Departmental sources

Author's address: Iermakov Sergii Sidorovich; Kharkiv National Pedagogical University, Kharkiv, Ukraine; email: sportart@gmail.com

Abilities (motor abilities) – Stable, enduring traits that, for the most part, are genetically determined and that underlie a person's skill in a variety of tasks. People differ with respect to their patterns of strong and weak abilities, resulting in differences in their levels of skill [30].

Skill – The underlying potential for performance in a given task, which changes with practice experience, and a host of situational and environmental factors [30].

Tori and Uke – tori, the person who applies a technique in *judo* training. The receiver of the technique is referred to as uke [67].

Kumite – a judo standing technique performed by grabbing the opponent's jacket or body part(s) with one or both hands before initiating an attack [35].

Laterality – the tendency to use preferentially the organs (hand, foot, ear, eye) of the same side in voluntary motor acts.

The Delphi method (Delphi technique) – a method of group decision-making and forecasting that involves successively collating the judgments of experts [43].

On-demand and uniformed public services – in Poland they consist of professional formations (police, armed forces, border guard, fire service). The characteristic features of these groups are as follows: orders, uniforms, being placed in barracks, restrictions on private and family life, a possibility to receive special perks from the state [57].

On-demand public services – these are social groups in which availability consists in the assumed type of social relationships. They include subordinating some participants of social life to others. The people in charge do not only give orders to those under them, but also they are in a position to enforce these orders or obedience [57].

Introduction

In modern system of higher education formal technologies are implemented in sphere of physical education and sport training. In such system student is only passive participant [1]. It happens because pedagogue cannot formulate motivation, to cultivate students' interest. All trainings are conducted by old patterns; there is no novelty and students' understanding of how these exercises influence on organism [2]. One of training approaches can be usage of elements and special exercises from different kinds of sports. It will permit to form student's healthy life style and ability to independently train certain kind of sports [3, 4].

The most important component of training process is students' training of motor abilities and skills in compliance with general didactic approaches. Such training methodic requires clearly set tasks, development of means and methods for these tasks' solution, determination of laws of this process and specificities of training principles' realization [5-7]. In such case the purpose of training is achieved by mastering of certain motor actions. The latter can be distributed into three groups: sequence of material's delivery, sequence of mastering of material of motor actions' training methodic [8].

Theory of motor actions training, which is a unity of complex of sciences' theoretical principles (pedagogic, physiological, psychological and etc.), is the foundation of our research:

– scientific theory of training, which permits to study and analyse training process in connection with progress of pedagogic science and substantiation of educational process's functioning [9];

– general theory and methodic of physical education;

– researches in pedagogic process of labour, learning and sport functioning [10-12].

In theory and practice of training process usually three stages are specified (initial, profound training, consolidation and further perfection), which differ by tasks and methodic of teaching [13]. The task of teaching is to give knowledge, to work out abilities and form skills. The main purpose is working out of student's correct understanding of sport duels. Training of sport duels (judo) is a pedagogic process, forming student's knowledge, abilities and skills with simultaneous physical development. The content of learning material and training process shall always be directed at solution of certain sport-pedagogic task [14, 15]. Motor action is a mean of solution of certain motor task. If the task is complex and requires solution of more minor motor tasks then the method of its solution has complex structure. Such structure includes appropriate quantity of operations and each of them shall be an object of study [16, 17].

In judo optimization of physical exercises' trainings technique is an important problem. However, as on today there is no single opinion of specialists about training of physical exercises' technique. It is connected with quantity of physical exercise's repetitions in one session and in one week (month, quarter, semester, academic year). All listed above creates problem of reliable optimization of judo training process. In spite of evident urgency of the mentioned problem specialists have not found optimal solution till now.

That is why the purpose of the research is theoretical-scientific substantiation, working out and experimental verification of informational-matrix technology of students' training to motor experience.

Material and methods

For stating experiment we prepared two groups of students: experimental group (EG) (n=30) and control group (CG) (n=30). All required procedures for verification of groups' uniformity have been conducted ($p<0.05$). Experiment lasted during period from 2010 to 2014. We used statistical methods for determination of qualitative and quantitative indicators of the received results of the research (X mean, t, p, s). The content of the study was approved by the local Committee for Scientific Study Ethics.

In experiment we used "informational-matrix methodic" of judo techniques' training [18], which is built on the base of known in linear algebra object – matrix [19]. This matrix is written in the form of rectangular table of field' elements (for example, integers, actual or complex numbers) and is a combination of lines and columns, on crosses of which its elements locate. Quantity of lines and columns set the size of

matrix [19]. It is known that in process of training the students' volume of knowledge and skills increase. The quantity of tasks, solved by them, also increases. Application of matrixes is one of directions of education optimization in pedagogic researches [20, 21]. For example, for describing of knowledge transformation in students' educational process, matrix model was offered. It permits to calculate knowledge vector after teaching period by already known knowledge vector [22].

The offered by us "informational-matrix training technology" differs from already known in pedagogic [20-22] and includes two elements: informational provisioning of process; methodic of fulfilment of martial art technique, described in matrix. The worked out by us matrix of motor experience mastering consists of lines (setting degree of resistance) and columns (setting the temp of movements). The sense of the methodic is that for every degree of resistance 7 throws are fulfilled. With it for low and high movements' temp 2 throws are assigned, for average: 3 throws (Table 1). Then, through training matrix we move to knowledge, abilities and skills. For elite sportsmen degree of resistance and temp of movements will have other values in rectangular matrix [18].

Table 1. Methodic of motor experience mastering when training judo throws

Temp of movements	Exercise		
	Load		
	without resistance	with ½ resistance	with full resistance
Low (L)	2	2	2
Average (Av)	3	3	3
High (H)	2	2	2
Total	7	7	7

Matrix technology of training was used. Training by rectangular matrixes was conducted by triad principle "knowledge – ability – skill", which set dozing of movements' temp and forces of adversary's resistance. In our case rectangular training matrix is a structuralized enumeration of temp of fulfilment and resistance force of partner (*uke*). This enumeration contains knowledge, abilities and skills. On the base of rectangular matrix methodic of optimal training by profoundness of training is built: knowledge (space indicator), ability (space and temp-rhythm indicator), and skill (space, temp-rhythm and power indicators of movements).

Results

The theory of sports' future prognostication and its conceptual apparatus are regarded by us as a form of organization of scientific research: formation of hypothesis and its transformation in theory; origin of problem as results of scientific research's completion and application of the obtained knowledge. The main conceptions of prognostication theory are the set of procedures and results [5, 8, 9]. Apparatus of scientific prognostication contains:

1. Forecast is a form of qualitative expression of future phenomenon. It is based on knowledge (problematic, hypothetic, knowledge in the form of laws).

2. Prognostication is the form of qualitative expression of future phenomenon.

3. Planning is the process, which envisages fulfilment of real action for achievement of expected result.

4. Simulation is a form of forecasting, which creates conditions of one plan's transition to the other.

5. Anticipation – instant form of forecasting of the coming event. It is the highest form of control of human motor functioning.

Therefore, for prognostication (qualitative determination of event's indicators) it is necessary to realize forecast (qualitative determination of probability of the event itself). The procedure of forecasting is fully expressed in theory of sportsmen's stage by stage training [3, 4]. Forecasting occurs when "reasonable" grounds are present. We have developed structure of forecasting grounding depending on kind of knowledge, involved in forecasting grounds [1, 3]. The structure of forecasting grounding includes four main components (listed in order of grounds' strength weakening): law, regularity, principle (principal statement) and rule. Every component is a member of structure of educational process's didactic.

Let us regard all elements of educational process's didactic turn by turn.

Laws, regularities

Knowing of laws states in phenomena invariance as a property of any characteristic to remain

unchangeable under any (within definite system) changes (transformations). Especially clear it can be seen when analysing those laws, which can be described by mathematic function. As it is known functional dependence is a connection of any values, if certain values (called arguments) are corresponded to by strictly determined other values (functions). General biological law of optimality says: degree of interaction inside and between systems shall be optimal [23].

The process of motor skills' formation is based on law of differentiation. Training of differentiated inhibition facilitates removal of muscular extra contractions and quick manifestation of motor skill. For effective manifestation of law of differentiation it is necessary to maximally relax large muscular groups of a sportsman.

With holistic fulfilment of motor act and absence of possibility to differentiate movements by separate indicators, control of the movement is realized by leading for the sportsman indicator. With it, we can observe the following: the closer are connections by three indicators (space, time and strength), the higher coordination the sportsman has.

Principles

The offered training technology includes the following principles: trainings; methodological principles of sport selection; didactic; building of movements; rational application of forces; biomechanical waving movements; scientific control of generalized fitness; prognostication of sport future; brain's functioning; prognostication [5, 9, 13].

Rules

Rules on movements' building at training stages are as follows: 1. Rule of subordination; 2. Rule of autonomy; 3. Rule of synergy; 4. Rule of antagonism; 5. Rule of correlation; 6. Rule of "shoulder girdle position". When fulfilling sport exercises two rules are marked out:

1. **Rule of "diversity of single"** means great number of sides, specificities and opportunities in fulfilment of main task;

2. **Rule of unity of heterogeneous** means purposefulness and mutual assistance of great number of different movements (significant and minor), combined for fulfilment of main task in long lasted training.

This chapter includes also other rules: didactic; pedagogic; cybernetic; organizational.

As example of didactic apparatus's usage we supply methodic technique of training to new motor actions. For training to new motor actions the following fact is interesting: when high degree of fatigue is achieved variability of differentiation of force reduces. This phenomenon can be used as methodic technique for training and perfection of movements for rising their stability and reliability. In this case we use quite new principle that processes of optimal control of central nervous system's (CNS) functioning shall be regarded from the point of view of complex energy-informational optimality criterion (adequate correlation of rigid and flexible systems). Thus, usage of didactic apparatus permits to fulfil analysis of different sides of students' complex motor skills and abilities. As a result of study of rectangular matrixes effectiveness at initial formation of experimental group students' motor experience we received the following:

Training of judo techniques (*o soto otoshi*, *de ashi barai*, *tai otoshi*) were conducted in the following methodic sequence:

1. Low movement's temp was set: 2 throws without partner's resistance were fulfilled in turn, then – with half of resistance (by legs' and back's muscles) and then – with full resistance (by arms' legs and back's muscles).

2. When sportsman, who fist fulfilled the movement had rest, his partner fulfilled the same movement with low temp.

3. Average movement's temp was set: 3 throws without partner's resistance were fulfilled in turn, then – with half of resistance (by legs' and back's muscles) and then – with full resistance (by arms' legs and back's muscles).

4. When sportsman, who fist fulfilled the movement had rest, his partner fulfilled the same movement with low temp.

5. High movement's temp was set: 2 throws without partner's resistance were fulfilled in turn, then – with half of resistance (by legs' and back's muscles) and then – with full resistance (by arms' legs and back's muscles).

6. When sportsman, who fist fulfilled the movement had rest, his partner fulfilled the same movement with low temp.

By such methodic initial training of three judo techniques was realized (Table 1).

First we start training of *o soto otoshi* technique. Mastering of the technique was organized by informational-matrix training technology, the sense of which is turn by turn mastering of the following: knowledge (space indicator), ability (space and temp-rhythm indicator) and skill (space, temp-rhythm and power indicators of movements) (Table 1).

After it, partners start mastering of this block in motion by analogous schema.

Methodic of mastering of other two throws is the same.

Generally accepted methodic of techniques and their combinations' training in martial arts (judo, free style wrestling, Greco-Rome wrestling and sambo) implies certain quantity of first technique repetitions completely and then – of second technique – also completely. At next training combination is trained completely. Quantity of repetitions with mastering of combination for resistance *o soto otoshi – o goshi* (where *o soto otoshi* – simulation of throw and athletes throws his partner with technique *o goshi*) is, by our data, 500+500+500=1500 repetitions. In our research we offer respectively: 21 + 21 + 21 = 63 repetitions for one matrix. For determination of matrixes' quantity (we called them "cycles of repetitions") we conducted pedagogic experiment, which permitted to find quantity of cycles for students with different coordination ($p<0.05$):

– for high coordination: 3cycles;

– for low coordination: 8 cycles.

Thus, total quantity of throws' repetitions by our methodic is:

{(S= 63 repetitions) × [(3÷8) cycles]} = 189_3 and 504_8 repetitions (i.e. 189 repetitions for students with high coordination and 504 for students with low coordination). With it initial training of techniques was conducted up to 80% of skilled level (assessed by experts). Saving of time for training techniques up to 80% of skilled level:

$1500/189_3$ = 7.96 times (maximum);

$1500/504_8$ = 2,97 times (minimum).

Thus, mastering of martial arts techniques as per the offered methodic saves training time: from 2.97 to 7.96 times.

Building of motor exercise by training theory [2, 5] consists of two parts. One part describes indicators of motor exercise (space, time, speed-power, anticipation). The second part describes methodic of motor exercise's training. In its turn, motor exercise's training methodic consists of three parts: orientation, executive and control-correcting. Objects, requiring sportsman's attention in fulfilment of action are called main anchor points (MAP). Their combination, which composes program of actions, is called orientation basis of actions (OBA) [24].

Orientation basis of actions (OBA) is full only, when it contains necessary and sufficient information. Criterion of necessity and sufficiency envisages formation of moor action's image by every of main anchor points (MAP). In this period fulfilment of motor action is influenced by different unfavourable factors: conditions of fulfilment, long pauses between exercises and so on.

Motor abilities are of high didactic value, because their formation requires from student the following: Active participation in training process; teach to analyse the sense of the set tasks and conditions of fulfilment; control over own mental, sense and motor functioning.

Characteristics of skill's appearance: automatic character of movements, variability of skill, stability. The formed and sufficiently consolidated in practice skills do not disappear even with long pauses in their application. Ion many years' process of physical education training of different motor actions is constant. One of them are formed at level of abilities, other – as skills, third (reconstructing many times) acquire features of abilities and skills. Regarding mastering process of any separate motor action it would be correct to speak about relatively completed training cycle. All training cycle depends on quantity of hours, assigned by curriculum for mastering of motor exercises. This time determines profoundness of mastering of motor exercise, which would meet its confidently unmistaken fulfilment.

Table 2. Results of planning of time shortening in judo technique' training in forming experiment

Traditional training methodic – up to failure CG (n=30)												
						September						
NL	1	2	3	4	5	6	7	8	9	10	11	12
NE	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
						October						
NL	13	14	15	16	17	18	19	20	21	22	23	24
NE	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24
						November						
NL	25	26	27	28	29	30	31	32	33	34	35	36
NE	T25	T26	T27	T28	T29	T30	T31	T32	T33	T34	T35	T36
						December						
NL	37	38	39	40	41	42	43	44	45	46	47	48
NE	T37	T38	T39	T40	T41	T42	T43	T44	T45	T46	T47	T48
Informational-matrix training technology EG (n=30)												
						September						
NL	1	2	3	4	5	6	7	8	9	10	11	12
NE	T1/12	T2/11	T3/10	T4/9	T5/8	T6/7	T7/6	T8/5	T9/4	T10/3	T11/2	T12/1
						October						
NL	13	14	15	16	17	18	19	20	21	22	23	24
NE	T13/24	T14/23	T15/22	T16/21	T17/20	T18/19	T19/18	T20/17	T21/16	T22/15	T23/14	T24/13

Where: NL – numbers of trainings; NE – numbers of tasks at trainings; T1-T48 – tasks for mastering of training material

In training theory [5, 13, 25-27] technology of motor exercise's mastering, depending on its indicators, is worked out rather sufficiently. For acceleration of training process we use informational-matrix training technology with usage of rectangular matrixes of repetitions for mastering of techniques' elements.

Below we supply results of planning of time shortening in judo technique' training in forming experiment (first semester of academic year) for control (CG) and experimental (EG) groups (Table 2).

1. Traditional training methodic – up to failure (CG).

2. Informational-matrix training technology with usage of optimal mastering of moor exercises by rectangular matrixes (EG).

In Table 3 we provide calculation of quantity of fulfilled by standard methodic and by informational-matrix training technology motor actions.

As we see by traditional training methodic – "up to failure of throws execution" control group students fulfilled 1500 repetitions for mastering of combination up to 80% of skilfulness.

Experimental group student fulfilled 63 repetitions for one cycle of matrix. For student with good coordination in judo 3 cycles were enough, that was 63 × 3 = 189 repetitions (1500/189=7.93 times quicker). For students with poor coordination in judo 8 cycles of matrix were enough that was 63 × 8 = 504 repetitions (1500/504=2.97 times quicker).

Saving of time for profound mastering of techniques up to 80% of skilfulness was as follows:

$1500 : 189_3$ = 7. 93 times (maximum);

$1500: 504_8$ = 2,97 times (minimum).

Thus, mastering of judo techniques by informational-matrix training technology saves training time from 2.97 to 7.93 times.

Table 3. Calculation of quantity of executed motor actions

By traditional training methodic – up to failure CG (n=30)				
o soto otoshi	+	*ura nage*	=	combination of techniques *(ura nage against o soto otoshi)*
500 repetitions		500 repetitions		500 repetitions
S = 1500 repetitions				
By informational-matrix training technology EG (n = 30)				
soto otoshi	+	*ura nage*	=	combination of techniques: *(ura nage agains o soto otoshi)*
21 repetitions		21 repetitions		21 repetitions
∑ = 63 repetitions × (3÷8) cycles = 189_3 and 504_8 repetitions				

Table 4. Results of experts' assessment of quality of judo techniques' (throws) mastering after experiment

Statistic indicators		*De ashi barai*		*O soto otoshi*		*Tai otoshi*	
		CG	EG	CG	EG	CG	EG
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
Number of students	n	30	30	30	30	30	30
t – Student	t	15.7		5.87		7.18	
Probability	p	≤0.001		≤0.001		≤0.001	

Below results of statistic processing of the received results are shown (Table 4).

Discussion

From the point of view of motor skill's formation in legs and arms' movements (in context of theory of functioning; mastering of knowledge, formation of actions and conceptions) [28] and considering hereditary tendency to certain movements [1, 3, 7, 10] theoretically we can assume that the process of motor skill's formation will be accelerated. It is connected with the fact that on the base of already existed (though subconsciously motor automaticity) the processes of formation of orientation basis of actions (OBA) will not be hindered by rejection of extra motor coordination. Orientation part will be formed and coordinate with executive part of action quicker and better. Control-correcting part also will be unnecessary or expressed only partially, providing effectiveness of executive part. Therefore, from positions of theory of functioning, knowledge mastering, formation of actions and conceptions [28], the process of motor action's automation is as follows: orientation basis of actions (OBA) and control-correcting part are "collapsed". Executive part remains expressed and developed. And, in our opinion, this process will be as quicker as motor automaticity is better expressed and hereditary conditioned.

Thus, we can state the following:

– we have significantly expanded views on theory of motor actions' training;

– we have supplemented conception of motor actions' profound training, depending on quantity of exercise's repetitions;

– shortening of complex technical actions' training terms on the base of informational-matrix training technology we consider to be quite a novelty.

Our experiment is an example of the use in training of combat sports and martial arts practices and methods of modern pedagogy, physiology, psychology, etc. but also mathematical methods. Although we rely mainly on the Russian science papers, it shows clearly that science is one. Such evidence provide – in our opinion – precisely those works in which so expressively broken down, are artificial language barriers in science, as a consequence of long-term isolation of scholars through the Iron Curtain.

The necessity of overcoming these barriers truly write Barczyński et al. [29]. Our work, in the sense of elementary premises and assumptions, refers directly to well-established in Anglo-Saxon area of sports science concept of motor learning and performance [30].

But we can identify these achievements of sport science specialists – speaking symbolically – the Russian-speaking area, which are just applied among professionals of science of martial other linguistic areas. An example are recent articles of Brazilian experts co-operating with professor Leszek Szmuchrowskim [31, 32], graduate and Ph.D. of the Academy of Physical Education in Warsaw, Poland.

Returning to the essence of our experiment, we emphasize that an important force-limiting the need for adjustments to prepare for competitions are, for example. Amendments of the rules of combats. Empirical evidence of such changes in judo deliver papers: Boguszewski [33] – relationships between the rules and the way of struggle applied by top world male judoists; Kiyoshi et al. [34] – the transformation of technical-tactical behaviours for hand techniques used in attacking; Ito et al. [35, 36] – kumite techniques in judo. While the individualization of training tasks can be combined with laterality factor [37] and many other features that empirically considered to be leading in forecasting successes of combat sports athletes [38-41].

In optimizing the process of training in combat sports, martial arts and extreme sports, importance is gaining the matter of expert method, known as the Delphi method [42, 43]. In combat sports is used during evaluation and validation of training means [31, 32], evaluation of specific abilities to practice judo [44], classification of judo motor skills [45].

In the field of self-defence art (strongly associated with martial arts) are used while specific motor simulation tests [38, 46, 47] and also associated with the combat tests type of hand-to-hand fights [48]. Similarly, in the field of safe fall. From evaluate the susceptibility to injuries during the fall [49, 50] through education for checking the effects of adaptation [51, 52], including forcing fall by an external force using a special rotating training simulator [53, 54]. Cognitively most valuable are the results of the control body while forcing by an external force fall in extreme conditions [55, 56].

Motor stimulation methods are increasingly being used in the preparation on-demand and uniformed public services and on-demand public services [57]. It should be expected more and more important recommendations from research conducted by specialists science of martial arts [58-65]. The reports of research far outweigh well-documented effects of training. Much less is works whose authors examine ways and means of achieving training goals. Particularly important are the works on the methodology of measurement, documentation and programming optimal training workload [66]. Health – not the sport result – is in fact the supreme value.

Conclusions

Control of movements in interconnection with environment is one of the most complex functions of nervous system, involving its different levels. At every level a lot of nervous formations function and they send impulses of different frequency to working muscle groups. From supreme brain's levels signals come to definite muscles and control their "re-switching" by different frequency. At every re-switching stage correction of signals is possible due to feedbacks by muscles' contraction, especially if deviation from previously formed motor program happens.

When mastering judo technique it is necessary to range all three movement's indicators: space, time and speed-power. With it space indicator plays leading role – just it is the most important in our case; other indicators are the background and come to first place depending on degree of deviation from the program.

The model of informational-matrix students' training is built on the base of general theory motor actions' training and is based on main

didactic definitions: MAP (main anchor points) and OBA (orientation base of action – movement's trajectory).

When required knowledge and full view are formed at each MAP, they become key points of trajectory (KPT) and practical fulfilment of whole action on full orientation base of actions (OBA) becomes possible.

With critical value of Student's t-criterion (t_{kp} = 2.1) it becomes evident that the applied informational-matrix training technology confidently ($p \leq 0.001$) improve quickness of judo techniques' mastering.

References

1. Arziutov GN. Teoriia predvideniia v dziudo [Theory of forecasting in judo], Kiev; 1998 [in Russian]
2. Arziutov GM. Methodology of effective study of technique in the single combats. Scientifically-Pedagogical Problems of Physical Culture 2011; 15: 3-8
3. Arziutov GN. Rol' i znachenie nauchnogo predvideniia pri proektirovanii mnogoletnej podgotovki sportsmenov v edinoborstvakh (na primere dziudo) [Role and significance of scientific forecasting in projecting of martial arts sportsmen's many years training (on example of judo)]. Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports 1999; 13: 39-48 [in Russian]
4. Jagiello W, Wolowicz J. Body composition in junior Polish representatives in judo. Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports 2009; 12:196-202 [in Russian]
5. Arziutov GN. Mnogoletniaia podgotovka v sportivnykh edinoborstvakh [Many years training in sport martial arts]. Kiev; 1999 [in Russian]
6. Iermakov SS, Boychenko NV. Tekhniko-takticheskaia podgotovka sportsmenov-iuniorov v "kiokushinkaj" karate pri pomoshchi special'nykh tekhnicheskikh sredstv [Technique-tactic skill of caratists of the style "Kyokushinkai" with a help of special technical means]. Physical Education of Students 2010; 4: 30-36 [in Russian]
7. Jagiello W, Dornowski M, Wolska B. Basic technical skills (throws) in 17–19-year-old judokas. Physical Education of Students 2014; 6: 77-80
8. Platonov VN. Obshchaia teoriia podgotovki sportsmenov v Olimpijskom sporte [The general theory of preparation of sportsmen in the Olympic sport]. Kiev: Olympic Literature; 1997 [in Russian]
9. Arziutov GN. Metodologiia mnogoletnej podgotovki v sportivnykh edinoborstvakh [Methodology of many years training in sport martial arts]. Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports 1999; 7: 45-51 [in Russian]
10. Koblev IaK. Sistema mnogoletnej podgotovki sportsmenov mezhdunarodnogo klassa v bor'be dziudo [System of many years training of judo international class sportsmen]. Doctoral Dissertation. Moscow; 1990 [in Russian]
11. Adashevskiy VM, Iermakov SS, Gritsyuk SA. Osnovnye kinematicheskie kharakteristiki udarnykh dejstvij v taekvondo [Basic kinematics descriptions of shock actions in taekwondo]. Physical Education of Students 2010; 4: 3-5 [in Russian]
12. Adashevskiy VM, Dylewski M, Iermakov SS. Biomekhanicheskie aspekty tekhniko-takticheskikh dejstvij v dziudo [Biomechanical aspects of the technical and tactical actions in the judo]. Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports 2011; 3: 3-8 [in Russian]
13. Arziutov G, Borodin Y. Metodologiia teorii poetapnoj mnogoletnej podgotovki sportsmenov v edinoborstvakh [Methodology of theory of stage-by-stage long-term preparation of sportsmen in single combats]. Physical Education of Students 2010; 2: 7-10 [in Russian]
14. Jagiello W, Kalina RM, Jagiello M. Sposobnost' k sokhraneniiu ravnovesiia tela u studentov raznykh sportivnykh specializacij [The ability to maintain the body balance in the students of different sports specialization]. Physical Education of Students 2010; 6: 79-82 [in Russian]
15. Jagiello W, Kozina ZhL, Jagiello M. Somatic aspects of sports championship in taekwondo ITF. Physical Education of Students 2015; 4: 51-55
16. Arzutov G. Control's optimisation of training process of sportsmen in judo. The 1st international judo symposium: Jodokan, Sept. 25. 1995: 17
17. Beygul IO. The influence of sports activities for personality of judoist. Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports 2014; 12: 7-12
18. Shul'c GK, Arziutov GM. Informacijno-matrichna metodika navchannia tekhnici dziudo [Informational-matrix methodic of judo techniques' training]. Kiev; 1999 [in Ukrainian]
19. Beezer RA. First Course in Linear Algebra. Congruent Press, Gig Harbor: Washington; 2014
20. Ryzhkova AI. Matrichnyj analiz i sravnenie pedagogicheskikh sistem [Matrix analysis and comparison of pedagogic systems]. Gramota, 2012; 3(58): 120-124. [in Russian]
21. Fedotova OD. Podgotovka magistrov i aspirantov v usloviiakh matrichnoj organizacii obrazovatel'nogo processa: vozmozhno li eto? [Preparation of masters and post graduates in conditions of educational process's matrix organization. Is it possible?] Naukovedenie. 2014; 4 (23):1-10
22. Komlev VV, Zhukov VP, Mizonov VE et al. Matematicheskoe modelirovanie i strukturnaia optimizaciia obrazovatel'nykh tekhnologij [Mathematical simulation and structural optimization of educational technologies]. Vestnik IGEU. 2006; 3: 1-4 [in Russian]
23. Eshbi Ross U. Konstrukciia mozga [Brain's structure]. Moscow; Foreign Literature; 1962 [in Russian]
24. Bernshtejn NA. O postroenii dvizhenij [On building of movements]. Moscow; Medicine; 1947 [in Russian]
25. Podrigalo LV, Iermakov SS, Galashko NI et al. Assessment of arm wrestlers' adaptation status on the base of saliva biochemical characteristics in dynamic of competition and training loads. Journal of Physical Education and Sport 2015; 15(4): 849-856
26. Podrigalo LV, Iermakov SS, Nosko MO et al. Study and analysis of armwrestlers' forearm muscles' strength. Journal of Physical Education and Sport 2015; 15(3): 531-537
27. Bogen MM. Obuchenie dvigatel'nym dejstviiam [Training of motor actions]. Physical Culture and Sport Moscow: 1985 [in Russian]
28. Gal'perin PIa. Psikhologiia kak ob'ektivnaia nauka [Psychology as objective science]. Moscow; 1998 [in Russian]
29. Barczyński BJ, Graczynski M, Kalina RM. Barriers Restricting the Free Dissemination of Scientific Achievements: Own Experiences in Crossing Walls and Bridges. J Hum Kinet 2009; 22(22): 7-14
30. Schmidt RA, Wrisberg CA. Motor Learning and Performance. A Situation-Based Learning Approach. Fourth Edition. Human Kinetics; 2008
31. Pedrosa GF, Soares YM, Gonçalves R et al. Elaboration and evaluation of judo training means. Arch Budo 2015; 11: 7-16
32. Dias da Silva RA, Motta Drummond MD, Couto BP et al. Content validation of training means for taekwondo. Arch Budo 2015; 11: 305-317
33. Boguszewski D. Relationships between the rules and the way of struggle applied by top world male judoists. Arch Budo 2011; 7(1): 27-32
34. Kiyoshi I, Nobuyoshi H, Mitsuru N et al. The transformation of technical-tactical behaviors for hand techniques used in attacking below the belt after the 2010 International Judo Federation rule revision. Arch Budo 2013; 1: 1-6
35. Ito K, Hirose N, Nakamura M et al. Judo Kumi-te

Pattern and Technique Effectiveness Shifts After the 2013 International Judo Federation Rule Revision. Arch Budo 2014; 10: 1-9

36. Ito K, Hirose N, Maekawa N et al. Alterations in Kumite Techniques and the Effects on Score Rates following the 2013 International Judo Federation Rule Revision. Arch Budo 2015; 11: 87-92
37. Dopico X, Soler EI, Carballeira E et al. The relationship between motoric dominance and functional dominance while executing judo techniques: a study on laterality. Arch Budo 2014; 10: 307-314
38. Kalina RM, Chodała A, Dadeło S et al. Empirical basis for predicting success in combat sports and self-defence. Journal of Kinesiology 2005; 37, 1:1-13
39. Sadowski J, Gierczuk D, Miller J et al. Success factors in elite WTF taekwondo competitors. Arch Budo 2012; 8(3): 141-146
40. Moreira PVS, Crozara LF, Goethel MF et al. Talent detection in taekwondo: which factors are associated with the longitudinal competitive success? Arch Budo 2014; 10: 295-306
41. Pion J, Fransen J, Lenoir M et al. The value of non-sport-specific characteristics for talent orientation in young male judo, karate and taekwondo athletes. Arch Budo 2014; 10: 147-154
42. Oxford Dictionaries [Internet] Oxford University Press 2013 [cited 2013 Aug 10]. Available from: http://oxforddictionaries.com/definition/english/Delphi-technique
43. Bąk R. Definition of extreme physical activity determined through the Delphi method. Arch Budo Sci Martial Art Extreme Sport 2013; 9: 17-22
44. Maekawa N, Hirose N, Ito K et al. The method of expert evaluation of specific abilities to practice judo – proposition of Japanese top level university judo coaches. Arch Budo, 2013; 4: 219-225
45. Dopico X, Iglesias-Soler E, Carballeira E. Classification of judo motor skills: tactical and motor criteria approach. Arch Budo Sci Martial Art Extreme Sport. 2014; 10: 75-83
46. Harasymowicz J, Kalina RM. Honourable self-defence – the theoretical and methodological basis of training. Wydawnictwo Novum, Płock; 2006
47. Kalina RM, Jagiełło W, Wiktorek P. Motor competence in self-defence of students of a detectives' school during their course of studies. Arch Budo 2007; 3(3):1-6
48. Ashkinazi S, Jagiełło W, Kalina RM et al. The importance of hand-to-hand fights for determining psychomotor competence of antiterrorists. Arch Budo 2005; 1(1): 8-12
49. Kalina RM, Barczyński BJ, Klukowski K et al. The method to evaluate the susceptibility to injuries during the fall – validation procedure of the specific motor test. Arch Budo 2011; 7(4):201-215
50. Kalina RM**.** Non-apparatus safe falls preparations test (N-ASFPT) evaluation procedure. Arch Budo 2013; 9(4): 255-265
51. Kalina M, Barczyński J, Jagiełło W et al. Teaching of safe falling as most effective element of personal injury prevention In people regardless of gender, age and type of body build-the use of advanced information technologies to monitor the effects of education. Arch Budo 2008; 4(4): 82-90
52. Gąsienica-Walczak B, Barczyński BJ, Kalina RM et al. The effectiveness of two methods of teaching safe falls to physiotherapy students. Arch Budo 2010; 6(2): 63-71
53. Mroczkowski A. Rotating training simulator – an apparatus used for determining the moment of inertia, assisting learning various motor activities during rotational movements and simulating falls imposed by internal force. Arch Budo Sci Martial Art Extreme Sport 2014; 10: 59-66
54. Mroczkowski A, Mosler D. Rotating training simulator as an assessment tool measuring susceptibility of the body injuries during the fall caused by an external force – validation procedure. In: Kalina RM (ed.) Proceedings of the 1st World Congress on Health and Martial Arts in Interdisciplinary Approach, HMA 2015, 17–19 September 2015, Czestochowa, Poland. Warsaw: Archives of Budo; 2015: 202
55. Michnik R, Jurkojć J, Wodarski P et al. Similarities and differences of body control during professional, externally forced fall to the side performed by men aged 24 and 65 years. Arch Budo 2014; 10: 233-243
56. Michnik R, Jurkojć J, Wodarski P et al. Similarities and differences of the body control during professional collision with a vertical obstacle of men aged 24 and 65. Arch Budo 2015; 11: 27-39
57. Gnieciak E. Kobiety jako zawodowi żołnierze – wybrane aspekty socjologiczne. [In:] Maciejewski J, Dojwa K (ed.). Kobiety w grupach dyspozycyjnych społeczeństwa. Wydawnictwa Uniwersytetu Wrocławskiego. Wrocław; 2007: 139-48 [in Polish]
58. Sterkowicz S. Test specjalnej sprawności ruchowej w judo. Antropomotoryka, 1995; 12: 29-44 [in Polish]
59. Bukowiecka D. System diagnozowania sprawności fizycznej funkcjonariuszy policji. PhD thesis. Akademia Wychowania Fizycznego w Warszawie. Warszawa, 2005 [in Polish]
60. Dadeło S. Czynniki determinujące kompetencje pracowników ochrony na Litwie. AWF Warszawa-Vilnius, 2005 [in Polish, abstract in English, in Lithuanian]
61. Jagiełło W, Wójcicki Z, Barczyński BJ et al. Optimal body balance disturbance tolerance skills as a methodological basis for selection of the firefighters to solve difficult tasks of rescue. Ann Agric Environ Med 2014; 21(1): 148-155
62. Milazzo N, Farrow D, Fournier JF. Enhancing the decision making of skilled karate athletes with a "no-feedback" perceptual training program. Arch Budo 2014; 10: 261-271
63. Dadelo S, Veršinskas R, Piwowarski J et al. The most commonly used arrest and self-defence actions arsenal by different officers of internal services Arch Budo 2015; 11: 285-291
64. Sogabe A, Sterkowicz-Przybycień K, Maehara K et al. Effect of preferred body stance side on the performance of Special Judo Fitness Test in Japanese judo athletes. Arch Budo 2015; 11: 1-6
65. Vujkov S, Calleja-González J, Krneta Z et al. Physiological responses the organism of karate athletes specialists of kata and kumite during simulated competition. Arch Budo 2015; 11: 365-370
66. Kalina RM**.** Methodology of measurement, documentation and programming optimal workload continuous with variable intensity – applications in sports medicine, physiotherapy, geriatrics, health-related training, sport for all. Arch Budo 2012; 8(4): 235-249
67. Budō. The Martial Ways of Japan. Nippon Budokan Foundation; 2009

Cite this article as: Iermakov SS, Arziutov GN, Jagiełło W. Quick training of students to judo techniques. Arch Budo 2016; 12: 15-24