

## SIMULATION OF JUNIOR SCHOOLCHILDREN'S TRAINING TO ACROBATIC EXERCISES AND VAULTS

Khudolii O.M.<sup>1</sup>, Ivashchenko O.V.<sup>1</sup>, Chernenko S.O.<sup>2</sup>  
<sup>1</sup>H.S. Skovoroda Kharkiv National Pedagogical University  
<sup>2</sup>Donbass State Machine-building Academy

**Abstract.** *Purpose:* to determine peculiarities of formation of junior schoolchildren's motor skills. *Material:* 172 pupils participated in the research. In every parallel of forms there were 48 pupils. Factorial experiment of 2<sup>3</sup> type was conducted. *Results:* it was determined that effectiveness of schoolchildren's training (1<sup>st</sup> – 2<sup>nd</sup> forms – to forward roll; 3<sup>rd</sup> – 4<sup>th</sup> forms to vault) is influenced positively on be the following: increasing of attempts up to 12 times, quantity of repetitions in one attempt – up to 3 times, interval of rest shall be within 60—180 sec. In training process Attention is accentuated on quantity of attempts. For each form specific methodic peculiarities of exercise's fulfillment were formulated. *Conclusions:* factorial experiment of 2<sup>3</sup> type permitted to study multi-factorial structure of training process of 1<sup>st</sup>-4<sup>th</sup> forms' schoolchildren and specify optimal correlations of quantity of attempts, quantity of repetitions in one attempt and rest interval.

**Key words:** training, motor skills, schoolchildren, junior forms, acrobatic, vault.

### Introduction

One of problems, which is faced by school physical education, is optimization of schoolchildren's training process [1, 7, 25-27]. Works by O.V. Ivashchenko [5, 6], D.T. Miroshnichenko [9], O. M. Khydolii [13, 16], O. M. Khudolii, S.S. Iermakov [15] are devoted to optimization of schoolchildren's training to physical exercises.

In our previous works we determined that level of motor fitness of junior school age children is influenced by correlation of learning processes and development of motor skills (O. M. Khudolii, O. V. Ivashchenko, S.O. Chernenko [18, 19]). We found out that effectiveness of learning process is increased if method of algorithmic orders is used (O. M. Khudolii [13], O. V. Ivashchenko [5]) and proper alternation of exercises' fulfillment and rest is considered (O. M. Khudolii [9], O. V. Ivashchenko [6], V. I. Miroshnichenko [8]). One of methods of studying peculiarities of children's and adolescents motor skills' formation is simulation, conception of which was delivered in works by S.S. Iermakov [2, 3, 4], O. M. Khudolii, O.V. Ivaschenko [17, 20, 21], O. M. Khudolii, S.S. Iermakov [15].

Thus, studying of formation of junior schoolchildren's motor skills is rather urgent.

### Purpose, tasks of the work, material and methods

*The purpose of the work* is to determine peculiarities of formation of junior schoolchildren's motor skills.

*The methods and organization of the research:* in our work we used generalization and analysis of scientific and methodic literature data, general-scientific methods of theoretical character such as: analogy, analysis, synthesis, abstraction, induction as well as general-scientific methods of empirical character: observation, testing experiment.

In process of preparation of our researches we used conceptual approaches to planning of experiment in studying of training process's effectiveness and models' working out, which were substantiated in works by O.M. Khudolii, T.V.Karpunets [11], O.M. Khudolii, O.V. Ivashchenko [12, 21, 23]. In dissertations of O.M. Khudolii [14], O.V. Ivashchenko [6], V.I. Miroshnichenko [8] it was determined that control of learning-training process will be more effective, if modes of training are determined on the base of regression models, received as a result of complete factorial experiment (CFE) of type CFE 2<sup>k</sup>.

In the research we used plans of factorial experiment of CFE 2<sup>k</sup> type (see table 1). We researched motor modes of forward roll training by 1<sup>st</sup>-2<sup>nd</sup> forms' schoolchildren, jumps over width of gymnastic horse of 3<sup>rd</sup> form schoolchildren and jump with bent legs over gymnastic goat of 4<sup>th</sup> form pupils. The purpose of CFE was to optimize training modes and, on basing on analysis of regression equations, determine peculiarities of motor skills' formation of 1<sup>st</sup>-4<sup>th</sup> form's pupils.

Table 1

*Matrix of 2<sup>3</sup> factorial experiment in studying of influence of different modes of exercises' repetitions on level of their fitness*

| Experimental groups | Factors  |  |  |
|---------------------|--|--|--|
|                     | x <sub>1</sub><br>quantity of attempts (times) | x <sub>2</sub><br>quantity of repetitions in one attempt (times) | x <sub>3</sub><br>rest interval (sec.) |
| 1                   | 6  | 1  | 60                                     |

| Experimental groups | Factors                               |   |                               |
|---------------------|---------------------------------------|---|-------------------------------|
|                     | $x_1$<br>quantity of attempts (times) | $x_2$<br>quantity of repetitions in one attempt (times) | $x_3$<br>rest interval (sec.) |
| 2                   | 12                                    | 1   | 60                            |
| 3                   | 6                                     | 3   | 60                            |
| 4                   | 12                                    | 3   | 60                            |
| 5                   | 6                                     | 1   | 180                           |
| 6                   | 12                                    | 1   | 180                           |
| 7                   | 6                                     | 3   | 180                           |
| 8                   | 12                                    | 3   | 180                           |

In pedagogic experiment we studied influence of quantity of attempts ( $x_1$ ), quantity of repetitions in one attempt ( $x_2$ ) and rest intervals ( $x_3$ ) on fitness of 1<sup>st</sup>-4<sup>th</sup> form pupils' in gymnastic exercises. In training of gymnastic exercises, at every training session we assessed fitness level with alternative method ("fulfilled", "not fulfilled"), calculated probability of exercises' fulfillment ( $p = n/m$ , where  $n$  — quantity of successfully fulfilled attempts,  $m$  — total quantity of attempts).

In training of junior school age children we used method of algorithmic orders. Transition to next exercise was realized after three successful attempts. 1<sup>st</sup>-4<sup>th</sup> form pupils were trained to forward roll, jump over gymnastic gout with bent legs and with pushed legs [5, 22].

Training of forward roll was conducted in 1<sup>st</sup> and 2<sup>nd</sup> forms. *Technique of fulfillment*: forward roll – move body ahead with full rotation and successive touching of floor with shoulders and back. Forward roll is fulfilled from position: squat with hands resting on floor; hands shall be placed at 30-40 cm distance from tiptoes; resting on hands, unbend legs. Strongly bending backbone and dropping head on chest fall down ahead, bending arms. Slowing fall, softly touch floor with neck and blades, tuck quickly and roll forward.

Training tasks:

1. From position sitting on floor roll back in tuck and turn in initial position.
2. From squat position with hands on floor roll back in tuck and turn in initial position.
3. From standing position with hands on floor, legs are expanded, make forward roll in sitting position with expanded legs.
4. From standing position with hands on floor make forward roll in sitting position in tuck.
5. From standing position with hands on floor make forward roll in sitting position with hands on floor.
6. From squat position with hands on floor roll forward.
7. Make forward roll from main stance.
8. Three forward rolls at convenient temp.

Vault over width of gymnastic horse (3<sup>rd</sup> form), training tasks:

1. From lying position with hands on floor go in standing position with hands on floor, legs are widely expanded and quickly straighten body.
2. From 2—3 step run jump in squat position with hands on floor and expand legs.
3. From 2—3 step run jump in standing position with hands on horse with handle, expanded legs – on horse, torso is bent; dismount.
4. From squat on horse (gout) jump down with legs expanded over one more horse or gout standing in front..
5. Jump from the spot with expanded legs over width of horse with handle.
6. Jump from the spot with expanded legs over length of gout.
7. With expanded legs jump over length of gout and make bridge at 1 meter distance from apparatus.

8. The same but jump over width of horse.

Vault over width of gout with bent legs (4<sup>th</sup> form), training tasks:

1. From lying position with hands on floor, simultaneously pushing up with two arms and two legs take squat position with arms stretched forward.
2. From squat position with hands on floor jump not loosing hands' contact with floor.
3. From, 3 meters' run jump into squat on gout with hands, touching the gout; dismount with bent legs.
4. From squat position with hands on bench, jump with bent legs over gymnastic bench.
5. From 3-5 meters' run jump over width of gout with bent legs.
6. From 5-7 meters' run jump over width of gout with bent legs, as far as possible from the apparatus.
7. From full run jump over width of gout with bent legs.
8. From full run jump over width of gout with bent legs and make bridge at distance of 1 m from the apparatus.

In every parallel of forms 48 pupils participated in the research; in total -172 pupils.

**Results of the research**

Results of factorial experiment are given in table 2.

Table 2

*Regressive dependence of fitness in gymnastic exercises on quantity of attempts ( $x_1$ ), quantity of repetitions in one attempt ( $x_2$ ) and rest intervals ( $x_3$ ) of 1-4 form pupils*

|   | Description of exercises  | Regression equation for coded variables  |
|---|---|--|
| 1 | 1. From position sitting on floor roll back in tuck and turn in initial position.   | $Y = 0.863 + 0.025 x_2$                  |
|   | 2. From squat position with hands on floor roll back in tuck and turn in initial position.                                  | $Y = 0.755 + 0.035 x_1 + 0.02 x_2$       |
|   | 3. From standing position with hands on floor, legs are expanded, make forward roll in sitting position with expanded legs. | $Y = 0.815 + 0.023 x_1 - 0.023 x_1x_3$   |
|   | 4. From standing position with hands on floor make forward roll in sitting position in tuck.                                | $Y = 0.83 + 0.028 x_1 + 0.063 x_2$       |
|   | 5. From standing position with hands on floor make forward roll in squat position with hands on floor.                      | $Y = 0.73 + 0.028 x_1 - 0.028 x_1x_2x_3$ |
| 2 | 1. From sitting in tuck position roll backward and turn in initial position   | $Y = 0.858 + 0.033 x_2$                  |
|   | 2. From squat position with hands on floor roll backward in tuck and return in initial position                             | $Y = 0,741 + 0.049 x_1 - 0.029 x_1x_3$   |
|   | 3. From standing position with legs expanded make forward roll in sitting position with legs expanded.                      | $Y = 0.829 + 0.021 x_1 + 0.044 x_2$      |
|   | 4. From standing position with hands on floor and legs expanded   | $Y = 0.819 + 0.026 x_1 + 0.054 x_2$      |

|   | Description of exercises   | Regression equation for coded variables |
|---|--|---|
|   | make forward roll in sitting position in tuck  |   |
|   | 5. From standing position with hands on floor and legs expanded<br>make forward roll in squat with hands on floor.   | $Y = 0.745 + 0.045 x_1 - 0.03 x_2 x_3$  |
| 3 | 1. From lying position with hands on floor, by pushing up with legs<br>take standing position with hands on floor and legs expanded and<br>quickly straighten the body p | $Y = 0.789 + 0.034 x_1 + 0.024 x_2 x_3$ |
|   | 2. From 2—3 step run jump in squat position with hands on floor and<br>legs expanded   | $Y = 0.685 + 0.028 x_1 - 0.02 x_1 x_3$  |
|   | 3. From 2—3 step run jump in standing position with hands on floor;<br>torso is and legs are expanded on horse with handle and dismount<br>arching torso                 | $Y = 0.714 + 0.039 x_1 - 0.044 x_2 x_3$ |
|   | 4. In squat on horse jump with expanded legs over horse or gout,<br>standing in front  | $Y = 0.699 + 0.044 x_1 + 0.034 x_1 x_2$ |
|   | 5. Jump from the spot with expanded legs over horse with handles   |   |
| 4 | 1. From lying position with hands on floor, simultaneously pushing<br>up with two arms and two legs take squat position with arms<br>stretched forward.                  | $Y = 0.828 + 0.025 x_1 + 0.055 x_2$     |
|   | 2. From squat position with hands on floor jump not losing hands'<br>contact with floor.   | $Y = 0.821 + 0.041 x_1$                 |
|   | 3. From 3 meters' run jump into squat on gout with hands, touching<br>the gout; dismount with bent legs.   | $Y = 0.699 + 0.054 x_1 + 0.021 x_1 x_3$ |
|   | 4. From squat position with hands on bench, jump with bent legs over<br>gymnastic bench.   | $Y = 0.716 + 0.059 x_1 - 0.026 x_2 x_3$ |
|   | 5. From 5-7 meters' run jump over width of gout with bent legs   | $Y = 0.72 + 0.033 x_2$                  |

Level of mastering of forward roll by *first* form pupils is influenced by the following:

- *The first task* “from position sitting on floor roll back in tuck and turn in initial position” is positively influenced by quantity of repetitions in one attempt ( $x_2$ ) (see table 1).
- *The second task* “from squat position with hands on floor roll back in tuck and turn in initial position” is positively influenced by quantity of attempts ( $x_1$ ) and quantity of repetitions in one attempt ( $x_2$ ).
- *The third task* “from standing position with legs expanded make forward roll in sitting position with legs expanded” is positively influenced by quantity of attempts ( $x_1$ ) and negatively - interaction of quantity of repetitions and rest interval ( $x_1x_3$ ).
- *The forth task* “from standing position with hands on floor and legs expanded make forward roll in sitting position in tuck” is positively influenced by quantity of attempts ( $x_1$ ) and quantity of repetitions in one attempt ( $x_2$ ).
- *The fifth tasks* “from standing position with hands on floor make forward roll in squat position with hands on floor” is positively influenced by quantity of attempts ( $x_1$ ) and negatively – interaction of all factors ( $x_1x_2x_3$ ).

Thus, effectiveness of *first form* pupils’ training to “forward roll” is positively influenced by increase of quantity of attempts up to 12 times, quantity of repetitions in one attempt up to 3 times and rest interval within 60-180 seconds. In training process attention shall be paid to quantity of attempts.

Level of mastering of forward roll by *second form* pupils is influenced by the following:

*The first task* “from sitting in tuck position roll backward and turn in initial position” is positively influenced by quantity of repetitions in one attempt ( $x_2$ ).

- *The second task* “from squat position with hands on floor roll backward in tuck and return in initial position” is positively influenced by quantity of attempts ( $x_1$ ) and negatively - interaction of quantity of attempts and rest intervals ( $x_1x_3$ ).
- *The third task* “from standing position with legs expanded make forward roll in sitting position with legs expanded” is positively influenced by quantity of attempts ( $x_1$ ) and quantity of repetitions in one attempts ( $x_2$ ).
- *The forth task* “from standing position with hands on floor and legs expanded make forward roll in sitting position in tuck” is positively influenced by quantity of attempts ( $x_1$ ) and quantity of repetitions in one attempt ( $x_2$ ).
- *The fifth tasks* “from standing position with hands on floor and legs expanded make forward roll in squat with hands on floor” Is positively influenced by quantity of attempts ( $x_1$ ) and negatively – interaction of repetitions in one attempt and rest intervals ( $x_2x_3$ ).

Thus, effectiveness of *second form* pupils’ training to “forward roll” is positively influenced by increase of quantity of attempts up to 12 times, quantity of repetitions in one attempt up to 1- 3 times and rest interval within 60-180 seconds. In training process attention shall be paid to quantity of attempts.

Level of mastering of vault “over width of horse, legs expanded” by *third form* pupils is influenced by the following:

- *The first task* “from lying position with hands on floor, by pushing up with legs take standing position with hands on floor and legs expanded and quickly straighten the body” is positively influenced by quantity of attempts ( $x_1$ ), interaction of quantity of repetitions in one attempt and rest interval ( $x_2, x_3$ ).
- *The second task* “from 2—3 step run jump in squat position with hands on floor and legs expanded” is positively influenced by quantity of attempts ( $x_1$ ), and negatively – interaction of quantity of attempts and rest intervals ( $x_1, x_3$ ).
- *The third task* “from 2—3 step run jump in standing position with hands on floor; torso is and legs are expanded on horse with handle and dismount arching torso” is positively influenced by quantity of attempts ( $x_1$ ), and negatively – interaction of quantity of repetitions in one attempts and rest intervals ( $x_2, x_3$ ).
- *The forth task* “in squat on horse jump with expanded legs over horse or gout, standing in front” is positively influenced by quantity of attempts ( $x_1$ ), and interaction of quantity of attempts and quantity of repetitions in one attempt ( $x_1, x_2$ ).

Thus, effectiveness of *third form* pupils’ training to vault “over width of horse, legs expanded” is positively influenced by increase of quantity of attempts up to 12 times, quantity of repetitions in one attempt up to 3 times and rest interval within 60-180 seconds. In training process attention shall be paid to quantity of attempts.

- Level of mastering of vault “over width of gout with bent legs” by *forth form* pupils is influenced by the following:
- *The first task* “from lying position with hands on floor, simultaneously pushing up with two arms and two legs take squat position with arms stretched forward” is positively influenced by quantity of attempts ( $x_1$ ) and quantity of repetitions in one attempt ( $x_2$ ).
- *The second task* “from squat position with hands on floor jump not loosing hands’ contact with floor” is positively influenced by quantity of attempts ( $x_1$ ).
- *The third task* “from 3 meters’ run jump into squat on gout with hands, touching the gout; dismount with bent legs” Is positively influenced by quantity of attempts ( $x_1$ ), by interaction of quantity of attempts and rest interval ( $x_1x_3$ ).
- *The forth task* “from squat position with hands on bench, jump with bent legs over gymnastic bench” is positively

influenced by quantity of attempts ( $x_1$ ), and negatively – by interaction of quantity of repetitions in one attempt and rest interval ( $x_2x_3$ ).

- *The fifth tasks* “from 5-7 meters’ run jump over width of gout with bent legs” is positively influenced by quantity of repetitions in one attempt ( $x_2$ ).

Thus, effectiveness of forth *form* pupils’ training to vault “over width of gout with bent legs” is positively influenced by increase of quantity of attempts up to 12 times, quantity of repetitions in one attempt up to 3 times and rest interval within 60-180 seconds. In training process attention shall be paid to quantity of attempts and quantity of repetitions in one attempt.

#### Discussion

Results of the research permitted to supplement the data about planning of experiment in researching of training process’s effectiveness and working out of training models (O.M. Khudolii, T.V. Karpunets [11], O.M. Khudolii, O.V. Ivashchenko [12, 21, 23]). We proved the fact that control of training process is the most effective, if training modes are determined on the base of regression models, received as a result of complete factorial experiment of CFE  $2^k$  type (O.M. Khudolii [14], O.V. Ivashchenko [6], V.I. Mirosnichenko [8]).

The novelty of our work is the data about modes of 1<sup>st</sup>-4<sup>th</sup> form pupils’ gymnastic exercises training.

#### Conclusions:

Experiment of  $2^3$  type permitted to study multi-factorial structure of training process’s modes, applied to 1<sup>st</sup>-4<sup>th</sup> form pupils; to specify optimal correlations of quantity of attempts, quantity of repetitions in one attempt and rest interval in period of training of acrobatic exercises and gymnastic vaults at physical culture lessons.

Effectiveness of *first form* pupils’ training to “forward roll” is positively influenced by increase of quantity of attempts up to 12 times, quantity of repetitions in one attempt up to 3 times and rest interval within 60-180 seconds. In training process attention shall be paid to quantity of attempts.

Effectiveness of *second form* pupils’ training to “forward roll” is positively influenced by increase of quantity of attempts up to 12 times, quantity of repetitions in one attempt up to 1-3 times and rest interval within 60-180 seconds. In training process attention shall be paid to quantity of attempts.

Effectiveness of *third form* pupils’ training to vault “over width of horse, legs expanded” is positively influenced by increase of quantity of attempts up to 12 times, quantity of repetitions in one attempt up to 3 times and rest interval within 60-180 seconds. In training process attention shall be paid to quantity of attempts.

Effectiveness of forth *form* pupils’ training to vault “over width of gout with bent legs” is positively influenced by increase of quantity of attempts up to 12 times, quantity of repetitions in one attempt up to 3 times and rest interval within 60-180 seconds. In training process attention shall be paid to quantity of attempts and quantity of repetitions in one attempt.

*The prospects of further researches* imply determination of training modes’ influence on dynamic of indicators of junior school age children’s motor indicators.

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#### Conflict of interests

The authors declare that there is no conflict of interests.

#### References:

- 1 Bal'sevich VK. *Ontokineziologiya cheloveka* [Onto kinesiology human], Moscow: Theory and practice of physical culture; 275. (in Russian)
- 2 Iermakov S. Modeli biomekhanicheskikh sistem v organizacii effektivnogo dejstviiia sportsmena [Models of bio-mechanical systems in organization of sportsman’s effective functioning]. *Pedagogics, psychology, medical-biological problems of physical training and sports* 2001;17:40–47. (in Russian)
- 3 Iermakov SS. Modeli rabochikh poz sportsmena kak faktor effektivnosti vypolnenniia dvigatel'nykh dejstvij [Models of working postures as factor of effectiveness of motor actions’ fulfillment]. *Fizicheskoe vospitanie studentov tvorcheskikh special'nostej* 2001;4:16–22. (in Russian)
- 4 Iermakov SS. Biomekhanichni modeli udarnikh rukhiv u sportivnikh igrakh u konteksti vdoskonalennia tekhnichnoi pidgotovki sportsmeniv [Bio-mechanical models of strike movements in context of perfection of sportsmen technical fitness]. *Teoriia ta praktika fizichnogo vikhovannia* 2010;4:11–18. (in Ukrainian)
- 5 Ivashchenko OV. Metodika navchannia gimnastichnim vpravam shkil'noi programi [Methodic of gymnastic exercises’ training in school program]. *Teoriia ta praktika fizichnogo vikhovannia* 2001;1:26–31. <http://dx.doi.org/10.17309/tmfv.2001.1.7> (in Ukrainian)
- 6 Ivashchenko O. V. *Normativnye pokazateli trenirovochnykh nagruzok na nachal'nom etape podgotovki iunykh gimnastok 6–8 let. Cand. Diss.* [Normative indicators of training loads at initial stage of junior, 6-8 yrs., girl-gymnasts], Moscow; 1988. (in Russian)
- 7 Круцевич ТЮ, Безверхня ГВ. *Rekreaciia u fizichnij kul'turi riznikh grup naseleenniia* [Recreation in physical education of different population groups], Kiev: Olympic Literature; 2010. (in Ukrainian)
- 8 Mirosnichenko VI. *Metodika formirovaniia dvigatel'nykh navykov u detej mladshhego shkol'nogo vozrasta. Cand. Diss.* [Methodic of motor skills’ formation in junior school age children. Cand. Diss.], Moscow; 1988. (in Russian)

- Russian)
- 9 Miroshnichenko DT. Metodika navchannia akrobaticnim vpravam uchniv molodshikh klasiv [Methodic of junior form pupils' training to acrobatic exercises]. *Teoriia ta metodika fizichnogo vikhovannia* 2007;12:29—31. (in Ukrainian)
  - 10 Khudolij OM. Navantazhennia u sportivnomu trenuvanni iunikh gimnastiv [Loads in sport training of junior gymnasts]. *Teoriia ta metodika fizichnogo vikhovannia* 2001;3:13-19. (in Ukrainian)
  - 11 Khudolii OM, Karpunec' TV. Planuvannia eksperimentu v doslidzhenni procesu pidgotovki iunikh gimnastiv [Planning of experiment in study of junior gymnasts' training]. *Teoriia ta metodika fizichnogo vikhovannia* 2002;4:2—8. <http://dx.doi.org/10.17309/tmfv.2002.4.73> (in Ukrainian)
  - 12 Khudolii OM, Ivashchenko OV. Konceptual'ni pidkhodi do rozrobki programi naukovikh doslidzhen' u fizichnomu vikhovanni [Conceptual approaches to working out of program of scientific researches in physical education]. *Teoriia ta metodika fizichnogo vikhovannia* 2004;4:2—5. <http://dx.doi.org/10.17309/tmfv.2004.4.140> (in Ukrainian)
  - 13 Khudolii OM. Tekhnologiiia navchannia gimnastichnim vpravam. Dopovid' 1 [Technology of gymnastic exercises' training. Report 1]. *Teoriia ta metodika fizichnogo vikhovannia* 2009;8:19—34. <http://dx.doi.org/10.17309/tmfv.2009.9.562> (in Ukrainian)
  - 14 Khudolii OM. *Teoretiko-metodichni zasadi sistemi pidgotovki iunikh gimnastiv 7—13 rokiv. Dokt. Diss.* [Theoretical-methodic principles of system of junior, 7-13 yrs. age, gymnasts' training Dokt. Diss.], Kiev; 2011. (in Ukrainian)
  - 15 Khudolii OM, Iermakov SS. Zakonomirnosti procesu navchannia iunikh gimnastiv [Training process of junior gymnasts]. *Teoriia ta metodika fizichnogo vikhovannia* 2011;5:3—18. <http://dx.doi.org/10.17309/tmfv.2011.5.707> (in Ukrainian)
  - 16 Khudolii ON. Zakonomernosti formirovaniia dvigatel'nykh navykov u iunikh gimnastov [Regularities of motor skills' formation in junior gymnasts]. *Nauka v olimpijskom sporte* 2012;1:36—46 (in Russian)
  - 17 Khudolii OM, Ivashchenko OV. Konceptual'ni pidkhodi do modeliuvaniia procesu navchannia i rozvitku rukhovikh zdibnostej u ditej i pidlitkiv [Conceptual approaches to simulation of training process and development of children's and adolescents' motor skills]. *Teoriia ta metodika fizichnogo vikhovannia* 2013;2:3—16. <http://dx.doi.org/10.17309/tmfv.2013.2.1012>(in Ukrainian)
  - 18 Khudolii OM, Ivashchenko OV, Chernenko SO. Chinniki, shcho vplivaiut' na efektyvnist' navchannia fizichnim vpravam khlopchikiv molodshikh klasiv [Factors, influencing on effectiveness of physical exercises' training of junior form boys]. *Teoriia ta metodika fizichnogo vikhovannia* 2013;1:21—26. <http://dx.doi.org/10.17309/tmfv.2013.1.1006>(in Ukrainian)
  - 19 Khudolii OM, Ivashchenko OV, Chernenko SO. Chinniki, shcho vplivaiut' na efektyvnist' navchannia fizichnim vpravam divchatok molodshikh klasiv [Factors, influencing on effectiveness of physical exercises' training of junior form girls]. *Teoriia ta metodika fizichnogo vikhovannia* 2013;2:43—47. <http://dx.doi.org/10.17309/tmfv.2013.2.1016>(in Ukrainian)
  - 20 Khudolii OM, Ivashchenko OV. Informacijne zabezpechennia procesu navchannia i rozvitku rukhovikh zdibnostej ditej i pidlitkiv (na prikladi sportivnoi gimnastiki) [Informational provisioning of training process and development of children's and adolescents, motor skills (on example of calisthenics)]. *Teoriia ta metodika fizichnogo vikhovannia* 2013;4:3—18. <http://dx.doi.org/10.17309/tmfv.2013.4.1031>(in Ukrainian)
  - 21 Khudolii OM, Ivashchenko OV. *Modeliuvaniia procesu navchannia ta rozvitku rukhovikh zdibnostej u ditej i pidlitkiv* [Simulation of training process and development of children's and adolescents' motor skills], Kharkov: OVS, 2014. (in Ukrainian)
  - 22 Khudolii OM, Ivashchenko OV. *Teoriia ta metodika vikladannia gimnastiki* [Theory and methodic of gymnastic's training], Kharkov: OVS, 2014. (in Ukrainian)
  - 23 Khudolii OM, Ivashchenko OV. *Osnovi naukovo-doslidnoi roboti u fizichnomu vikhovanni i sporti* [Principles of scientific research work in physical education and sports], Kharkov: OVS, 2014. (in Ukrainian)
  - 24 Adashevskiy VM, Iermakov SS, Firsova IuIu. Physical mathematical modelling of difficult elements of acrobatic rock-and-roll. *Physical Education of Students* 2013;3:3-10. doi:10.6084/m9.figshare.662463
  - 25 Ivashchenko OV, Khudolii OM, Iermakova TS, Pilewska Wiesława, Muszkieta Radosław, Stankiewicz Błazej. Simulation as method of classification of 7-9th form boy pupils' motor fitness. *Journal of Physical Education and Sport (JPES)* 2015;15(1):142-147. <http://dx.doi.org/10.7752/jpes.2015.01023>
  - 26 Ivashchenko OV, Iermakova TS, Cieślicka M, Zukowska H. Discriminant analysis in classification of motor fitness of 9-11 forms' juniors. *Journal of Physical Education and Sport (JPES)* 2015;15(2):238 – 244. <http://dx.doi.org/10.7752/jpes.2015.02037>
  - 27 Khudolii OM, Iermakov SS, Prusik K. Classification of motor fitness of 7-9 years old boys. *Journal of Physical Education and Sport (JPES)* 2015;15(2): 245 - 253. <http://dx.doi.org/10.7752/jpes.2015.02038>

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**Information about the authors:**

**Khudolii O.M.:** <http://orcid.org/0000-0002-5605-9939>; [tmfv@tmfv.com.ua](mailto:tmfv@tmfv.com.ua); H.S. Skovoroda Kharkiv National Pedagogical University; Artema str. 29, Kharkov, 61002, Ukraine.

**Ivashchenko O.V.:** <http://orcid.org/0000-0002-2708-5636>; [tmfv@tmfv.com.ua](mailto:tmfv@tmfv.com.ua); H.S. Skovoroda Kharkiv National Pedagogical University; Artema str. 29, Kharkov, 61002, Ukraine.

**Chernenko S.O.:** <http://orcid.org/0000-0001-9375-4220>; [chernenko.sergey@mail.ru](mailto:chernenko.sergey@mail.ru); Donbass State Machine-building Academy st. Shkadinova, 72, Kramatorsk, Donetsk region, 84313, Ukraine.

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