EFFECTIVENESS OF JUNIOR FORM PUPILS’ TRAINING OF GYMNASTIC EXERCISES IN DIFFERENT MODES OF THEIR FULFILLMENT

Chernenko S.O.
Donbass State Machine-Building Academy

Abstract. **Purpose:** determination of junior pupils’ motor skills’ formation. **Material:** in the research 172 pupils participated: in every parallel of forms – 48 pupils. **Results:** effectiveness of 1st form pupils’ is positively influenced (exercise – forward roll) by increase of attempts up to 12 times; quantity of repetitions in one attempt shall be within 1–3. For 2nd form pupils (exercise – forward roll), 3rd form (exercise – vault over the width of gymnastic horse) and 4th form pupils (exercise – vault over width of gout with bent legs) positive influence was rendered by increase of repetitions in one attempt up to 3 times and quantity of attempts within 6–12 times. Attention shall be accentuated on quantity of exercise’s repetitions in one attempt (2nd, 4th forms) and quantity of attempts (4th from). **Conclusions:** Experiment of 2^3 type permitted to study multi-factorial structure of modes of 1–4 forms’ schoolchildren’s training to physical exercises; to specify optimal correlations of quantity of attempts, quantity of repetitions in one attempt and rest interval in period of acrobatic exercises’ and gymnastic vaults’ training at physical culture lessons. **Key words:** training, motor skills, schoolchildren, gymnastic, teaching.

Introduction

In modern conditions of weakening of schoolchildren’s motor functioning, low resistance of their organisms to diseases there appears the problem of optimization of children’s and adolescents’ physical education (V.K. Baltsevich [1], T.Yu. Krutsevych, G.V. Bezverkhnia [12], O.M. Khudolii, O.V. Ivashchenko [35]). Effectiveness of physical education is influenced by correlation of physical exercises’ training and development of motor abilities. Development of motor abilities is effective if they become a component of motor skills’ mastering (A. M. Shlemin [38], M. M. Bogen [3], V. I. Liakh [15], O.M. Khudolii [26, 27, 28, 30], O.M. Khudolii O.M. Khudolii [29], D.T. Miroshnichenko [17]).

In researches of O.V. Ivashchenko [10], D.T. Miroshnichenko [17] there was regarded methodic of training of curriculum physical exercises from. In works by O.M. Khudolii [28, 30], O.M. Khudolii, S.S. Iermakov [29] laws of motor skills’ formation in junior gymnasts were substantiated. For junior schoolchildren technical approaches to training of light athletic, gymnastic, acrobatic exercises, climbing the rope were offered (A. A. Zdanieich [9], D.T. Miroshnichenko [17], V. Rybalko [21], O.M. Khudolii [27], O.V. Ivashchenko [10]).

It was established that effectiveness of training increases if methods of programmed training were used (A.I. Berg, I.I. Tikhonov [2], V.P. Golubiev [4], A.M. Shlemin [38], Zh.K. Kholodov, P.N. Khlomeniuk [22], A.N. Laputin [13], P.K. Petrov, [18, 19, 20], O.M. Khudolii [27, 28], O.V. Ivashchenko [10]) and modes of exercises’ and rest’s alternation were considered (O.V. Ivashchenko [23], O.V. Ivashchenko [11], V. I. Miroshnichenko [16], O.V. Ivashchenko, O.V. Ivashchenko [31, 35]).

One of methods of children’s and adolescents’ motor skills’ studying is simulation, conception of which was delivered in works by O.M. Khudolii [26], A.O. Lopatyeva [14], S.V. Dmitriyeva [5], Milić, M., Milavić, B., & Grgantov, Z. [43], O.M. Khudolii, O.V. Ivashchenko [31, 35], O.M. Khudolii [6, 7, 8], O.M. Khudolii, O.M. Khudolii [29], Ivashchenko O.V., Khudolii O.M., Yermakova T.S., Pilewska W., Muszkieta R., Stankiewicz B. [40], Ivashchenko O.V., Yermakova T.S., Cieślicka M., Zukowska H. [41], Khudolii O.M., Iermakov S.S., Prusik K. [42], Adashevsksiy V. M., Iermakov S. S. [39].

In works of O.M. Khudolii, O.V. Ivashchenko [31, 35] there was studied level of physical exercises’ mastering and its dynamic. For determination of training process’s laws study of level increment of physical exercises’ mastering as a criterion of training effectiveness is rather promising. Thus, study of junior schoolchildren’s motor skills’ formation is rather important and urgent.

**Table 1**

**Matrix of 2^3 type factorial experiment in studying of different modes of exercise’s repetitions for level of its mastering**

<table>
<thead>
<tr>
<th>Experimental groups</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>x1</td>
</tr>
<tr>
<td></td>
<td>quantity of attempts (times)</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
Stomach is bent expanded legs. Chest fall down ahead, bending arms. Slowing fall, softly rest on neck and blades, quickly tuck and make roll. Hands are placed at 30° with full turnover and successive touching floor with shoulders and back. Forward roll is fulfilled from squat position, bent legs (4th form pupils). Vault over width of gymnastic horse (3rd form pupils); vault over width of gout with legs apart and legs bent (4th form pupils). The purpose of FFE was to optimize modes of training and determination of junior pupils’ motor skills’ formation. In the research we used plans of factorial experiment of type FFE. The methods and organization of the work: in the work we used analysis and generalization of scientific and methodic literature data, theoretical general-scientific methods: analogy, analysis, synthesis, abstraction, induction. Besides, we used empiric general scientific methods: observation, testing, experiment.

In the process of planning of our research we used conceptual approaches to planning of experiment, which were substantiated in works of O.M. Khudolii and T.V. Karpunets [24], O.M. Khudolii and O.V. Ivashchenko [31, 35], O.M. Khudolii [26]. In dissertation works of O.M. Khudolii [28], O.V. Ivashchenko [11], V.I. Miroshnichenko [16] there was stated that control over training process would be more effective with determination of training modes on the base of regressive models by results of full factorial experiment (FFE) of type FFE 2^k. In the research we used plans of factorial experiment of type FFE 2^4 (see table 1). We researched motor modes of training: forward roll (1st, 2nd forms’ pupils); vault over width of horse (3rd form pupils); vault over width of gout with bent legs (4th form pupils).

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

The purpose of the work is determination of junior pupils’ motor skills’ formation.

The methods and organization of the work: in the work we used analysis and generalization of scientific and methodic literature data, theoretical general-scientific methods: analogy, analysis, synthesis, abstraction, induction. Besides, we used empiric general scientific methods: observation, testing, experiment.

In the process of planning of our research we used conceptual approaches to planning of experiment, which were substantiated in works of O.M. Khudolii and T.V. Karpunets [24], O.M. Khudolii and O.V. Ivashchenko [31, 35], O.M. Khudolii [26]. In dissertation works of O.M. Khudolii [28], O.V. Ivashchenko [11], V.I. Miroshnichenko [16] there was stated that control over training process would be more effective with determination of training modes on the base of regressive models by results of full factorial experiment (FFE) of type FFE 2^k. In the research we used plans of factorial experiment of type FFE 2^4 (see table 1). We researched motor modes of training: forward roll (1st, 2nd forms’ pupils); vault over width of horse (3rd form pupils); vault over width of gout with bent legs (4th form pupils). The purpose of FFE was to optimize modes of training and determine peculiarities of formation of 1st-4th form schoolchildren’s motor skills on the base of regression equations’ analysis. In pedagogic experiment we studied influence of quantity of attempts (x1), quantity of repetitions in one attempt (x2) and rest intervals (x3) on change of mastering level’s increment of 1st-4th form schoolchildren.

In the process of gymnastic exercises’ training we assessed level of mastering with alternative method (“fulfilled”, “not fulfilled”), considered probability of exercise’s fulfillment (p = n/m, where n — quantity of successfully fulfilled attempts, m — general quantity of attempts). Then we analyzed increment of mastering of gymnastic exercises.

In training of junior school age children we used method of algorithmic orders. Transition to next exercises was realized after three successful attempts. In 1st-4th forms we trained forward roll, vault over gout with legs apart and legs bent [10, 36].

Training of forward roll was in 1st-2nd forms. Technique of fulfillment: forward roll – forward movement of body with full turnover and successive touching floor with shoulders and back. Forward roll is fulfilled from squat position, hands are placed at 30–40 cm from tip toes (resting on hands) unbend legs. Strongly bending back and dropping head on chest fall down ahead, bending arms. Slowing fall, softly rest on neck and blades, quickly tuck and make roll.

**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 apart, 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 (3rd form), training tasks:
1. From lying position with hands on floor go in standing position with hands on floor, legs are wide apart 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 hours with handle, legs apart – on horse, torso is bent; dismount.
4. From squat on horse (gout) jump down with legs apart over one more horse or gout standing in front.
5. Jump from the spot with legs apart over width of horse with handle.
6. Jump from the spot with legs apart over length of gout.
7. With legs apart 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 (4th form), training tasks:
1. From lying position with hands on floor, simultaneously pushing up with two arms and two legs take...
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 2-3.

<table>
<thead>
<tr>
<th>Form</th>
<th>Description of exercises</th>
<th>Regression equation for coded variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>From position sitting on floor roll back in tuck and turn in initial position.</td>
<td>$Y = 0.45 + 0.108x_1 + 0.078x_3$</td>
</tr>
<tr>
<td></td>
<td>From squat position with hands on floor roll back in tuck and turn in initial position.</td>
<td>$Y = 0.57 - 0.063x_1x_2$</td>
</tr>
<tr>
<td></td>
<td>From standing position with hands on floor, legs apart, make forward roll in sitting position with expanded legs.</td>
<td>$Y = 0.561 + 0.096x_1 + 0.056x_2$</td>
</tr>
<tr>
<td></td>
<td>From standing position with hands on floor make forward roll in sitting position in tuck.</td>
<td>$Y = 0.55 + 0.091x_1$</td>
</tr>
<tr>
<td></td>
<td>From standing position with hands on floor make forward roll in squat position with hands on floor.</td>
<td>$Y = 0.64 + 0.064x_1$</td>
</tr>
<tr>
<td>2</td>
<td>From sitting in tuck position roll backward and turn in initial position</td>
<td>$Y = 0.504 + 0.071x_2$</td>
</tr>
<tr>
<td></td>
<td>From squat position with hands on floor roll backward in tuck and return in initial position</td>
<td>$Y = 0.658 + 0.095x_2$</td>
</tr>
<tr>
<td></td>
<td>From standing position with legs apart make forward roll in sitting position with legs expanded.</td>
<td>$Y = 0.628 + 0.01x_2$</td>
</tr>
<tr>
<td></td>
<td>From standing position with hands on floor and legs apart make forward roll in sitting position in tuck</td>
<td>$Y = 0.629 + 0.064x_1$</td>
</tr>
<tr>
<td></td>
<td>From standing position with hands on floor and legs apart make forward roll in squat with hands on floor.</td>
<td>$Y = 0.663 + 0.078x_2$</td>
</tr>
<tr>
<td>3</td>
<td>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</td>
<td>$Y = 0.636 + 0.054x_2$</td>
</tr>
<tr>
<td></td>
<td>From 2—3 step run jump in squat position with hands on floor and legs expanded</td>
<td>$Y = 0.703 + 0.053x_2 - 0.08x_3$</td>
</tr>
<tr>
<td></td>
<td>From 2—3 step run jump in standing position with hands on floor; torso is and legs apart on horse with handle and dismount arching torso</td>
<td>$Y = 0.711 + 0.069x_2$</td>
</tr>
<tr>
<td></td>
<td>In squat on horse jump with legs apart over horse or gout, standing in front</td>
<td>$Y = 0.714 + 0.066x_2$</td>
</tr>
<tr>
<td></td>
<td>Jump from the spot with legs apart over horse with handles</td>
<td>$Y = 0.663 + 0.06x_2 - 0.06x_1x_3$</td>
</tr>
</tbody>
</table>
### Results of dispersion analysis for FFE 23, which studies dependence of increment of gymnastic exercises mastering on quantity of attempts ($x_1$), quantity of repetitions in one attempt ($x_2$) and rest intervals ($x_3$) of 1–4 form pupils

<table>
<thead>
<tr>
<th>Form</th>
<th>Description of exercises</th>
<th>Regression equation for coded variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>From sitting in tuck position roll back in tuck and turn in initial position.</td>
<td>[ Y = 0.628 + 0.07x_1 + 0.43x_2 ]</td>
</tr>
<tr>
<td>2</td>
<td>From squat position with hands on floor jump not loosing hands’ contact with floor.</td>
<td>[ Y = 0.613 + 0.055x_1 + 0.075x_2 ]</td>
</tr>
<tr>
<td>3</td>
<td>From 3 meters’ run jump into squat on gout with hands, touching the gout; dismount with bent legs.</td>
<td>[ Y = 0.739 — 0.061x_1x_2 + 0.061x_1x_3 ]</td>
</tr>
<tr>
<td>4</td>
<td>From squat position with hands on bench, jump with bent legs over gymnastic bench.</td>
<td>[ Y = 0.739 + 0.061x_1 ]</td>
</tr>
<tr>
<td>5</td>
<td>From 5–7 meters’ run jump over width of gout with bent legs</td>
<td>[ Y = 0.68 + 0.05x_2 — 0.06x_1x_2 ]</td>
</tr>
</tbody>
</table>

### Table 3

<table>
<thead>
<tr>
<th>Form</th>
<th>Description of exercises</th>
<th>Regression equation for coded variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>From sitting in tuck position roll back in tuck and turn in initial position.</td>
<td>[ Y = 0.628 + 0.07x_1 + 0.43x_2 ]</td>
</tr>
<tr>
<td>2</td>
<td>From squat position with hands on floor jump not loosing hands’ contact with floor.</td>
<td>[ Y = 0.613 + 0.055x_1 + 0.075x_2 ]</td>
</tr>
<tr>
<td>3</td>
<td>From 3 meters’ run jump into squat on gout with hands, touching the gout; dismount with bent legs.</td>
<td>[ Y = 0.739 — 0.061x_1x_2 + 0.061x_1x_3 ]</td>
</tr>
<tr>
<td>4</td>
<td>From squat position with hands on bench, jump with bent legs over gymnastic bench.</td>
<td>[ Y = 0.739 + 0.061x_1 ]</td>
</tr>
<tr>
<td>5</td>
<td>From 5–7 meters’ run jump over width of gout with bent legs</td>
<td>[ Y = 0.68 + 0.05x_2 — 0.06x_1x_2 ]</td>
</tr>
<tr>
<td>Form</td>
<td>Description of exercises</td>
<td>Regression equation for coded variables</td>
</tr>
<tr>
<td>------</td>
<td>-----------------------------------------------------------------------------------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td></td>
<td>with hands on floor and legs apart and quickly straighten the body</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>From 2—3 step run jump in squat position with hands on floor and legs apart</td>
<td>12.27 18.72 0.04 43.48 4.24 16.98 4.24</td>
</tr>
<tr>
<td>3.</td>
<td>From 2—3 step run jump in standing position with hands on floor; torso is and legs apart on horse with handle and dismount arching torso</td>
<td>7.26 60.9 7.26 2.43 0.18 14.67 7.26</td>
</tr>
<tr>
<td>4.</td>
<td>In squat on horse jump with legs apart over gout, standing in front</td>
<td>10.36 55.04 10.36 0.01 3.31 4.4 16.48</td>
</tr>
<tr>
<td>5.</td>
<td>Jump from the spot with legs apart over horse with handles</td>
<td>23.37 25.64 5.29 1.90 30.52 8.95 4.29</td>
</tr>
<tr>
<td>1.</td>
<td>From lying position with hands on floor, simultaneously pushing up with two arms and two legs take squat position with arms stretched forward.</td>
<td>58.55 21.58 10.75 2.68 1.86 2.68 1.86</td>
</tr>
<tr>
<td>2.</td>
<td>From squat position with hands on floor jump not loosing hands’ contact with floor.</td>
<td>26.37 49.04 2.67 2.67 3.48 3.48 12.26</td>
</tr>
<tr>
<td>3.</td>
<td>From 3 meters’ run jump into squat on gout with hands, touching the gout; dismount with bent legs.</td>
<td>9.6 9.6 31.62 14.34 1.59 1.59 31.62</td>
</tr>
<tr>
<td>4.</td>
<td>From squat position with hands on bench, jump with bent legs over gymnastic bench.</td>
<td>73.04 10.98 10.98 0.27 0.27 0.76 3.68</td>
</tr>
<tr>
<td>5.</td>
<td>From 5-7 meters’ run jump over width of gout with bent legs</td>
<td>9.85 23.32 33.58 9.85 9.85 11.42 2.09</td>
</tr>
</tbody>
</table>

Increment of first form pupil’s mastering of first task (from position sitting on floor roll back in tuck and turn in initial position) is positively influenced by quantity of attempts \((x_1)\) and rest interval \((x_3)\) (see table 2). Increment of first form pupil’s mastering of second task (from squat position with hands on floor roll back in tuck and turn in initial position) is negatively influenced by interaction of quantity of attempts and quantity of repetitions \((x_1x_2)\). Increment of first form pupil’s mastering of third task (from standing position with hands on floor, legs apart, make forward roll in sitting position with expanded legs) is positively influenced by quantity of attempts \((x_1)\) and quantity of repetitions \((x_2)\). Increment of mastering of forth task (from standing position with hands on floor make forward roll in sitting position in tuck) is positively influenced by quantity of attempts \((x_1)\). Increment of fifth task mastering (from standing position with hands on floor make forward roll in squat position with hands on floor) is positively influenced by quantity of attempts \((x_1)\).

Thus, effectiveness of first form pupils’ training of forward roll is positively influenced by the following: quantity of attempts up to 12 times; quantity of repetitions in one attempt – up to 1-3 times; rest interval - 60—180 sec. In process of training attention should be accentuated on quantity of attempts.

Increment of second form pupil’s mastering of first task (from sitting in tuck position roll backward and turn in initial position) is positively influenced by quantity of attempts \((x_1)\). Increment of second form pupil’s mastering of second task (from squat position with hands on floor roll backward in tuck and return in initial position) is positively influenced by quantity of repetitions in one attempt \((x_2)\). Increment of third task mastering (from standing position with legs apart make forward roll in sitting position with legs apart) is positively influenced by quantity of repetitions in one attempt \((x_2)\). Increment of forth task mastering (from standing position with hands on floor and legs apart make forward roll in sitting position in tuck) is positively influenced by quantity of attempts \((x_1)\). Increment of fifth task mastering (from standing position with hands on floor and legs apart make forward roll in squat with hands on floor) is positively influenced by quantity of repetitions in one attempt \((x_2)\).

Thus, effectiveness of second form pupils’ training of forward roll is positively influenced by the following: quantity of attempts up to 6 - 12 times; quantity of repetitions in one attempt – up to 3 times; rest interval - 60—180 sec. In process of training attention should be accentuated on quantity of repetitions in one attempt.

Increment of third form pupils’ mastering of first task in training of “vault over width of gymnastic horse with legs apart” (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 repetitions in one attempt ($x_1$). Increment of third form pupils’ mastering of second task (from 2-3 step run jump in squat position with hands on floor and legs apart) is positively influenced by quantity of repetitions in one attempt and negatively - by rest interval ($x_2$). Increment of third task mastering (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 repetitions ($x_3$). Increment of forth task mastering (in squat on horse jump with expanded legs over horse or gout, standing in front) is positively influenced by quantity of repetitions in one attempt ($x_2$). Increment of fifth task mastering (jump from the spot with expanded legs over horse with handles) is positively influenced by quantity of repetitions ($x_2$) and interaction of quantity of attempts with rest intervals ($x_1 x_2$).

Thus, effectiveness of third form pupils’ training of “vault over width of gymnastic horse with legs apart” is positively influenced by the following: quantity of attempts up to 6 - 12 times; quantity of repetitions in one attempt – up to 3 times; rest interval - 60—180 sec. In process of training attention should be accentuated on quantity of repetitions in one attempt.

Increment of forth form pupils’ mastering of first task in training of “vault over width of gout” (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 ($x_2$). Increment of forth form pupils’ mastering of second task (from squat position with hands on floor jump not loosing hands’ contact with floor) is positively influenced by quantity of attempts ($x_1$) and quantity of repetitions in one attempts ($x_2$). Increment of forth form pupils’ mastering of third task (from 3 meters’ run jump into squat on gout with hands, touching the gout; dismount with bent legs) is positively influenced by interaction of quantity of attempts with quantity of repetitions in one attempt ($x_1 x_2$) and interaction of quantity of attempts, quantity of repetitions in one attempt and rest interval ($x_1 x_2 x_3$). Increment of forth task mastering (from squat position with hands on bench, jump with bent legs over gymnastic bench) is positively influenced by quantity of attempts ($x_1$). Increment of fifth task mastering (from 5-7 meters’ run jump over width of gout with bent legs) is positively influenced by quantity of repetitions in one attempt ($x_2$), and negatively – by interaction of quantity of attempts with quantity of repetitions in one attempt ($x_1 x_2$).

Thus, effectiveness of forth form pupils’ training of “vault over width of gout” is positively influenced by the following: quantity of attempts up to 6 - 12 times; quantity of repetitions in one attempt – up to 3 times; rest interval - 60—180 sec. In process of training attention should be accentuated on quantity of attempts in one attempt and on quantity of attempts.

Results of dispersion analysis for FFE 2^3 are given in table 3.

Increment of first form pupils’ mastering (forward roll) of first task “from position sitting on floor roll back in tuck and turn in initial position” is influenced by quantity of attempts - by 57.42% ($x_1$) and by rest interval – by 29.84% ($x_2$) (see table 3, fig.1). Increment of second task’s mastering (“from squat position with hands on floor roll back in tuck and turn in initial position”) is influenced by interaction of quantity of attempts and quantity of repetitions in one attempt - by 49.29% ($x_1 x_2$), by 28.47% — by quantity of repetitions in one attempt ($x_2$), by 15.45% — by quantity of attempts ($x_1$). Increment of third task’s mastering (“from standing position with hands on floor, legs apart, make forward roll in sitting position with legs apart”) by 50.25% is influenced by quantity of attempts ($x_1$), by 17.16% — by quantity of repetitions in one attempt ($x_2$), by 15.67% — by rest interval ($x_3$). Increment of forth task’s mastering (“from standing position with hands on floor, legs apart, make forward roll in sitting position in tuck”) by 46.68% is influenced by quantity of attempts ($x_1$), by 20.94% — by quantity of repetitions in one attempt ($x_2$), by 20.94% — by rest interval ($x_3$). Increment of fifth task’s mastering (“from standing position with hands on floor make forward roll in squat position with hands on floor”) by 60.22% is influenced by quantity of attempts ($x_1$), by 16.87 — by interaction of quantity of attempts with rest interval ($x_1 x_3$).

Thus, effectiveness of first form pupils’ training of forward roll by 15-60% is influenced by the following: quantity of attempts up to 12 times; quantity of repetitions in one attempt – up to 1-3 times; rest interval - 60—180 sec. In process of training attention should be accentuated on quantity of attempts.

Increment of second form pupils’ (forward roll) mastering of first task (“from sitting in tuck position roll backward and turn in initial position”) by 40.69% is influenced by quantity of repetitions in one attempt ($x_2$). Increment of second form pupils’ mastering of second task (“from squat position with hands on floor roll backward in tuck and return in initial position”) by 78.35% is influenced by quantity of repetitions in one attempt ($x_2$). Increment of third task’s mastering of (“from standing position with legs apart make forward roll in sitting position with legs apart”) by 77.25% is influenced by quantity of repetitions in one attempt ($x_2$). Increment of forth task’s mastering of (“from standing position with hands on floor and legs apart make forward roll in sitting position in tuck”) by 51.37% is influenced by quantity of attempts ($x_1$), by 21.5% — by quantity of repetitions in one attempt ($x_2$). Increment of fifth task’s mastering of (“from standing position with hands on floor and legs apart make forward roll in squat position with hands on floor”) by 61.32% is influenced by quantity of repetitions in one attempt ($x_2$).

Thus, effectiveness of second form pupils’ training of forward roll by 40.69—78.35% is influenced by the following: quantity of attempts up to 6 - 12 times; quantity of repetitions in one attempt – up to 3 times; rest interval - 60—180 sec. In process of training attention should be accentuated on quantity of repetitions in one attempt.

Increment of third form pupils’ (“vault over width of gymnastic horse with legs apart”) mastering of first task (“from lying position with hands on floor, by pushing up with legs take standing position with hands on floor and legs apart and quickly straighten the body”) by 26.2% is influenced by quantity of repetitions in one attempt ($x_2$), by 23.82%
— by quantity of attempts \((x_1)\), by \(23.82\%\) — by rest interval \((x_3)\). Increment of third form pupils’ mastering of second task (“from 2—3 step run jump in squat position with hands on floor and legs apart”) by \(43.48\%\) is influenced by rest interval \((x_3)\), by \(18.72\%\) — by quantity of repetitions in one attempt \((x_2)\). Increment of third task’s mastering of (“from 2—3 step run jump in standing position with hands on floor; torso is and legs apart on horse with handle and dismount arching torso”) by \(60.9\%\) is influenced by quantity of repetitions in one attempt \((x_2)\). Increment of forth task’s mastering of (“in squat on horse jump with legs apart over horse or gout, standing in front”) by \(50.4\%\) is influenced by quantity of repetitions in one attempt \((x_2)\). Increment of fifth task’s mastering by \(25.64\%\) is influenced by quantity of repetitions \((x_2)\), by \(30.52\%\) — by interaction of quantity of attempts with rest intervals \((x_3)x_2)\).

Thus, effectiveness of third form pupils’ training of “vault over width of gymnastic horse with legs apart” is positively influenced by the following: quantity of attempts up to 6 - 12 times; quantity of repetitions in one attempt – up to 3 times; rest interval - 60—180 sec. In process of training attention should be accentuated on quantity of repetitions in one attempt.

Increment of forth form pupils’ (“vault over width of gout”) mastering of 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”) by \(58.55\%\) is influenced by quantity of attempts \((x_1)\), by \(21.58\%\) — by quantity of repetitions in one attempt \((x_2)\). Increments of second task’s mastering of (“from squat position with hands on floor jump not loosing hands’ contact with floor”) by \(26.37\%\) is influenced by quantity of attempts \((x_1)\), by \(49.04\%\) — by quantity of repetitions in one attempt \((x_2)\). Increment of third task’s mastering of (“from 3 meters’ run jump into squat on gout with hands, touching the gout; dismount with bent legs”) by \(31.62\%\) is influenced by interaction of quantity of attempts with quantity of repetitions in one attempt \((x_1)x_2)\), by \(31.62\%\) — by interaction of quantity of attempts, quantity of repetitions in one attempt and rest interval \((x_1)x_2)x_3)\). Increment of forth task’s mastering of (“from squat position with hands on bench, jump with bent legs over gymnastic bench”) by \(73.04\%\) is influenced by quantity of attempts \((x_1)\). Increment of fifth task’s mastering of (“from 5–7 meters’ run jump over width of gout with bent legs”) by \(23.32\%\) is influenced by quantity of repetitions in one attempt \((x_2)\), by \(23.32\%\) — by interaction of quantity of attempts with quantity of repetitions in one attempt \((x_1)x_2)\).

Thus, effectiveness of forth form pupils’ training of “vault over width of gout” is positively influenced by the following: quantity of attempts up to 6 - 12 times; quantity of repetitions in one attempt – up to 3 times; rest interval - 60—180 sec. In process of training attention should be accentuated on quantity of attempts in one attempt and on quantity of attempts.

**Discussion**

Results of the research permitted to supplement the data about planning of experiment in studying of training process’s effectiveness and working out of training models (O.M. Khudolii, T.V. Karpunets [24]; O.M. Khudolii, O.V. Ivashchenko [31, 35]; O.M. Khudolii, O.V. Ivashchenko, S.O. Chernenko [32, 33]). We have confirmed that control over training process is more effective with specifying of training modes on the base of regressive models by full factorial experiment of FFE 2\(^t\) type (O.M. Khudolii [28], O.V. Ivashchenko [11]; V.I. Miroshnichenko [16]).

We also supplemented the data of O.M. Khudolii and O.V. Ivashchenko [31, 35] about possibility to use level of mastering of physical exercises and its dynamic for assessment of training effectiveness. It was established that for obtaining objective information about training process studying of physical exercises’ mastering level’s increment is promising as a criterion of assessment of training effectiveness.

The novelty is the data about modes of gymnastic training of 1\(^{st}\)-4\(^{th}\) form pupils.

**Conclusions:**

Experiment of 2\(^t\) type permitted to realize the following: study multi-factorial structure of modes of 1\(^{st}\)-4\(^{th}\) form pupils’ training of physical exercises; to specify optimal correlations of quantity of attempts, quantity of repetitions in one attempt and rest intervals.

Effectiveness of first form pupils’ training of forward roll is positively influenced by the following: quantity of attempts up to 12 times; quantity of repetitions in one attempt – up to 1-3 times; rest interval - 60—180 sec. In process of training attention should be accentuated on quantity of attempts.

Effectiveness of second form pupils’ training of forward roll by 40.69—78.35\% is influenced by the following: quantity of attempts up to 6 - 12 times; quantity of repetitions in one attempt – up to 3 times; rest interval - 60—180 sec. In process of training attention should be accentuated on quantity of repetitions in one attempt.

Effectiveness of third form pupils’ training of “vault over width of gymnastic horse with legs apart” is positively influenced by the following: quantity of attempts up to 6 - 12 times; quantity of repetitions in one attempt – up to 3 times; rest interval - 60—180 sec. In process of training attention should be accentuated on quantity of repetitions in one attempt.

Effectiveness of forth form pupils’ training of “vault over width of gout” is positively influenced by the following: quantity of attempts up to 6 - 12 times; quantity of repetitions in one attempt – up to 3 times; rest interval - 60—180 sec. In process of training attention should be accentuated on quantity of repetitions in one attempt and on quantity of attempts.

The prospects of further researches are determination of training modes’ influence on dynamic of indicators of motor skills’ progressing in junior school age children.
References:
1. Bal'sevich VK. Ontokineziologya cheloveka [Onto kinesiology human], Moscow: Theory and practice of physical culture; 275. (in Russian)
2. Berg AI, Tikhonov II. Problemy programirovannogo obuchenia [Problems of programmed teaching], Leningrad: Knowledge; 1968. (in Russian)
3. Bogen MM. Obuchenie dvigatel'nym dejstviiam [Training of motor actions], Moscow: Physical Culture and Sport; 1985. (in Russian)
6. Iermakov S. Modeli biomekhanicheskikh sistem v organizatsii effektivnogo dejstviia sportmena [Models of biomechanical systems in organization of sportman’s effective functioning], Pedagogics, psychology, medical-biological problems of physical training and sports 2001;17:40–47. (in Russian)
8. Iermakov SS. Biomekhanichni modeli udarnikh rukhiv u sportivnikh igrah u konteksti vdoskonalennia tekhnikhnoi pidgotovki sportmeniv [Bio-mechanical models of strike movements in context of perfection of sportmen technical fitness], Teorii ta praktiki fizichnogo vikhovannia 2010;4:11–18. (in Ukrainian)
11. Ivashchenko O. V. Normativyne pokazateli trenirovychnykh nagruzok na nachal'nom etape podgotovki iunykh gymnast 6—8 let. Cand. Diss. [Normative indicators of training loads at initial stage of juvenile, 6-8 yrs., girls-gymnasts], Moscow; 1988. (in Russian)
12. Krucevich TV. Bezverkhnia GV. Rekreacija u fizichnej kul'turi riznikh grup naselennia [Recreation in physical education of different population groups], Kiev: Olympic Literature; 2010. (in Ukrainian)
19. Petrov PK. Informacionnye tehnologii v fizicheskoj kul'ture i sporte [Information technologies in physical culture and sports], Moscow: Academy; 2013. (in Russian)
20. Petrov PK. Osnovy programmirovannogo obuchenia v fizicheskom vospitanii [Principles of programmed training in physical education], Ust'nov; 1987. (in Russian)
25. Khudolii OM, Ivashchenko OV. Konceptual'ni pidkhodi do rozrobbi programi naukovikh doslidzhen’ u fizichnomu vikhovannii [Conceptual approaches to working out of program of scientific researches in physical
34. Khudolii OM, Ivaschenko OV. Informatsyionnye zabezpecheniya processu navchannya i rozvitku rukhovikh zdibnostei detei 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)
35. Khudolii OM, Ivaschenko OV. Modeliuvannia procesu navchannya ta rozvitku rukhovikh zdibnostei u ditei i pidlitkiv [Simulation of training process and development of children’s and adolescents’ motor skills], Kharkov: OVS, 2014. (in Ukrainian)
37. Khudolii OM, Ivaschenko 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)
Information about the author:
Chernenko S.O.; http://orcid.org/0000-0001-9375-4220; chernenko.sergey@mail.ru; Donbass State Machine-building Academy; st. Shkadinova, 72, Kramatorsk, Donetsk region, 84313, Ukraine.

Cite this article as: Chernenko S.O. Effectiveness of junior form pupils' training of gymnastic exercises in different modes of their fulfillment. Pedagogics, psychology, medical-biological problems of physical training and sports, 2015:8:65-74. http://dx.doi.org/10.15561/18189172.2015.0809

The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/html/arhiv_e.html

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (http://creativecommons.org/licenses/by/3.0/deed.en).

Received: 15.06.2015
Accepted: 10.07.2015; Published: 20.07.2015