

## SIMULATION OF JUNIOR PUPILS' TRAINING OF BALL THROWING TO VERTICAL TARGET

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**Abstract.** *Purpose:* determination of motor skills' peculiarities of junior pupils. *Material:* the research covered 172 pupils. *Results:* effectiveness of training of 1-4 forms' pupils to "ball throw to vertical target" is positively influenced by increasing of starts quantity up to 12, quantity of repetitions in one start – up to 3 with rest interval of 60 sec. For 1<sup>st</sup> form pupils quantity of repetitions in one start was accentuated; for 2<sup>nd</sup> form pupils – reduction of rest interval up to 60 sec.; for 3<sup>rd</sup> form – quantity of starts and quantity of repetitions in one start were accentuated and for 4<sup>th</sup> form pupils – interaction of quantity of starts and repetitions in one start. *Conclusions:* experiment permitted to study multi-factor structure of physical training process of 1<sup>st</sup>-4<sup>th</sup> forms pupils, to specify optimal correlations of quantity of starts, quantity of repetitions in one start and rest interval in training to "ball throw to target" at physical culture lessons.

**Key words:** training, motor skills, ball throw, junior pupils.

### Introduction

One of problem of school physical education is seeking of new ways of schoolchildren learning process's optimizing (Cieślicka M., Muszkieta R., Napierała M., Żukow W. [24]; Ivashchenko O.V., Khudolii O.M., Yermakova T.S., Pilewska W., Muszkieta R., Stankiewicz B. [25]; Zdanevich A. A. [1]).

The works of A.A. Zdanevich [1], O.V. Ivaschenko [2], V Rybalko [4], D.T. Miroshnichenko [5], O.M. Khudolii [10, 12, 13, 15], O.M. Khudolii, O.V. Ivaschenko, S.S. Yermakov [14], O.M. Khudolii, O.V. Ivaschenko [19, 20]. Junior school age children's motor fitness is influenced by correlation of learning process and development of motor abilities. Development of motor abilities is effective if they become a component of motor skills (O.M. Khudolii, O.V. Ivaschenko, S.O. Chernenko [17, 18]. It was determined that effectiveness of learning increases, if method of algorithmic orders is used (O.M. Khudolii [10, 15], O.V. Ivaschenko [2]), and regiment of exercises and rest alternate (O.M. Khudolii [9], O.V. Ivaschenko [3], V.I. Miroshnichenko [4], O.M. Khudolii, O.V. Ivaschenko [19, 20, 21]. One of methods of study of children's and adolescents' motor skills formation is simulation, conception of which is rendered in works of O.M. Khudolii [9], O.M. Khudolii, O.V. Ivaschenko [16, 19, 20], O.M. Khudolii, O.V. Ivaschenko, S.S. Yermakov [14], Ivashchenko O.V., Khudolii O.M., Yermakova T.S., Pilewska W., Muszkieta R., Stankiewicz B. [20], Adashevskiy V. M., Iermakov S. S. [23].

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

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

*The purpose of the work* is determination of peculiarities of motor skills' formation of junior schoolchildren.

*The methods and organization of the research:* analysis and generalization of scientific and methodic literature, general-scientific theoretical methods such as analogy, analysis, synthesis, abstraction, induction; general empirical methods: observations, testing, experiment.

In the process of our research we used conceptual approaches to planning of experiment for studying of effectiveness of learning process and working out of learning processes' models, which were substantiated in works of O.M. Khudolii, T.V. Karpunets [7], O.M. Khudolii, O.V. Ivaschenko [8, 20], O.M. Khudolii [9]. In dissertation thesis of O.M. Khudolii [13], O.V. Ivaschenko [3], V.I. Miroshnichenko [4] there was defined that control of learning process would be more effective, if learning modes are determined on the base of regressive models, received as a result of complete factor experiment (CFE) of CFE 2<sup>n</sup> type.

In our research we used plans of factor experiment of CFE 2<sup>3</sup> type (see table 1). We studied motor modes of 1<sup>st</sup>-4<sup>th</sup> form pupils' training to ball throw to target. The purpose of CFE was to optimize training modes and, on the base of analysis of regression equations, determine peculiarities of 1<sup>st</sup>-4<sup>th</sup> form pupils' motor skills' peculiarities.

In pedagogic experiment we studied influence of quantity of starts ( $X_1$ ), quantity of repetitions in start ( $X_2$ ) and rest intervals ( $X_3$ ) on level of exercises' mastering by 1<sup>st</sup>-4<sup>th</sup> form pupils.

In the process of track and fields events exercises' training, level of mastering ("fulfilled", "not fulfilled") was assessed at every lesson; probability of exercises' fulfillment was calculated ( $p = n/m$ , where  $n$  — quantity of successful fulfillments,  $m$  — general quantity of attempts).

In training of junior school age children method of algorithmic orders was used. Transition to next exercise was permitted after three successful fulfillments of previous one. In 1<sup>st</sup>-4<sup>th</sup> forms ball throw to vertical target was trained (see table 2) [1, 6, 10].

Technique of ball throw to vertical target is as follows: stand with left side, facing the target; feet – at shoulder width. Bending right leg, incline torso to the right. Right arm with ball move to the right, left arm shall be bent in front of chest. Throw is fulfilled with active unbending of right leg, chest turn to side of throw and shifting body mass to left leg, taking position of pulled bow: both legs are straight, right leg is on toe, left – on full foot; arm with ball is bent under approximately 120° angle and moved backward. From this position without any pause and fixing, straighten torso and move arm with ball over shoulder. After throwing of ball turn torso to the right, move left arm aside.

Training of ball throw to vertical target was conducted in 1<sup>st</sup>-4<sup>th</sup> form as per program, presented in table 2. In the research 48 pupils from every form (172 in total) participated.

### Results of the research

Results of factor experiment are given in tables 3-4.

Table 1

*Matrix of factor experiment of 2<sup>3</sup> type, (study of influence of different exercise's repetition modes on level of their mastering)*

| Experimental groups | Factors                                      |                                                              |                                        |
|---------------------|----------------------------------------------|--------------------------------------------------------------|----------------------------------------|
|                     | X <sub>1</sub><br>quantity of starts (times) | X <sub>2</sub><br>quantity of repetitions in a start (times) | X <sub>3</sub><br>rest interval (sec.) |
| 1                   | 6                                            | 1                                                            | 60                                     |
| 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                                    |

Table 2

*Training tasks for ball throw to vertical target for junior pupils (A.A. Zdanevich, 1995; V. Rybalko 2005; modified)*

| Exercises                                                               | Methodic of assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Ball throws on floor                                                 | Mark «0». Ball completely on hand. Biting hand's movement is absent.<br>Mark «1». Correct and relaxed hold with index and middle fingers behind the ball; thumb and ring fingers support its side.<br>Biting movement: quick proximal joint's movement in direction of throw, then shtp braking.                                                                                                                                                                                     |
| 2. Ball throws forward-upward, feet on shoulder width                   | Mark «0». Initial position of elbow aside of head, feet are not parted, ball is thrown from shoulder.<br>Mark «1». Ball is over shoulder a little higher than head; arm is slightly bent in radiocarpal joint, elbow is at ear level, left arm is a little raised. Hand fulfills biting movement.                                                                                                                                                                                    |
| 3. Ball throws forward-upward, left feet in front.                      | Mark «0». Moving of throwing arm aside torso; in initial position body mass is concentrated on front foot; left arm is dropped.<br>Mark «1». From initial position left leg moves forward, torso is bent backward, body mass – concentrated on a little bent right leg; arm with ball is shifted upward-backward; left arm is raised upward-forward.<br>Consequent work of right leg, torso, left leg and throwing arm shall be executed.                                            |
| 4. Ball throws forward-upward, with left side facing direction of throw | Mark «0». Torso forward bent at the moment of throw, arm with ball moves in side trajectory, left leg is bent in knee at throw moment.<br>Mark «1». Correctness of initial position, videlicet left side faces to target, feet – at shoulder width; body mass – on right foot, turned outside at angle of 25-45 degrees; body mass is transferred on left foot at moment of taking position – pulled bow” with turning face to target.                                               |
| 5. Ball throws with side facing wall                                    | Mark «0». Absence of shoulders' turn with left side facing direction of throw after moving ball; absence of body mass transferring on front foot at the Account of back leg's unbending at moment of jerk; absence of biting movement at moment of ball throw; torso bends forward and aside.<br>Mark «1». Ball throw is fulfilled from the same initial position. Legs are completely straighten, chest moves forward-upward, hand fulfills biting movement at the moment of throw. |

|                                                  |                                                                                                                                                                                                                                                                           |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6. Ball throws to target from 3 meters' distance | Mark «0». Not correct initial position, body mass transferring on front foot, bending of right leg at the moment of body mass transferring forward, no hitting the target.<br>Mark «1». Ball throw from the same initial position. Throw at due time, hitting the target. |
| 7. Ball throws to target from 5 meters' distance | Ditto                                                                                                                                                                                                                                                                     |
| 8. Ball throws to target from 8 meters' distance | Ditto                                                                                                                                                                                                                                                                     |

Table 3

*Regressive dependence of mastering level of small ball throw to target on quantity of starts ( $X_1$ ), quantity of repetitions in one start ( $X_2$ ) and rest intervals ( $X_3$ ) of 1<sup>st</sup>-4<sup>th</sup> form pupils y*

| Form | Quantity of exercises                                                  | Equation of regression for coded variables        |
|------|------------------------------------------------------------------------|---------------------------------------------------|
| 1    | 1. Ball throws on floor                                                | $Y = 0,76 - 0,085x_2 + 0,04x_1x_2$                |
|      | 2. Ball throws forward-upward (feet at shoulder width)                 | $Y = 0,77 - 0,051x_2 + 0,046x_1x_2$               |
|      | 3. Ball throws forward-upward with front left foot                     | $Y = 0,8 - 0,044x_2 + 0,049x_1x_2$                |
|      | 4. Ball throws forward-upward with left side facing direction of throw | $Y = 0,67 + 0,091x_1 + 0,056x_2 - 0,096x_1x_2$    |
| 2    | 1. Ball throws on floor                                                | $Y = 0,701 + 0,034x_1x_2 + 0,041x_1x_2x_3$        |
|      | 2. Ball throws forward-upward (feet at shoulder width)                 | $Y = 0,755 + 0,025x_2x_3 + 0,033x_1x_2x_3$        |
|      | 3. Ball throws forward-upward with front left foot                     | $Y = 0,735 + 0,03x_2x_3 + 0,04x_1x_2x_3$          |
|      | 4. Ball throws forward-upward with left side facing direction of throw | $Y = 0,554 + 0,086x_1 + 0,071x_2 - 0,061x_1x_2$   |
| 3    | 1. Ball throws on floor                                                | $Y = 0,783 - 0,023x_1 - 0,028x_1x_3$              |
|      | 2. Ball throws forward-upward (feet at shoulder width)                 | $Y = 0,738 + 0,02x_1 - 0,035x_3$                  |
|      | 3. Ball throws forward-upward with front left foot                     | $Y = 0,773 + 0,05x_1 + 0,028x_1x_2x_3$            |
|      | 4. Ball throws forward-upward with left side facing direction of throw | $Y = 0,686 - 0,05x_2 + 0,041x_1x_3 - 0,041x_2x_3$ |
|      | 5. Ball throws with left side facing wall                              | $Y = 0,591 + 0,06x_1 + 0,09x_2 - 0,086x_1x_2$     |
| 4    | 1. Ball throws on floor                                                | $Y = 0,754 + 0,024x_1 + 0,026x_2$                 |
|      | 2. Ball throws forward-upward (feet at shoulder width)                 | $Y = 0,766 + 0,034x_1 + 0,039x_2$                 |
|      | 3. Ball throws forward-upward with front left foot                     | $Y = 0,828 + 0,035x_1 - 0,038x_2x_3$              |
|      | 4. Ball throws forward-upward with left side facing direction of throw | $Y = 0,696 + 0,021x_1 + 0,021x_3 + 0,026x_1x_3$   |
|      | 5. Ball throws with left side facing wall                              | $Y = 0,683 + 0,06x_1 + 0,038x_2$                  |

Table 4

*Results of dispersion analysis for CFE  $\Pi\Phi E 2^3$ , which determines dependence of mastering level in ball throw to target on quantity of starts ( $X_1$ ), quantity of repetitions in start ( $X_2$ ) and rest intervals ( $X_3$ ) of 1<sup>st</sup>-4<sup>th</sup> form pupils*

| Form | Quantity of exercises   | Relations of mean squares (%) |       |          |       |          |          |             |
|------|-------------------------|-------------------------------|-------|----------|-------|----------|----------|-------------|
|      |                         | $x_1$                         | $x_2$ | $x_1x_2$ | $x_3$ | $x_1x_3$ | $x_2x_3$ | $x_1x_2x_3$ |
| 1    | 1. Ball throws on floor | 2.25                          | 72.25 | 16       | 0.25  | 0        | 0.25     | 9.0         |

|   |                                                                        |       |       |       |       |       |       |       |
|---|------------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|
|   | 2. Ball throws forward-upward (feet at shoulder width)                 | 6.74  | 50.4  | 41.04 | 0.74  | 0.02  | 0.26  | 0.74  |
|   | 3. Ball throws forward-upward with front left foot                     | 2.20  | 33.36 | 41.43 | 4.6   | 12.01 | 0.24  | 6.12  |
|   | 4. Ball throws forward-upward with left side facing direction of throw | 37.34 | 14.18 | 41.54 | 3.09  | 0.17  | 0.56  | 3.09  |
| 2 | 1. Ball throws on floor                                                | 5.34  | 19.78 | 23.07 | 2.56  | 0.79  | 13.96 | 34.47 |
|   | 2. Ball throws forward-upward (feet at shoulder width)                 | 14.46 | 11.42 | 8.75  | 2.85  | 14.46 | 17.85 | 30.17 |
|   | 3. Ball throws forward-upward with front left foot                     | 3.47  | 0.86  | 0.86  | 7.82  | 0     | 31.30 | 55.65 |
|   | 4. Ball throws forward-upward with left side facing direction of throw | 41.67 | 28.44 | 21.01 | 0.07  | 3.86  | 1.05  | 3.86  |
| 3 | 1. Ball throws on floor                                                | 28.22 | 8.71  | 8.71  | 8.71  | 42.16 | 3.13  | 0.34  |
|   | 2. Ball throws forward-upward (feet at shoulder width)                 | 19.81 | 2.78  | 1.23  | 60.68 | 0.30  | 0     | 15.17 |
|   | 3. Ball throws forward-upward with front left foot                     | 61.82 | 2.47  | 1.39  | 12.51 | 0.61  | 2.47  | 18.70 |
|   | 4. Ball throws forward-upward with left side facing direction of throw | 10.98 | 31.58 | 2.51  | 9.15  | 22.61 | 22.61 | 0.51  |
|   | 5. Ball throws with left side facing wall                              | 19.38 | 35.49 | 35.49 | 3.28  | 0.90  | 3.28  | 2.15  |
| 4 | 1. Ball throws on floor                                                | 40.3  | 49.2  | 0.11  | 9.05  | 0.11  | 1.0   | 0.11  |
|   | 2. Ball throws forward-upward (feet at shoulder width)                 | 38.3  | 50.5  | 2.5   | 4.2   | 0.05  | 4.2   | 0.05  |
|   | 3. Ball throws forward-upward with front left foot                     | 31.06 | 0.6   | 7.7   | 0.6   | 1.4   | 35.6  | 22.8  |
|   | 4. Ball throws forward-upward with left side facing direction of throw | 25.8  | 0.8   | 7.2   | 25.8  | 39.4  | 0.08  | 0.8   |
|   | 5. Ball throws with left side facing wall                              | 51.8  | 20.2  | 12.9  | 10.8  | 0.3   | 2.2   | 1.4   |

Analysis of equations of regression showed that for *first form pupils* mastering level in *first* exercise –“ball throws on floor” is negatively influenced by quantity of repetitions ( $x_2$ ) and positively influenced by interaction of quantity of starts and quantity of repetitions in start ( $x_1x_2$ ) (see table 1). Training results depend by 72.25 % on quantity of repetitions in start ( $x_2$ ) and by 16 % on interaction of quantity of starts and quantity of repetitions in start ( $x_1x_2$ ).

Mastering level in *second* exercise –“Ball throws forward-upward (feet at shoulder width)” is negatively influenced by quantity of repetitions ( $x_2$ ) and positively – by interaction of quantity of starts and quantity of repetitions in start ( $x_1x_2$ ). Training results depend by 50.4 % on quantity of repetitions in start ( $x_2$ ) and by 41.04 % on interaction of quantity of starts and quantity of repetitions in start ( $x_1x_2$ ).

Mastering level in *third* exercise –“Ball throws forward-upward with front left foot” is negatively influenced by quantity of starts ( $x_1$ ) and positively by interaction of quantity of starts and quantity of repetitions in start ( $x_1x_2$ ). Training results depend by 33.36 % on quantity of repetitions in start ( $x_2$ ) and by 41.43 % on interaction of quantity of starts and quantity of repetitions in start ( $x_1x_2$ ).

There is positive influence on mastering level in *fourth* exercise –“Ball throws forward-upward with left side facing direction of throw” rendered by quantity of starts ( $x_1$ ), quantity of repetitions in start ( $x_2$ ) and negative influence rendered by interaction of quantity of starts and quantity of repetitions in start ( $x_1x_2$ ). Training results depend by 37.34 % on quantity of starts ( $x_1$ ) and by 14.18 % on quantity of repetitions in start ( $x_2$ ) and by 41.54% on interaction of quantity of starts and quantity of repetitions in start ( $x_1x_2$ ).

Thus, effectiveness of *first form* schoolchildren’s training to –“Ball throw to vertical target” is positively influenced by 6-12 starts with quantity of repetitions in every start – 2; rest interval of 60-180 sec. Quantity of

repetitions in start shall be accentuated in choosing of training mode.

Mastering level of 2<sup>nd</sup> form pupils in first exercise –Ball throws on floor” is positively influenced by interaction of quantity of starts and quantity of repetitions in start ( $x_1x_2$ ) and interaction of all factors ( $x_1x_2x_3$ ). Training results depend by 23.07 % on interaction of quantity of starts and quantity of repetitions in start ( $x_1x_2$ ) and by 34.47% - on interaction of all factors ( $x_1x_2x_3$ ).

Mastering level of second exercise –Ball throws forward-upward (feet at shoulder width)” is positively influenced by interaction of quantity of starts and quantity of repetitions in start ( $x_1x_2$ ) and interaction of all factors ( $x_1x_2x_3$ ). Training results depend by 17.8 % on interaction of quantity of starts and quantity of repetitions in start ( $x_1x_2$ ) and by 30.17% - on interaction of all factors ( $x_1x_2x_3$ ).

In third exercise –Ball throws forward-upward with front left foot” mastering level is positively influenced by interaction of quantity of repetitions in one start with rest intervals ( $x_2x_3$ ) and interaction of all factors ( $x_1x_2x_3$ ). Training result depends by 31.03 % on interaction of quantity of repetitions in start with rest interval ( $x_2x_3$ ) and by 55.65 % on interaction of all factors ( $x_1x_2x_3$ ).

Level of forth exercise –Ball throws forward-upward with left side facing direction of throw ” mastering is positively influenced by quantity of starts ( $x_1$ ), quantity of repetitions in one start ( $x_2$ ) and negatively influenced by their interaction ( $x_1x_2$ ). Training result depends by 41.67 % on quantity of starts ( $x_1$ ), by 28.44 % — on quantity of repetitions in one start ( $x_2$ ) and by 21.01 % — on interaction of quantity of starts with quantity of repetition in start ( $x_1x_2$ ).

Thus effectiveness of training of 2<sup>nd</sup> form pupils to –ball throw to vertical target” is positively influenced by increasing of quantity of starts up to 12 times, quantity of repetitions in one start – to 3 times and reduction of rest interval to 60 sec. Interaction of three factors ( $x_1x_2x_3$ ) shall be accentuated when choosing mode of training.

Mastering level of 3<sup>rd</sup> form pupils in first exercise –Ball throws on floor” is negatively influenced by quantity of starts ( $x_1$ ) and interaction of quantity of starts and rest intervals ( $x_1x_3$ ). Training result depends by 28.22 % on quantity of starts ( $x_1$ ) and by 42.16 % — on interaction of quantity of starts and rest intervals ( $x_1x_3$ ).

In second exercise –Ball throws forward-upward (feet at shoulder width)” mastering level is positively influenced by quantity of starts ( $x_1$ ) and negatively – by rest interval ( $x_3$ ). Training result depends by 19.81 % on quantity of starts ( $x_1$ ) and by 60.68 % — on rest interval ( $x_1x_3$ ). Increasing of rest interval to 180 sec. reduces mastering level.

In third exercise –Ball throws forward-upward with front left foot” mastering level is positively influenced by quantity of starts ( $x_1$ ) and interaction of all factors ( $x_1x_2x_3$ ). Training result depends by 61.82 % on quantity of starts ( $x_1$ ) and by 18.7 % — on interaction of all factors ( $x_1x_2x_3$ ).

Level of mastering in forth exercise –Ball throws forward-upward with left side facing direction of throw” is influenced positively by interaction of quantity of starts and rest interval ( $x_1x_3$ ) and negatively – by quantity of repetitions in one start ( $x_2$ ), as well as by interaction of quantity of repetitions in start and rest interval ( $x_2x_3$ ). Training result depends by 31.58 % on quantity of repetitions in one start ( $x_2$ ), by 22.61 % — on quantity of starts and rest intervals ( $x_1x_3$ ), by 22.61 % — on interaction of quantity of repetitions in start and rest interval ( $x_2x_3$ ).

Mastering level in fifth exercise –Ball throws with left side facing wall ” is positively influenced by quantity of starts ( $x_1$ ), rest intervals ( $x_3$ ), and negatively – by interaction of quantity of starts with quantity of repetitions in one start ( $x_1x_2$ ). Training result depends by 38 % on quantity of starts ( $x_1$ ), by 35.49 % — on rest interval ( $x_2$ ), by 35.49 % — on interaction of quantity of starts with quantity of repetitions in one start.

Thus effectiveness of 3<sup>rd</sup> form pupils’ training to –Ball throw to vertical target” is positively influenced by quantity of starts up to 12 times, quantity of repetitions in start – to 3 times and reduction of rest interval up to 60 sec. In training process it is necessary to accentuate attention at interaction of quantity of starts and quantity of repetitions in one start.

Mastering level of 4<sup>th</sup> form pupils in first exercise –Ball throws on floor” is positively influenced by quantity of starts ( $x_1$ ), quantity of repetitions in one start ( $x_2$ ). Training result depends by 40.3 % on quantity of starts ( $x_1$ ) and by 49.2 % on quantity of repetitions in one ( $x_2$ ).

Mastering level in second exercise –Ball throws forward-upward (feet at shoulder width)” is positively influenced by quantity of starts ( $x_1$ ), quantity of repetitions in one start ( $x_2$ ). Training result depends by 38.3 % on quantity of starts ( $x_1$ ) and by 50.5 % — on quantity of repetitions in one start ( $x_2$ ).

In third exercise –Ball throws forward-upward with front left foot” level of mastering is positively influenced by quantity of starts ( $x_1$ ) and negatively – by interaction of quantity of starts and rest intervals ( $x_2x_3$ ). Training result depends by 31.06 % on quantity of starts ( $x_1$ ) and by 35.5 % — on interaction of quantity of starts and rest intervals ( $x_2x_3$ ).

Mastering level in forth –Ball throws forward-upward with left side facing direction of throw” exercise is positively influenced by quantity of approaches ( $x_1$ ), rest interval ( $x_3$ ) and their interaction ( $x_1x_3$ ). Training result depends by 25.8 % by quantity of starts ( $x_1$ ), by 25.8 % — on rest interval ( $x_3$ ), by 39.4 % — on their interaction ( $x_1x_3$ ).

In fifth exercise –Ball throws with left side facing wall” mastering level is positively influenced by quantity of starts ( $x_1$ ) and quantity of repetitions in one start ( $x_2$ ). Training result depends by 51.8 % on quantity of starts ( $x_1$ ) and by 20.2 % — on quantity of repetitions in one start ( $x_2$ ).

Thus, effectiveness of 4<sup>th</sup> form pupils’ training to –ball throw to vertical target” is positively influenced by increasing of starts to 12 times, quantity of repetitions – to 3 times with rest interval 60 sec. Attention shall be

accentuated to quantity of starts and quantity of repetitions in one start.

### Discussion

Results of the research permitted to supplement data about planning experiment for study of training process's effectiveness and working out of training models (O.M. Khudolii, T.V. Karpunets [7], O.M. Khudolii, O.V. Ivaschenko [8], O.M. Khudolii [9]). We have proved that control over training process becomes more effective is training modes are determined on the base of regressive models, received as a result of complete factor experiment of CFE 2<sup>k</sup> type (O.M. Khudolii [13], O.B. Ivaschenko [3], V.I. Miroshnichenko [4]).

Data about modes of training of 1<sup>st</sup>-4<sup>th</sup> schoolchildren to physical exercises are the novelty.

### Conclusions

Experiment of 2<sup>3</sup> type permitted to study multi factor structure of modes of 1<sup>st</sup>-4<sup>th</sup> form pupils' training to physical exercises, to determine optimal correlations of starts' quantity, quantity of repetitions in one start and rest interval in training of "ball throws".

Effectiveness of 1<sup>st</sup>-4<sup>th</sup> form pupils' training to "ball throw to vertical target" is positively influenced by increase of starts' quantity to 12, quantity of repetitions in one start – to 3 times with rest interval of 60 sec. For first form pupils quantity of repetitions in one start shall be accentuated when choosing mode of training; for second form pupils – reduction of rest interval to 60 sec. shall be paid attention to; for third form pupils – interaction of quantity of starts and quantity of repetitions in one start; for fourth form pupils interaction of starts' quantity and repetitions in one start shall be accentuated.

The prospects of further researches imply determination of influence of training modes on dynamic of junior schoolchildren motor skills' indicators.

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### Conflict of interests

Author declares absence of any conflict of interests.

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