Level of physical exercises’ mastering in structure of 11-13 yrs age boys’ motor fitness

Ivashchenko O.V., Iermakov S.S., Khudolii O.M., Cretu M., Potop V.

1H.S. Skovoroda Kharkiv National Pedagogical University, Ukraine
2Kazimierz Wielki University, Bydgoszcz, Poland
3University of Pitesti, Romania
4Ecological University of Bucharest, Romania

Abstract

Purpose: to find the place of physical exercises’ mastering level in structure of 11-13 yrs age boys’ motor fitness.

Material: in the research 11 yrs age boys (n=58), 12 (n=76) and 13 years age (n=93) participated. Testing program included well-known tests: “Forward roll”, “Backward roll”, “Vault”, “Climbing rope (three attempts)”, “Bridge”, “Stance on shoulder blades”.

Results: By indicators of physical condition 11-13 yrs age boys statistically confidently differ one from another (p<0,001). Level of mastering of gymnastic exercises “Backward roll”, “Vault”, “Climbing rope (three attempts)”, “Bridge”, “Stance on shoulder blades” with age statistically confidently increases (p<0,001).

Conclusions: In factorial structure of motor fitness, level of physical exercises’ mastering has weight 17,5% (11 yrs age), 36,6% (12 years), 28,5% (13 years). Analysis of communities showed that in 11-13 yrs age boys training of motor abilities is effective (if they become a component of mastered motor skills).

Keywords: motor abilities, level of mastering, factorial analysis, 11-13 yrs age boys.

Introduction

The problem of optimization of schoolchildren’s physical education was regarded in works of Bodnar I. [1], Vas’kiv Iu.V. [2], Krucievich T. et al. [9], Ivashchenko O.V. [8]. Bodnar I. stresses on need in searching new approaches to integrated physical education of different health groups’ schoolchildren [1]. The authors defined urgent problems of educational process’ perfection at physical culture lessons. Theoretical aspects and conditions of implementation in educational process of such innovative approaches as culturologic, competence, synergetic, axiologic, achmeologic and other are regarded. The ways of the mentioned approaches’ implementation in real educational process are open. The results of innovative approaches implementation in personality oriented educational process are analyzed. It was proved that implementation of innovative approaches facilitates rising of educational process’ organization. Its basis is personality oriented approach to pupils. Besides, certain difficulties in educational process’s organization in comprehensive schools were found [2]. Methodic materials for planning of physical education process in comprehensive schools have been worked out [9]. Conception of physical education, which was built on the base of physical education’s simulation, motor abilities’ training and pedagogic control has been created. This conception includes: application of factorial and discriminant models of functional state age changes and motor fitness. The purpose of this conception is: planning of educational material, current, finalizing and stage-by-stage control of children’s fitness; modes of loading in a lesson and in series of lessons; regimes of alternation of relaxation and exercises [8].

In schoolchildren’s physical education there marked out directions of researches, which are connected with studying of motor abilities [5, 6, 7] and process of motor actions’ training [17, 20, 28]. Peculiarities of functional, coordination and power fitness of children and adolescents have been found [4, 11]. Dependence of training of power loads’ effects on regime of exercises’ fulfillment and relaxation has been determined [18, 23]. The process of motor actions’ training was studied from position of interdisciplinary connections [12, 13]; formation of motor competence [14, 15]; formation of meta-cognitive behavior [16]; verbal perception in mastering of sport movements [19]; optimization of regimes of exercises’ repetitions and rest intervals [20, 26, 28].

However, in available scientific literature there is a little data about wholeness of motor abilities’ development and children’s and adolescents’ training [27, 29]. Thus, study of motor fitness influence on level of physical exercises’ mastering is rather relevant. In other works training of motor fitness and dynamic of physical exercises’ mastering in 11-13 yrs age girls were regarded [31, 32]. In our work we have studied motor fitness and dynamic of physical exercises’ mastering in 11-13 yrs age boys.

The purpose of the research is to find the place of physical exercises’ mastering level in structure of 11-13 yrs age boys’ motor fitness.

Material and methods

Participants: in the research 11 yrs age boys (n=58), 12 (n=76) and 13 years age (n=93) participated.

Organization of the research: we used the following methods of research: analysis of scientific-methodic literature, pedagogic testing, methods of mathematical statistic. Testing program included well known tests. We registered: body length and mass, vital capacity of lungs (VCL), right and left hand dynamometry. We registered
results in the following tests: “Pressing ups”, times”, “legs’ rising in hanging on Sweden wall position, times”, “Angle on parallel bars, sec.”, “Torso rising in sitting position from lying on back position during 1 min.”, “Forward torso rising from sitting position (legs apart), cm”, “Hanging on bent arms, sec.”, “Torso rising from lying on abdomen position during 30 sec., times”, “Long jump from the sport, cm”, “Throw of filled ball (1 kg) in sitting position”, “Shuttle run 4x9 m, sec.” [25].

We studied mastering level of exercises: “Forward roll”, “Backward roll”, “Vault”, “Climbing rope (three attempts)”, “Bridge”, “Stance on shoulder blades”. [27].

Statistical analysis: the data were processed with the help of statistical analysis program IBM SPSS 20. The used factorial analysis included implied method of principle components. Method of rotation implied Varimax with normalization of Keiser. For every variable we calculated components. Results of the researches are presented in tables 1-7.

Table 1. Testing results of 11-13 yrs boys

| № | Description of parameters | Age | N  | X       | m       | Difference | t      | P       |
|---|---------------------------|-----|----|---------|---------|------------|--------|---------|
| 1 | Height, cm                | 11  | 58 | 143,172 | .857    | -7,182     | -5,654 | <0.001  |
|   |                           | 12  | 76 | 150,355 | .896    | -5,525     | -4,581 | <0.001  |
|   |                           | 13  | 93 | 155,580 | .726    | -12,408    | -10,866| <0.001  |
| 2 | Body mass, kg             | 11  | 58 | 42,302  | 1,040   | -4,288     | -2,889 | <0.001  |
|   |                           | 12  | 76 | 46,591  | 1,038   | -11,005    | -7,257 | <0.001  |
|   |                           | 13  | 93 | 1722,413| 45,951  | -285,480   | -4,451 | <0.001  |
| 3 | VCL, cm3                  | 12  | 76 | 2007,894| 36,838  | -270,599   | -5,055 | <0.001  |
|   |                           | 13  | 93 | 2278,494| 37,880  | -556,080   | -9,245 | <0.001  |
| 4 | Right hand dynamometry, kg| 12  | 76 | 18,448  | .360    | -3,485     | -4,220 | <0.001  |
|   |                           | 13  | 93 | 25,784  | .670    | -7,336     | -8,189 | <0.001  |
| 5 | Left hand dynamometry, kg | 12  | 76 | 19,881  | .710    | -4,441     | -4,536 | <0.001  |
|   |                           | 13  | 93 | 24,322  | .668    | -6,736     | -6,814 | <0.001  |
| 6 | Pressing ups, times       | 12  | 76 | 21,881  | .881    | -2,828     | -2,224 | <0.05   |
|   |                           | 13  | 93 | 24,709  | .895    | -4,485     | -3,572 | <0.001  |
| 7 | Chin ups, times           | 11  | 58 | 2,197   | .222    | -1,361     | -3,572 | <0.001  |
|   |                           | 12  | 76 | 3,559   | .292    | -1,800     | -4,517 | <0.001  |
| 8 | Legs’ rising, hanging on  | 11  | 58 | 4,758   | .394    | -0,440     | -0,737 | <0.05   |
|   | Sweden wall, times        | 12  | 76 | 4,802   | .431    | -2,810     | -4,647 | <0.001  |
|   |                           | 13  | 93 | 7,612   | .417    | -2,854     | -4,649 | <0.001  |
| 9 | Angle on parallel bars,   | 11  | 58 | 1,206   | .211    | .009       | .335   | <0.05   |
|   | secc., times              | 12  | 76 | 1,197   | .177    | .609       | 2,294  | <0.05   |
|   |                           | 13  | 93 | 1,806   | .191    | .599       | 2,039  | <0.05   |
| 10| Torso rising from position| 11  | 58 | 39,000  | .736    | .592       | .617   | <0.05   |
|   | lying on back during 1     | 12  | 76 | 38,407  | .621    | -5,151     | -5,615 | <0.001  |
|   | minute, times             | 13  | 93 | 43,559  | .655    | -4,559     | -4,497 | <0.001  |
| 11| Forward torso bending in   | 11  | 58 | 4,051   | .380    | -1,448     | -2,728 | <0.01   |
|   | sitting position (legs apart), cm | 12  | 76 | 5,500   | .361    | 2,231      | 5,305  | <0.001  |
|   |                           | 13  | 93 | 3,268   | .239    | .782       | 1,835  | <0.05   |
| 12| Hanging on bent arms, sec. | 11  | 58 | 5,327   | .692    | -1,646     | -1,368 | <0.05   |
|   |                           | 12  | 76 | 6,973   | .907    | -2,563     | -1,996 | <0.05   |
|   |                           | 13  | 93 | 9,537   | .893    | -4,210     | -3,348 | <0.001  |

Results

Results of the researches are presented in tables 1-7. By indicators of physical condition 11-13 yrs age boys confidently differ one from another (p<0.001). Body length increased by 8.6%, by 30.9% — body mass, by 32.33% — vital capacity of lungs, by 39.7% — strength of right hand and by 38,3,8% — strength of left hand.

12 yrs boys show confidently better results than 11 yrs boys in tests: “Chin ups in lying position, times”, “Legs’ rising, hanging on Sweden wall, times”, “Angle on parallel bars, sec., times”, “Forward torso bending in sitting position (legs apart), cm”, “Hanging on bent arms, sec.”, “Torso rising from lying on abdomen position during 30 sec., times”, “Long jump from the sport, cm”, “Throw of filled ball (1 kg) from sitting position, cm”.

13 yrs boys show confidently better results in the following tests: “Pressing ups, times”, “Chin ups, times”, “Legs’ rising, hanging on Sweden wall, times”, “Angle on parallel bars, sec., times”, “Torso rising from position lying on back during 1 minute, times”, “Torso rising from lying on abdomen position during 30 sec., times”, “Long jump from the spot, cm”, “Throw of filled ball (1 kg) from sitting position, cm”.

Statistical analysis: the data were processed with the help of statistical analysis program IBM SPSS 20. The used factorial analysis included implied method of principle components. Method of rotation implied Varimax with normalization of Keiser. For every variable we calculated components. Results of the researches are presented in tables 1-7.
Table 1 (Continued)

| №  | Description of parameters                               | Age | N  | X   | m   | Difference of mean values | t   | P       |
|----|--------------------------------------------------------|-----|----|-----|-----|---------------------------|-----|---------|
| 13 | Torso rising from lying on abdomen position during 30 sec., times | 11  | 58 | 19,137 | .399 | -1.809 | -2.638 | <0.005  |
|    |                                                        | 12  | 76 | 20,947 | .515 | -4.783 | -6.704 | <0.001  |
|    |                                                        | 13  | 93 | 25,731 | .488 | -6.593 | -9.494 | <0.001  |
| 14 | Long jump from the spot, cm                            | 11  | 58 | 144,913 | 2,282 | -5.217 | -8.313 | <0.05   |
|    |                                                        | 12  | 76 | 150,131 | 1,779 | -16.513 | -7.678 | <0.001  |
|    |                                                        | 13  | 93 | 166,645 | 1,290 | -21.731 | -8.935 | <0.001  |
| 15 | Throw of filled ball (1 kg) from sitting position, cm  | 11  | 58 | 209,396 | 5,283 | -57.313 | -6.838 | <0.001  |
|    |                                                        | 12  | 76 | 266,710 | 6,109 | -69.633 | -9.435 | <0.001  |
|    |                                                        | 13  | 93 | 336,344 | 4,427 | -126.947 | -18.163 | <0.001  |
| 16 | Shuttle run, 4x9 m, sec.                               | 11  | 58 | 11,526 | .093 | 114.667 | 2.052 | >0.05   |
|    |                                                        | 12  | 76 | 11.526 | 1.010 | 260.000 | 2.030 | <0.05   |
| 17 | Forward roll, level of mastering                       | 11  | 58 | 80,689 | 2,252 | -9.047 | -3.126 | <0.002  |
|    |                                                        | 12  | 76 | 89,736 | 1.854 | -3.596 | -1.537 | <0.05   |
|    |                                                        | 13  | 93 | 93,333 | 1.477 | -12.643 | -4.900 | <0.001  |
| 18 | Backward roll, level of mastering                      | 11  | 58 | 64,931 | 2.926 | -14.016 | -3.557 | <0.001  |
|    |                                                        | 12  | 76 | 78,947 | 2.619 | -9.654 | -2.877 | <0.001  |
|    |                                                        | 13  | 93 | 88,602 | 2.149 | -23.671 | -6.163 | <0.001  |
| 19 | Vault, level of mastering                              | 11  | 58 | 91,052 | 1.732 | -7.775 | -2.999 | <0.05   |
|    |                                                        | 12  | 76 | 91,828 | 1.856 | -19.758 | -6.362 | <0.001  |
|    |                                                        | 13  | 93 | 91,928 | 1.930 | -16.379 | -3.995 | <0.05   |
| 20 | Climbing rope (three attempts), level of mastering     | 11  | 58 | 68,620 | 3.482 | -16.379 | -3.995 | <0.05   |
|    |                                                        | 12  | 76 | 85,000 | 2.402 | -1.236 | -3.355 | <0.05   |
|    |                                                        | 13  | 93 | 86,236 | 2.700 | -17.615 | -4.015 | <0.001  |
| 21 | Bridge, level of mastering                             | 11  | 58 | 82,069 | 3.432 | -11.878 | -3.388 | <0.002  |
|    |                                                        | 12  | 76 | 93,947 | 1.590 | 3.839 | 1.445 | <0.05   |
|    |                                                        | 13  | 93 | 90,107 | 2.019 | -8.038 | -2.158 | <0.05   |
| 22 | Stance on shoulder blades, level of mastering          | 11  | 58 | 85,517 | 2.243 | -2.903 | -0.986 | <0.05   |
|    |                                                        | 12  | 76 | 88,421 | 1.919 | -4.267 | -1.614 | <0.05   |
|    |                                                        | 13  | 93 | 92,688 | 1.803 | -7.170 | -2.481 | <0.05   |

* comparison of 11-12 years; ** comparison of 12-13 years; *** comparison of 11-13 years

Table 2. Matrix of factorial analysis of 11 yrs boys’ testing. Rotation method: Varimax with Keiser’s normalization

| №  | Description of parameters               | Component 1 | Component 2 | Component 3 | Component 4 | Component 5 | Component 6 | h2  |
|----|----------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-----|
| 1  | VCL, cm3                                | .778        | .379        | .803        |             |             |             |     |
| 2  | Right hand dynamometry, kg              | .702        | .343        | .318        | .827        |             |             |     |
| 3  | Left hand dynamometry, kg               |             | .741        | .633        |             |             |             |     |
| 4  | Pressing ups, times                     | .530        | -.606       | .784        |             |             |             |     |
| 5  | Chin ups, times                         | .373        | -.693       | .788        |             |             |             |     |
| 6  | Legs’ rising, hanging on Sweden wall, times | .706        |             |             |             |             |             |     |
| 7  | Angle on parallel bars, sec., times     | .803        | -.346       | .897        |             |             |             |     |
| 8  | Torso rising from position lying on back during 1 minute, times | .534        | -.472       | .719        | .368        | .635        | .639 |     |
| 9  | Forward torso bending in sitting position (legs apart), cm | .777        |             | .706        |             |             |             |     |
| 10 | Hanging on bent arms, sec               | .664        | -.329       | .747        |             |             |             |     |
| 11 | Torso rising from lying on abdomen position during 30 sec., times | -.368       | .635        | .639        |             |             |             |     |
| 12 | Long jump from the spot, cm             | .569        | -.382       | .854        | -.449       | .602        |             |     |
| 13 | Throw of filled ball (1 kg) from sitting position, cm | .725        |             | .510        |             |             |             |     |
| 14 | Shuttle run, 4x9 m, sec.                | .627        |             |             |             |             |             |     |
| 15 | Forward roll, level of mastering        | .657        |             |             | -.378       | .601        |             |     |
Table 2 (Continued)

| № | Description of parameters                        | Component 1 | Component 2 | Component 3 | Component 4 | Component 5 | Component 6 | h2 |
|---|--------------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|----|
| 16| Backward roll, level of mastering                | .446        | .615        |             |             |             |             | .750|
| 17| Vault, level of mastering                        | .759        |             |             |             |             |             | .685|
| 18| Climbing rope (three attempts), level of mastering| .778        |             |             |             |             |             | .750|
| 19| Bridge, level of mastering                       | .834        |             |             |             |             |             | .815|
| 20| Stance on shoulder blades, level of mastering     | .850        |             |             |             |             |             | .860|
| 21| Bridge, level of mastering                       | .532        | .412        | .366        | .390        |             |             | .759|
| 22| Stance on shoulder blades, level of mastering     | .736        |             |             |             |             |             | .706|

Table 3. Full explained dispersion

| Component | Interpretation                                           | Sum of squares of rotation loads | % of dispersion | Cumulative % |
|-----------|----------------------------------------------------------|----------------------------------|-----------------|--------------|
| 1         | Level of mastering and motor fitness                    | 17,505                           | 17,505          |              |
| 2         | Physical condition                                      | 17,108                           | 34,613          |              |
| 3         | Strength of hand                                        | 13,390                           | 48,003          |              |
| 4         | Functional state of respiratory system                  | 8,954                            | 56,957          |              |
| 5         | Motor coordination                                      | 8,896                            | 65,853          |              |
| 6         | Static power                                            | 6,920                            | 72,773          |              |

Table 4. Matrix of actorial analysis of 12 yrs boys’ testing. Rotation method: Varimax with Kwisber’s normalization

| № | Description of parameters                        | Komponenta | Component 1 | Component 2 | Component 3 | Component 4 | h2 |
|---|--------------------------------------------------|-------------|-------------|-------------|-------------|-------------|----|
| 1 | Height, cm                                        |             | .821        |             |             |             | .781|
| 2 | Body mass, kg                                     | -.364       |             | .703        |             |             | .719|
| 3 | VCL, cm³                                          |             | .533        |             | .511        |             | .588|
| 4 | Right hand dynamometry, kg                       |             | .776        |             | .300        |             | .768|
| 5 | Left hand dynamometry, kg                        |             | .729        |             |             |             | .659|
| 6 | Pressing ups, times                              | .632        | .413        |             |             |             | .687|
| 7 | Chin ups, times                                  | .761        | .441        |             |             |             | .842|
| 8 | Legs’ rising, hanging on Sweden wall, times      | .654        |             | .525        |             |             | .783|
| 9 | Angle on parallel bars, sec., times               | .455        | .309        | .665        |             |             | .761|
| 10| Torso rising from position lying on back during 1 minute, times | .806 | .354 |             |             |             | .803|
| 11| Forward torso bending in sitting position (legs apart), cm | -.513 | -.609 |             |             |             | .707|
| 12| Hanging on bent arms, sec.                        | .549        |             | .629        |             |             | .788|
| 13| Torso rising from lying on abdomen position during 30 sec., times | .696 | .433 |             |             |             | .723|
| 14| Long jump from the spot, cm                       | .699        | .328        | .613        |             |             | .613|
| 15| Throw of filled ball (1 kg) from sitting position, cm | .341 |             | .712        |             |             | .640|
| 16| Shuttle run, 4x9 m, sec.                          | -.596       | .438        | -.371       |             |             | .708|
| 17| Forward roll, level of mastering                  | .887        |             |             |             |             | .812|
| 18| Backward roll, level of mastering                 | .927        |             |             |             |             | .902|
| 19| Vault, level of mastering                         | .806        |             | -.315       |             |             | .772|
| 20| Climbing rope (three attempts), level of mastering| .858        |             |             |             |             | .778|
| 21| Bridge, level of mastering                        | .572        | -.547       | .309        |             |             | .762|
| 22| Stance on shoulder blades, level of mastering     | .860        |             |             |             |             | .817|
sitting position, cm”,” “Shuttle run 4x9 m, sec”.

The level of mastering the exercises “Forward roll”, “Backward roll”, “Vault”, “Climbing rope (three attempts)”, “Bridge”, “Stance on shoulder blades” statistically confidently increases with age (p<0.001) (see table 1).

Thus, in 11-13 yrs age boys we noted positive dynamic of physical condition, motor abilities and gymnastic exercises’ mastering level indicators.

For specifying motor fitness influence on physical exercises’ mastering level we fulfilled factorial analysis.

Results of factorial analysis are given in tables 1-7. In the process of analysis in 11 yrs boys we marked out six factors, which explain 72,773% of total dispersion (see table 2-3).

Factor 1 has the highest weight (21,735%) and

Table 5. Full explained dispersion

| Component | Interpretation | Sum of squares of rotation loads | % of dispersion | Cumulative % |
|-----------|----------------|---------------------------------|----------------|--------------|
| 1         | Level of mastering and motor fitness | 36,646 | 36,646 | |
| 2         | Physical condition | 14,067 | 50,713 | |
| 3         | Speed power | 12,639 | 63,352 | |
| 4         | Physical condition | 11,255 | 74,607 | |

Table 6. Matrix of actorial analysis of 13 yrs boys’ testing. Rotation method: Varimax with Kwisier’s normalization

| № | Description of parameters | Components | Components | Components |
|---|--------------------------|------------|------------|------------|
| 1 | Height, cm               | ,706       | ,762       | ,357       |
| 2 | Body mass, kg            | ,380       | ,501       | ,486       |
| 3 | VCL, cm3                 | ,381       | ,937       | ,901       |
| 4 | Right hand dynamometry, kg | ,950     | ,314       | ,737       |
| 5 | Left hand dynamometry, kg | ,424       | ,666       | ,921       |
| 6 | Pressing ups, times      | ,388       | ,699       | ,810       |
| 7 | Chin ups, times          | ,345       | ,766       | ,795       |
| 8 | Legs’ rising, hanging on Sweden wall, times | ,791 | ,792 | |
| 9 | Angle on parallel bars, sec., times | ,376 | ,680 | ,800 |
| 10 | Torso rising from position lying on back during 1 minute, times | ,347 | ,582 | ,595 |
| 11 | Forward torso bending in sitting position (legs apart), cm | ,334 | ,766 | ,797 |
| 12 | Hanging on bent arms, sec. | ,728 | ,380 | ,858 |
| 13 | Torso rising from lying on abdomen position during 30 sec., times | ,376 | ,680 | ,813 |
| 14 | Long jump from the spot, cm | ,347 | ,582 | ,814 |
| 15 | Throw of filled ball (1 kg) from sitting position, cm | ,334 | ,796 | ,797 |
| 16 | Shuttle run, 4x9 m, sec. | ,376 | ,680 | ,813 |
| 17 | Forward roll, level of mastering | ,347 | ,582 | ,595 |
| 18 | Backward roll, level of mastering | ,334 | ,766 | ,797 |
| 19 | Vault, level of mastering | ,325 | ,821 | ,833 |
| 20 | Climbing rope (three attempts), level of mastering | ,313 | ,759 | ,858 |
| 21 | Bridge, level of mastering | ,302 | ,748 | ,876 |
| 22 | Stance on shoulder blades, level of mastering | ,291 | ,737 | ,895 |

Table 7. Full explained dispersion

| Component | Interpretation | Sum of squares of rotation loads | % of dispersion | Cumulative % |
|-----------|----------------|---------------------------------|----------------|--------------|
| 1         | Level of mastering and motor fitness | 28,497 | 28,497 | |
| 2         | Strength of abdomen muses | 20,299 | 48,796 | |
| 3         | Physical condition | 16,126 | 64,922 | |
| 4         | Flexibility | 6,994 | 71,916 | |
| 5         | Speed power | 6,821 | 78,737 | |
correlates with the following tests’ results:
- Climbing rope (three attempts), level of mastering.
- Vault, level of mastering, 834.
- Backward roll, level of mastering, 778.
  The factor was named level of mastering and motor fitness.
  Factor 2 has weight 17,108% and correlates with the following results:
  - Height, cm — 778.
  - Body mass, kg — 702.
  The factor was named physical condition.
  Factor 3 has weight 13,390% and correlates with the following:
  - Right hand dynamometry, kg — 606.
  - Left hand dynamometry, kg — 693.
  The factor was named hand’s strength.
  Factor 4 has weight 8,954% and correlates with the following:
  - VCL, cm³ — 741.
  The factor was named functional state of respiratory system.
  Factor 5 has weight 8,896% and correlates:
  - Forward torso bending in sitting position (legs apart), cm — 635.
  - Shuttle run, 4x9 m, sec — 615.
  The factor was named motor coordination.
  Factor 6 has weight 6,920% and correlates with the following tests’ results:
  - Hanging on bent arms, sec — 449.
  The factor was named static power.
  Analysis of communities showed that in motor fitness structure of 11 yrs boys the biggest influence is rendered by: “Chin ups — 97”, “Climbing rope (three attempts), level of mastering — 860”, “Hanging on bent arms — 854”, “Vault, level of mastering — 815”.
  Analyzing 12 yrs boys we marked out 4 factors, which explain 74,607% of total indicators’ dispersion (see table 4, 5).
  Factor 1 has the highest weight (36,646%) and correlates with:
  - Backward roll, level of mastering — 927.
  - Forward roll, level of mastering — 887.
  - Climbing rope (three attempts), level of mastering — 858.
  - Vault, level of mastering — 806.
  The factor was named level of mastering and motor fitness.
  Factor 2 has weight — 14,067% and correlates with physical condition indicators:
  - Right hand dynamometry, kg — 776.
  - Left hand dynamometry, kg — 729.
  - VCL, cm³ — 533.
  The factor was named physical condition.
  Factor 3 has weight — 12,639% and correlates with the following:
  - Long jump from the spot, cm — 699.
  - Angle on parallel bars, sec — 665.
  - Hanging on bent arms, sec — 629.
  The factor was named speed power.
  Factor 4 has weight — 11,255% and correlates:
  - Height, cm — 821.
  - Body mass, — 703.
  The factor was named physical condition.
  Analysis of communities showed that in motor fitness structure of 12 yrs boys the biggest influence is rendered by: “Backward roll, level of mastering — 902”, “Chin ups, times — 842”, “Forward roll, level of mastering — 812”.
  Analyzing 13 yrs boys we marked out 5 factors, which explain 78,737% of total indicators’ dispersion (see table 6, 7).
  Factor 1 has the biggest weight (28,497%), and correlates with the following results:
  - Forward roll, level of mastering — 904.
  - Backward roll, level of mastering — 889.
  - Vault, level of mastering — 886.
  - Climbing rope (three attempts), level of mastering — 811.
  The factor was named level of mastering and motor fitness.
  Factor 2 has the biggest weight — 20,299% and correlates with the following results:
  - Angle on parallel bars, sec — 791.
  - Legs’ rising on Sweden wall, times — 766.
  - Hanging on bent arms, sec — 728.
  The factor was named speed power.
  Factor 3 has weight — 16,126% and correlates with the following:
  - Left hand dynamometry, kg — 950.
  - Right hand dynamometry, kg — 937.
  - Body mass, kg — 762.
  - Height, cm — 706.
  The factor was named physical condition.
  Factor 4 has weight — 6,994% and correlates with the following results:
  - Forward torso bending in sitting position (legs apart), cm — 821.
  The factor was named flexibility.
  Factor 5 has weight — 6,821% and correlates with the following tests’ results:
  - Throw of filled (1 kg) ball from sitting position, cm — 796.
  The factor characterizes speed power.
  Analysis of communities showed that motor fitness of 13 yrs. boys is influenced to the largest extent: “Left hand dynamometry, kg — 921”, “Vault, level of mastering — 895”, “Stance on shoulder blades, level of mastering — 917”, “Forward roll, level of mastering — 883”.

Discussion

In our work we studied assumption about wholeness of motor abilities processes’ development and training from position of systemic approach [3, 8]. We found that variation of results in total dispersion of 11-13 yrs boys by 72,773%, 74,607%, 78,737% depends on the regarded factors. Mastering level in factorial structure has weight 17,505% (11 years), 36,646% (12years), 28,497% (13...
The conducted factorial analysis permitted to regard development of motor abilities and training as holistic process. It supplements the data of Ivashchenko O. et al. [21], Ivashchenko O. et al. [22] about effectiveness of factorial analysis application in physical education. Analysis of communities in factorial analysis permits to find the role of one or another indicator in factorial structure of the process. It points at demand in application of multidimensional mathematical statistic methods in studying of children’s and adolescents’ physical education laws [8, 24, 25, 33].

Conclusions
In 11-13 yrs boys we found positive dynamic of physical condition, indicators of motor abilities’ development and mastering level of gymnastic exercises.

We found that variation of results in total dispersion of 11-13 yrs boys by 72,773%, 74,607%, 78,737% depends on the regarded factors. Mastering level in factorial structure has weight 17,505% (11 years), 36,646% (12 years), 28,497% (13 years). Analysis of communities in factorial analysis permits to find that in 11-13 yrs boys development of motor abilities is effective if they are a component of the mastered motor skills.

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Conflict of interests
The authors declare that there is no conflict of interests.
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Information about the authors:

Ivashchenko O.V.; http://orcid.org/0000-0002-2708-5636; tmfv@tmfv.com.ua; H.S. Skovoroda Kharkiv National Pedagogical University; Alchevskyh str. 29, Kharkiv, 61002, Ukraine.

Iermakov S.S.; http://orcid.org/0000-0002-5039-4517; sportart@gmail.com; Kazimierz Wielki University; Sport str. 2, of.209, 85-064 Bydgoszcz, Poland.

Khudolii O.M.; http://orcid.org/0000-0002-5605-9939; tmfv@tmfv.com.ua; H.S. Skovoroda Kharkiv National Pedagogical University; Alchevskyh str. 29, Kharkiv, 61002, Ukraine.

Cretu Marian; http://orcid.org/0000-0003-1934-0534; marian.cretu@efsupit.ro; University of Pitesti: Pitesti, arges, Romania; Str. Targul din Vale, nr.1, 110040 Pitesti, Arges, Romania.

Potop Vladimir; http://orcid.org/0000-0001-8571-2469; vladimir_potop@yahoo.com; Ecological University of Bucharest; Bulevardul General Vasile Milea 1G, Bucureşti 061341, Romania.

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