MOTOR SKILLS IN PHYSICAL FITNESS STRUCTURE OF 8-YEAR-OLD GIRLS

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Abstract

The purpose of the study was to determine the priority of motor skills in the motor fitness structure of 8-year-old girls.

Materials and methods. The study participants were 40 8-year-old girls. The children and their parents were informed about all the features of the study and gave their consent to participate in the experiment. The study used the following research methods: analysis of scientific and methodological literature, pedagogical observations, testing of motor fitness, probabilistic approach to assessing the learning process, methods of mathematical statistics. In the experiment, the study controlled the level of proficiency in the following exercises: “Shoulder stand”, “Bridge from supine position”, “One leg swing upward circle”.

Results. The level of fitness of the 8-year-old girls is homogeneous by the development of “agility”, “movement coordination”, “speed strength”, and “endurance”; inhomogeneous – by the development of flexibility, arm strength, vestibular stability, and the level of proficiency.

The most informative indicators that determine the level of the 8-year-old girls’ motor fitness are: No. 14 “One leg swing upward circle, level of proficiency” ($r = 0.890$); No. 7 “Mixed hang rope pull-ups, times” ($r = 0.889$); No. 13 “Bridge from supine position, level of proficiency” ($r = 0.842$).

Conclusions. Based on factor analysis, it was found that the level of proficiency in exercises influences the variation of testing results, and the development of motor skills is a priority in the educational process at primary school. The level of proficiency in the exercises “Shoulder stand” and “One leg swing upward circle” shows that the exercises are difficult for 8-year-old girls to perform. Based on the data analysis, it can be argued that the comprehensive development of motor abilities ensures the formation of motor skills, and the improvement of the level of development of 8-year-old girls’ arm flexors and vestibular stability will positively influence the educational process effectiveness.

Keywords: 8-year-old girls, motor skills, motor abilities, factor analysis.

Introduction

The studies by Krutsevych (2012), Krutsevych, Napadii, and Trachuk (2014) elaborated on the concept of improving secondary school physical education programs and periodizing schoolchildren’s physical training in the educational process.


However, further research is needed to determine the priority of motor skills development in the primary school educational environment.

The purpose of the study was to determine the priority of motor skills in the motor fitness structure of 8-year-old girls.

Materials and Methods

Study Participants

The study participants were 40 8-year-old girls. The children and their parents were informed about all the features of the study and gave their consent to participate in the experiment.
Organization of the Study

The study used the following research methods: analysis of scientific and methodological literature, pedagogical observations, testing of motor fitness, probabilistic approach to assessing the learning process, methods of mathematical statistics.

The study recorded the indicators of height (cm), body weight (kg), and the results in tests No. 3 "Standing long jump, cm", No. 4 “Middle- and long-distance running. 300 m running, s", No. 5 "30 m sprint running from a standing start, s", No. 6 "Seated forward bend, cm", No. 7 "Mixed hang rope pull-ups, times", No. 8 "Shuttle run 4×9 m, s", No. 9 “Combined movements of arms, torso and legs, points”, No. 10 “Maintenance of stable posture – standing on one leg with closed eyes, s”; No. 11 “Walking along straight line after 5 rotations, deviations in cm”.

The study recorded the primary schoolchildren’s level of proficiency in gymnastic exercises. The coefficient was determined by the formula: \( p = (m/n)\times100 \), where \( p \) is the level of proficiency, \( m \) is the number of successfully performed exercises, \( n \) is the total number of attempts to perform the exercise. In the experiment, the study controlled the level of proficiency in the following exercises: “Shoulder stand”, “Bridge from supine position”, “One leg swing upward circle”.

Statistical Analysis

The study materials were processed using the IBM SPSS 20 statistical analysis software. Factor analysis was performed. In the factor analysis, the study used the model of principal components with the rotation method: Varimax with Kaiser Normalization.

The study protocol was approved by the Ethical Committee of the University. In addition, the children and their parents or legal guardians were fully informed about all the features of the study, and a signed informed-consent document was obtained from all the parents.

Results

Table 1 shows the results of testing the 8-year-old girls’ motor fitness.

The analysis of the coefficients of variation of testing results showed that the 8-year-old girls’ fitness is homogeneous by the following tests: No. 1 “Height, cm” (3.86%); No. 8 “Shuttle run 4×9 m, s” (4.76%); No. 5 “30 m running from a standing start, s” (6.36%); No. 9 “Combined movements of arms, torso and legs, points” (7.87%); No. 4 “300 m running, s” (11.08%); No. 3 “Standing long jump, cm” (11.51%); No. 2 “Body weight, kg” (16.71%); No. 13 “Bridge from supine position, level of proficiency” (25.67%).

The level of the girls’ fitness is inhomogeneous by the results of tests: No. 6 “Seated forward bend, cm” (55.42%); No. 10 “Maintenance of stable posture – standing on one leg with closed eyes, s” (71.57%); No. 7 “Mixed hang rope pull-ups, times” (61.54%); No. 11 “Walking along straight line after 5 rotations, deviations in cm” (89.25%); No. 12 “Shoulder stand, level of proficiency” (41.29%); No. 14 “One leg swing upward circle, level of proficiency” (80.89%).

The coefficient of variation in terms of the level of proficiency in the exercises “Shoulder stand, level of proficiency” and “One leg swing upward circle, level of proficiency” shows that the exercises are difficult to perform.

Thus, the level of fitness of the 8-year-old girls is homogeneous by the development of “agility”, “movement coordination”, “speed strength”, and “endurance”; inhomogeneous – by the development of flexibility, arm strength, vestibular stability, and the level of proficiency.

Table 2 shows the results of factor analysis. The analysis identified five factors that explain 74.253% of the variation of results.

The first factor has a weight of 16.411%. With the factor, the greatest correlation is in the level of proficiency in exercise No. 14 “One leg swing upward circle, level of proficiency” (r = 0.640); tests No. 7 “Mixed hang rope pull-ups, times” (r = 0.721); No. 3 “Standing long jump, cm” (r = 0.716). The factor is called the level of proficiency in gymnastic exercises that require a complex demonstration of strength.

The second factor has a weight of 15.359%. With the factor, the greatest correlation is in: No. 12 “Shoulder stand, level of proficiency” (r = -0.733); No. 11 “Walking along straight line after 5 rotations, deviations in cm” (r = 0.811). The factor is bipolar, on the one hand, the lower the level of proficiency, the greater the influence of the factor; on the other - reducing the error in vestibular stability reduces the influence of the factor, which points to the influence of vestibular stability on the level of proficiency in acrobatic exercises. The factor is called vestibular stability.

The third factor has a weight of 15.252%. With the factor, the greatest correlation is in: No. 1 “Height, cm” (r = 0.581); No. 2 “Body weight, kg” (r = 0.609); No. 4 “300 m running, s” (r = 0.630). The factor is called physical development.

The fourth factor has a weight of 14.694%. With the factor, the greatest correlation is in: No. 7 “Mixed hang rope pull-ups, times” (r = 0.566); No.14 “One leg swing upward circle, level of proficiency” (r = 0.510). The factor is called strength fitness.

The fifth factor has a weight of 12.537%. With the factor, the greatest correlation is in test: No. 10 “Maintenance of
The paper assumed that motor skills occupy a leading place in the motor fitness structure of 8-year-old girls. So, the level of proficiency in exercises determines the variation of testing results by 16.411%. Thus, the study’s findings make it possible to accept the research hypothesis on the leading role of motor skills development in physical education classes at primary school.

The analysis of the coefficients of variation points to heterochrony in the development of the 8-year-old girls’ motor abilities. The level of proficiency in exercises No. 12 and 14 indicates that the exercises are difficult for 8-year-old girls to perform. Based on the data analysis, it can be argued that the comprehensive development of motor abilities ensures the formation of motor skills, and the improvement of the level of development of 8-year-old girls’ arm flexors and vestibular stability will positively influence the educational process effectiveness.

The obtained results supplement the data on the relationship between the level of proficiency in gymnastic exercises and the level of development of strength and vestibular stability (Ivashchenko, Berezhna, & Cieślicka, 2020; Ivashchenko & Sirichenko, 2020). As with 7-year-old girls, there is considerable variation in the development of flexibility, arm strength, and vestibular stability. Similarly, based on factor analysis, it was found that the level of proficiency in exercises affects the variation of testing results, and the development of motor skills is a priority in the educational process at primary school; the development of vestibular stability ensures the formation of motor skills, and the level of general physi-

### Table 2. The results of factor analysis. Girls aged 8 (n = 40)

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicator</th>
<th>Component 1</th>
<th>Component 2</th>
<th>Component 3</th>
<th>Component 4</th>
<th>Component 5</th>
<th>h²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Height, cm</td>
<td>-0.445</td>
<td>0.581</td>
<td>0.393</td>
<td>0.393</td>
<td>0.393</td>
<td>0.805</td>
</tr>
<tr>
<td>2</td>
<td>Body weight, kg</td>
<td>-0.587</td>
<td>0.609</td>
<td>0.439</td>
<td>0.439</td>
<td>0.439</td>
<td>0.774</td>
</tr>
<tr>
<td>3</td>
<td>Standing long jump, cm</td>
<td>0.716</td>
<td>0.359</td>
<td>0.630</td>
<td>0.406</td>
<td>0.406</td>
<td>0.660</td>
</tr>
<tr>
<td>4</td>
<td>300 m running, s</td>
<td></td>
<td>0.415</td>
<td>-0.493</td>
<td>0.454</td>
<td>0.454</td>
<td>0.722</td>
</tr>
<tr>
<td>5</td>
<td>30 m running from a standing start, s</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Seated forward bend, cm</td>
<td>0.534</td>
<td>0.380</td>
<td>0.458</td>
<td></td>
<td></td>
<td>0.834</td>
</tr>
<tr>
<td>7</td>
<td>Mixed hang rope pull-ups, times</td>
<td>0.721</td>
<td>0.566</td>
<td></td>
<td></td>
<td></td>
<td>0.889</td>
</tr>
<tr>
<td>8</td>
<td>Shuttle run 4×9 m, s</td>
<td>-0.598</td>
<td>0.315</td>
<td>0.331</td>
<td></td>
<td></td>
<td>0.604</td>
</tr>
<tr>
<td>9</td>
<td>Combined movements of arms, torso and legs, points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Maintenance of stable posture – standing on one leg with closed eyes, s</td>
<td>-0.399</td>
<td>-0.368</td>
<td>-0.538</td>
<td></td>
<td></td>
<td>0.601</td>
</tr>
<tr>
<td>11</td>
<td>Walking along straight line after 5 rotations, deviations in cm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Shoulder stand, level of proficiency</td>
<td>-0.733</td>
<td>0.464</td>
<td></td>
<td></td>
<td></td>
<td>0.762</td>
</tr>
<tr>
<td>13</td>
<td>Bridge from supine position, level of proficiency</td>
<td>0.496</td>
<td>0.546</td>
<td>0.362</td>
<td></td>
<td></td>
<td>0.842</td>
</tr>
<tr>
<td>14</td>
<td>One leg swing upward circle, level of proficiency</td>
<td>0.640</td>
<td>-0.327</td>
<td>0.510</td>
<td>0.331</td>
<td></td>
<td>0.890</td>
</tr>
</tbody>
</table>

**Fig. 1.** The graphic representation of a two-factor model of testing results: 1 – height (cm), 2 – body weight (kg), 3 – “Standing long jump (cm)”, 4 – “Middle- and long-distance running. 300 m running (s)”, 5 – “30 m sprint running from a standing start (s)”, 6 – “Seated forward bend (cm)”, 7 – “Mixed hang rope pull-ups (times)”, 8 – “Shuttle run 4×9 m (s)”, 9 – “Combined movements of arms, torso and legs (points)”, 10 – “Maintenance of stable posture – standing on one leg with closed eyes (s)”, 11 – “Walking along straight line after 5 rotations (deviations in cm)”, 12 – “Shoulder stand, level of proficiency”, 13 – “Bridge from supine position, level of proficiency”, 14 – “One leg swing upward circle, level of proficiency”
rical fitness is the reserve in training 7-year-old girls that will improve the educational process effectiveness (Ivashchenko & Sirichenko, 2020).

The results of factor analysis confirm the integrity of the process of motor skills formation and motor abilities development in children, give the opportunity to determine the direction of motor abilities development (Khudolii, Ivashchenko, & Chernenko, 2015; Ivashchenko, Iermakov, Khudolii, Cretu, & Potop, 2017).

The results of the study highlight the need to develop a teaching technique which would include the development of motor abilities and series of learning tasks (Ivashchenko, Khudolii, Iermakov, Chernenko, & Holovko, 2015), organization of a series of classes (Hellin, Garcia-Jimenez, & Garcia-Pellicer, 2019a; Hellin, Garcia-Jimenez, & Garcia-Pellicer, 2019b; Grofik, Mitaš, Jakubec, Svozil, & Frömel, 2020), and modes of alternating exercises and rest intervals (Ivashchenko & Cieslicka, 2017; Cieslicka & Ivashchenko, 2017; Marchenko & Kovalenko, 2020).

Thus, the 8-year-old girls’ motor fitness is determined, on the one hand, by the level of development of arm strength and the level of proficiency in strength gymnastic exercises; on the other hand, by vestibular stability and the level of proficiency in acrobatic exercises.

Conclusions

Based on factor analysis, it was found that the level of proficiency in exercises influences the variation of testing results, and the development of motor skills is a priority in the educational process at primary school.

The level of proficiency in the exercises “Shoulder stand” and “One leg swing upward circle” shows that the exercises are difficult for 8-year-old girls to perform. Based on the data analysis, it can be argued that the comprehensive development of motor abilities ensures the formation of motor skills, and the improvement of the level of development of 8-year-old girls’ arm flexors and vestibular stability will positively influence the educational process effectiveness.

Acknowledgement

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Conflict of Interests

The authors declare no conflicts of interest.

References


РУХОВІ НАВИЧКИ У СТРУКТУРІ ФІЗИЧНОЇ ПІДГОТОВЛЕННОСТІ ДІВЧАТОК 8 РОКІВ

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; Д – підготовка рукопису; Е – збір коштів


Мета дослідження – визначити пріоритет рухових навичок у структурі рухової підготовленості дівчаток 8 років.

Матеріали і методи. У дослідженні прийняли участь 40 дівчаток 8 років. Діти та їхні батьки були інформовані про всі особливості дослідження і дали згоду на участь в експерименті. У дослідженні використані такі методи дослідження як аналіз наукової та методичної літератури, педагогічні спостереження, тестування рухової підготовленості, ймовірнісний підхід до оцінки процесу навчання, методи математичної статистики. В експерименті контролювався рівень навченості таким вправам: стійка на лопатках, міст із положення лежачи, підйом переворотом в упор махом однією.


Найбільш інформативними показниками, які визначають рівень рухової підготовленості дівчаток 8 років є: No 14 «Підйом переворотом в упор махом однією, рівень навченості» (r = 0.890); No 7 «Згинання й розгинання рук у змішаному висі на канаті, рази» (r = 0.889); No 13 «Міст із положення лежачи, підйом переворотом в упор махом однією» (r = 0.842).

Висновки. На основі факторного аналізу встановлено, що рівень навченості вправам впливає на варіацію результатів тестування, а формування рухових навичок має пріорітет в освітньому процесі у молодшій школі. Рівень навченості вправ «Стійка на лопатках» і «Підйом переворотом в упор махом однією» свідчить про те, що вправи є мало доступними для дівчаток 8 років. На основі аналізу даних можна стверджувати, що комплексний розвиток рухових здібностей забезпечує формування рухових навичок, а підвищення рівня розвитку сили згиначів рук і вестибулярної стійкості у дівчаток 8 років дозволить позитивно впливати на ефективність навчального процесу.

Ключові слова: дівчатка 8 років, рухові навички, рухові здібності, факторний аналіз.
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