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PERFORMANCE OF HAND MOVEMENTS BY 3-5-YEAR-OLD GIRLS WITH DIFFERENT HANDEDNESS

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Abstract

The purpose of the study was to determine the state of performance of motor actions by girls with different handedness, which establishes a valid program for each age period of 3–5 years.

Materials and methods. Sixty girls took part in the study (compared with the right-, left-hand preference, and ambidexterity), each attended a preschool, and at the time of the study, the age of each was within the range of 3 years 5 months 2 days to 3 years 5 months and 29 days. To obtain the necessary data, motor actions determined by the current child development program in the preschool period were used. The quality of the girls' performance of each defined motor action was assessed, and the procedure took place in January of each new school year, that is, when the girls were first 3 years old, then 4 and 5 years old.

Results. Each age of the period of 3-5 years is marked by handedness-related features of development and manifestation of the motor function of girls when performing motor actions with their hands. At the same time, the majority of motor actions were performed by the girls of each sample with a score lower than the maximum score. This does not contribute to the intensive development of the motor function of girls, which differs from the task defined by the current program for preschool education institutions. Comparing the results of girls with different handedness, it was found that in most motor actions, the scores obtained for performance differ by a statistically significant amount, and at each age of the studied period.

Conclusions. Establishing features in the quality of performance of motor actions by girls with different handedness at each age period of 3-5 years is an important task. To increase the effectiveness of the educational process, the teacher needs to pay more attention to the study of those motor actions that were evaluated with low scores in girls with a certain preferred hand.

Keywords: girls, preschool age, hand asymmetry, motor function, development.

Introduction

In the preschool period, one of the main functions of a child is movement (Katzmarzyk & Silva, 2013). Therefore, educators pay considerable attention to the development of this function, especially during physical education, which is implemented in various forms of classes (Altavilla & Di Tore, 2016; Di Tore et al., 2016). At the same time, the basis of such classes is the content of the current program on child development in the preschool period (Bayer et al., 2014). This content provides motor actions that a child at a certain age of 3-6 years should master at the level of exploration of degrees of freedom, and preferably at the highest level, that is, at the level of capitalization of degrees of freedom (Bernstein, 1991; Schmidt & Lee, 2013).

However, at the current stage, the issue of the state of formation of children's abilities and skills in motor actions, which are determined by the specified current program, has not been sufficiently studied (Turvey & Fonseca, 2009).

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The need for such information does not raise doubts, because it allows establishing the effectiveness of physical education in the formation of abilities, and skills in basic motor actions, as well as shortcomings and discrepancies between the required and real results.

On the other hand, the achievement of the goal of physical development of children in the preschool period is greatly facilitated by the implementation in practice of the provision on taking into account their characteristics (Malina et al., 2004; Kalinková, 2007). One of the effective criteria for individualization is the child's handedness (Iedynak et al., 2017; De Kovel et al., 2019; Güntürkün et al., 2020). This is due to the discrepancy in the development of motor function (Reiss, 2000), physical qualities (Galamanzhuk & Iedynak, 2016), psychosocial (Fisher, 2006; Iedynak & Galamanzhuk, 2010), physiological (Galamanzhuk et al., 2019) and some other performance abilities (Scharoun & Bryden, 2014; Ratini, 2021) of children in the preschool period.

At the same time, there are separated studies (Galamanzhuk, 2015) aimed at establishing peculiarities in the formation of motor skills and skills of children with different handedness in actions determined by the current program of their development in the preschool period as basic motor actions. In this regard, research on solving such a problem is relevant.

The purpose of the study was to determine the state of performance of motor actions by girls with different handedness determined by the current program for each age period of 3-5 years.

Materials and methods

Study participants

60 girls took part in the study: 20 each with the right (R), left (L) hand preference, and ambidexterity (A), each attending a preschool; the base of the study was a total of 15 preschool education institutions located in various cities of the western region of Ukraine. At the time of the beginning of the study, the age of all the girls ranged from 3 years 5 months 2 days to 3 years 5 months and 29 days. The main attention was focused on evaluating the girls' performance of each defined motor action. The results were recorded in January of each new academic year, that is, when the same girls were first 3 years old, then 4 and 5 years old.

Study organization

To obtain the necessary data, girls' performance of motor actions determined by the current program for each age period of 3-5 years was evaluated (Bayer et al., 2014). In particular, at the age of 3, such actions were: collecting balls, carrying them and putting them in a certain place (basket, box); rolling the ball on an inclined surface; rolling the ball with one or two hands to the teacher; rolling the ball with one or two hands under the arc; rolling the ball with one or two hands to each other, moving behind it during its roll; throwing the ball forward with both hands from below; throwing the ball forward from the chest; throwing the ball from behind the head; throwing the ball with both hands to the teacher; trying to catch the ball thrown by the teacher (distance 80-100 cm); throwing the ball over the rope stretched at the level of the child's chest (distance 1-1.5 m); throwing a ball (weight 100 g) at a horizontal target (basket, box) with the right and left hands from a distance of 1.3-1.5 m; throwing objects with the right and left hands at a distance; throwing a ball (weight 100 g) at a vertical target from a distance of 1-1.5 m. At the age of 4, girls performed the following motor actions: rolling the ball from the teacher to the child and back from a half-squat position (distance 1.5-2 m); rolling the ball between objects into the goal (width 50-60 cm, distance 1.5-2 m); throw the ball to the teacher with both hands from below and from the chest; catching the ball thrown by the teacher (distance – 1.5 m); throwing a ball (weight 100 g) at a horizontal target (basket, box) from a distance of 1.5-2.0 m; throwing the ball with both hands from the chest and from below into a basket (box) standing on the floor at a distance of 2 m; after throwing the ball on the floor, trying to catch it two or three times in a row; throwing a ball (weight 100 g) with the right and left hands at a vertical target (the height of the center of the target is 1.2 m above the floor, the distance to the target is 1.5-2.0 m); throwing a ball (weight 100 g) with the right and left hands at a distance (distance 3-5 m). At the age of 5, the girls' performance of the following motor actions was assessed: throwing a ball from one hand to another at a different pace; while standing still, hitting the ball on the floor (12 repetitions); throwing the ball to another child with two hands from the chest; throwing the ball from behind the head while standing or moving forward; catching the ball from different starting positions; catching the ball after bouncing off the floor; throwing and catch the ball with both hands (up to 20 times in a row); hitting the wall with a ball; throwing a stuffed ball (weight 1 kg) to another child; catching a stuffed ball; throwing a small ball into the ring at a height of 2.2 m from the floor; throwing objects (bag, ball) with the right and left hands for 3-5 m; throwing a ball (weight 100 g) at a moving target.

Recommendations (Grime & Wright, 2016) regarding the use of the Delphi Method were taken into account when evaluating the correct performance of motor actions by girls. Thus, 5 experts (2 Candidates of Science and 3 Doctors of Science) took part in the assessment, all of them specialists in physical education of children, and each of them has at least 10 years of experience. The girls were given 2 attempts to perform each motor action, and the best one was evaluated. But the girls did not know that their performance was being evaluated; this made it possible to minimize the excitement of the girls because it could affect the correct performance of the motor action (Thomas et al., 2011). The evaluation took place in two rounds: first, each expert evaluated the performance of all the girls' proposed motor actions, after that he studied the results of the questionnaires of his colleagues, video recordings of the girls' performance of the motor actions, and corrected (if he changed his mind) his evaluation results. After that, each expert received a final score, which was used to assess the girls' performance of a certain motor action; all five scores were taken into account when finding the average score for the performance of each motor action.

Experts took into account the recommendations for the assessment of motor development and function in preschool children (Tieman et al., 2005; Timmons et al., Pfeiffer, 2007). A system was chosen to provide the evaluation with one of the following points: "3" – the highest point, which indicates the achievement of the set goal due to the technically correct

performance of all movements in the action, which is evidenced by the absence of errors; "2" – the set goal is achieved because the motor action is performed correctly in general, except for one or two movements (parameters – movement trajectory, pace, etc.) that are reproduced with minor errors, that is, that do not affect the result; "1" – the set goal was not achieved due to difficulties in performing the motor action, although individual movements (parameters) were reproduced correctly.

The girls' hand preference was determined at the beginning of the study, taking into account the recommendations (Edlin et al., 2015) using the Short Form of Edinburgh Handedness Scale (Veale, 2014). The organization of the study took into account the provisions of the Helsinki Declaration of the World Medical Association (WMA-2013) on the ethical principles of medical research with human participants. The research protocol was approved by the ethics commission of Kamianets-Podilskyi National University.

Statistical analysis

All statistical analyzes were performed using SPSS Version 21. For each assessment, the following calculations were performed: arithmetic mean (M), standard deviation (SD), and Kolmogorov-Smirnov Test (KS). The last one made it possible to establish a difference from the normal distribution of individual values in each sample of girls (Vincent, 2005). In this regard, when comparing two averages, non-parametric tests were used, namely Mann-Whitney (U, Z values), and Wilcoxon (W values); the 0.05, 0.01, 0.001 levels of probability were used to indicate statistical significance (Khalafian, 2007).

Results

Before starting the analysis of the data obtained in experimental groups of girls in each age period of 3-5 years, the correspondence of the individual values distribution of each indicator to the normal distribution was established. It was found that in 3-year-old girls with different hand preferences, the distribution of individual results differed from the normal one (Table 1).

In addition, the obtained data indicated that girls from A and R performed for the highest score of "3" for one movement out of all 14 offered. Moreover, it was the same motor action, namely "to collect balls, carry them, and put them in a certain place." The same result was noted for girls from L, but they additionally scored a score of "3" for the performance of "rolling a ball with one or two hands to the teacher" and "throwing objects with the right and left hands at a distance." But the former also had the least number of motor actions, the performance of which was evaluated with the lowest score "1". There were 6 such actions, while the girls from A – 9, from R – 10.

Comparing the scores of these 3-year-old girls with different hand preferences for performing the specified 14 motor actions, the following was found. In girls from A and L, as well as from L and R, 8 grades differed by a statistically significant value, while in girls from A and R – 6 (Table 2).

In all cases, such a feature was noted for the score for performing the motor action "rolling the ball with one or two hands to the teacher", because it was the highest in girls with L (3 points), while it was significantly lower in R, namely 2.45±0.6 points ($p = 0.001$), in A the smallest, – 1.9±0.85 (respectively, $p = 0.013$ and $p = 0.001$).

At four years old, the distribution of the obtained data differed from the normal one (Table 3).

The following was also noted: according to the obtained data, out of all 9 motor actions, the highest score of "3" was evaluated for the performance of only one action and only by girls from A, namely "throw a ball weighing 100 g with the right and left hands at a distance (a distance of at least

Table 1. Results of performance of motor actions by 3-year-old girls with different handedness

N	Motor action	girls with A (n=20)			girls with A (n=20)			girls with R (n=20)		
		M	SD	K-S, p	M	SD	K-S, p	M	SD	K-S, p
1	Collect balls, carry them and put them in a certain place (basket, box)	3.00	0	<0.01	3.00	0	<0.01	3.00	0	<0.01
2	Roll the ball on an inclined surface	1.85	0.37	<0.01	1.75	0.44	<0.01	1.25	0.64	<0.01
3	Roll the ball with one or two hands towards the teacher	1.90	0.85	<0.01	3.00	0	<0.01	2.45	0.60	<0.01
4	Roll the ball with one or two hands under the arc	1.00	0	<0.01	0.75	0.44	<0.01	0.8	0.52	<0.01
5	Roll the ball with one or two hands to each other, moving behind it during its roll	1.55	1.10	<0.01	1.00	0	<0.01	0.9	0.79	<0.01
6	Throw the ball forward with both hands from below	2.25	0.91	<0.01	2.25	0.85	<0.01	1.35	0.93	<0.01
7	Throw the ball forward from the chest	2.10	0.64	<0.01	2.50	0.51	<0.01	1.65	0.88	<0.01
8	Throw the ball from behind the head	2.05	0.94	<0.01	2.25	1.33	<0.01	1.55	0.94	<0.01
9	Throw the ball with both hands to the teacher	1.85	0.87	<0.01	2.25	0.85	<0.01	2.5	0.60	<0.01
10	Try to catch the ball thrown by the teacher (distance 80-100 cm)	1.20	1.00	<0.01	1.50	1.15	<0.01	1.65	0.49	<0.01
11	Throw the ball over the rope stretched at the level of the child's chest (distance 1-1.5 m)	1.00	0.56	<0.01	1.50	0.89	<0.01	0.8	0.89	<0.01
12	Throw the ball (weight 100 g) at a horizontal target with the right and left hands (distance - 1.3-1.5 m)	1.80	0.83	<0.01	1.25	0.44	<0.01	0.95	0.89	<0.01
13	Throw objects with the right and left hands at a distance	2.70	0.47	<0.01	3.00	0	<0.01	2.65	0.59	<0.01
14	Throw a ball (weight 100 g) at a vertical target from a distance of 1-1.5 m	1.80	0.83	<0.01	2.50	0.51	<0.01	1.8	0.95	<0.01

Table 2. Comparison of the results of performance by 3-year-old girls motor actions with different handedness

Motor action (N)	Mean Rank		Sum of Rank		U	W	Z	Asymp.Sig (2-talled)
	A (n=20)	L (n=20)	A (n=20)	L (n=20)				
1	20.50	20.50	410.0	410.0	200.0	410.0	.000	1.000
2	21.50	19.50	430.0	390.0	180.0	390.0	-.781	0.435
3	13.50	27.50	270.0	550.0	60.0	270.0	-4.480	0.000
4	23.00	18.00	460.0	360.0	150.0	360.0	-2.360	0.018
5	27.50	13.50	550.0	270.0	60.0	270.0	-4.512	0.000
6	20.63	20.38	412.5	407.5	197.5	407.5	-.074	0.941
7	17.25	23.75	345.0	475.0	135.0	345.0	-1.190	0.047
8	18.88	22.13	377.5	442.5	167.5	377.5	-.999	0.318
9	18.00	23.00	360.0	460.0	150.0	360.0	-1.443	0.149
10	19.00	22.00	380.0	440.0	170.0	380.0	-.840	0.401
11	16.25	24.75	325.0	495.0	115.0	325.0	-2.481	0.013
12	24.13	16.88	482.5	337.5	127.5	337.5	-2.247	0.025
13	17.50	23.50	350.0	470.0	140.0	350.0	-2.623	0.009
14	15.75	25.25	315.0	505.0	105.0	315.0	-2.751	0.006
	A (n=20)	R (n=20)	A (n=20)	R (n=20)				
1	20.50	20.50	410.0	410.0	200.0	410.0	.000	1.000
2	21.50	19.50	430.0	390.0	180.0	390.0	-.781	0.435
3	13.50	27.50	270.0	550.0	60.0	270.0	-4.480	0.000
4	23.00	18.00	460.0	360.0	150.0	360.0	-2.360	0.018
5	27.50	13.50	550.0	270.0	60.0	270.0	-4.512	0.000
6	20.63	20.38	412.5	407.5	197.5	407.5	-.074	0.941
7	17.25	23.75	345.0	475.0	135.0	345.0	-1.190	0.047
8	18.88	22.13	377.5	442.5	167.5	377.5	-.999	0.318
9	18.00	23.00	360.0	460.0	150.0	360.0	-1.443	0.149
10	19.00	22.00	380.0	440.0	170.0	380.0	-.840	0.401
11	16.25	24.75	325.0	495.0	115.0	325.0	-2.481	0.013
12	24.13	16.88	482.5	337.5	127.5	337.5	-2.247	0.025
13	17.50	23.50	350.0	470.0	140.0	350.0	-2.623	0.009
14	15.75	25.25	315.0	505.0	105.0	315.0	-2.751	0.006
	L (n=20)	R (n=20)	L (n=20)	R (n=20)				
1	20.50	20.50	410.0	410.0	200.0	410.0	.000	1.000
2	25.25	15.75	505.0	315.0	105.0	315.0	-2.898	0.004
3	25.50	15.50	510.0	310.0	100.0	310.0	-3.592	0.000
4	20.13	20.88	402.5	417.5	192.5	402.5	-.261	0.794
5	22.00	19.00	440.0	380.0	170.0	380.0	-1.113	0.266
6	25.50	15.50	510.0	310.0	100.0	310.0	-2.849	0.004
7	26.00	15.00	520.0	300.0	90.0	300.0	-3.168	0.002
8	24.25	16.75	485.0	335.0	125.0	335.0	-2.169	0.030
9	19.13	21.88	382.5	437.5	172.5	382.5	-.822	0.411
10	19.75	21.25	395.0	425.0	185.0	395.0	-.433	0.655
11	24.75	16.25	495.0	325.0	115.0	325.0	-2.478	0.013
12	23.00	18.00	460.0	360.0	150.0	360.0	-1.518	0.129
13	23.50	17.50	470.0	350.0	140.0	350.0	-2.619	0.009
14	24.75	16.25	495.0	325.0	115.0	325.0	-2.487	0.013

Note: Mann-Whitney U, Wilcoxon W; a reliably significant difference between the two means is highlighted in color

3-5 m)". As for the lowest score, it was used to evaluate the performance of 5 motor actions by girls with A, and L and the performance of 6 actions by girls with R.

Other data related to the comparison of scores obtained for the performance of each of the 9 specified motor actions (Table 4).

At 5 years, the distribution of most of the obtained data differed from normal, and exceptions were characteristic of each group of girls (Table 5).

We received data that indicated the following: out of all 13 motor actions, the performance of only one action by girls from A and R was rated the highest.

Table 3. Results of performance of motor actions by 4-year-old girls with different handedness

N	Motor action	girls with A (n=20)			girls with L (n=20)			girls with R (n=20)		
		M	SD	K-S, p	M	SD	K-S, p	M	SD	K-S, p
1	Roll the ball from the teacher to the child and back from a half-squat position (1.5-2 m)	2.05	0.51	<0.01	1.50	0.89	<0.01	2.15	0.67	<0.10
2	Roll the ball between objects into the goal (width 60-50 cm, distance 1.5-2 m)	2.10	0.85	<0.15	1.75	0.85	<0.05	1.85	0.99	<0.15
3	Throw the ball to the teacher with both hands from below and from the chest	2.10	1.02	<0.05	2.50	0.51	<0.05	2.40	0.68	<0.05
4	Catch the ball thrown by the teacher (distance - 1.5 m)	1.85	0.88	<0.10	1.75	0.85	<0.05	1.65	1.09	>0.20
5	Throw the ball (weight 100 g) at a horizontal target from a distance of 1.5-2.0 m	0.85	067	<0.10	2.25	0.85	<0.05	1.85	0.99	>0.20
6	Throw the ball with both hands from the chest and from below into a basket standing on the floor (distance - 2 m)	1.45	0.76	<0.01	2.00	1.03	<0.05	1.80	0.89	>0.20
7	After throwing the ball on the floor, try to catch it two or three times in a row	1.00	0.79	>.20	0.50	0.51	<0.05	0.75	1.02	<0.05
8	Throw the ball (weight 100 g) with the right and left hands at a vertical target (the height of the center of the target is 1.2 m above the floor, the distance to the target is 1.5 -2.0 m	1.00	0.79	>.20	1.25	0.44	<0.01	1.30	0.86	<0.10
9	Throw a ball (weight 100 g) with the right and left hands at a distance (a distance of at least 3-5 m)	3.00	0	<0.01	2.25	0.44	<0.01	2.50	0.61	<0.05

Table 4. Comparison of the results of performance by 4-year-old girls motor actions with different handedness

Motor action (N)	Mean Rank		Sum of Rank		U	W	Z	Asymp. Sig (2-talled)
	A (n=20)	L (n=20)	A (n=20)	L (n=20)				
1	25.13	15.88	502.5	317.5	107.5	317.5	-2.693	0.007
2	22.75	18.25	455.0	365.0	155.0	365.0	-1.297	0.195
3	18.75	22.25	375.0	445.0	165.0	375.0	-1.057	0.290
4	21.13	19.88	422.5	397.5	187.5	397.5	-0.365	0.715
5	13.00	28.00	260.0	560.0	50.00	260.0	-4.254	0.000
6	17.75	23.25	355.0	465.0	145.0	355.0	-1.718	0.046
7	24.00	17.00	480.0	340.0	130.0	340.0	-2.063	0.039
8	18.75	22.25	375.0	445.0	165.0	375.0	-1.068	0.286
9	28.00	13.00	560.0	260.0	50.00	260.0	-4.837	0.000
	A (n=20)	R (n=20)	A (n=20)	R (n=20)				
1	19.58	21.43	391.5	428.5	181.5	391.5	-0.593	0.553
2	21.90	19.10	438.0	382.0	172.0	382.0	-0.803	0.422
3	19.20	21.80	384.0	436.0	174.0	384.0	-0.771	0.441
4	21.33	19.68	426.5	393.5	183.5	393.5	-0.466	0.641
5	14.85	26.15	297.0	523.0	87.0	297.0	-3.205	0.000
6	18.00	23.00	360.0	460.0	150.0	360.0	-1.483	0.138
7	22.65	18.35	453.0	367.0	157.0	367.0	-1.239	0.215
8	18.80	22.20	376.0	444.0	166.0	376.0	-0.982	0.326
9	25.00	16.00	500.0	320.0	110.0	320.0	-3.354	0.000
	L (n=20)	R (n=20)	L (n=20)	R (n=20)				
1	15.88	25.13	317.5	502.5	107.5	317.5	-2.686	0.007
2	19.88	21.13	397.5	422.5	187.5	397.5	-0.362	0.717
3	21.00	20.00	420.0	400.0	190.0	400.0	-0.305	0.760
4	20.75	20.25	415.0	405.0	195.0	405.0	-0.141	0.888
5	22.75	18.25	455.0	365.0	155.0	365.0	-1.288	0.198
6	21.50	19.50	430.0	390.0	180.0	390.0	-0.581	0.561
7	20.00	21.00	400.0	420.0	190.0	400.0	-0.302	0.763
8	20.38	20.63	407.5	412.5	197.5	407.5	-0.079	0.937
9	17.88	23.13	357.5	462.5	147.5	357.5	-1.644	0.100

Note: Mann-Whitney U, Wilcoxon W; a reliably significant difference between the two means is highlighted in color

Table 5. Results of performance of motor actions by 5-year-old girls with different handedness

N	Motor action	girls with A (n=20)			girls with L (n=20)			girls with R (n=20)		
		M	SD	K-S, p	M	SD	K-S, p	M	SD	K-S, p
1	Throw the ball from one hand to the other at different paces	2.00	0.56	<0.05	2.00	1.03	<0.05	2.10	0.72	<0.15
2	Hit the ball on the floor while standing still (12 repetitions),	1.95	1.10	>0.20	1.50	0.89	<0.01	1.35	0.81	<0.05
3	Throw the ball with the other to the child with two hands from the chest,	2.15	0.67	<0.10	2.25	0.85	<0.05	2.05	0.76	>0.20
4	Throw the ball from behind the head while standing or moving forward	1.75	1.07	>0.20	2.50	0.89	<0.01	2.25	0.85	<0.05
5	Catch the ball from different starting positions	1.70	0.73	<0.10	1.00	0.73	<0.15	1.15	0.49	<0.01
6	Catch the ball after bouncing off the floor	1.80	1.01	<0.10	1.75	0.85	<0.05	2.10	0.79	>0.20
7	Throw and catch the ball with both hands (up to 20 times in a row	1.30	0.73	<0.10	2.25	0.85	<0.05	2.05	0.89	<0.15
8	Hit the wall with the ball	1.85	0.67	<0.10	2.75	0.44	<0.01	2.20	0.77	<0.15
9	Throw the stuffed ball (weight 1 kg) to another child	1.70	0.47	<0.01	2.50	0.51	<0.05	1.85	0.88	>0.20
10	Catch a stuffed ball	2.15	0.37	<0.01	2.00	0.73	<0.15	1.80	1.01	>0.20
11	Throw a small ball into a ring at a height of 2.2 m from the floor	2.10	1.02	<0.01	1.50	1.15	>0.20	1.45	0.69	<0.01
12	Throw objects (bag, ball) with the right and left hands at 3-5 m	3.00	0	<0.01	2.75	0.44	<0.01	3.00	0	<0.01
13	Throw a ball (weight 100 g) at a moving target	1.80	0.83	<0.01	1.00	0	<0.01	1.45	0.94	<0.10

When comparing grades, it was found that 7 grades differed by a statistically significant amount for girls from A and L, 4 grades for girls from A and R, and 4 for girls with L and R – 3 (Table 6).

Discussion

During the preschool period, the formation and further development of the child's motor function take place (Wilmore et al., 2012; Katzmarzyk & Silva, 2013). Therefore, in this period, one of the defining tasks for teachers, pediatricians, and psychologists is to ensure a targeted impact on the child's motor function (Herasymchuk et al., 2014; Iedynak & Galamanzhuk, 2017). For this, physical exercises are used, which, as well as motor actions used in everyday life, is necessary to teach the child (Altavilla & Di Tore, 2016; Galamanzhuk & Iedynak, 2016). Therefore, considerable attention is paid to this issue in the preschool period and the search for effective criteria for the individualization of education and child development is carried out (Galamanzhuk et al., 2019). One of the promising criteria is the handedness of each child (Güntürkün et al., 2020; Ratini, 2021).

The data obtained at each age testified to the existence of peculiarities in the quality of performance of motor actions by girls with different handedness. So, at 3 years old, the result was as follows: for the highest score of "3", girls from A and R performed one motor action each, girls from L – three, for the lowest score of "1" – respectively 9, 10 and 6 actions out of all 14 offered. When comparing the grades, their discrepancy was found (at the level of p = 0.05÷0.0001), namely: the girls from L had 8 of these when compared with the grades of girls from A and R, as well as 6 – when comparing the grades in the last two samples.

At the age of 4, the comparison of grades showed that girls with A significantly (at the level of p = 0.05÷0.001) differed by 5 and 2 grades from those obtained by girls with L and R; in the latter, the assessment for the performance of one motor action differed.

At the age of 5, by comparison, the following was established: in girls with A, 7 and 4 grades differed (at the level of p = 0.05÷0.001) from those obtained by girls with L and R; in the latter, the score for performing 3 motor actions differed.

One of the reasons for this result is the connection of handedness in the human motor cortex, which is quite strong because r = -0.76 (p = 0.01) (Volkmann et al, 1998). At the same time, the expansion of the hand motor cortex in the dominant hemisphere may provide extra space for the cortical encoding of a greater motor skill repertoire of the preferred hand. As noted by (Gainotti, 2015), manual experience acquired during tool manipulation can influence the hemispheric representation of tools and other artifacts.

The data of our study confirm that the performance of motor actions, which children learned during the school year, contributed to an increase in the level of motor function development. But the results of girls with different handedness were not the same, which was associated with a complex of characteristics. Some of the main ones were satisfactorily explained as follows: with an increase in the complexity of the motor action, the volume of brain areas that are sequentially involved in its implementation increases, and contralateral and ipsilateral activations also increase; it provides intensive development of motor function (Gut et al., 2007). Important to the above is also the data that, regardless of handedness, when performing a motor action with the non-leading hand, both hemispheres are involved in this activity (Scharoun & Bryden, 2014; De Kovel et al., 2019).

In addition, the obtained data were associated with differences in the development of the physical condition of children with different handedness (Galamanzhuk, 2015).

In a practical aspect, the obtained data will contribute to increasing the results of teaching children new motor actions. Also, these data are important, because they complement the idea of the manifestation of different degrees of freedom in the functioning of cortical structures of children with different handedness.

We see the prospect of further research in obtaining information related to the selection of flexible, diverse,

Table 6. Comparison of the results of performance by 5-year-old girls motor actions with different handedness

Motor action (N)	Mean Rank		Sum of Rank		U	W	Z	Asymp. Sig (2-talled)
	A (n=20)	L (n=20)	A (n=20)	L (n=20)				
1	20.50	20.50	410.0	410.0	200.0	410.0	0.000	1.000
2	23.13	17.88	462.5	357.5	147.5	357.5	-1.521	0.128
3	19.50	21.50	390.0	430.0	180.0	390.0	-0.582	0.561
4	16.38	24.63	327.5	492.5	117.5	327.5	-2.440	0.015
5	25.00	16.00	500.0	320.0	110.0	320.0	-2.630	0.009
6	21.25	19.75	425.0	395.0	185.0	395.0	-0.426	0.670
7	14.88	26.13	297.5	522.5	87.5	297.5	-3.195	0.000
8	13.75	27.25	275.0	545.0	65.0	275.0	-3.980	0.000
9	14.00	27.00	280.0	540.0	70.0	280.0	-4.019	0.000
10	21.63	19.38	432.5	387.5	117.5	387.5	-0.736	0.461
11	23.5	17.5	470.0	350.0	140.0	350.0	-1.721	0.095
12	23.0	18.00	460.0	360.0	150.0	360.0	-2.360	0.018
13	26.00	15.00	520.0	300.0	90.0	300.0	-3.797	0.000
	A(n=20)	R(n=20)	A(n=20)	R(n=20)				
1	20.30	20.70	406.0	414.0	196.0	406.0	-0.115	0.909
2	24.03	16.98	480.5	339.5	129.5	339.5	-1.989	0.047
3	21.20	19.80	424.0	396.0	186.0	396.0	-0.413	0.680
4	17.88	23.13	357.5	462.5	147.5	357.5	-1.497	0.134
5	24.53	16.48	490.5	329.5	119.5	329.5	-2.503	0.012
6	19.05	21.95	381.0	439.0	171.0	381.0	-0.832	0.405
7	16.18	24.83	323.5	496.5	113.5	323.5	-2.471	0.013
8	17.90	23.10	358.0	462.0	148.0	358.0	-1.519	0.129
9	19.40	21.60	388.0	432.0	178.0	388.0	-0.663	0.507
10	22.40	18.60	448.0	372.0	162.0	448.0	-1.152	0.249
11	23.88	17.13	477.0	342.5	132.5	477.0	-2.044	0.041
12	20.50	20.50	410.0	410.0	200.0	410.0	0.000	1.000
13	22.23	18.78	444.5	375.5	165.5	375.5	-0.984	0.325
	L(n=20)	R(n=20)	L(n=20)	R(n=20)				
1	20.00	21.00	400.0	420.0	190.0	400.0	-0.289	0.773
2	20.88	20.13	417.5	402.5	192.5	402.5	-0.239	0.811
3	22.00	19.00	440.0	380.0	170.0	380.0	-0.866	0.386
4	22.38	18.63	447.5	372.5	162.5	372.5	-1.180	0.238
5	19.38	21.63	387.5	432.5	177.5	387.5	-0.707	0.480
6	18.13	22.88	362.5	457.5	152.5	362.5	-1.365	0.172
7	21.75	19.25	435.0	385.0	175.0	385.0	-0.726	0.468
8	24.50	16.50	490.0	330.0	120.0	330.0	-2.458	0.014
9	21.38	19.63	427.5	392.5	182.5	392.5	-0.507	0.612
10	21.50	19.50	430.0	390.0	180.0	390.0	-0.572	0.567
11	20.75	20.25	415.0	405.0	195.0	405.0	-0.144	0.886
12	18.00	23.00	360.0	460.0	150.0	360.0	-2.360	0.018
13	17.00	24.00	340.0	480.0	130.0	340.0	-2.196	0.028

Note: Mann-Whitney U, Wilcoxon W, the particularly significant difference between the two means is highlighted in color

non-programmed strategy options for the implementation of various activities (Kuhl & Kazen, 2008; Porac, 2016).

Conclusions

At each age of 3-5 years, the development and manifestation of the motor function of girls when performing motor actions with their hands is marked by features due to handedness. At the age of 3, girls with A and R had the highest score for performing one motor action, girls with L had three, and the lowest score was 9, 10, and 6 of all 14 actions, respectively. At the age of 4, for the highest score, girls from A performed only one motor action, girls from L and R – none, for the lowest score – 5, 5, and 6 motor actions out of all 9 offered. At the age of 5, girls from A and R performed one motor action each for the highest score, girls from L –none, for the lowest score – 8, 6, and 5 motor actions out of all 13 offered.

When comparing the scores obtained by girls with different handedness, in most cases a statistically significant (at the level of $p < 0.05 \div 0.0001$) discrepancy was found in each age period of 3-5 years.

To increase the effectiveness of the educational process, the teacher needs to pay more attention to the study of motor

actions, the performance of which was evaluated by girls with a certain preferred hand with low scores.

Conflict of interest

The authors state no conflict of interest.

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СТАН ВИКОНАННЯ РУХІВ ДІВЧАТКАМИ 3-5 РОКІВ ІЗ РІЗНОЮ МАНУАЛЬНОЮ АСИМЕТРІЄЮ РУХОВИХ ДІЙ РУКАМИ

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Реферат. Стаття: 10 с., 6 табл., 36 джерел.

Мета дослідження полягала у визначенні стану виконання дівчатками з різною мануальною асметрією рухових дій руками, що встановлює чинна програма для кожного віку періоду 3-5 років.

Матеріали та методи. У дослідженні взяло участь 60 дівчаток (порівно з правою, лівою домінуючою рукою та амбідекстрією), кожна відвідувала заклад дошкільної освіти, а на момент початку дослідження вік кожної знаходився в межах 3 років 5 місяців 2 днів до 3 років 5 місяців і 29 днів. Для одержання необхідних даних було використано рухові дії, що визначені чинною програмою розвитку дитини у дошкільний період. Оцінювали якість виконання дівчатками кожної визначеної рухової дії, процедура відбувалася у січні кожного нового навчального року, тобто коли дівчаткам було спочатку 3 роки, потім 4 та 5 років.

Результати. Кожний вік періоду 3-5 років відзначається зумовленими мануальною асметрією особливостями розвитку і вияву моторної функції дівчаток при виконанні рухових дій руками. При цьому, більшість рухових дій виконувалася дівчатками кожної вибірки на нижчий від максимального бал. Це не сприяє інтенсивному розвитку моторної функції дівчаток, що відрізняється від завдання, яке визначено чинною програмою для закладів дошкільної освіти. Порівнюючи результати дівчаток із різною мануальною асметрією виявили, що у більшості рухових дій одержані за виконання оцінки відрізняються на статистично значущу величину, причому в кожному віці досліджуваного періоду.

Висновки. Встановлення особливостей у якості виконання дівчатками з різною мануальною асиметрією рухових дій руками в кожному віці періоду 3-5 років є важливим завданням. Для збільшення дієвості освітнього процесу педагогу необхідно підвищити увагу до вивчення тих рухових дій, які в дівчаток із певною мануальною асметрією були оцінені низькими балами.

Ключові слова: дівчатка, дошкільники, мануальна асиметрія, моторна функція, розвиток.

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