



How to cite / Як цитувати статтю: Demenko M, Harbuzova V, Obukhova O, Biesiedina A, Levchenko Z. Personal component of graphomotor skills of children aged 5–8 years. *East Ukr Med J.* 2023;11(4):442-452

DOI: [https://doi.org/10.21272/eumj.2023;11\(4\):442-452](https://doi.org/10.21272/eumj.2023;11(4):442-452)

ABSTRACT

Maryna Demenko

<https://orcid.org/0000-0003-0717-5922>

Viktoriiia Harbuzova

<https://orcid.org/0000-0001-7183-6997>

Olha Obukhova

<https://orcid.org/0000-0002-2104-8412>

Antonina Biesiedina

<https://orcid.org/0000-0001-7294-3137>

Zoya Levchenko

<https://orcid.org/0000-0003-0722-830X>

Department of Physiology and Pathophysiology with course of Medical Biology, Sumy State University, Sumy, Ukraine

PERSONAL COMPONENT OF GRAPHOMOTOR SKILLS OF CHILDREN AGED 5–8 YEARS

Aim: to assess the personal component of graphomotor skills in children aged 5–8 years. The period of a child's individual development coincides with the beginning of schooling and is marked by increased sensitivity of the body to factors in the external environment, which can lead to disharmonious development and deterioration of health. This justifies the search for new approaches in the development of criteria for prognostic assessment of the development level of senior preschoolers and junior schoolers.

The object of the research is the personality characteristics of children and the level of neuroticism.

Material and methods. Students of grades 1–2 (6–8 years) and children of preschool age (5 years) from secondary schools and preschools in Sumy (Ukraine) (five secondary schools and four preschools in the city, 487 children were examined) participated in the study. Assessment of the level of neuroticism in children was performed using six scales reflecting the main aspects of the manifestation of neurotic changes in children: level of depression, asthenia, behavioral reactions, autonomic disorders, sleep disorders, and anxiety.

Part of the simplest mathematical processing was performed on a personal computer using the standard statistical packages Statgrhics, STATISTICA (descriptive statistics, Student's test, correlation, variance and factor analyses; risk calculation). The Excel package was used for the initial preparation of tables and intermediate calculations.

Results. For children aged 5–8 years with low levels of graphomotor skills, the scores of the scales "level of depression", "asthenia", "behavioral reactions", and "anxiety" were higher compared to the scores of the children with average levels of graphomotor skills. This conclusion was confirmed by the established direct correlation between the graphomotor skills

indicator and emotional stability ($r = 0.32, p < 0.01$), which indicated an increase of children's emotional stability with an increase in the level of graphomotor skills formation.

Conclusions. It has been established that the indicators of borderline neurotic disorders of children aged 5–8 years are at low levels of formation, that is, there are no signs of their manifestations, which indicates the absence of a decrease in vitality, low self-esteem, slow thinking, motor limitations, feelings of depression.

The inverse correlation between the indicator of graphomotor skills and the average values of the "behavior disorder" scale indicates an increase in manifestations of hyperactivity of children when graphomotor skills are not formed ($r = -0.22, p < 0.05$).

Keywords: children, graphomotor skills, borderline neurotic disorders, emotional stability, education in Ukraine.

Corresponding author: Maryna Demenko, Sumy State University, Educational and Scientific Medical Institute, Department of Physiology and Pathophysiology with course of Medical Biology, Sumy, Ukraine
e-mail: zavadaska.mm@gmail.com

РЕЗЮМЕ

Марина Деменко

<https://orcid.org/0000-0003-0717-5922>

Вікторія Гарбузова

<https://orcid.org/0000-0001-7183-6997>

Ольга Обухова

<https://orcid.org/0000-0002-2104-8412>

Антоніна Бессідіна

<https://orcid.org/0000-0001-7294-3137>

Зоя Левченко

<https://orcid.org/0000-0003-0722-830X>

*Сумський державний університет,
Навчально-науковий медичний
інститут, кафедра фізіології та
патофізіології з курсом медичної
біології, м. Суми, Україна*

ОСОБИСТІСНИЙ КОМПОНЕНТ ГРАФОМОТОРНИХ НАВИЧОК У ДІТЕЙ 5–8 РОКІВ

Мета: оцінити особистісний компонент графомоторних навичок у дітей 5–8 років. Період індивідуального розвитку дитини збігається з початком навчання в школі і характеризується підвищеною чутливістю організму до факторів зовнішнього середовища, що може призвести до дисгармонійного розвитку та погіршення здоров'я. Це обумовлює пошук нових підходів у розробці критеріїв прогностичного оцінювання рівня розвитку дітей старшого дошкільного та молодшого шкільного віку.

Об'єкт дослідження є особливості особистості дітей та рівень невротизації.

Методи: у дослідженні брали участь учні 1–2 класів (6–8 років) та діти дошкільного віку (5 років) загальноосвітніх шкіл та дошкільних навчальних закладів м. Суми (Україна) (п'ять загальноосвітніх шкіл та чотири дошкільні заклади міста, обстежено 487 дітей). Оцінку рівня невротизації дітей проводили за шістьма шкалами, які відображають основні аспекти прояву невротичних змін дітей: рівень депресії, астенія, поведінкові реакції, вегетативні розлади, розлади сну і тривожності.

Частина найпростішої математичної обробки виконувалися на персональному комп'ютері з використанням стандартних статистичних пакетів Statgrhics, STATISTICA (дескриптивна статистика, критерій Стьюдента, кореляційний, дисперсійний та факторний аналізи; розрахунок ризиків). Для початкової підготовки таблиць і проміжних розрахунків використовувався пакет Excel.

Результати. У дітей 5–8 років із низьким рівнем графомоторики значення шкал «рівень депресивності», «астенія», «поведінкові реакції» та «тривожність» вищі порівняно зі шкалами групи дітей із середнім рівнем розвитку

рівня графомоторики. Цей висновок підтверджується встановленим прямим кореляційним зв'язком між показником графомоторики та емоційною стійкістю ($r = 0,32$, $p < 0,01$), що свідчить про підвищення емоційної стійкості дітей із підвищенням рівня сформованості графомоторики.

Висновки. Встановлено, що у дітей 5–8 років показники рівня невротизації знаходяться на низьких рівнях формування, тобто відсутні ознаки їх проявів, що свідчить про відсутність у дітей зниження життєвого тону, низької самооцінки, уповільненості темпу мислення, рухової обмеженості, почуття пригніченості.

Зворотний кореляційний зв'язок між показником графомоторних навичок та середніми значеннями шкали «порушення поведінки» свідчить про зростання проявів гіперактивності у дітей при несформованості графомоторних навичок ($r = -0,22$, $p < 0,05$).

Ключові слова: діти, графомоторика, граничні невротичні розлади, емоційна стійкість, освіта в Україні.

Автор, відповідальний за листування: Марина Деменко, кафедра фізіології та патофізіології з курсом медичної біології, Сумський державний університет, Навчально-науковий медичний інститут, Суми, Україна

e-mail: zavadska.mm@gmail.com

INTRODUCTION / ВСТУП

The period of a child's individual development coincides with the beginning of schooling and is marked by increased sensitivity of the body to environmental factors, which can lead to disharmonious development and deterioration of health [1, 2, 3]. All mentioned above causes the search for new approaches in the development of criteria for prognostic assessment of the level of development of children senior preschool and junior school age, the determination of an individual typology of adaptation reactions of the organism, taking into account the peculiarities of the morphofunctional constitution and intersystemic functional interactions [4, 5, 6, 7].

Mechanisms of physiological adaptation play an important role in adapting a child to the formation of graphomotor skills (GMS), knowledge of their features is necessary for early detection of minimal deviations in the state of health and forehanded application of corrective measures. Therefore, in preschool age, preparation for writing is favorable for the development of children's cognitive states. However, the issue of the relationship between the state of non-verbal mental and physical functions, the degree of their maturity and the features of learning graphomotor skills is not sufficiently disclosed in the literature. Undoubtedly, a child who is functionally ready for learning is better adapted to

the difficulties while entering school, and adapts more effectively to learning conditions. Questions related to functional readiness, establishing the optimal age for the start of systematic education, the search for rational forms, methods, modes of education, timely detection of deviations in the processes of growth, development, and the state of health of children with regard to systematic education at school attract attention of specialists in various fields of science, including teachers, psychologists, physiologists and hygienists [2, 4, 8, 9].

Thus, an emotional component dominates in the structure of adaptation mechanisms in primary school age, but while transitioning to systematic learning maladaptation may occur, which is manifested in the dysfunction of self-regulation mechanisms and a decrease in the productivity of cognitive processes [2, 4].

According to the data of physiologists and psychologists, children of the senior preschool and junior school age groups have poorly developed small muscles of the hands, imperfect coordination of movements, incomplete ossification of the wrist and fingers' phalanges. This fact indicates that the organization of movements at the highest level of cortical regulation is not yet sufficiently differentiated and is characterized by the heterochronic development of the body's articular and muscle receptor systems [3, 10].

It has been established that the graphomotor skill (GMS) is a complex hierarchical self-regulating structure that reflects motor actions due to fine differentiated sensitivity, adequate motor imagination, memory that provides effective control of movements and motor actions based on precise self-control and self-regulation [6].

Therefore, the assessment of the parts of the personal component of graphomotor skills determines the direction of our research.

Material and methods

Students of grades 1–2 (6–8 years) and children of preschool age (5 years) from secondary schools and preschools in Sumy (Ukraine) (five secondary schools and four preschools in the city, 487 children were examined) participated in the study.

The usage of all research methods was agreed with the administration of educational institutions, a psychologist, educators and teachers. Written parental permission was obtained for each child's participation. Only children with a working right hand were involved in performing research tasks.

In order to study the psychophysiological status and personal qualities of children, informative methods suitable for mass examinations, simple in data processing, were used without implementation of special equipment. All studies were conducted from 8 to 10 am.

Assessment of the level of neuroticism in children allows to evaluate six scales that reflect the main aspects of the manifestation of neurotic changes in children: the level of depression, asthenia, behavioral reactions, autonomic disorders, sleep disorders and anxiety [11].

Children's graphomotor skills were evaluated using an integral assessment, which was developed based on the use of conditional units and weighting coefficients for each indicator obtained by experts. In addition, only informative indicators are used that can be compared with current rules and requirements. This technique distinguishes three levels: high, medium and low [12].

Part of the simplest mathematical processing was performed on a personal computer using the standard statistical packages Statgraphics, STATISTICA (descriptive statistics, Student's test, correlation, variance and factor analyses; risk calculation). The Excel package was used for the initial preparation of tables and intermediate calculations [13].

Results and discussion

The majority of children with an average level of GMS formation ($64.9 \pm 0.4\%$, $p < 0.001$) showed the greatest manifestations of the level of depression,

while among children with low and high levels of GMS, were found significantly fewer individuals with low levels of manifestation of the level of depression ($13.7 \pm 0.2\%$ and $21.3 \pm 0.2\%$, respectively).

For children aged 5–8 years with low levels of GMS, the values of the scales the level of depression, asthenia, behavioral reactions and anxiety are higher compared to the scales of the group of children with average levels of GMS (Table 1).

The group of children with high levels of GMS has the highest manifestations of "sleep disorder" (9.6 ± 0.5 points) compared to other groups of children, which may indirectly indicate the appearance of the first signs of level of neuroticism with the lowest level of anxiety (6.2 ± 0.4 points).

For children with an average level of formation of GMS, manifestations of the scales of level of neuroticism are insignificant. Children with high levels of GMS have manifestations of vegetative disorders, low levels of anxiety. Children with a low level of GMS have the highest manifestations of behavioral disorders and anxiety, which is characterized by a general state of emotional experience of waiting for trouble, anticipation of a threat when the automaticity of writing skills is not formed. The established data is confirmed by the inverse correlation between the GMS indicator and the average values of the behavioral reactions scale, which indicates an increase in manifestations of hyperactivity of children with underdeveloped graphomotor skills ($r = -0.22$, $p < 0.05$).

For girls with low levels of GMS, the level of manifestation of "behavioral reactions" is maximum, which is 2.5 points higher than the data of children with average levels of GMS and by 3 points more than the indicator of children with high levels of GMS (Table 2).

Manifestations of "vegetative disorders", which indirectly indicate the vegetative regulation of the child's body, are maximal for children with high levels of GMS. A similar pattern was established by the indicator of "sleep disorder" for girls. Thus, girls with high levels of GMS have 2.4 points higher values of the "sleep disorder" indicator compared to girls with average levels of GMS and 2.1 points higher than girls with low levels of GMS.

In contrast to the established manifestations of vegetative disorders and sleep disorders, the mean values of anxiety are higher for girls with low levels of GMS. The difference between the anxiety data of girls with low and medium levels of GMS is 2.0 points and 2.9 points between data with low and high levels of GMS.

Table 1 – Indicators of the level of neuroticism in children 5–8 years ($M \pm m$, points)

Scales	Level of GMS		
	High $N = 108$	Medium $N = 304$	Low $N = 75$
The level of depression	$8.4 \pm 0,3$	7.8 ± 0.2	$8.9 \pm 0.4^*$ $t_{c,H} = 2.4$
Asthenia	$8.5 \pm 0,4$	$8,3 \pm 0,2$	$9.3 \pm 0.5^*$ $t_{c,H} = 1.9$
Behavioral reactions	$5.1 \pm 0.5^{***}$ $t_{e,H} = 3.6$	5.3 ± 0.3	$8.04 \pm 0.7^\circ$ $t_{c,H} = 3.8$
Autonomic disorders	9.8 ± 0.4	$8.7 \pm 0.3^{\circ\circ}$ $t_{c,e} = 2,1$	8.9 ± 0.5
Sleep disorders	$9.6 \pm 0.5^{**}$ $t_{e,H} = 1.9$	$8.3 \pm 0.3^{\circ\circ\circ}$ $t_{c,e} = 2.4$	8.2 ± 0.6
Anxiety	$6.2 \pm 0.4^{***}$ $t_{e,H} = 3.4$	6.7 ± 0.2	$8.3 \pm 0.5^\circ$ $t_{c,H} = 3.3$

Notes:

1. $*$ – $p < 0.05$ – probable difference between indicators of low and medium levels of GMS;
2. $**$ – $p < 0.05$ – probable difference between indicators of low and high levels of GMS;
3. $***$ – $p < 0.001$ – probable difference between indicators of low and high levels of GMS;
4. $^\circ$ – $p < 0.001$ – probable difference between indicators of low and medium levels of GMS;
5. $^{\circ\circ}$ – $p < 0.05$ – probable difference between indicators of medium and high levels of GMS;
6. $^{\circ\circ\circ}$ – $p < 0.01$ – probable difference between indicators of medium and high levels of GMS

Table 2 – Indicators of the level of neuroticism in girls 5–8 years ($M \pm m$, points)

Scales	The level of GMS		
	High $N = 51$	Medium $N = 141$	Low $N = 35$
The level of depression	8.6 ± 0.5	7.9 ± 0.3	8.5 ± 0.5
Asthenia	8.7 ± 0.5	8.4 ± 0.3	8.8 ± 0.6
Behavioral reactions	$4.7 \pm 0.7^\times$ $t_{e,H} = 2.6$	5.2 ± 0.5	$7.7 \pm 0.9^*$ $t_{c,H} = 2.2$
Vegetative disorders	$10.9 \pm 0.6^{**}$ $t_{e,H} = 2.2$	$9.04 \pm 0.4^{\circ\circ\circ}$ $t_{c,e} = 2.6$	8.8 ± 0.7
Sleep disorders	$10.9 \pm 0.7^{***}$ $t_{e,H} = 3.3$	$8.5 \pm 0.4^{\circ\circ\circ}$ $t_{c,e} = 2.9$	7.4 ± 0.8
Anxiety	$5.9 \pm 0.6^{***}$ $t_{e,H} = 3.4$	6.8 ± 0.3	$8.8 \pm 0.6^\circ$ $t_{c,H} = 2.7$

Notes:

1. $*$ – $p < 0.05$ – probable difference between indicators of low and medium levels of GMS;
2. $**$ – $p < 0.05$ – probable difference between indicators of low and high levels of GMS;
3. $***$ – $p < 0.001$ – probable difference between indicators of low and high levels of GMS;
4. $^\circ$ – $p < 0.001$ – probable difference between indicators of low and medium levels of GMS;
5. $^{\circ\circ\circ}$ – $p < 0.01$ – probable difference between indicators of medium and high levels of GMS;
6. $^\times$ – $p < 0.01$ – probable difference between indicators of low and high levels of GMS

Similarly to the group of girls, significant manifestations of asthenia and vegetative disorders were found for boys with low levels of GMS (Table 3). The rate of depression for boys with low

levels of GMS is 15.2% higher than the rate in the group of boys with average levels of GMS and by 10.9% more than the rate of the group of boys with high levels of GMS.

Table 3 — Indicators of the level of neuroticism in boys 5–8 years old ($M \pm m$, points)

Scales	The level of GMS		
	High $N = 57$	Medium $N = 163$	Low $N = 39$
The level of depression	$8.2 \pm 0,4$	7.8 ± 0.3	$9.2 \pm 0.5^*$ $t_{c,H} = 2.4$
Asthenia	$8.3 \pm 0,5$	8.3 ± 0.3	$9.6 \pm 0.7^*$ $t_{c,H} = 2.1$
Behavioral reactions	$5.5 \pm 0,7^{**}$ $t_{6,H} = 2.5$	5.3 ± 0.4	$8.4 \pm 1.03^{***}$ $t_{c,H} = 3.1$
Vegetative disorders	8.7 ± 0.6	8.4 ± 0.3	9.1 ± 0.8
Sleep disorders	8.5 ± 0.7	8.1 ± 0.4	8.8 ± 0.8
Anxiety	6.6 ± 0.6	6.7 ± 0.3	7.9 ± 0.7

Notes:

1. * – $p < 0.05$ – probable difference between indicators of low and medium levels of GMS;
2. ** – $p < 0.05$ – probable difference between indicators of low and high levels of GMS;
3. *** – $p < 0.001$ – probable difference between indicators of low and medium levels of GMS

The average values of the asthenia scale for boys with a low level of GMS are 13.5% higher than the data of groups with medium and high levels of GMS. Probable differences are established by the indicator of behavioral reactions between groups of levels of GMS. The highest values of the behavioral reactions scale were found for boys with low levels of GMS, as the difference between groups with low and high levels of GMS is 34.5% and 36.9% between groups with low and medium levels of GMS.

The analysis of the age characteristics of level of neuroticism of children made it possible to

establish the absence of probable differences in the indicators of the scales depending on the level of GMS, with the exception of 6-year-old children according to the indicators of the "vegetative disorders" and "anxiety" scales. The specific gravity of "vegetative disorders" for 6-year-old children with an average level of GMS is 18.5% less than for children with a high level of GMS. The number of "anxious" children with a high level of GMS is 21.4% less than children of the group with a low level of GMS (Table 4).

Table 4 — Indicators of the level of neuroticism in 6-year-old children ($M \pm m$, points)

Scales	Levels of GMS		
	High $N = 38$	Medium $N = 85$	Low $N = 49$
The level of depression	8.9 ± 0.6	8.2 ± 0.4	8.6 ± 0.4
Asthenia	9.3 ± 0.6	8.8 ± 0.4	9.3 ± 0.5
Behavioral reactions	5.7 ± 0.9	5.6 ± 0.7	7.3 ± 0.8
Vegetative disorders	10.8 ± 0.7	$8.8 \pm 0.5^{**}$ $t_{c,6} = 2.4$	9.1 ± 0.7
Sleep disorders	9.6 ± 0.8	8.4 ± 0.5	8 ± 0.7
Anxiety	$6.6 \pm 0.7^*$ $t_{6,H} = 2.1$	7.5 ± 0.4	8.4 ± 0.5

Notes:

1. * – $p < 0.05$ – probable difference between indicators of low and high levels of GMS;
2. ** – $p < 0.05$ – probable difference between indicators of medium and high levels of GMS

Thus, the peculiarities of the manifestations of level of neuroticism of children aged 5–8 years are as follows: children with a high level of formation of GMS are characterized by manifestations of sleep disorders, vegetative disorders at the lowest signs of anxiety. Children with low levels of GMS have the highest manifestations of behavioral disorders and anxiety, which may indicate changes in personal qualities while acquiring writing skills.

The next stage of the study of the personal

qualities of children with different levels of graphomotor skills' development was the assessment of children's emotional stability when mastering the skills.

In general, the majority of children aged 5–8 years have an excellent level of emotional stability ($33.9 \pm 0.7\%$, $p < 0.001$), while $26.2 \pm 0.7\%$ of children were with a good level, a satisfactory level represents $24.6 \pm 0.6\%$ of those examined and an unsatisfactory level – $15.3 \pm 0.5\%$ of children (Fig. 1).



Figure 1 – Division of levels of emotional stability of children aged 5–8 years (%)

Gender differences in the levels of children's emotional stability consist in the probable predominance of excellent and good levels in both girls and boys.

The analysis of the results of the emotional stability evaluation of children with different levels of GMS formation indicates the growth of emotional stability during the formation of graphomotor skills. The average values of emotional stability of children with low levels of

GMS are 5% lower than the indicator of children with high levels of GMS. No significant differences were found between the indicators of emotional stability of children with medium and high levels of GMS. This conclusion is confirmed by the established direct correlation between the GMS indicator and emotional stability ($r = 0.32$, $p < 0.01$), which indicates an increase of children's emotional stability with an increase in the level of GMS formation (Table 5).

Table 5 – Indicator of emotional stability of children aged 5–8 years depending on the level of development of graphomotor skills ($M \pm m$)

Levels of GMS	Indicator of emotional stability, points
High, $n = 132$	$38.2 \pm 0.4^*$, $t_{6,H} = 3.8$
Medium, $n = 387$	38.2 ± 0.2
Low, $n = 123$	$36.2 \pm 0.4^*$, $t_{c,H} = 5.6$

Note: * – $p < 0,001$ – probable difference between indicators

For children with low levels of GMS, a probable advantage of an unsatisfactory level of emotional stability was established ($34.2 \pm 0.7\%$). The group of children with high levels of GMS is characterized by

a probable advantage of an excellent level of emotional stability ($46.9 \pm 0.9\%$) over good (19.7 ± 0.6), satisfactory ($19.7 \pm 0.6\%$) and unsatisfactory ($13.6 \pm 0.5\%$) levels (Fig. 2).

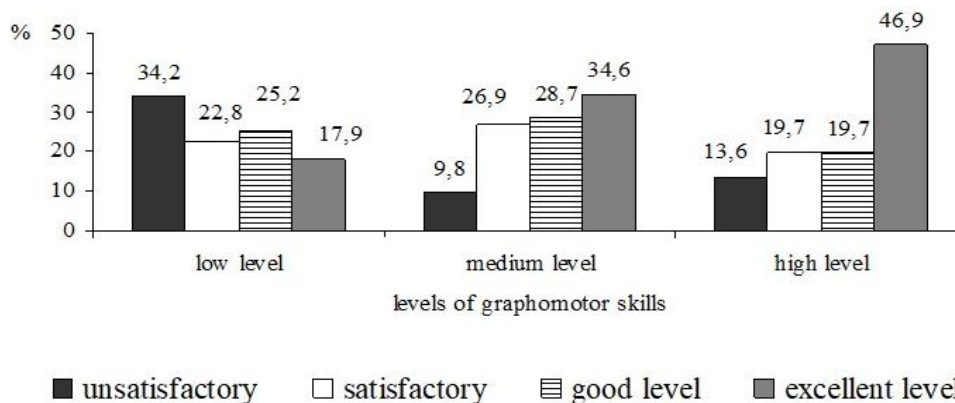


Figure 2 — Division of levels of emotional stability of children aged 5–8 years depending on the level of development of graphomotor skills (%)

An excellent level ($34.6 \pm 0.7\%$) of emotional stability was established for children with average levels of GMS, while only $9.8 \pm 0.4\%$ of children with an unsatisfactory level of emotional stability were identified.

For girls with different levels of the GMS formation the average values of emotional stability

repeat the pattern of sample changes in general, which consists in the increase in the values of emotional stability by 5.1% with an increase in the level of GMS formation. Girls with low levels of GMS have the lowest values of emotional stability compared to groups of children with medium and high levels of GMS (Table 6).

Table 6 — Indicator of emotional stability of girls aged 5–8 years depending on the level of development of graphomotor skills ($M \pm m$)

Levels of GMS	Indicator of emotional stability, points
High, $n = 59$	39.1 ± 0.5 , $t_{6,H} = 2.9$
Medium, $n = 182$	38.3 ± 0.2 , $t_{C,H} = 2.8$
Low, $n = 61$	37.1 ± 0.5

Note: * – $p < 0.05$ – probable difference between indicators

The division of the levels of emotional stability among girls with different levels of the GMS formation made it possible to establish a probable advantage of an excellent level of emotional stability of children with medium ($33.5 \pm 0.7\%$) and high

($54.2 \pm 0.9\%$) levels of GMS. For girls with low levels of GMS, we established a probable advantage of good ($27.9 \pm 0.7\%$) and unsatisfactory ($26.2 \pm 0.7\%$) levels over excellent ($24.6 \pm 0.6\%$) and satisfactory ($21, 3 \pm 0.6\%$) levels of emotional stability (Fig. 3).

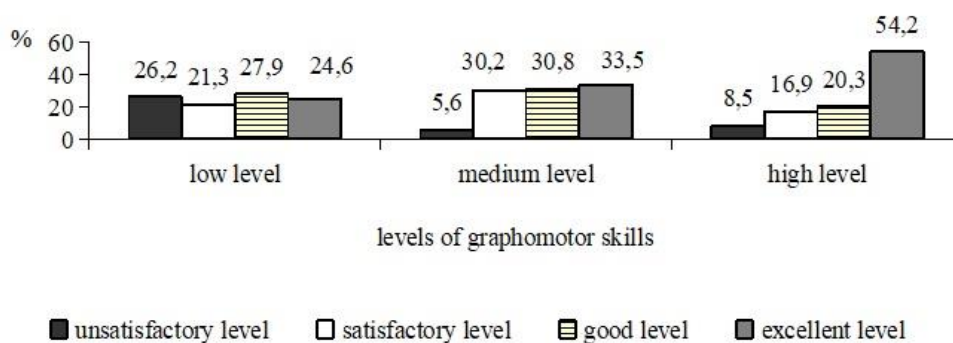


Figure 3 — Division of levels of emotional stability of girls aged 5–8 years depending on the level of development of graphomotor skills (%)

An excellent level of emotional stability ($33.5 \pm 0.7\%$) prevails for girls with average levels of GMS, with no differences between good and satisfactory levels of emotional stability. At the same time, the unsatisfactory level ($5.6 \pm 0.3\%$) of

emotional stability has the smallest share in this girls' group. The indicator of emotional stability of boys aged 5–8 years with low levels of GMS is probably lower than the indicators of boys with average GMS levels (Table 7).

Table 7 – Indicator of emotional stability of boys aged 5–8 years depending on the level of graphomotor skills ($M \pm m$)

Levels of GMS	Indicator of emotional stability, points
High, $n = 70$	37.6 ± 0.6
Medium, $n = 188$	37.9 ± 0.3
Low, $n = 51$	$36.1 \pm 0.5, t_{c,n} = 3.2$

Note: * – $p < 0.01$ – probable difference between indicators

Boys with medium and high levels of GMS probably have an excellent level of emotional stability ($34.6 \pm 0.8\%$, $41.4 \pm 0.8\%$, $p < 0.05$, respectively) (Fig. 4).

A satisfactory level ($21.4 \pm 0.6\%$) of emotional stability was established for boys with high levels of GMS, while the group with an average level of GMS

had a good level of emotional stability ($26.1 \pm 0.7\%$, $p < 0.05$). Thus, boys with a high level of mental health have a share of a good level of emotional stability ($18.6 \pm 0.6\%$), and a group of boys with an average level of mental health have a satisfactory level of emotional stability ($24.5 \pm 0.6\%$).

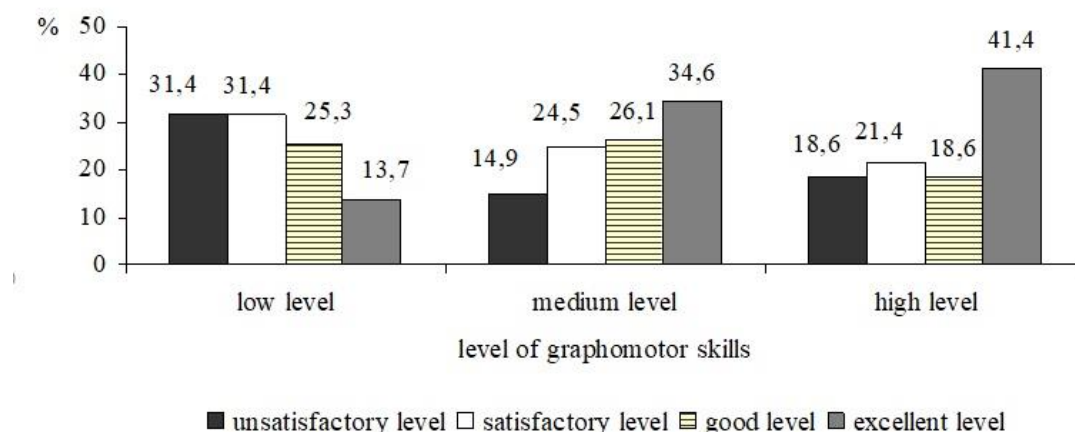


Figure 4 – Division of levels of emotional stability of boys aged 5–8 years depending on the level of development of graphomotor skills (%)

With a low level of development of boys' mental health, unsatisfactory ($31.4 \pm 0.7\%$) and satisfactory ($31.4 \pm 0.7\%$) levels of emotional stability are likely to be higher, which is manifested by aggressiveness, anxiety, bad mood and sometimes the development of psychosomatic

diseases. $25.3 \pm 0.6\%$ of boys with good and $13.7 \pm 0.5\%$ with excellent levels of emotional stability are characterized by the qualities of emotional stability, such as openness, organization, decisiveness and activity.

CONCLUSIONS / ВИСНОВКИ

It has been established that the indicators of level of neuroticism of children aged 5–8 years are at low levels of formation, that is, there are no signs of their manifestations, which indicates the absence of a

decrease in vitality, low self-esteem, slowness of thinking, motor limitations, feelings of depression.

The inverse correlation between the indicator of graphomotor skills and the average values of the behavioral reactions scale indicates an increase in

manifestations of hyperactivity of children when graphomotor skills are not formed ($r = -0.22$, $p < 0.05$).

There is a tendency to increase manifestations of vegetative disorders and sleep disorders in the group of girls with high levels of GMS, while in the group of girls with low levels of GMS, there is a tendency to increase manifestations of vegetative disorders, asthenia, and anxiety, which indicates a higher level of emotional distress of children.

The scales of vegetative disorders, sleep disorders and anxiety of boys do not depend on the level of GMS, which may indicate the exclusion of these characteristics from the parts of the personal

component of boys, as leading in the formation of graphomotor skills.

With the overall predominance of the share of children with an excellent level of emotional stability, there are manifestations of a decrease in its level for boys, which can be manifested in isolation, anxiety, shyness, timidity, internal tension, insufficient social adaptation and bad mood.

It has been established that the level of emotional stability of children aged 5–8 years increases with the growth of the level of mental health formation, which is confirmed by a direct correlation between indicators of mental health and emotional stability ($r = 0.3$, $p < 0.01$).

CONFLICT OF INTEREST / КОНФЛІКТ ІНТЕРЕСІВ

The authors declare no conflict of interest.

FUNDING / ДЖЕРЕЛА ФІНАНСУВАННЯ

None.

AUTHOR CONTRIBUTIONS / ВКЛАД АВТОРІВ

All authors substantively contributed to the drafting of the initial and revised versions of this paper. They take full responsibility for the integrity of all aspects of the work.

REFERENCES/СПИСОК ЛІТЕРАТУРИ

1. Berdnyk O, Polka N, Rudnytska O, Dobrianska O, Shevchuk K. School starting age as a risk factor for adolescent health. *Child's health*. 2022;(6.66):39–43. <https://doi.org/10.22141/2224-0551.6.66.2015.74952>
2. Kocherga OV. *Psykhofiziolojiia shestyrichnykh pershoklasnykh i adaptatsiia do shkoly*. [Psychophysiology of six-year-old first-graders and adaptation to school]. Kyiv: School World, 2010. 128 p.
3. Pirozhenko T, Karabaeva I, Soloviova L, Khartman O. Study of the readiness of older preschool children for systematic education in the conditions of reforming the Ukrainian school. *Psychological journal*. 2022;8(2):18–32. <https://doi.org/10.31108/1.2022.8.2.2>
4. Kokun OM. *Psykhofiziolojiia* [Psychophysiology]. Kyiv: Center for Educational Literature; 2006. 184 p.
5. Gashaj V, Oberer N, Mast F, Roebbers C. Individual differences in basic numerical skills: The role of executive functions and motor skills. *Journal of Experimental Child Psychology*. 2019;128June:187–195. <https://doi.org/10.1016/j.jecp.2019.01.021>
6. Zavadaska M, Biesiedina A, Oleshko T, Starchenko A. Physiological component of graph-motor skills of children aged from 5 to 8 years old. *Physical Activity Review*. 2019;7:125–133. <https://doi.org/10.16926/par.2019.07.15>
7. Verych S, Ren L. Correction of negative emotional states of children with special educational needs as a factor of motivation their educational and cognitive activities in condition of martial law. *Bulletin of the Chernihiv Collegium National University named after T. G. Shevchenko*. 2023;23(179):14–18. <https://doi.org/10.58407/visnik.232303>
8. Barger M, Kim E, Kuncel N, Pomerantz E. The relation between parents' involvement in children's schooling and children's adjustment: A meta-analysis. *Psychological Bulletin*. 2019;145(9):855–890. <https://doi.org/10.1037/bul0000201>
9. Reshetniak V. Implementation of the european experience in the new Ukrainian school «primary education». *Bulletin of the Glukhiv National Pedagogical University named after Oleksandr Dovzhenko Series: Pedagogical Sciences*. 2021;3(47):137–143. <https://doi.org/10.31376/2410-0897-2021-3-47-137-143>
10. Dehtiarenko TV, Kovylyna VH. *Psykhofiziolojiia rozvytku*. [Psychophysiology of development]. Kyiv: UAID "Rada"; 2022. 327 p.
11. Sednev VV. [Diagnosis of neurotic disorders in children of primary and secondary school age]. *Practical psychology and social work*. 1998;3:17–20.
12. Verbenko MM, Kalynychenko IO, Antomonov MIu. *Metodyky hihienichnoi otsinky umov formuvannia hrafichnykh navychok pysma u ditei*. [Methods of hygienic assessment of the conditions for the formation of graphic writing skills in children]. Sumy: Sumy DPU named after A. S. Makarenko, 2011. pp.8-13.

13. Antomonov MІu. *Matematycheskaia obrabotka y analiz medyko-byolohycheskykh dannukh.*

[Mathematical processing and analysis of medical and biological data]. 2nd. Kyiv. 2018. 579 p.

Received 25.11.2023

Accepted 05.12.2023

Одержано 25.11.2023

Затверджено до друку 05.12.2023

INFORMATION ABOUT THE AUTHORS / ВІДОМОСТІ ПРО АВТОРІВ

Maryna Demenko

Candidate of Biological Sciences, a senior lecturer (Department of Physiology and Pathophysiology with course of Medical Biology)

Sumy State University, Educational and Scientific Medical Institute, Ukraine

Rymskoho-Korsakova Str., 2, Sumy, Ukraine, 40007

e-mail: zavadska.mm@gmail.com

phone: +80664906722

ORCID ID: <https://orcid.org/0000-0003-0717-5922>

Viktoriia Harbuzova

Doctor of Biological Sciences, Professor (Head of Department of Physiology and Pathophysiology with course of Medical Biology)

Sumy State University, Educational and Scientific Medical Institute, Ukraine

Rymskoho-Korsakova Str., 2, Sumy, Ukraine, 40007

e-mail: v.garbuzova@med.sumdu.edu.ua

ORCID ID: <https://orcid.org/0000-0001-7183-6997>

Olha Obukhova

Candidate of Biological Sciences, Associate Professor (Department of Physiology and Pathophysiology with course of Medical Biology)

Sumy State University, Educational and Scientific Medical Institute, Ukraine

Rymskoho-Korsakova Str., 2, Sumy, Ukraine, 40007

e-mail: o.obukhova@med.sumdu.edu.ua

ORCID ID: <https://orcid.org/0000-0002-2104-8412>

Antonina Biesiedina

Candidate of Pedagogical Sciences, Associate Professor (Department of Physiology and Pathophysiology with course of Medical Biology)

Sumy State University, Educational and Scientific Medical Institute, Ukraine

Rymskoho-Korsakova Str., 2, Sumy, Ukraine, 40007

e-mail: a.besedina@med.sumdu.edu.ua

ORCID ID: <https://orcid.org/0000-0001-7294-3137>

Zoya Levchenko

Assistant (Department of Physiology and Pathophysiology with course of Medical Biology)

Sumy State University, Educational and Scientific Medical Institute, Ukraine

Rymskoho-Korsakova Str., 2, Sumy, Ukraine, 40007

e-mail: z.levchenko@med.sumdu.edu.ua

ORCID ID: <https://orcid.org/0000-0003-0722-830X>