Original Article

Relationship of successful formation of choreographic skills in young athletes with psychophysiological characteristics

GEORGIY KOROBEYNIKOV[1], LESIA KOROBEYNIKOVA[2], MARIA BULATOVA[3], VERONIKA MISHKO[4], MIRELA FLORINA CRETU [5], OLENA YARMAK[6], IRENE KHMELNITSKA[7], MYKOLA KUDRIA[8]

[1,2,37,8,]National University of Physical Education and Sport, Kiev, UKRAINE
[4]National University, Uzhhorod, UKRAINE
[5]PhD student - University of Pitesti, ROMANIA
[6]National Agrarian University, BilaTserkva, UKRAINE

Abstract.
*Purpose:*tostudy the relationship between the success of choreographic skills forming in young athletes with psychophysiological characteristics.
Material: The article presents the results of a comprehensive study of the mental state and condition of neurodynamic and cognitive characteristics in young dancers with different levels of success in choreographic skills mastering. The study involved 32 qualified young athletes engaged in sports dancing. The age of the athletes is 14-15 years, which corresponds to the age category "Juniors" in this sport. To solve this goal, we used the following research methods: evaluation of performance in sports dancing, research of the cognitive sphere; study of neurodynamic functions; methods of mathematical statistics.
Results: The correlation between the level of success in sports dancing and the state of psychophysiological functions in young dancers was revealed. A study of neurodynamic characteristics has revealed that more successful young dancers, compared to less successful ones, have a higher rate of perception and processing of visual information. This result shows that neurodynamic properties are directly involved in the training and learning of young dancer's choreographic skills. In addition, it was found that young dancers with a high level of success in the formation of choreographic skills exhibit reduced values of nervous system lability, which reduces the probability of uncontrolled movements and increased concentration in conditions of reproduction of psychomotor skills.
Conclusions: It has been found that success in sports dancing among young athletes to be related to cognitive characteristics: attention, speed of visual perception, level of operative and logical thinking. However, the most important cognitive characteristic in sports dancing is the verbal sphere of perception and processing of information.
Keywords: success, choreographic skills, young athletes, psychophysiological characteristics

Introduction

Among modern sports it is possible to distinguish a separate group which is a combination of both sports and artistic components of activity. One of these is sports dancing. A sport dancing as a kind of sport has a history of development. During this time, from the field of art, dances have become a sport, while retaining their characteristics. So, modern sports dance is a synthesis of art and sport (Potop, 2008).

Every year, sports dance is gaining popularity with the advent of a large number of world prestigious competitions, including its inclusion in the Olympic Games. Considering that sports dance is a young enough sport, many scientific directions concerning the approaches and criteria for improving training and competitive activity have not been studied.

For the development of sports dancing, as a spectacular sport that has gained a lot of fans, both among professionals and spectators, there is a need for scientific substantiation and development of a modern training system for qualified athletes (Raiola 2015; Stoeber et al., 2016;Grigore et al., 2019a).

There is practically no data in the scientific literature concerning the consideration of issues related to the level of manifestation of genetically determined factors of different origins in order to achieve the maximum results of the athlete. Particularly interesting problem was the study of the relationship of individual-typological, psychophysiological characteristics with performance in sports dancing (Korobeynikov et al., 2016).

Among the scientific work of researchers, one of the popular areas is to study the psychological aspects of sports dancing at different stages of training (Năstase 2012; Bläsing et al., 2012).

Corresponding Author: GEORGIY KOROBEYNIKOV, e-mail: k.george.65.w@gmail.com

GEORGIY KOROBEYNIKOV, LESIA KOROBEYNIKOVA, MARIA BULATOVA, VERONIKA MISHKO, MIRELA FLORINA CRETU, OLENA YARMAK, IRENE KHMELNITSKA, MYKOLA KUDRIA

As a kind of sport that requires the implementation of complex coordination skills that are performed in the context of musical accompaniment, sports dancing reveals different abilities of a person, including cognitive functions (Potop et al., 2010; Soronovich et al., 2013; Grigore, 2014; Chernozub et al., 2018;Grigore et al., 2019b). After all, cognitive functions are responsible not only for the learning process, but also directly involved in the formation and implementation of sports activities (Bläsing et al., 2009). Cognitive functions include characteristics of perception of external information, attention, memory and thinking. Performing of complicated dance elements and synchronizing musical accompaniment require the involvement of various types of athlete's cognitive characteristics (Grigore et al., 2018). Therefore, improving the process of demonstration maximum opportunities in sports dancing is an urgent issue.

At the same time, the manifestation of cognitive abilities, as well as artistic functions, is related to the individual-topological properties of the athlete's nervous system. They are based on neurodynamic functions, most of which are genetically conditioned. Individual-typological properties are divided into three characteristics: strength of the nervous system, balance and mobility of nervous processes (Korobeynikov et al., 2006).

For sports dancing, it is the ratio of the individual-typological properties of the nervous system that is most relevant. After all, according to research by Raiola (Raiola et al., 2015) and Cumming (Cumming et al., 2013), the formation of complex motor dance skills is associated with the level of endurance of the nervous system. Our previous studies also indicate this (Korobeynikov et al., 2017).

At the same time, the analysis of the current scientific literature indicates that there is a lack of research on the issue of the process of forming a high degree of success in sports dancing.

Purpose: To study the relationship between the success of choreographic skills formation in young athletes with psychophysiological characteristics.

Materials and Methods

In our research, we have applied the methodology of assessing dance sport skills, which was proposed in 2013 and was introduced for use in international competitions. The rating system is based on the evaluation of the individual criteria of each pair. Performance in sports dancing was evaluated on five criteria (on a ten-point scale). According to the level of success, all athletes were divided into two groups: high level of success (12 persons,> 71 points for special tests) and low level of success (20 persons, <70 points for special tests).

Studies of mental processes were determined by tests of verbal intelligence ("comparison of numbers"test)and non-verbal intelligence ("establishment of consistent patterns" test).The assessment of the state of psychophysiological functions was performed using psychomotor (determination of the sensorimotor response and "tapping test") and neurodynamic (assessment of latent time of simple visual-motor reaction, balance and functional mobility of nervous processes) characteristics. All of the above methods are components of the hardware and software "Multipsychometer-05" complex.All of athletes gave the permission to participate in this research, in accordance with the recommendations of the Committee on Ethics of Biomedical Research.

The research materials were processed by statistical methods using correlation analysis by statistical software "Statistica 7.0" and "Microsoft Excel".

Results

Analysis of psychophysiological characteristics in the formation of difficult coordination choreographic skills indicates the presence of mental stress in young athletes with a low level of success in the conditions of training activities. In addition, it has been found that dancers with high levels of success show lower values of anxiety compared to another group of athletes.

The indicated result indicates that the level of success in sports dancing is related to the presence of optimal mental state, in particular, increased mental tension and increased anxiety level are a negative factor for success. Optimization of the level of mental tension is ensured by the activation of the sympatho-adrenal system in dancers with a high level of success in choreographic skills. At the same time, the system of vegetative regulation in dancers with high levels of performance is more advanced than in dancers with reduced levels of performance in choreographic skills. This fact is confirmed by the lack of fatigue and mental anxiety in the dancers of this group, compared to the group with a low level of success.

The study of neurodynamic functions has established that according to the test of functional mobility of nervous processes, the limiting time of information processing in dancers with a high level of success to choreographic skills has less absolute values, which indicates a more mobile nervous system. In other words, it can be argued that the functional mobility of the nervous processes directly ensures the success of mastering complex choreographic skills in sports dancing.

A study of neurodynamic characteristics revealed that successful young dancers, compared to less successful ones, have a higher rate of perception and processing of visual information (Table 1). It is probably that the process of forming complex choreographic skills depends on the system of neurodynamic response, in particular, the system of perception and processing of visual information.

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Table 1. Indicators of neurodynamic functions in dancers with different manifestations of sports performance (median, upper and lower quartile)

Parameter	More successful dancers (n=12)	Less successful dancers (n=20)
Latent time of simple visual-motor reaction, ms	244,79 229,49; 341,41	289,61* 251,52; 302,01
Stability, convencional units	18,16 13,61; 18,32	15,44* 12,02; 17,01
Accuracy (balance of nervous processes), convencional units	2,90 2,50; 3,15	2,50 2,00; 3,40
Bandwidth of the visual analyzer (functional mobility of nervous processes), convencional units	1,75 1,45; 1,85	1,80 1,50; 1,90
Regularity(tapping-test), convencional units	2,70 2,45; 3,10	2,60 2,40; 3,00

Note. * - p <0.05, compared to the group of more successful dancers

Thus, success in mastering choreographic skills among young athletes in sports dancing is due to optimization of psycho-emotional state and speed of perception and processing of visual information.

Among the psychological and physiological characteristics that provide the efficiency in sports dancing, one of the important properties are cognitive functions, because they are responsible not only for the learning process, but also take a direct part in the formation and implementation of sports activities.

Traditionally, cognitive functions include characteristics of perception of external information, attention, memory, and thinking (Korobeynikov et al., 2019). In sporting dances, performing complex elements, synchronizing musical accompaniment and implementing motor skills require the involvement of the entire cognitive sphere of the dancer.

In spite of the fact that scientific researches concerning organization of training process, physical preparation, perfection of sports skill in sports dances in recent years have been studied in some way, there are practically no studies of the connection between the state of cognitive functions and the success of young dancers in 15-16 years old.

In the study of cognitive characteristics, it was revealed that young dancers with high levels of athletic performance revealed the best values of logical and operational thinking in the processing of verbal information (Table 2). In fact, success in sports dancing among young athletes is provided by a high level of verbal intelligence, in particular, a manifestation of attention functions, speed of visual perception, and an increased level of operational and logical thinking.

Table 2. Indicators of cognitive test for verbal stimuli "establishment of consistent patterns" in dancers with different levels of athletic performance (median, upper and lower quartile)

Parameter	More successful dancers (n=12)	Less successful dancers (n=20)
Productivity,convencional units	18,00; 16,00; 20,00	17,00 16,00; 20,00
Speed, convencional units	3,50 3,17; 4,36	3,58 3,00; 4,00
Accuracy,convencional units	0,90 0,88; 0,96	0,87* 0,81; 0,91
Efficiency,convencional units	60,00 56,00; 66,95	49,29* 46,81; 66,96

Note. * - p <0.05, compared to a group of more successful dancers

Based on this, the success in sports dances among young dancers is due to the high level of activation of leading cognitive functions: attention, perception and increase of the level of operative and logical thinking in the processing of verbal visual information. After all, as you know, verbal intelligence in sports activities makes it possible to perform consciously complex motor skills, which is of particular importance in the implementation of dance programs. In addition, the presence of verbal intelligence makes it possible to perceive consciously the external information from the coach aimed at correcting the performance of technical skills.

Studying the differences between groups of dancers with different levels of success in performing a non-verbal cognitive test revealed an advantage in speed characteristics in successful athletes. However, due to the increased speed of information processing in successful dancers, the attention function is diminished, which is reflected in the decrease in the level of efficiency and stability of the test performance. This result is consistent

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with previous studies. It is the concentration of attention that gives the additional mobilizing element of greater competitive advantage for the dancer in the conditions of competitive activity.

According to the results of the researches, the idea of forming a functional system in young dancers that was responsible for the success in sports dancing have been obtained. In particular, it was found that the level of success depends on the balance between the level of functional mobility of the nervous processes and the ability to form and reproduce motor skills. At the same time, the high level of dynamism and lability of the nervous system negatively affects the process of perception of verbal information in the conditions of learning motor skills. This in turn complicates the ability to form complex choreographic skills.

The revealed links between the performance in sports dancing with the psychophysiological characteristics of young athletes have revealed the main factors that influence the process of learning choreographic skills. The correlation of success with indicators of speed of perception and processing of information, level of psycho-emotional tension and excitability of nervous processes, as well as with cognitive characteristics: attention, speed of visual perception, level of operative and logical thinking was identified. At the same time, it was found that the most important cognitive characteristic of young dancers is verbal intelligence.

For the development of the relevant criteria, the main informative indicators that determine the effectiveness of forming difficult choreographic skills among young dancers were selected: regularity(by tapping test), visual analyzer bandwidth (by functional mobility of nervous processes), accuracy (by test of balance of nervous processes) and accuracy (by verbal test).

A further algorithm involved the construction of a mathematical model that took into account the weight contributions of each of the informative indicators responsible for the successful acquisition of choreographic skills in young dancers.

The developed model was characterized by ranking the absolute values of the identified indicators on a five-point scale from the best (5 points) to the worst (1 point). The ranking was performed by the sigmal deviations from the statistical average value in the group of dancers (Table 3).

Table 3. Results of an integrated model of success in mastering complex choreographic skills in young dancers

Parameter	Performance level				
	High	Above middle	Middle	Below middle	Low
	5	4	3	2	1
Accuracy (verbal test)	$\geq$1,00	0,99-0,65	0,64-0,70	0,69-0,51	$\leq$ 0,50
Accuracy (balance of nervous processes)	$\geq$ 3,70	3,69-3,20	3,21-2,80	2,79-2,40	$\leq$ 2,39
Bandwidth of the visual analyzer (functional mobility of nervous processes)	$\leq$ 1,50	1,51-1,60	1,61-1,80	1,81-1,90	$\geq$ 1,91
Regularity(tapping-test)	$\geq$ 5,91	5,90-4,60	4,59-3,50	3,49-2,80	$\leq$ 2,79

The analysis according to the forecast has revealed that 30% of dancers have high level of success, 40% have average level of success, and 30% – low level of success.

Accounting that the previous division of young dancers into more or less successful in mastering choreographic skills, it was found that approximately 30% of people had a high level of success. This circumstance confirms the validity and informativeness of the proposed mathematical model of prognosis for successful development of complex choreographic skills for young dancers, based on the study of the main characteristics of the individual-typological properties of the nervous system.

The model of performance prediction among young dancers for validity and informativeness was separately examined. 24 young athletes were tested for this purpose. Research shows that young dancers lack a low level of success. This is due to the fact that the beginning of classes for children occurs at 5-7 years of age and already among the youth spontaneously selected potentially successful athletes. Among the tested athletes, 13 dancers had a high and 11 dancers had an average level of prognosis for learning choreographic skills.

Discussion

Sport dance is a fairly new sport, and many areas for improving training and competition activities remain practically unexplored. Scientists have noted that there is a problem of subjective moments in assessing creativity in competitions (Năstase 2012; Stoeber et al., 2016). On the modern development of the history of sports dance, it is necessary to note the transition from the art to the field of sports. The process of training high-class athletes is conducted at the level of extreme physical and mental strength. This leads to an in-depth study of scientific ideas about the physiological mechanisms of improving the functional reserves of the human organism in the process of adaptation to increasing loads (Kozina et al., 2017). It is very important that in the training of

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high scilledathletes,the growth of results is observed with the use of loads oriented to the maximum development of genetically determined features (Makarenko et al., 2011).

The success of sports, especially in creative forms such as sports dances, is influenced by many factors. However, the most influential factors are the factors due to the individual-typological properties of the athlete's higher nervous activity, which are genetically determined on the one hand, and on the other, the manifestation of these characteristics is related to the functional state of the organism. Such factors are the neurodynamic characteristics of higher nervous activity (Korobeynikov et al., 2019; Chernozub et al., 2018). The level of manifestation of neurodynamic properties reflects the ability of athletes to withstand significant physical, psychological, intellectual, volitional and emotional stress caused by the characteristics of sports activities, without consequences for health. In sports dancing, as in other sports, the level of manifestation of neurodynamic functions plays an extremely important role. The athlete-dancer, presenting himself and his skills on the floor, should be as concentrated as possible and have an optimal state of "alertness", which maximally affects the result.

In the course of scientific research we have found that there is a connection between the success of mastering choreographic skills in sports dancing with neurodynamic and cognitive functions in young dancers. It should be noted that the quality of the formation of motor skills depends on the individual-typological properties of higher nervous activity. It is known that the implementation of complex technical elements in sports dancing requires the individual to develop coordination skills. At the same time, the manifestation of high success at performing special technical elements in young dancers is associated with the mobilization of adaptation resources, which is manifested by increased activation of the sympathoadrenal system of the body.

It is established that there is a correlation of success with indicators of the speed of perception and processing of information, the level of psycho-emotional tension and excitement of nervous processes. Success in sports dancing among young athletes has been found to be related to cognitive characteristics: attention, speed of visual perception, level of operative and logical thinking. However, the most important cognitive characteristic in sports dancing is the verbal sphere of perception and processing of information.

Among the informative indicators that influence the effectiveness of forming complex choreographic skills in young dancers, the following parameters are distinguished: regularity(by tapping test), visual analyzer throughput (by functional mobility of nervous processes), accuracy (by the test of balance of nervous processes)and accuracy (by verbal test).

Conclusions

The relation between the level of success in sports dances and the state of psychophysiological functions in young dancers is revealed. A study of neurodynamic characteristics has revealed that more successful young dancers, compared to less successful ones, have a higher rate of perception and processing of visual information. This result shows that neurodynamic properties are directly involved in the training and learning process of young dancer's choreographic skills. In addition, it was found that young dancers with a high level of success in the formation of choreographic skills exhibit reduced values of nervous system lability, which reduces the probability of uncontrolled movements and increased concentration in conditions of reproduction of psychomotor skills. Success in sports dancing among young athletes has been found to be related to cognitive characteristics: attention, speed of visual perception, level of operative and logical thinking. However, the most important cognitive characteristic in sports dancing is the verbal sphere of perception and processing of information.

Competing Interests
The authors declare that they have no competing interests.

References
Bläsing, B., Tenenbaum, G., & Schack, T. (2009). The cognitive structure of movements in classical dance. Psychology of Sport and Exercise, 10(3), 350-360.

Bläsing, B., Calvo-Merino, B., Cross, E. S., Jola, C., Honisch, J., & Stevens, C. J. (2012). Neurocognitive control in dance perception and performance. Acta psychologica, 139(2), 300-308.

Chernozub, A., Imas, Y., Korobeynikov, G., Korobeynikova, L., Potop, V., Lytvynenko, Y., ... & Dubachinskiy, O. (2018). The influence of dance and power fitness loads on the body morphometric parameters and peculiarities of adaptive-compensatory reactions of organism of young women. Journal of Physical Education and Sport, 18(2), 955-960.

Cumming, J., & Williams, S. E. (2013). Introducing the revised applied model of deliberate imagery use for sport, dance, exercise, and rehabilitation. Movement & Sport Sciences-Science & Motricité, (82), 69-81.

Grigore M.F. (2014) The Contribution of DanceSport Specific Means to theDevelopment of Psycho-Motor Skills of Junior I Dancers (12- 13Years Old). Procedia - Social and Behavioral Sciences,(137), 43-49.

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Grigore, M.F., Grigore, V., & Potop, V. (2018). Studyon the Influence of the Specific Training on the Technical and Artistic Execution of the Choreographies by the Dancers Aged 12 – 13 Years.Journal of Physical Education and Sport, 18(5),2193 – 2198.

Grigore, M. F., Cretu M. F., Buftea, V.,Potop, V., Grigore, V. (2019a).The particularities of planning the basic methodological components in thespecific training of junior i dancers.Journal of Physical Education and Sport,19(6), 2147 – 2151.

Grigore, M. F., Grigore, V., &Potop, V. (2019b). Influence of the specific training means on the psychomotorskills of junior Idancers.University Annals, Series Physical Education and Sport / Science, Movement and Health, 19(2 Suppl), 243-248.

Korobeynikov, G., Rossokha, G., Koniaeva, L., Medvedchuk, K., & Kulinich, I. (2006). Psychophysiological diagnostics of functional states in sports medicine. Bratislavske lekarske listy, 107(5), 205.

Korobeynikov, G. V., & Myshko, V. V. (2016). Connection of supreme nervous functioning's neuro-dynamic characteristics with success of junior sportsmen in sports dances. Pedagogics, psychology, medical-biological problems of physical training and sports, (4), 17-23.

Korobeynikov, G. V., Myshko, V. V., Pastukhova, V. A., & Smoliar, I. I. (2017). Cognitive functions and success in choreography skills' formation in secondary school age dancers. Pedagogics, psychology, medical-biological problems of physical training and sports, (1), 18-22.

Korobeynikov, G., Potop, V., Ion, M., Korobeynikova, L., Borisova, O., Tishchenko, V., ... & Smoliar, I. (2019). Psychophysiological State of Female Handball Players with Different Game Roles. Journal of Physical Education and Sport, 19(3), 1698.

Kozina, Z., Prusik, K., Görner, K., Sobko, I., Repko, O., Bazilyuk, T., & Korol, S. (2017). Comparative characteristics of psychophysiological indicators in the representatives of cyclic and game sports. Journal of Physical Education and Sport, 17(2), 648-655. doi:10.7752/jpes.2017.02097.

Năstase, V. D. (2012). Theoretical design definition of dance sport. Procedia-Social and Behavioral Sciences, 51, 888-890.

Potop, V., (2008). Introduction to Dance Sport. Bucharest:Bren Publishing House.

Potop, V., Urichianu, S., Grigore, M.,& Grigore, V. (2010). Development of the Coordinative Capacity in SportDancers Aged 14 to 15 Years through Balance Improvement. In: Palestrica of the Third Millenium.Civilization and Sport, (11)2, 124-130.

Raiola, G. (2015). Inclusion in sport dance and self perception. Sport Science, 8(1), 99-102.

Soronovich, I. M., Chaikovsky, E. V., & Pilevskaya, V. (2013). Features of functional support of competitive activity in sports dance given the differences prepared by partners. Physical education of students, 17(6), 78-87.

Stoeber, J., & Madigan, D. J. (2016). Measuring perfectionism in sport, dance, and exercise: Review, critique, recommendations. In The psychology of perfectionism in sport, dance and exercise (pp. 47-72). Routledge.

Makarenko, M. V., Lysohub, V. S., Kozhemiako, T. V., & Chernenko, N. P. (2011). Age-dependent speed of the central information processing among persons with the different level of the nervous processing functional mobility. Fiziolohichnyi zhurnal, 57(1), 88-93.