

THE INFLUENCE OF AGILITY INDICATORS ON FORMATION OF VOCATIONAL READINESS IN LAW ENFORCEMENT OFFICERS

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Abstract. *The experience of warfare in Ukraine proves the importance of increasing the degree of psychophysical readiness in law enforcement officers. The aim - to determine the significance of the main components of physical readiness of law enforcement officers for productive work performing. Material and methods: Servicemen (n=368) of the National Guard of Ukraine were interviewed. Spearman's rank correlation analysis of indicators' interrelation was carried out. The opinions of experts and beginners reliably differed on a number of indicators. Coordination of movements was significantly correlated with relatively the largest number of indicators of physical readiness, as well as psychological performance of servicemen. It has been established that agility is related to concentration, endurance, span and switching of attention. Conclusions: For the successful professional growth of the students of educational institutions of the National Guard of Ukraine, it is necessary to develop their agility, and especially coordination of movements. It is associated with improving the speed and strength of the officers of the National Guard of Ukraine, as well as attention and logical thinking.*

Keywords: *cadets, important qualities, professionally psychophysical training, students, servicemen.*

Introduction

The experience of warfare in Ukraine, transformation of power structures to NATO standards surely prove that increasing the degree of psychophysical readiness of law enforcement officers is relevant. A high level of development of psychophysical qualities of a specialist contributes to success in professional activities of numerous specialists, and in extreme conditions ensures the preservation of work capacity, health and life. The aim of study - to determine the significance of the main components of physical readiness of law enforcement officers for productive work performing.

Literature review

Analysis of special literature showed that psychophysical training contributes to solving the tasks of preparation for work. The expediency of increasing level of development of psychophysical preparation in students-representatives of relatively peaceful professions: IT specialists, railway workers, economists, designers (Andres, 2019; Andres, 2021; Chernovsky & Kolumbet, 2016; Kozina et al., 2014; Ostapenko, 2014; Pichurin, 2015) has been proven. At the same time, it has been proven that training programs, using agility development tools are particularly effective for the formation of a number of professionally important competencies (Kozina et al., 2014; Lisowski & Mihuta, 2013; Ostapenko, 2014; Pichurin, 2015; Rolyuk, 2015; Shalupin et al., 2022).

Agility is a fundamental quality for our interaction with physical, social and cultural environment. It ensures balance, accuracy and creativity of human movements in everyday life. Agility is important at any age. In preschool age, it contributes to the formation of reading and writing skills (Emami et al., 2019; Planinsec, 2002; Uhrich & Swalm, 2007). Coordination exercises improve the

cognitive performance of adolescents in tasks that require flexible attention and short reaction time (Alesi et al., 2016; Burns et al., 2017; Emami et al., 2019; Zach & Shalom, 2016). They improve academic success of middle school students in geometry, drawing, etc. (Allen et al., 2019; Hötting et al., 2012; Kwok et al., 2011; Latino et al., 2021). Physical agility exercises help to reduce the level of personal anxiety in young people (Pichurin, 2015). Performance of agility exercises improves memory and spatial cognition in healthy adults (Dunsky, 2019; Rogge et al., 2017), visual memory and executive function (Berti et al., 2019; Duru et al., 2020). In the elderly, coordination and balance training activates visual-spatial connections in the brain, prevents mental and physical deterioration (Crush & Loprinzi, 2017; Wołoszyn et al., 2020), improves cognitive and executive functions (Lopes et al., 2019), and reduces depression (Crush & Loprinzi, 2017).

There are significant differences in assessment of the achieving professionally important qualities. There is no information about the opinions of cadets of higher education institutions of the National Guard of Ukraine regarding the importance of agility for increasing the degree of their professional readiness to act as assigned. The lack of analysis of the degree of importance of each component of agility for improving the readiness components of law enforcement officers complicates the process of selecting effective means of physical education in students of higher education institutions of the National Guard of Ukraine, for preparation of psychophysical training programs, inhibits the increase in degree of professional readiness of internal affairs officers to act as assigned. This is detrimental to ensuring the country's defense capability, increasing the security of its citizens, and maintaining law and order of the state.

Methodology and organization of the research

The questionnaire developed by us was consisted of 3 parts: the current state of psychophysical preparedness of the military; physical and psychological training of military personnel, mental qualities; socio-demographic data of respondents (age, length of military service, duration of sports activities, etc.). The required sample size was determined using G*Power software (Faul et al., 2007) with an alpha level of $p = 0.05$, a power of 0.95, and a mean effect size of $d = 0.50$. A power analysis for the t-test (difference between two independent means) suggests that we would need a sample size of $n = 176-246$ participants (distribution coefficient 1–0.5). The research was conducted in November-December 2021. Each participant provided informed consent to participate in the study. Measures were taken to ensure the anonymity of the participants. A questionnaire was distributed among cadets and teachers of higher educational institutions of the National Guard of Ukraine via GoogleForms. Respondents assessed the degree of importance of professionally important physical qualities and psychological indicators for the performance of the assigned actions by the

personnel of the National Guard of Ukraine on a 5-point scale (where 5 is the highest value). Questionnaires in which answers to questions were omitted were not taken into account during the analysis. The participants were introduced to the purpose and tasks of the study. The participants were servicemen of the National Guard of Ukraine. Depending on the work experience, the respondents were divided into two groups (Table 1).

Table 1 Respondents' sample characteristic (made by authors)

Indicators	«Experts», n=131			«Beginners», n=237			p<
	mo	X	σ	mo	X	σ	
Military rank	Major, lieutenant colonel, colonel			Soldier, senior soldier, lieutenant, senior lieutenant			–
Age	31	35.87	7.68	4	26.05	5.98	0.000
Work experience	9	16.20	7.64	4	3.46	4.19	0.000

The group of "experts" was represented by senior officers aged 24 to 52. The group of beginners (beginners) included junior officers and soldiers aged 19 to 46. The reliability of differences between the average values of both samples was calculated using the Student's t-test. In order to confirm the hypothesis and ensure its completeness in order to triangulate the survey, Spearman's correlation analysis of relations between indicators was conducted. The closeness of correlation was considered noticeable when correlation coefficients ranged from $r=0.60-0.70$ and dense when correlation coefficients were within $r=0.70-0.90$.

Results of the research

The importance of physical and psychological qualities for the vocational training of the National Guard of Ukraine personnel is higher than average, as on a 5-point scale it is estimated to be 4 points and above (Table 2). The highest rating points were given to such manifestations of agility as coordination of movements, a sense of rhythm, ability to differentiate efforts and movements in space, as well as ability to keep static and dynamic balance. Among psychological performance, respondents consider logical thinking, concentration and stability of attention, long-term memory, concentration and attention span to be professionally important.

Table 2 Importance of physical and psychological qualities in vocational training of National Guard of Ukraine personnel (points, on a 5-points scale) (made by authors)

Physical qualities (abilities)	Indicators	Importance, points (as per a 5-points scale)
Agility	Movements' coordination	4.35±0.73
	Sense of rhythm	4.26±0.81
	Ability to differentiate movements in space	4.23±0.78

	Ability to keep dynamic balance	4.23±0.84
	Ability to keep static balance	4.18±0.86
	Ability to differentiate efforts	4.14±0.78
	Ability to differentiate time periods	4.09±0.82
Strength	Speed force	4.29±0.77
	Maximum strength	4.21±0.73
Stamina	Strength endurance	4.27±0.77
	Aerobic endurance	3.93±0.84
Speed	Speed	4.27±0.82
	The time of a simple reaction to a visual stimulus	4.21±0.89
	Speed of a single movement	4.19±0.82
	Movements' frequency	4.17±0.80
	Time of a simple reaction to an acoustic stimulus	4.14±0.93
	Time for choice reaction	4.14±0.88
	Complex reaction time	4.03±0.91
Flexibility	Flexibility	3.92±1.04
Psychological performance	Logical thinking	4.39±0.85
	Attention stability	4.37±0.82
	Concentration	4.37±0.83
	Long-term memory	4.34±0.82
	Attention span	4.29±0.81
	Attention distribution	4.15±0.88
	Attention switch	4.11±0.93
	Imagination	4.10±0.97
	Short-term memory	3.73±1.23

The results of the research (Fig. 1) showed that there are significant differences between indicators of senior and junior officers. Thus, representatives of the senior officers attached a significantly greater ($p < 0.05-0.01$) value to such physical qualities as: speed of simple reaction to a visual stimulus, speed of complex reaction, speed of reaction with a choice, frequency of movements, ability to keep a static and as well as dynamic balance (according to which the reliability of the differences of the indicators approached the reliable level, - $p = 0.059$).

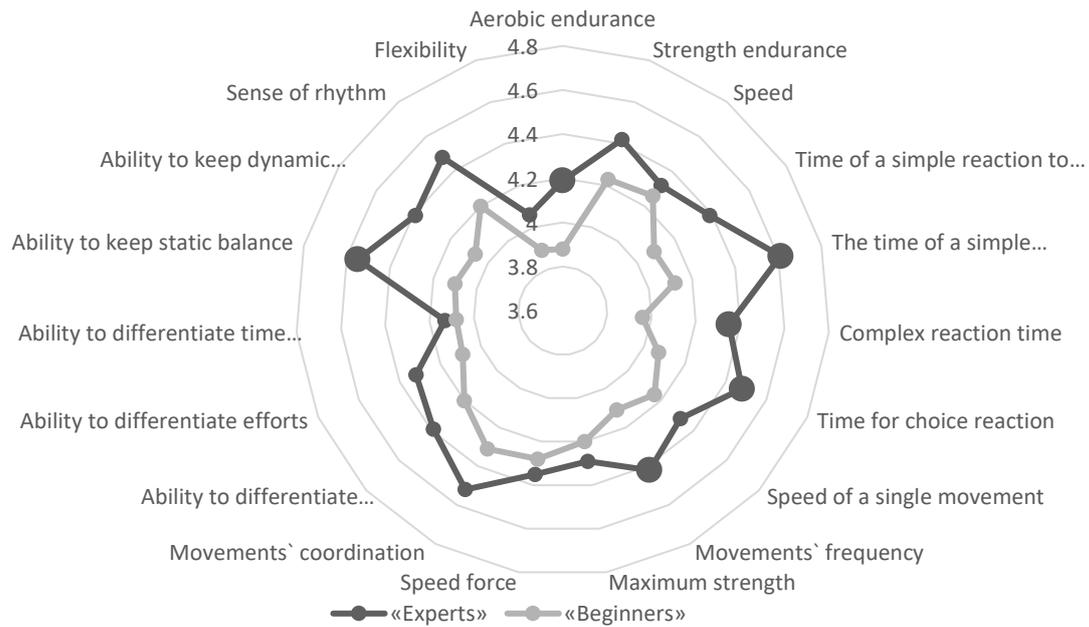


Figure 1 The importance of physical qualities for vocational performance of the National Guard of Ukraine officers from the point of view of "experts" and "beginners" (made by authors)

Indicators with statistically significant differences are marked as large: aerobic endurance - $p=0.0580$, simple reaction time to a visual stimulus - $p=0.008$, complex reaction time - $p=0.026$, choice reaction time - $p=0.017$, movement frequency - $p=0.052$, ability to keep static balance - $p=0.009$, ability to keep dynamic balance - $p=0.059$

Also, answers of junior officers differed in number of psychological performance indicators: short-term memory, long-term memory, concentration, switching of attention and logical thinking for the successful performance of their official duties as assigned (Fig. 2).

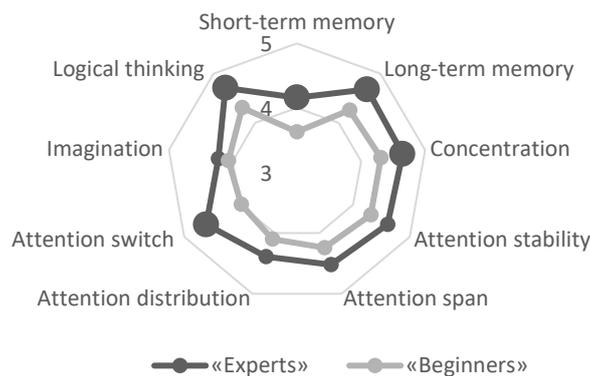


Figure 2 The importance of psychological performance for the successful work of the National Guard of Ukraine officers from the point of view of "experts" and "beginners" (made by authors)

Indicators with statistically significant differences are marked as large: short-term memory - $p=0.029$, long-term memory - $p=0.010$, concentration of attention - $p=0.040$, logical thinking - $p=0.019$, attention switching - $p=0.001$

It should be noted that all indicators of agility showed reliable correlation coefficients of noticeable density with other manifestations (Table 3).

Table 3 Correlation of agility indicators in servicemen (made by authors)

Physical qualities		1	2	3	4	5	6	7
1	Coordination	1.00	<i>712</i>	645	673	<i>707</i>	663	587
2	Differentiation of movements in space	<i>712</i>	1,00	<i>715</i>	697	691	697	624
3	Differentiation of efforts	645	<i>715</i>	1,00	696	<i>712</i>	<i>704</i>	641
4	Differentiation of time periods	673	697	696	1,00	667	661	665
5	Static balance	<i>707</i>	691	<i>712</i>	667	1,00	<i>744</i>	<i>778</i>
6	Dynamic balance	663	697	<i>704</i>	661	<i>744</i>	1,00	623
7	Sense of rhythm	587	624	641	665	<i>778</i>	623	1.00

Notes:

1. prominent correlation coefficients are marked in bold; in italics - close correlation coefficients;
2. zero and point are omitted

The agility indicators were not so often correlated with other physical qualities (Table 4). Most often (5 times) such a manifestation as coordination of movements was noticeably and tightly correlated.

Table 4 Correlation between agility indicators and physical preparedness indicators in servicemen (made by authors)

Physical qualities/agility types	1*	2	3	4	5	6	7
Aerobic endurance	563	512	572	450	547	551	427
Strength endurance	451	472	389	387	523	472	426
Speed	586	439	499	428	566	500	485
SRT to acoustic stimulus	509	447	396	473	399	442	327
SRT to visual stimulus	558	587	517	567	546	582	499
Time for complex reaction	623	613	597	564	595	619	524
Time for choice reaction	695	561	510	527	592	590	537
Speed of single move	573	654	563	576	568	610	551
Frequency of moves	662	647	574	522	661	<i>704</i>	545
Maximum strength	635	503	522	535	644	537	516
Speed force	607	685	578	442	437	514	420
Flexibility	457	500	571	495	541	577	503

Notes:

1. prominent correlation coefficients are marked in bold; in italics - close correlation coefficients;
2. zero and point are omitted;
3. * - the numbering of the agility types is the same as in table 3

Significant correlation coefficients of physical fitness indicators among themselves were even rarer (Table 5). Only speed indicators: time of a simple reaction to an auditory and visual stimulus, time for complex reaction and choice reaction, speed of a single movement and frequency of movements were significantly correlated with other (except flexibility) physical qualities, were often close to agility.

Table 5 Correlation between physical preparedness indicators in servicemen (made by authors)

Physical qualities	Aerobic endurance	Strength endurance	Speed	SRT to acoustic stimulus	SRT to visual stimulus	Complex reaction time	Choice reaction time	Speed of single movement	Movement frequency	Maximum strength	Sped force
Aerobic endurance	1.00	569	492	383	535	556	530	464	520	429	078
Strength endurance	569	1.00	568	256	445	481	455	495	516	469	008
Speed	492	568	1.00	410	448	396	501	373	449	551	405
SRT to acoustic stimulus	383	256	410	1.00	629	531	439	496	474	300	347
SRT to visual stimulus	535	445	448	629	1.00	677	611	621	633	280	592
Complex reaction time	556	481	396	531	677	1.00	639	598	627	422	106
Choice reaction time	530	455	501	439	611	639	1.00	570	632	401	522
Speed of single movement	464	495	373	496	621	598	570	1.00	665	469	678
Moves frequency	520	516	449	474	633	627	632	665	1.00	437	437
Maximum strength	429	469	551	300	280	422	401	469	437	1.00	584
Speed force	078	008	405	347	592	106	522	678	437	584	1.00
Coordination	560	451	586	509	558	623	695	573	662	635	607
Differentiation of movements in space	512	472	439	447	587	613	561	654	647	503	685
Differentiation of efforts	572	389	499	396	517	597	510	563	574	522	578
Differentiation of time periods	450	387	428	473	567	564	527	576	522	535	442
Static balance	547	523	566	399	546	595	592	568	661	644	437
Dynamic balance	551	472	500	442	582	619	590	610	704	537	514
sense of rhythm	427	426	485	327	499	524	537	551	545	516	420
Flexibility	545	433	488	388	500	513	506	437	508	470	493

Notes:

1. prominent correlation coefficients are marked in bold; in italics - close correlation coefficients;
2. zero and point are omitted

Physical qualities were noticeably correlated with indicators of mental training not as often as with indicators of physical readiness (Table 6). However, agility indicators showed tangible relations much more often than other physical qualities. To be noted that, as previously, such a type of agility as coordination (5 out of 9 in psychological performance) showed the largest number of noticeable relations with mental indicators.

Table 6 Correlation of physical indicators and psychological performance in servicemen
(made by authors)

Indicators	Short-term memory	Long-term memory	Concentration	Attention stability	Attention span	Imagination	Attention distribution	Switching attention	Logical thinking
Aerobic endurance	325	482	477	442	517	417	506	488	414
Strength endurance	199	454	440	478	410	329	392	299	375
Flexibility	353	509	493	484	526	571	521	480	460
Maximum strength	194	324	485	549	477	439	458	422	447
Speed force	205	605	592	522	598	272	451	340	349
Speed	217	440	459	527	448	493	452	387	523
SRT to acoustic stimulus	202	407	445	469	452	384	431	351	382
SRT to visual stimulus	351	560	572	444	573	511	587	577	416
Complex reaction time	430	459	527	461	495	350	508	579	437
Choice reaction time	415	549	566	616	535	472	646	591	625
Speed of single movement	374	570	608	535	544	379	493	352	504
Moves frequency	329	538	632	528	549	460	571	462	523
Coordination	393	549	691	640	610	475	580	612	650
Differentiation of movements in space	416	520	635	528	489	455	520	481	488
Differentiation of efforts	445	539	624	547	604	506	515	542	574
Differentiation of time periods	44	438	570	538	580	491	532	543	544
Static balance	377	506	653	549	536	518	563	532	615
Dynamic balance	501	531	645	597	530	525	552	631	520
Sense of rhythm	344	475	590	513	546	523	477	438	569

Notes:

1. prominent correlation coefficients are marked in bold;

2. zero and point are omitted

Discussion

According to our data, manifestations of agility: coordination, ability to differentiate efforts and movements in space, ability to keep static and dynamic balance were rated the highest by respondents. This confirms the opinion of

(Kozina et al., 2014; Lisowski & Mihuta, 2013; Ostapenko, 2014; Pichurin, 2015; Rolyuk, 2016; Shalupin et al., 2022) that agility indicators have relatively the greatest importance in professional training of military personnel (Pichurin, 2015; Rolyuk, 2016; Shalupin et al., 2022), and proves expediency of including means of improving the coordination of movements in training programs: programs with a priority application of sports games contribute to the development of cognitive indicators in railway students (Pichurin, 2015), special sports training exercises – in students of higher education institutions of civil aviation (Shalupin et al., 2022), military pentathlon exercises – in intelligence officers (Rolyuk, 2016). Agility itself is important for representatives of a number of professions in cases that are dangerous to life and health, as it contributes to increasing the amount of attention and reducing the time required for cognitive processing of information (Emami et al., 2019).

Agility is also important for health, as the amount of motor activity of an adult depends on the number of movements learned in childhood; and the amount of motor activity corresponding to hygienic requirements ensures health. Coordination training contributes to the creation of a cell reserve that affects an ability to learn throughout our life (Kopp, 2012).

The significant differences in assessment of qualities importance for the professional success in "beginners" and "experts", we found out in our research, indicate that junior officers underestimate the importance of developing their agility (sense of rhythm, keeping dynamic balance) and speed (time of simple reaction to a visual stimulus). It has been established that psychological performance such as logical thinking, concentration and attention stability and long-term memory have relatively the greatest importance in preparation for the performance of official duties in officers of the National Guard of Ukraine. According to our data the views of "experts" and "beginners" reliably differed on a number of indicators, so it is obvious that cadets and junior officers underestimate the importance of a number of psychological performance indicators: long-term memory, concentration of attention and logical thinking for successful performance of their official duties. Therefore, in order to increase the level of professional competence in cadets of the National Guard of Ukraine, it is important to provide them with information on importance of relevant psychophysical performance for their further successful work.

In order to objectify the data, we received during the survey, it was decided to find out the relation between agility and other indicators of professional-applied psychophysical preparedness. The results of correlation analysis confirmed the importance of a high level of agility development for successful performance as intended. It was established that most often some indicators of agility were significantly connected with other manifestations, which is explained by the positive "transfer" of some types of agility to others. Commonly, such a manifestation of agility as coordination was significantly correlated (except sense

of rhythm). This indicator was significantly correlated with 5 other indicators of physical fitness: complex reaction time ($r=0.653$), choice reaction time ($r=0.695$), movement frequency ($r=0.662$), speed ($r=0.607$) and maximum strength ($r=0.635$). It showed the largest number of noticeable correlations with mental indicators (5 out of 9 mental qualities) (Fig. 3). Therefore, coordination is the most important professionally important physical quality, the improvement of which will contribute to the formation of a whole range of competencies in defenders of country's interests.

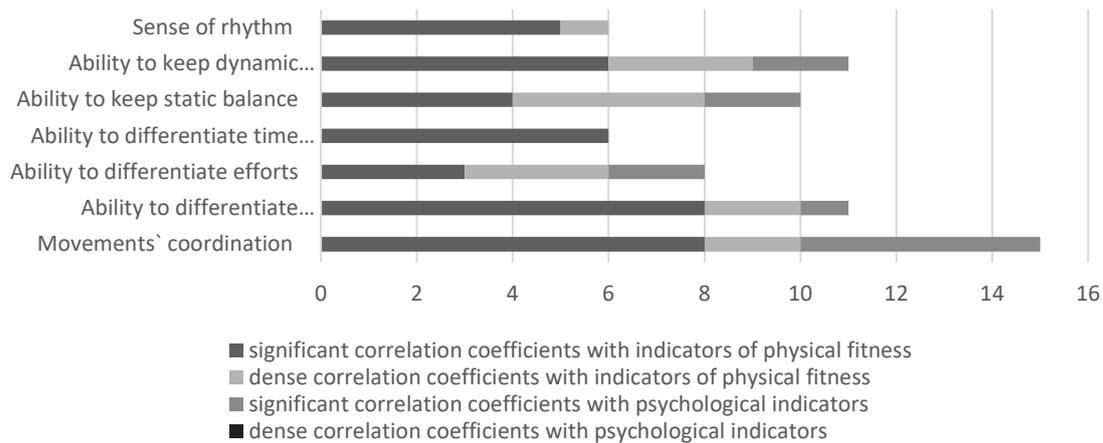


Figure 3 The number of noticeable and dense correlation coefficients of agility with indicators of physical fitness and psychological performance (made by authors)

The beneficial effect of physical activity on the brain has been well proven. It was established that not only regular training, but also short-term physical exertion can increase cognitive functions. The relationship between motor activity (in form of short-term running for 10 minutes) and visual attention was revealed (Niedermeier et al., 2020). A single ten-minute jogging intervention can help restore focus after long periods of sedentary study. It is more effective compared to the usual sedentary behavior during breaks between classes. Experts have found that more frequent and more intense motor activity is associated with better indicators of cognitive and mental health (Nakagawa et al., 2020; Voinea et al., 2019). At the same time, only 1-2 sessions per week of at least 10 minutes of moderate-to-vigorous-intensity physical activity (MVPA) were associated with more positive emotions and more mature coping strategies (Nakagawa et al., 2020).

The peculiarities of the impact of individual means of physical education on formation of psychophysical characteristics in students have been established (Pichurin, 2015). Athletics classes contribute to the formation of students' emotional stability, conscious observance of norms and rules of behavior, perseverance in achieving the goal, accuracy, responsibility, business orientation, development of imagination and creative potential of individual. Weightlifting classes contribute to the formation of self-confidence, independence in judgment

and behavior, openness, sociability, attentiveness, and activity in conflict resolution. Sports games contribute to the development of attention indicators in students (Pichurin, 2015). Playing volleyball has a positive effect on indicators of thinking processes, in particular on working memory, speed of mental processes and mental productivity (Salatenko & Dubynskaya, 2015). Bodyflex and Pilates classes contribute to increasing the levels of psychophysiological capabilities, mobility and strength of mental processes (Kozina et al., 2014).

It was determined that concentration, stability, span and switching attention are related to agility (see Table 6). Our results coincide with our previous data on positive influence of agility development tools towards attention indicators in students of the Institute of Information Technologies (Andres, 2019, 2021). Our data confirm the data of specialists (Pichurin, 2015), who proved the fact of improvement in selectivity, concentration and stability of attention with increasing of general level of physical fitness of students and, especially, coordination abilities. A statistically significant correlation of such indicators as agility (ability to estimate space-temporal parameters of movement) and selective attention ($r=-0.433$, $p<0.05$) was revealed (Pichurin, 2015), as well as between general level of physical fitness and selective attention ($r =0.538$, $p<0.05$). Professional exercises selected by specialists (Ostapenko, 2014), (namely for the development of reaction speed, motility, accuracy and coordination of movements, development of various types of memory, relaxation gymnastics complexes that included breathing exercises, static tension and muscle relaxation, i.e. aimed at the development of agility) had a positive effect on of such cognitive indicators of students as a) latent time of choice reaction and simple visual-motor reaction, complex sensorimotor reaction; b) level, speed and strength of excitation of the main nervous processes; c) concentration and attention stability; d) endurance and speed of finger moves.

Similar results were demonstrated in studies (Alesi et al., 2019; Budde et al., 2008; Pichurin, 2015; Salatenko & Dubynskaya, 2015; Wołoszyn et al., 2020) in individuals of a different age. For example, in kindergarten children, scientists have noticed a positive effect of agility training of various intensities on the reduction of reaction time and higher response accuracy (Yu-Kai et al., 2013), cognitive abilities (Planinsec, 2002), improvement of working memory and attention (Alesi et al., 2019). They found out that even short-term coordination exercises improve academic achievements in adolescents (Donnelly & Lambourne, 2011), their ability to understand the text they read (Uhrich & Swalm, 2007), indicators of visual-spatial perception, attention and working memory (Latino et al., 2021; Budde et al., 2008), cognitive functioning (Wołoszyn et al., 2020), and also contribute to the development of selectivity, concentration and stability of attention of young people (Pichurin, 2015).

Conclusions

Agility indicators are quite important during professional training of cadets of higher education institutions of the National Guard of Ukraine. Cadets and junior officers underestimate the importance of such manifestations of agility as a sense of rhythm, keeping of dynamic balance and such a type of speed as time of a simple reaction to a visual stimulus for the successful performance of their official duties. Also, they do not pay enough attention to such psychological performance as long-term memory, concentration of attention and logical thinking.

Coordination is an important type of agility, the improvement of which will contribute to improving the speed and strength of the officers of the National Guard of Ukraine, as well as attention and logical thinking.

The data received testify to importance of including a wide range of means for purposeful development of agility, especially the coordination of movements, in professional training programs for personnel of the National Guard of Ukraine, as well as to high informative significance of the results of agility tests in a set for determining professionally important qualities.

References

- Alesi, M., Bianco, A., Luppina, G., Palma, A., & Pepi, A. (2016). Improving Children's Coordinative Skills and Executive Functions: The Effects of a Football Exercise Program. *Percept Mot Skills*. 122(1), 27–46. DOI: <https://doi.org/10.1177/0031512515627527>
- Alesi, M., Bianco, A., Padulo, J., Vella, F. P., Petrucci, M., Paoli, A., & Palma, A. (2019). Motor and cognitive development: The role of karate. *Muscle Ligaments and Tendons Journal*. 04(02), 114. DOI: <https://doi.org/10.32098/mltj.02.2014.04>
- Allen, K., Higgins, S., & Adams, J. (2019). The relationship between visuospatial working memory and mathematical performance in school-aged children: a systematic review. *Educ. Psychol. Rev.* 31, 509–531. DOI: <https://doi.org/10.1007/s10648-019-09470-8>
- Andres, A. (2019). Peculiarity and indicators of students' attention to Institute of Information Technologies. *Physical Education, sport and health culture in modern society*. 1(45), 55–61. DOI: <https://doi.org/10.29038/2220-7481-2019-01-55-61>
- Andres, A. (2021). How to develop professionally important soft-skills for IT-professionals by means of physical education? *Journal of Human Sport and Exercise*. 16(3), 652-661. DOI: <https://doi.org/10.14198/jhse.2021.163.14>
- Berti, B., Momi, D., Sprugnoli, G., Neri, F., Bonifaz, M., Rossi, A., & Muscettola, M. (2019). Peculiarities of Functional Connectivity-including Cross-Modal Patterns-in Professional Karate Athletes: Correlations with Cognitive and Motor Performances. *Neural Plasticity*, ID 6807978. DOI: <https://doi.org/10.1155/2019/6807978>
- Budde, H., Voelcker-Rehage, C., Pietraßyk-Kendziorra, S., Ribeiro, P., & Tidow, G. (2008). Acute coordinative exercise improves attentional performance in adolescents. *Neurosci. Lett.* 441, 219–223. DOI: 10.1016/j.neulet.2008.06.024

- Burns, R. D., Fu, Y., Fang, Y., Hannon, J. C., & Brusseau, T. A. (2017). Effect of a 12-Week Physical Activity Program on Gross Motor Skills in Children. *Percept Mot Skills*, 124(6), 1121-1133. DOI: <https://doi.org/10.1177/0031512517720566>
- Chernovsky, S. M., & Kolumbet, A. N. (2016). Determination of future designers' professionally important coordination qualities. *Physical education of students*, 20(2), 38-4. DOI: <https://doi.org/10.15561/20755279.2016.0206>
- Crush, E.A., & Loprinzi, P.D. (2017). Dose-response effects of exercise duration and recovery on cognitive functioning. *Percept. Mot. Skills*, 124, 1164–1193. DOI: <https://doi.org/10.1177/0031512517726920>
- Donnelly, J. E., & Lambourne, K. (2011). Classroom-based physical activity, cognition, and academic achievement. *Prev. Med.* 52, 36-42
- Dunsky, A. (2019). The effect of balance and coordination exercises on quality of life in older adults: a mini-review. *Front. Aging Neurosci.* 11, 318.
- Duru, A. D., Balcioglu, T. H., Cakir, C. E. O., & Duru, D. G. (2020). Acute Changes in Electrophysiological Brain Dynamics in Elite Karate Players. *Iranian Journal of Science and Technology-Transactions of Electrical Engineering*, 44(1), 565-579. DOI: <https://doi.org/10.1007/s40998-019-00252-0>
- Emami Kashfi, T., Sohrabi, M., Saberi, Kakhki, A., Mashhadi, A., & Jabbari Nooghabi, M. (2019, Jun). Effects of a Motor Intervention Program on Motor Skills and Executive Functions in Children with Learning Disabilities. *Percept Mot. Skills*, 126(3), 477-498. DOI: <https://doi.org/10.1177/0031512519836811>
- Faul, F., Erdfelder, E., Lang, A. G., & Buchner A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behav Res Methods*, 39(2): 175–91. DOI: <https://doi.org/10.3758/BF03193146>
- Hötting, K., Reich, B., Holzschneider, K., Kauschke, K., Schmidt, T., Reer, R., Braumann, K. M., & Röder, B. (2012, Mar). Differential cognitive effects of cycling versus stretching/coordination training in middle-aged adults. *Health Psychol.* 31(2), 145–55. DOI: 10.1037/a0025371
- Kopp, B. (2012). A simple hypothesis of executive function. *Front. Hum. Neurosci.* 6, 159
- Kozina, Zh. L., Ilnitskaya, A. S., Paschenko, N. A., Koval, M. V. (2014). Integrated application of health improving methods of Pilates and Bodyflex for improving psychophysiological possibilities of students. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 3, 31–6. DOI: <https://doi.org/10.6084/m9.figshare.936963.v1>
- Kwok, T. C., Lam, K. C., Wong, P. S., Chau, W. W., Yuen, K. S., Ting, K. T., Chung, E. W., Li, J. C., & Ho, F. K. (2011). Effectiveness of coordination exercise in improving cognitive function in older adults: a prospective study. *Clin Interv Aging*, 6, 261–7. DOI: <https://doi.org/10.2147/CIA.S19883>
- Latino, F., Cataldi, S., & Fischetti, F. (2021). Effects of a Coordinative Ability Training Program on Adolescents' Cognitive Functioning. *Front. Psychol.* 12, 620440. DOI: <https://doi.org/10.3389/fpsyg.2021.620440>
- Lisowski, V., & Mihuta I. (2013). Importance of coordination skills essential psychophysical demonstrated competencies as a military specialists. *Physical education of students*, 17(6), 38–2. DOI: <https://doi.org/10.6084/m9.figshare.840501>
- Lopes, B. J., Oliveira, C. R., & Gottlieb, M. G. V. (2019). Effects of karate-dô training in older adults cognition: Randomized controlled trial. *Journal of Physical Education*, 30(1), 3030. DOI: <https://doi.org/10.4025/jphyseduc.v30i1.3030>
- Nakagawa, T., Koan, I., Chen, C., Matsubara, T., Hagiwara, K., Lei, H. J., & Nakagawa, S. (2020). Regular Moderate- to Vigorous-Intensity Physical Activity Rather Than Walking

- Is Associated with Enhanced Cognitive Functions and Mental Health in Young Adults. *International Journal of Environmental Research and Public Health*, 17(2), 14. DOI: <https://doi.org/10.3390/ijerph17020614>
- Niedermeier, M., Weiss, E.M., Steidl-Muller, L., Burtscher, M., & Kopp, M. (2020). Acute Effects of a Short Bout of Physical Activity on Cognitive Function in Sport Students. *International Journal of Environmental Research and Public Health*. 17(10), 13. DOI: <https://doi.org/10.3390/ijerph17103678>
- Ostapenko, Yu. A. (2014). Professionally significant psychophysiological qualities in information logical group of specialties during implementation of the experimental program of professionally applied physical training of students. *Pedagogy, psychology and medical and biological problems of physical education and sports*. 4, 34–39. DOI: <https://doi.org/10.6084/m9.figshare.951918>
- Pichurin, V. V. (2015). Psychological and psycho-physical training as a factor of personal anxiety at students *Pedagogics, psychology, medical-biological problems of physical training and sports*. 3, 46–52. DOI: 10.15561/18189172.2015.0307
- Planinsec, J. (2002, Apr). Relations between the motor and cognitive dimensions of preschool girls and boys. *Percept Mot Skills*. 94(2), 415–23. DOI: 10.2466/pms.2002.94.2.415
- Rogge, A. K., Röder, B., Zech, A., Nagel, V., Hollander, K., Braumann, K. M., et al. (2017). Balance training improves memory and spatial cognition in healthy adults. *Sci. Rep.* 7, 5661.
- Rolyuk, O. (2016). Special Military Training of Reconnaissance Officers. *Fiz. Vihov. Sport kul't. Zdor. Suchas. Susp.* 1(33), 57–63.
- Salatenko, I. A., Dubynskaya, O. Ya. (2015). Psychophysical improvement of female students of economic specialties under influence of sports-oriented technology based on the predominant use of volleyball. *Pedagogy, psychology, medical and biological problems of physical education and sports*. 12, 103–108.
- Shalupin, V., Rodionova, I., & Kumantsova, E. (2022). Improving the coordination capabilities of air transport control specialists as a condition for the safety of civil aviation, *Transportation Research Procedia*. 63, 525–9. DOI: <https://doi.org/10.1016/j.trpro.2022.06.044>
- Uhrich, T. A, & Swalm, R. L. (2007, Jun). A pilot study of a possible effect from a motor task on reading performance. *Percept Mot Skills*. 104(3), 1035–41. DOI: <https://doi.org/10.2466/pms.104.3.1035-1041>
- Voinea, F., Lică, E., & Gidu, D. V. (2019). Concentration capacity of attention and the effect of different exercise intensities on it, in schoolchildren. *J. Sport Kinetic Movement*. 33, 1/2019.
- Wołoszyn, N., Grzegorzczak, J., Wiśniowska-Szurlej, A., Kilian, J., & Kwolek, A. (2020, Mar). Psychophysical Health Factors and Its Correlations in Elderly Wheelchair Users Who Live in Nursing Homes. *Int J Environ Res Public Health*. 17(5), 1706. DOI: <https://doi.org/10.3390/ijerph17051706>
- Yu-Kai, C., Yu-Jung, J. T., Tai Ting, C., & Tsung-Min, H. (2013). The impacts of coordinative exercise on executive function in kindergarten children: an ERP study. *Exp. Brain Res*. 225, 187–196. DOI: 10.1007/s00221-012-3360-9
- Zach, S., & Shalom, E. (2016, Apr). The Influence of Acute Physical Activity on Working Memory. *Percept Mot Skills*. 122(2), 365–74. DOI: 10.1177/0031512516631066