PSYCHOLOGICAL ASSESSMENT OF 300 MILITARY PILOT STUDENTS, PILOTS AND FLIGHT CREW MEMBERS USING VIENNA TEST SYSTEM

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ABSTRACT

Purpose: *We aimed to to evaluate some psychological characteristics of military pilot students, pilots, and flight crew members by VTS system, at the Institute of Medicine for Air Defense - Air Force.*

Methods: *Cross-sectional description, combined with analysis of psychophysiological criteria by VTS system.*

Results:

- Assessment of cognitive and attention ability (COG): The highest number of correct responses was in the third round pilot student group (63.57 ± 6.84 times), the lowest number of correct responses was in the flight crew member group (49.01 ± 12.68 times); The highest number of incorrect response was in the flight crew member group (19.82 ± 9.81 times), the lowest number of incorrect responses was in the pilot group (16.19 ± 7.41 times).

- Assessment of stress tolerance (DT): The highest number of correct responses was in the third round pilot student group (223.54 ± 45.2 times), and the lowest number of correct responses was in the flight crew member group (171.68 ± 49.85 times); The highest number of incorrect responses was in the flight crew member group (16.37 ± 14.92 times), and the lowest number of incorrect responses was in third round pilot student group (25.89 ± 23.36 times).

- Evaluation of visual orientation (LVT): The best visual orientation ability was the of military pilot group, followed by the flight crew member group, the lowest was the pilot student group.

Keywords: Vienna Test System (VTS), aviation psychology.

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1. INTRODUCTIONS

Recruiting and training pilots is a very important prerequisite for the success of flying missions, especially with military flight missions. Military pilots are high-quality human resources of the army, so the selection and training of military pilots need to be given special attention. During the training process, and practice of flight missions, ensuring the health of military pilot students, pilots and flight crew members should always be maintained at a high level and stable over time [1].

In the criteria of selection and training of pilots in general, and of military pilots in particular, psychological tests always play an important role. Over the years, these tests have been carried out on paper, such as Bourdo test, compass, integrated thinking... Recently, the Vienna Test System (VTS) psychological testing system was developed by Schuhfried GmbH (Moedling, Austria) as a suitable and reliable tool for psychological assessment with various tests (COG, DT, LVT, SIGNAL, SMK...).

We carried out this study to evaluate some psychological characteristics of military pilot students, pilots, and flight crew members by VTS system, at the Institute of Medicine for Air Defense - Air Force.

2. SUBJECTS AND METHODS

2.1. Subjects

100 military student pilots (61 second round student pilots and 39 third round pilot students), 100 military pilots and 100 flight crew members at some units of the Ministry of National Defense.

2.2. Methods

- Study design: Cross-sectional description, combined with analysis of psychophysiological criteria by VTS system.

- Research process:

+ Selection of research subjects: selection of military pilot student during the medical examination and selection period for training military pilots; selection of military pilots and military flight crew members during the period of subjects participating in medical examination.

+ Collecting and backing up research data from the automatic system in health screening and health assessment.

+ Research period: From 2020-2022.

+ Research location: At the Institute of Medicine for Air Defense - Air Force.

- Research criteria and evaluation method on VTS system:

+ Assessment of cognitive and attention ability (COG test): Number of correct responses, number of incorrect responses, number of not responding or skips, average time of correct response (seconds), the average time of incorrect response (seconds).

+ Assessment of stress tolerance (DT): Number of correct responses, number of incorrect responses, number of skips, average time of response (seconds), number of stimuli, number of responses.

+ Assessment of visual orientation (LVT): Score, average time of correct response (seconds), average time of incorrect response (seconds), number of correct responses, number of views, time of doing the test.

- Ethical issues: The study was approved by the Institute's Ethics Committee. All information of the research subject is kept confidential and used for scientific research purposes only.

- Data processing: Ssing SPSS 22.0 biomedical statistical software.

3. RESULTS

Table 1. Aged of research subjects (n = 300)

Aged (years old)	Number	Percentage (%)
17-20	71	23.7
21-25	49	16.3
26-30	42	14.0
31-35	27	9.0
36-40	24	8.0
41-45	54	18.0
46-50	28	9.3
51-54	5	1.7
(min - max)	31.13 ± 10.65 (17 - 54)	

The subjects age were 17-54 years old (mean 31.13 ± 10.65 years old), the highest proportion was 17-20 years old group (23.7%), followed by 21-25 years old group (16.3%), and the lowest proportion was 51-54 years old group (1.7%).

Table 2. Assessment of cognitive and attention ability

Subject group ($\bar{x}$ ± SD) (min - max)	Number of correct responses	Number of incorrect responses	Number of not responding or skips	Average time (second)	
				Correct response	Incorrect response
Flight crew member (n = 100)	49.01 ± 12.68 (12 - 69)	19.82 ± 9.81 (5 - 60)	30.99 ± 12.68 (11 - 68)	1.16 ± 0.08 (0.79 - 1.426)	1.12 ± 0.11 (0.877 - 1.435)
Second round pilot student (n = 61)	60.73 ± 10.05 (22 - 75)	17.82 ± 8.7 (3 - 55)	19.27 ± 10.05 (5 - 58)	1.09 ± 0.07 (0.859 - 1.226)	1.08 ± 0.12 (0.812 - 1.343)
Third round pilot student (n = 39)	63.57 ± 6.84 (51 - 77)	16.37 ± 8.36 (6 - 53)	16.43 ± 6.84 (3 - 29)	1.07 ± 0.07 (0.903 - 1.209)	1.09 ± 0.13 (0.784 - 1.306)
Military pilot (n = 100)	56.31 ± 8.7 (29 - 74)	16.19 ± 7.41 (5 - 41)	23.69 ± 8.7 (6 - 51)	1.13 ± 0.08 (0.994 - 1.335)	1.09 ± 0.13 (0.693 - 1.383)
p	< 0.001	< 0.05	< 0.001	< 0.001	> 0.05

The results of evaluation of the number of correct responses in the COG test showed that: the highest number of correct responses was in the third round pilot student group (63.57 ± 6.84 times), the lowest number of correct responses was in the flight crew member group (49.01 ± 12.68 times).

Meanwhile, the highest number of incorrect responses was in the flight crew member group (19.82 ± 9.81 times) and the lowest number of incorrect responses in the pilot group (16.19 ± 7.41 times). The highest number of no responses was in the flight crew member group (23.69 ± 8.7 times), and the lowest number of no responses was in the pilot student group (second round was 19.27 ± 10.05 times and third round was 16.43 ± 6.84 times); The difference in the results of the number of correct responses, the number of incorrect responses, the number of times of no response between groups is statistically significant.

The shortest time of correct response was in the HVB group (third round pilot student group was 1.07 ± 0.07 seconds and second round pilot stud was 1.09 ± 0.07 seconds); The longest time of the correct response was flight crew member group (1.16 ± 0.08 seconds), the difference in the time of correct responses between groups was statistically significant with p < 0.001.

Table 3. Assessment of stress tolerance (DT) (B ± SD) (min-max)

Subject Group	Number of correct responses	Number of incorrect responses	Number of skips	Average time of response (seconds)	Number of stimuli	Number of responses
Flight crew member (n = 100)	171.68 ± 49.85 (60 - 272)	16.37 ± 14.92 (0 - 81)	26.99 ± 11.4 (8 - 54)	0.87 ± 0.12 (0.67 - 1.18)	206.72 ± 45.04 (95 - 290)	187.87 ± 55.32 (65 - 297)
Second round pilot student (n = 61)	220.77 ± 49.93 (46 - 357)	21.75 ± 15.72 (1 - 86)	0.76 ± 0.07 (0.59 - 0.92)	248.8 ± 42.33 (86 - 312)	240.89 ± 55.9 (47 - 331)	240.89 ± 55.9 (47 - 331)
Third round pilot student (n = 39)	223.54 ± 45.2 (52 - 320)	25.89 ± 23.36 (0 - 127)	0.75 ± 0.1 (0.61 - 1.21)	257.57 ± 42.08 (82 - 334)	249.43 ± 56.44 (52 - 369)	249.43 ± 56.44 (52 - 369)
Military pilot (n = 100)	215.68 ± 45.17 (88 - 314)	19.78 ± 18.44 (0 - 126)	23.27 ± 8.55 (6 - 51)	0.79 ± 0.11 (0.58 - 1.2)	244.92 ± 43.47 (123 - 343)	235.44 ± 52.1 (90 - 369)
p	< 0.001	< 0.05	> 0.05	< 0.001	< 0.001	< 0.001

Evaluation of the stress tolerance of the research subjects showed that: the highest number of correct responses was in the third round pilot student group (223.54 ± 45.2 times), the lowest number of correct responses was in the flight crew member group (171.68 ± 49.85 times).

The lowest number of incorrect responses was in the group of flight crew member group (16.37 ± 14.92 times), the highest number of incorrect responses was in third round pilot student group (25.89 ± 23.36 times). The difference between groups was statistically significant, with p < 0.05.

The highest number of skips was flight crew member group (26.99 ± 11.4 times), the lowest number of skips was in the pilot group (23.27 ± 8.55 times).

The average response time was shortest in the third round pilot student group (0.75 ± 0.1 seconds), the longest was in the flight crew member group (0.87 ± 0.12 seconds); the lowest number of stimuli and responses in the flight crew member group, the highest in the pilot student group; The difference was statistically significant with p < 0.001.

Table 4. Assessment of visual orientation (LVT) ($\bar{X}$ ± SD) (min-max)

Subject Group	Average Score	Average time of correct response (seconds)	Average time of incorrect response (seconds)	Number of correct responses	Number of views	Time of doing the test
Flight crew member (n = 100)	12.91 ± 4.95 (0 - 18)	3.75 ± 0.75 (2.73 - 6.31)	3.68 ± 0.83 (2.59 - 5.73)	17.6 ± 0.75 (14 - 18)	18.33 ± 2.0 (18 - 37)	72.71 ± 21.07 (50 - 218)
Second round pilot student (n = 61)	10.3 ± 4.83 (0 - 18)	4.08 ± 1.01 (2.61 - 7.78)	5.69 ± 5.39 (2.58 - 24.37)	17.54 ± 0.72 (15 - 18)	19.57 ± 6.13 (18 - 60)	81.26 ± 25.1 (49 - 177)
Third round pilot student (n = 39)	12.24 ± 4.95 (0 - 18)	3.71 ± 1.02 (2.62 - 8.26)	4.05 ± 1.76 (2.38 - 8.62)	17.53 ± 0.75 (15 - 18)	18.59 ± 2.76 (18 - 34)	72.82 ± 23.69 48 - 177)
Military pilot (n = 100)	13.95 ± 4.08 (1 - 18)	3.49 ± 0.67 (1.05 - 5.82)	3.78 ± 1.3 (2.38 - 8.24)	17.67 ± 0.64 (15 - 18)	18.23 ± 0.67 (18 - 23)	67.07 ± 13.76 (49 - 119)
p	< 0.001	< 0.001	> 0.05	> 0.05	> 0.05	< 0.001

Evaluation of visual orientation ability: the highest score was in the pilot group (13.95 ± 4.08 points), the lowest was in the second round pilot student group (10.3 ± 4. 83 points); The fastest time of correct response was the pilot group, the slowest was the pilot student group, the difference was statistically significant with p < 0.001.

The time of doing the test of the pilot group was the fastest with 67.07 ± 13.76 seconds, the slowest was the second round pilot student group (81.26 ± 25.1 seconds), the difference was statistically significant. However, there was no difference in the number of correct responses between the groups.

4. DISCUSSIONS

Attention is the active orientation of human consciousness to certain phenomena and objects, at the same time, separating them from other phenomena and objects [2]. The role of attention is diverse, it controls interaction with the environment and plays an adaptive role. Attention plays an important role when combining the past with the present, controlling and planning future actions. Attention is the process of focusing on a task or source of stimulation. Attention helps to ensure accuracy in some respects, allowing for quick learning and reaction [3]. Meanwhile, thinking is a cognitive process that indirectly reflects and generalizes the properties and regular relationships of things and phenomena of the objective world [2]. Thinking helps people to identify things and phenomena with their inherent characteristics and not to be confused with other things and phenomena.

Results of COG test on VTS system showed that the highest number of correct responses was in the third-round pilot student group (63.57 ± 6.84 times) and the lowest number was in the flight crew member group (49.01 ± 12.68 times). Meanwhile, the highest number of incorrect responses was in the flight crew member group (19.82 ± 9.81 times) and the lowest number was in the pilot group (16.19 ± 7.41 times). The highest number of non-response/ incorrect response was in the flight crew member group (30.99 ± 12.68) and the lowest number was in the pilot student group. The fastest time of the correct response was the third round of pilot student group (1.07 ± 0.07 seconds), and the slowest time was the flight crew member group (1.16 ± 0.08 seconds), the difference was statistically significant with p < 0.05. The study evaluated psychological indicators of Casutt et al (2014) was conducted on 244 healthy athletes using the COG test, the authors used an unlimited time test, based on the mean time of correct responses and inappropriate responses to assess selective attention. The recorded values in the range of 3.04-3.22 seconds [4]. Research by Marta et al. (2019) on 18 athletes showed that the average time of correct response was 1.7 seconds, the average time of incorrect response was 1.75 seconds, the number of correct responses was 73.66. Also in this study, the author

identified a neurofeedback training method that improves attention for athletes [3].

The results of stress tolerance (DT) on VTS system shoed that the highest number of correct responses was in the third-round pilot student group (223.54 ± 45.2 times), and the lowest number was in the flight crew member group (171.68 ± 49.85 times). The lowest number of incorrect responses was in the flight crew member group (16.37 ± 14.92 times), and the highest number was in the third-round pilot student group (25.89 ± 23.36 times). The highest number of skips was the flight crew member group, the lowest number was the pilot group the. The average response time was fastest in the third round pilot student group (0.75 ± 0.1 seconds), and the slowest was in the flight crew member group (0.87 ± 0.12 seconds). The lowest number of stimuli and responses in the flight crew member group, and the highest in the HVB group; The difference was statistically significant with $p < 0.001$. Stress tolerance is the ability to enable a person to respond effectively, quickly and appropriately to a given situation, even in an extreme condition [5]. In order to effectively manage stress, people need to be able to focus their attention, have the right level of motor coordination, and the ability to make accurate decisions [6], [7], [8].

The study on evaluating psychological indicators of Casutt et al (2014) among 244 healthy athletes when performing the DT test recorded the number of correct responses from 181.9 to 187.3 [4]. Research by Brigitta et al (2020) in Hungary when assessing the psychological function of 28 handball referees by DT test recorded the average number of correct responses was 259,3929 times, the average number of incorrect responses was 22,3751 times, average number of skips was 23.7857 times, average time of response was 0.6732 seconds, average number of stimuli was 292.4286 times, mean number of responses was 281.8214 times [9]. Research by Dávid et al (2022) on 24 race car drivers who performed the DT test showed that the number of correct responses was 265.3-267.3 times, the number of incorrect responses was 23.5-31.1 times, the number of skips was 15.5-20.3 times. The training program on fast response ability was applied on these subjects, that resulted in increase in number of correct responses, decrease in number of incorrect responses and the number of skips (288.8 times, 23.5 times and 15.5 times, respectively) [10].

Mature people have many jobs, many dominant tasks, causing them to often have to disperse their attention to different tasks. At the same time, the speed of information processing in the brain becomes slower with age. Therefore, the ability to focus attention, the ability to think quickly and accurately tends to decrease with age. In fact, in this study, the pilot student group had the youngest age, and the flight crew member group had the oldest age. Together with the ability to practice, the pilot group had time to train on information processing speed more often. Therefore, our research results have reflected the fact that the group of flight crew member had the ability to pay attention, cognition, and tolerance to stress significantly lower than that of the pilot student group and the pilot group. Meanwhile, the pilot group had significantly better stress tolerance than the pilot student group; on the contrary, the cognition and paying attention to the selection of the pilot student group were better.

In the assessment of visual orientation ability (LVT), the results of this study showed that the highest score was in the pilot group (13.95 ± 4.08 points), the lowest score was in the second round pilot student group (10.3 ± 4.83 points). The fastest time of correct response was in the pilot group (3.49 ± 0.67 seconds), and the slowest was the pilot student group. The fastest time of doing the test was in the PC group (67.07 ± 13.76 seconds), the slowest was in the second round HVB group (81.26 ± 25.1 seconds). The difference between groups was statistically significant. The study by David et al (2022) performed on 24 race car drivers founded that the reaction time when doing the LVT test was 3.80-3.83 seconds. In the same study, the author found that application of 6 weeks of training with 12 training sessions on responsiveness shortened the reaction time when taking the LVT test to 3.19 seconds. [10].

Pilot and flight crew members regularly perform aviation missions and train continuously with different conditions. In order to increase the ability to navigate in 3D space. In particular, the military pilot is in charge of controlling and operating aircraft to perform missions. This level of training is significantly more than the pilot student. Therefore, the best visual orientation ability was the military pilot group, followed by the military flight crew member group, and the lowest is the military pilot student group.

5. CONCLUSIONS

Investigation on 100 military pilot students, 100 pilots and 100 military television sets study flight crew members working at the flight units of the Ministry of National Defense. The psychological assessment was implemented by VTS system at the Institute of Medicine for Air Defense - Air Force, from 2020-2022 showed that:

- Evaluation of cognitive and attention ability using the COG test: The pilot student group and the military pilot gave the highest results, the flight crew member group gave the lowest.

- Assessment of stress tolerance through DT test: the military pilot group and the pilot student group gave significantly better results than the flight crew member group.

- Assessment of visual orientation with the LVT test: the military pilot group gave the highest results, followed by the flight crew member group, the lowest was the pilot student group.

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