Original Article

Perceptuo-cognitive Abilities and Performance in Two Groups of Successful Ab-initio Flying Trainees

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Thirty six flying trainees from Air Force-Naval stream (Gp I) and 25 flying trainees from Army stream (Gp II) were administered a battery of perceptuo-cognitive ability tests towards completion of their ab-initio training. Gp I obtained significantly higher scores on perceptual tests. Their mean scores were 121 and 77 on figure cancellation and perceptual speed tests as compared to 100 and 59 respectively on these two tests in Gp II subjects. Similarly Gp I scored higher on cognitive tests though the differences in the two groups on these tests were not statistically significant. Their mean scores on advanced progressive matrices and numerical ability test were 27.3 and 29.3 in Gp I as against 26.1 and 28.4 in Gp II subjects respectively. Correlation matrix between scores on perceptuo-cognitive abilities and performance did not show any significant correlation in Gp I in any of the tests. On the other hand Gp II subjects showed significant correlation in case of perceptual tests and a positive trend in correlation with cognitive tests.

Key words: Aircrew selection, performance rating, attributes of flying, psychological testing.

During the first years of World War I, a man who met simple physical requirements and was brave enough to fly, qualified for the aviation selection. An investigation of the British aircraft losses in the first years of World War I revealed that only 2% of the planes lost were downed by the enemy, mechanical defects accounted for another 8% whereas 90% of the accidents were due to the pilots' physical or psychological deficiencies. This was the end of a rather charming and cavalier approach to the selection of pilots[1] and beginning of emphasis on aptitudinal and personality variables in psychological tests for selection of pilots.

The present study deals with the analysis of perceptuo-cognitive abilities of flying trainees. These abilities form a continuum of general mental process. They encompass enormous diversity in the range of tasks and judgements. At one extreme of the range i.e., perception, judgement of colour or of size seem effortless and immediate[2]. On the other extreme, cognition involves greater effort expenditure at resource allocation to those activities like recognition, complex perceptions, reasoning, adaptation, computation and communication[3]. Although perceptuo-cognitive abilities form only one of the many dimensions of psychological selection of aircrew, they are easy to administer and score and have high degree of reliability.

The ab-initio trainees who underwent analysis of perceptuo-cognitive abilities belonged to two groups. The first group (Gp I) comprised of Air Force-Naval trainees who successfuly underwent intensive training in jet trainer aircraft for 170 hours and the other group (Gp II) comprised of Army trainees who completed 30 hours of flying training on propeller driven aircraft prior to their assignment for helicopter training for AOP duties. The performance of all the trainees was obtained on a questionnaire rating scale viz. Performance Questionnaire Rating (PQR) and from the actual aggregate of test results in flying subjects i.e. Performance Test Results (PTR). The aim of the study was to correlate the scores on perceptuo-cognitive abilities with performance results (PQR and PTR) in the two groups of trainees.

Material and Methods

Subjects

All the subjects had completed or were near completion of their ab-initio phase of flying training at the time of tests. Their training was associated with suspension rate of 20-30% for Gpl and 5-10% for Gp II. The subjects belonging to Gp I did not necessarily have the security for alternative employment in case of their suspension from flying whereas Gp II subjects

were already career officers in Army who had opted for flying as an additional qualification. Thus for obvious reasons the training demands as well as sample characteristrics in the two groups were different both qualitatively and quantitatively.

Gp I consisted of 36 unmarried subjects in the age group of 20 to 25 years with mean age of 21.5 years; 28 of them had graduated from NDA. Gp II comprised of 25 Army officers in the age group of 25 to 29 years with mean age of 26.1 years; 9 of them were married and 16 had graduated from NDA.

Psychological Tests

Psychological tests of perceptuo-cognitive abilities were administered to all the subjects. These tests included two tests each for speed of perception and cognitive abilities. Brief description of these tests including their scoring is given below.

Figure Cancellation Test (FCT)

This test finds out the speed of perception of small detail. There are 150 items in this test. Each item consists of 16 "8"'s. In certain items one figure of "8" is substituted by target figure of "6" at a random location. The task is to identify the items with the target figure. The number of correct answers constitutes the score. The time given for completing the test is three minutes.

Perceptual Speed Test (PST)

This test measures speed of perception of complex detail. It consists of 150 items. Each item consists of two columns of numerals, punctuations and letters. The task is to find out whether members in the second column are identical to the ones in the first column. The number of correct answers gives the score. The time given for completing the test is three minutes.

Advanced Progressive Matrices (APM)

This test measure the cognitive abilities. It is a non-verbal test of intellectual efficiency with which a person is able to form comparisons between figures and develop a logical method of reasoning. The test consists of 12 items in set I and 36 items in set II. In each item the upper part consists of a pattern with a piece cut out of it. The lower part consists of eight figures out of which only one is of the right pattern to fill the space. The number of correct answers out of the total of 36 problems in set II constitutes the score. Higher the score, better the cognitive ability. The time limits for Set I and Set II are 10 and 40 minutes respectively.

Numerical Ability Test (NAT)

This is another test to measure the cognitive ability. It is a test of numerical speed and accuracy and consists of 40 multiple choice questions. The number of correct answers constitutes the score. The time limit for the test is 25 min.

Performance Rating

Two types of performance ratings were obtained, viz., PTR and PQR. PTR was obtained by compiling aggregate marks secured by the trainees in the flying subjects at the end of the course. PQR was obtained with the help of a proforma questionnaire. A DPR Proforma[4] was modified and enlarged to have 17 questions regarding ability, aptitude and motivation of the trainees. Each question was rated on a 3-point scale. The proforma was filled by the instructors of the trainees in consultation with he flight commander.

Data Analysis

The scores obtained on various tests were tabulated and their mean (m) and standard deviation (sd) were calculated. Unpaired 't' test was applied for test of significance between the two groups. Correlation between the individual scores on perceptuo-cognitive tests and performance scores on both PTR and PQR were found out.

Results

Gp I obtained significantly higher scores on both the perceptual tests viz. FCT and PST as

compared to Gp II. On cognitive test scores (APM and NAT) no significant deferences were found between the groups. Performance scores on both PQR and PTR also showed no significant deferences between the two groups. (Table I)

Table II presents the correlation matrix between the perceputo-coginitive ability scores and the performances scores. Gp I has shown no

Table - I ***Perceptuo-cognitive ability and performance scoresin group I and group II subject. (m ± sd)***

Test	Group I	Group II
Perceptual ability		
FCT	121.0 ± 17.9***	100.0 ± 22.5
PST	77.0 ± 16.3***	59.0 ± 15.3
Cognitive ability		
APM	27.8 ± 3.8	26.1 ± 5.5
NAT	29.3 ± 4.4	28.4 ± 5.1
Performance scores		
PQR	37.0 ± 4.58	37.5 ± 5.1
PTR	3227.1 ± 143.38	3444.5 ± 246.8

*** P < 0.001.

significant correlation between scores on performance and different tests of perceptuo-cognitive abilities. Moreover scores on APM has shown negative trend of correlation with performance in Gp I. On the other hand correlation between performance scores and tests of perception show significant correlation in Gp II trainees. The correlation between APM and performance also shows positive trend in this group.

Table - II ***Correlation Matrix : Performance rating of perceptuo-cogntive abilities in Group I and Group II.***

Tests	Group I		Group II	
	PQR	PTR	PQR	PTR
FCT	0.09	− 0.14	0.39	0.63
PST	0.12	0.06	0.42	0.60
APM	− 0.41	− 0.24	0.19	0.25
NAT	0.14	0.17	0.13	0.03

Discussion

Gp I had scored high in perceptual tests as compared to Gp II. Both the groups had obtained above average scores in comparison to general population in these tests. These groups had also obtained high scores in intelligence tests as assessed by APM and NAT. This finding is in agreement with earlaier studies by Christy[5], Fine and Hartman[6], Jennings[7] and Reinhardt[8] that pilots are above average in their mental resources.

Correlation matrix between perceptuo-cognitive abilities and performance shows a contrast between the two groups with Gp I obtaining poor correlation and Gp II subjects obtaining significant correlation in perceptual tests and positive trend in case of cognitive tests. This contrast has to be viewed in the context of multifaceted attributes for flying career. The earliest workers have elaborated some of these variables in pilots. Logacre9 evaluated background, mental status, emotional stability and motivation. Trites and Kubala10 carried out longitudinal and concurrent studies in determining their desirable personality traits. Reinhardt8 resorted to analysis of 105 superior jet pilots for arriving at a common cluster of traits in them. Pilot selection test batteries evolved during World War II looked in for personality factors, intelligence, emotional stability and mechanical comprehension11. The various attributes get unravelled with increasing complexity of training demands. Ab-initio flying trainees in Gp II dealt with only basics of flying and in them perceptual abilities have shown significant correlation and cognitive abilities have shown positive trend of correlation with their perforamance scores. It can be presumed that Gp I trainees too had good initial correlation between perceptuo-cognitive abilities and performance parameters during the early part of flying training. On introduction of various advanced tactics in flying training this correlation becomes weaker as the other variables like emotional stability and motivation become more crucial in determining success.

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