Original Research

Personality traits of aeronautical engineers in the Indian Air Force

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ABSTRACT

Personality studies in aviation have traditionally focused on aircrew and air traffic controllers. Aeronautical engineers constitute a very component of aviation flight safety programs. An understanding of their psychological attributes can provide insights into their style of functioning and team behavior. Earlier studies have documented the personality profile of aircrew and air traffic controllers in the Indian Air Force (IAF). This study was carried out to analyze the personality characteristics of aeronautical engineers joining the IAF. A total of 113 cadets (engineering graduates) at the Air Force Academy, Hyderabad, India, completed the Cattell's 16 PF inventory. All subjects were male with a mean age of 23.1 ± 1.2 years. Scores on the five global personality factors were within the average range score of 4-7 for all factors. None of the 16 primary factors of the personality test showed significant deviations from the average of 4-7 except for tension (Q4) and self-reliance. As a group, they come out to be extraverted, socially participating and independent, persuasive and low on anxiety. Understanding the personality attributes vis-à-vis the required attributes to be effective in the organization have applications at selection as well in designing or modifying engineering education.

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Introduction

Personality is defined as "the characteristic way in which a person thinks, feels and behaves; the ingrained pattern of behavior that each person evolves, both consciously and unconsciously, as the style of life or way of being in adapting to the environment" [1]. Research on personality has primarily focused on two occupational groups in aviation, the aviator and the air traffic controller. Ostensibly, the objectives of early personality studies in aviation were to identify personality characteristics that might predict successful adaptation to military aeronautics for use in pilot selection [2]. Despite mixed success in predicting such an association, relation between personality and flying performance continues to attract continued interest [2]. The other group that has attracted interest is the Air Traffic Controller (ATCO). Attempts have been made to use personality assessment measures in the selection of air traffic controller specialist, both in the military and civilian domain. Studies in the Indian Air Force (IAF) have characterized personality attributes of a typical pilot, both from the fighter and transport streams [3] as well as the ATCO [4]. Some studies have recently attempted to analyze other psychological attributes such as stress coping and locus of control of aircrew [5] in the IAF. However, there has been no study on the personality or psychological attributes of aeronautical engineers in the IAF.

There are reports characterizing personality attributes of engineering students [6]. They reveal that students entering engineering courses are significantly more introverts, intuitive, thinking and judging when compared to those enrolled in non-engineering courses [6]. Literature is silent on studies on the personality of aeronautical engineers in military or commercial aviation. With evolving paradigms in effective communication and team management being applied to aviation maintenance

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domain, it is prudent to understand the personality traits of engineers, since they contribute to aviation safety critically.

Aeronautical engineers in the IAF are broadly divided into mechanical and electronic streams based on their college education. On successful completion of mandatory 22 weeks of military training and 52 weeks of professional training, they are commissioned as aeronautical engineers in the IAF. They are then assigned to an operational squadron or wing or even to the repair depots. Could different personality attributes, including stress coping strategies influence successful adaptation by fresh IAF engineers in the vastly different roles expected of them after a common generic training? A correlation of basic personality attributes with eventual success in their chosen streams could provide vital insights into making informed decisions about future employability of each graduating IAF engineer. This shall help the organization achieve a broader human resource management perspective, in selecting the 'right person for the right job' as well as define the future training potential as per their evaluated strengths and weaknesses.

This study was therefore an initial step to analyze the personality attributes of aeronautical engineers joining the IAF. An effort was also made to compare their personality profiles with that of the already documented IAF pilot and ATCO, to understand differences, if any.

Material and Methods

Engineering cadets (n = 113) undergoing military training at Air Force Academy (AFA), Hyderabad, India during the year 2004 participated in this study. All subjects were male with a mean age of 23.1 $\pm$ 1.2 years (range 21-27 years). Subjects were explained the purpose of the study and that their participation or otherwise or the results of the analysis of the questionnaire would in no way influence their training outcome at the Academy. Participation in the study was voluntary. They completed Cattell's 16 PF Inventory [3] which was administered in a classroom setting by the co-author of this study. Students 't' test was used to compare the personality profile of engineers with those of the reported profiles of the IAF pilot and ATCO.

Results

Personality Profile of Engineers : Scores on the five global personality factors of Cattell's Inventory were between the average range of 4-7. They generally scored higher on the independence (6.86 + 1.38) and extraversion (6.58+ 1.54) factors along with their corresponding contributing primary factors. They also scored higher on the tough-mindedness (5.75 + 1.42) and self-control (5.87 + 1.26) scales, and scored lower on the anxiety scale (4.01 + 1.53).

None of the 16 primary factors of the personality test showed significant deviations from the average range of 4-7 except for tension (Q4) and self-reliance. It was found that they scored high on social boldness (6.98 $\pm$ 1.63), emotional stability (6.99 $\pm$ 1.46), dominance (6.61 $\pm$ 1.37) and perfectionism (6.46 $\pm$ 1.50), whereas scores on tension (3.98 $\pm$ 1.59), apprehension (4.63 $\pm$ 1.40) and self-reliance (3.77 $\pm$ 1.68) were on the lower range of the average.

Comparison with Pilots and Air Traffic Controllers: Table 1 shows the comparison of the mean scores on the 16 PF obtained by the aeronautical engineers as compared with the earlier reported scores of the IAF pilots. Significant differences were observed between the mean scores of two groups. The engineers tended to be more emotionally stable, adaptive and mature, dominant forceful and assertive, livelier, spontaneous and socially bold.

Table 1: Comparison between Engineering cadets (N=113) and IAF pilot (N=107)

		Eng Mean	SD	Pilot Mean	SD	T	p
Warmth	(A)	5.66	1.89	5.70	1.90	.156	.87
Reasoning	(B)	6.36‘	1.37	6.40	1.90	.1798	.85
Emotional Stability	(C)	6.99	1.46	6.20	1.90	3.46	.0006 *
Dominance	(E)	6.61	1.37	5.30	1.90	5.88	.0001*
Liveliness	(F)	6.18	1.59	4.80	2.00	5.68	.0001*
Rule-Consciousness	(G)	5.55	1.52	5.90	1.60	1.66	.09*
Social Boldness	(H)	6.98	1.63	5.80	2.20	4.53	.0001*
Sensitivity	(I)	4.76	1.82	5.20	1.80	1.80	.07*
Vigilance	(L)	5.87	1.67	6.10	2.00	.92	.35
Abstractedness	(M)	4.97	1.65	5.00	1.80	0.12	.89
Privateness	(N)	5.44	1.42	5.50	1.90	.266	.79
Apprehension	(O)	4.63	1.40	5.40	1.90	3.43	.0007*
Openness to Change	(Q1)	6.07	1.74	5.60	1.80	1.96	.05*
Self Reliance	(Q2)	3.77	1.68	6.50	1.60	12.37	.0001*
Perfectionism	(Q3)	6.46	1.50	5.60	1.70	3.983	.0001*
Tension	(Q4)	3.98	1.59	5.80	1.70	8.20	.0001*

They also tended to be more open to change and experimenting, yet perfectionists, organized and self disciplined. On the other hand they tended to be non-conforming, expedient, unsentimental and objective, self assured and unworried. They also appear to be group oriented, affiliative, relaxed and patient.

Table 2 shows the comparison of the mean scores on the 16 PF obtained by the aeronautical engineers as compared with the ATCO. When compared to the average ATCOs' personality, the engineers tended to be more abstract in thinking, emotionally stable, mature, dominant, forceful and assertive, lively and spontaneous, socially bold, vigilant, open to change and experimenting and perfectionist and self disciplined. However, they were also more practical, solution oriented, self-assured, unworried, group oriented, relaxed and patient.

Discussion

The results of this study suggest that an average IAF engineer is an extravert, socially participating, independent and persuasive. He is also low on anxiety and unperturbed. On the contrary, an average engineer in the IAF is considered less extravert, less socially bold and less assertive compared to a pilot. Military pilots are described as more achievement oriented, outgoing, active, competitive, dominant and less introspective, emotionally, sensitive, and self-effacing than their non-flying counterparts [7, 8]. An average IAF pilot, on the other hand, has been described as a 'well adjusted individual, who shows borderline introverted tendencies and is not highly aggressive' [3]. This study was carried out on squadron pilots who were representative of the highest 30% (capability wise) of the pilot population of the IAF [3]. The ATCO profile derived from a study of 59 officers with mean

Table 2: Comparison between Engineering cadets (N=113) and IAF Air Traffic Controller (N=59)

		Eng Mean	SD	ATC Mean	SD	T	p
Warmth	(A)	5.66	1.89	5.63	1.81	0.10	0.92
Reasoning	(B)	6.36‘	1.37	4.86	1.68	6.2970	.0001*
Emotional Stability	(C)	6.99	1.46	5.56	2.08	5.245	.0001*
Dominance	(E)	6.61	1.37	6.17	2.03	1.68	0.09*
Liveliness	(F)	6.18	1.59	4.61	1.97	5.6	.0001*
Rule-Consciousness	(G)	5.55	1.52	5.75	1.78	0.77	0.44
Social Boldness	(H)	6.98	1.63	5.85	1.84	4.12	.0001*
Sensitivity	(I)	4.76	1.82	5.07	1.78	1.088	.286
Vigilance	(L)	5.87	1.67	5.36	2.06	1.75	0.08*
Abstractedness	(M)	4.97	1.65	5.88	1.92	3.24	.001*
Privateness	(N)	5.44	1.42	5.75	1.64	1.28	0.199
Apprehension	(O)	4.63	1.40	5.95	2.06	4.965	0.0001*
Openness to Change	(Q1)	6.07	1.74	4.32	1.57	6.47	0.0001*
Self Reliance	(Q2)	3.77	1.68	5.41	2.39	5.23	0.001*
Perfectionism	(Q3)	6.46	1.50	5.85	1.61	2.46	0.01*
Tension	(Q4)	3.98	1.59	5.93	2.05	6.89	0.0001*

age 30.7 years (range 19-42 years) described them as ‘low average on the uptake, ambivalent, accommodating, liked to work with others, adequate in emotional stability and tended to respect established traditions and customs of the society’ [4]. These and the results of our study seem to indicate that the perceived differences in the so-called generic image of officers of different branches is not supported from various studies carried out so far.

Effective engineers reportedly possess a broad knowledge base and wide entrepreneur skills [8]. These entrepreneurial abilities include better leadership skills and judgment, ability to handle pressure and being calm in crises, and enjoyment of challenges. Effective engineers were also perceived as having better interpersonal abilities including team working skills, are extravert forthright and optimistic. Surprisingly, authors of that study observed that ‘effective engineers were not necessarily good academic performers and vice versa [8]. Also effective engineers need not be technically more competent than less effective engineers. While the present study does not describe all the traits as observed for effective engineers, certain traits such as extraversion, assertive, dominance, self-assurance, and low anxiety appear to be present in these engineers. Their effectiveness at work can only be determined after a prospective follow up study.

Flying, air traffic control and engineering profession, beyond doubt requires different skills. While the skills required for flying (e.g. psychomotor, cognitive, teamwork etc.) and air traffic control (spatial processing etc) have been documented, there has been no such skill set description for aeronautical engineers. One reason for this may be that the range of tasks and activities

that can be carried out by the engineers is varied. Besides their acquired professional skills, they are also adept at resource management – both human and material. Especially so, since their responsibilities can range from flight line servicing in operational conditions to third line servicing of the aircraft at base repair depots or managerial responsibilities at formation headquarters. A subtle difference in personality among these varied professional groups working for a common purpose may be expected; and these differences are reflected in the mean personality scores of the three groups.

At this point it is important to comment on the selection procedures in the IAF. All the candidates for selection as an officer appear before a selection board. The assessment of prospective officers includes psychological evaluation, group testing and a personal interview. Although there is no specific test for evaluation of personality, emphasis is given to the presence of Officer Like Qualities (OLQ) among these candidates. Twenty-one OLQs have been grouped into four manageable major factors [4] and are utilised for assessing personality and aptitudes during selection. Based on the common system of selection, no significant difference in personality attributes or OLQ should be expected amongst officers, irrespective of whether they are meant for aviation or ground duties. The hypothesis that since the selection process does not differentiate between personality profiles of aircrew and ground crew at the selection stage, no significant differences in personality may be expected does not stand true. On the other hand, it is widely accepted that there may be certain inherent traits, including students' interests in various professional vocations that endear people to choose certain professions. Therefore differences in the personality attributes despite common OLQs are not surprising as is evident in this study.

Does an understanding of personality attributes or attributes of engineers have any implications for engineering education? Policy makers and researchers have observed that there appears to be a lack of research on the mechanisms of assessing effectiveness of engineering education, nor are there any measures of ideal end products of such education. It is also believed that since the qualities of effective engineers are not necessarily academic, engineering educators may have 'more areas to address than technical competence alone' [9]. It is here that this study can provide the initial inputs for modifying engineering education curriculum. If the personality attributes can be linked to longitudinal performance by assessment carried out at regular intervals throughout the military career, it could offer insights into the requirement of specific qualities for specific roles in the engineering branch. Understanding of effectiveness in different areas of aeronautical engineering can provide engineering educators with a clearer description of its ideal end product. Thus, an understanding of personality attributes of engineers, in particular those of effective engineers has implications for engineering education. This is particularly relevant with the decision to have engineering colleges run by the IAF. Once the desired 'end product' of engineering education is defined, the education process and curriculum can be suitably modified to meet the needs of the organization.

Conclusion

Significant differences in personality attributes of the engineering cadets were observed as compared to those of the typical IAF pilot and ATCO. An average IAF engineer is socially participating, extravert, independent and persuasive. He is low on anxiety and unperturbed. Understanding the personality attributes vis-à-vis the required attributes to be effective in the organization have applications at selection as well future employability of the young aeronautical

engineer. Implications for engineering education have also been discussed.

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