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Relationships of Anxiety Scores to Academy and Field Training Performance of Air Traffic Control Specialists

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16. Abstract

State-trait anxiety scores were used prior to the 1981 strike of air traffic control specialists (ATCSs) to estimate perceived levels of job stress in field studies of this occupational group. The present study assessed the relationship between anxiety, as measured by the State-Trait Personality Inventory (STPI), and post-strike ATCS trainee success at the FAA Academy and during field training. The STPI was administered to students who entered the FAA Academy between June 1984 and September 1985. Academy test scores were obtained for 1,790 students in the enroute option. Criterion data included the field training status of the Academy graduates as of July 1988. Statistical analyses determined the relationships between ATCS student scores on the STPI measures and (a) normative data and (b) Academy and field performance. ATCS students reported significantly lower state (current level) and trait (proneness) levels of anxiety than did either college students or military recruits. Individuals who were unsuccessful at the Academy, as well as those who were unsuccessful in the field, had higher overall anxiety scores. Trainees who had relatively high scores (for ATCS) on a combined index of the trait and state measures of anxiety exhibited significantly higher (a) percentages of Academy failures/withdrawals, (b) percentages of option switches in the field, and (c) overall field attrition than did trainees with low scores. Results support the operation of some personality-related self-selection among ATCS applicants regarding anxiety, and the importance of this characteristic for ATCS job success.

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RELATIONSHIPS OF ANXIETY SCORES TO ACADEMY AND FIELD TRAINING PERFORMANCE OF AIR TRAFFIC CONTROL SPECIALISTS

W. E. Collins, D. J. Schroeder, and L. G. Nye

INTRODUCTION

For more than a decade prior to the 1981 strike of air traffic control specialists (ATCSs), the State-Trait Anxiety Inventory (STAI) was used to provide psychological assessments in research studies related to the job stresses of controlling air traffic (6). Those studies showed that controller groups scored significantly below college student norms on both the A-state (current anxiety level) and A-trait (anxiety proneness) measures of the STAI, and that A-state scores (i) increased across an 8-hr work shift and (ii) were higher on shifts rated "difficult" than they were on "easy" shifts. Moreover, later studies indicated that ATCSs had lower state and trait anxiety scores than did other working adults, and that A-state scores increased from the beginning to the end of work shifts for employees in a variety of non-air-traffic jobs (e.g., engineers), just as they did for ATCSs.

Thus, ATCSs were shown to be well within normal limits on the indicators of psychological states used in these studies and appeared to experience <u>less</u> anxiety than is the average in other work settings.

During the same decade, STAI results from student Naval aviators in flight training were reported in a set of studies (1, 3) that indicated that aviator officer candidates scored lower in trait anxiety but higher in state anxiety than did the male college students who comprised the normative sample for the test. Moreover, voluntary dropouts from the flight training program did not differ in A-trait scores from those who continued in the program, but had higher A-state scores upon admission to the program (2).

The present study used the State-Trait Personality Inventory (STPI), which includes an updated version of the STAI, to assess the relationship between anxiety measures and the success of post-strike ATCS trainees at the FAA Academy and during field training.

METHOD

<u>State-Trait Personality Inventory (STPI).</u> The STPI comprises a total of 60 items divided into three "trait" and three "state" subscales for anxiety, curiosity, and anger. "Trait" scores require a response on a 4-point scale in terms of how the individual generally feels which includes (1) almost never, (2) sometimes, (3) often, and (4) almost always. Similarly, "state" items are rated on a 4-point scale comprising (1) not at all, (2) somewhat, (3) moderately so, and (4) very much so, to indicate how the individual feels at the present time. Scores for each of the six subscales can range from a minimum of 10 to a maximum of 40 based on the sum of the numbers (ratings) associated with the selected response alternatives (i.e., "not at all"=1); weights are reversed for 11 items, which are worded so that high

ratings indicate absence of the emotion. Only the anxiety subscales will be addressed in the paper.

The original version of this test (STAI) contained 20 items for each of the anxiety subscales, yielding a potential range of subscale scores from 20 to 80. Since some items were deleted from the original STAI test, and several new items were added to the current STPI anxiety subscales, scores from the older (STAI) version are not directly comparable to the current (STPI) form. However, the correlations of both the "state" and "trait" subscale scores of the STPI with the corresponding STAI subscales were .93 or greater for the normative groups of college students and military recruits (7).

Subjects. Subjects were 1790 students who entered the en route air traffic control option at the FAA Academy between June 1984 and September 1985. The sample comprised 1555 men and 235 women with a mean age of 25.9 years; 43.9% of the sample had graduated from college. Academy graduates were followed into field training (a process encompassing about three years) during which similar data were obtained through July 1988.

Procedure. The STPI was administered to ATCS students during the first day or two after their entry into the FAA Academy training program. The STPI was always the first of several tests and demographic questionnaires administered during the same block of time. Data regarding progress in the training program (all test scores; plus the designation of withdrawal, failure, or successful completion) were maintained in the Human Resources Research Division of the Civil Aeromedical Institute (CAMI). Statistical analyses included chi-square, t-tests, and multiple regression analyses to determine various relationships between ATCS student scores on the STPI measures and (i) normative STPI data and (ii) Academy and field training performance.

RESULTS AND DISCUSSION

Mean scores and standard deviations for the ATCS students on the A-state and A-trait subscales are presented in Table I along with normative data for the STPI (7) from college students and Navy recruits. Results of t-tests indicated that (i) both male and female ATCS students reported

TABLE I. MEANS AND STANDARD DEVIATIONS FOR STATE ANXIETY (A-STATE) AND TRAIT ANXIEY (A-TRAIT) SCALES FOR COLLEGE STUDENTS, NAVY RECRUITS, AND ATCS STUDENTS AS MEASURED BY THE STATE-TRAIT PERSONALITY INDEX (STPI).

	NORMATIVE SAMPLE					
	COLLEGE		NAVY		ATCS TRAINEES	
MEASURE	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN
A-State						
Mean	17.95	19.06	24.05	23.88	16.12	15.59
SD	5.52	6.25	7.14	7.94	4.80	4.33
A-Trait						
Mean	17.88	19.38	19.17	19.24	14.75	14.95
SD	4.47	5.65	5.14	5.56	3.78	3.64

significantly ($p<.001$ in all cases) lower state and trait anxiety than did either of the corresponding groups of college students or military recruits; and (ii) there were no within-group sex differences for ATCS students on either subscale. Sex differences in A-trait were evident in Spielberger's (7) normative sample of college students (but not with his Navy recruits) and were obtained in a study of community volunteers (8).

Other studies (4, 5) have shown significant relationships of both trainee age and their scores on the Multiplex Controller Aptitude Test (MCAT; a qualifying test for applicants to the ATCS program) with performance at the Academy and in field training. Thus the relationships of STPI anxiety scores with both age and MCAT scores are pertinent. Spearman correlation coefficients were computed for both state and trait anxiety with age and MCAT score and also with sex and level of education. Correlations were close to .00 with one exception, viz. between trait anxiety and education; that latter $r = .07$ was statistically significant, but obviously quite low. Thus, the relationship of anxiety scores to Academy and field training is essentially independent of these other potentially contributing factors to training success (see Table II).

TABLE II. INTERCORRELATIONS OF ANXIETY SCORES (A-TRAIT AND A-STATE), MULTIPLEX CONTROLLER APPITUDE TEST SCORES (MCAT), AGE, SEX, AND AMOUNT OF EDUCATION.

MEASURE	A-TRAIT	A-STATE	MCAT	AGE	SEX	ED
A-TRAIT	1.00	.54**	-.02	.00	.02	.07**
A-STATE		1.00	-.04	.00	-.03	.01
MCAT			1.00	-.21**	-.05	.02
AGE				1.00	.01	.09**
SEX					1.00	.06*
ED						1.00

* - Significant LE .01

** - Significant LE .001

The ATCS data for men and women were combined and three levels of anxiety were defined for both A-state and A-trait as follows:

Level	A-State	A-Trait	
Low	10	10	total score
Mid	11-22	11-19	total score
High	23+	20+	total score

The low anxiety level scores of 10 represent the minimum valid score for any STPI subscale. The minimum scores used to define the High anxiety levels equate to one (rounded) point above the mean anxiety subscale scores of the combined normative groups of college students and military recruits.

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TABLE III. A-STATE AND A-TRAIT ANXIETY LEVELS AND ACADEMY PERFORMANCE.

A-STATE LEVELS	PASS ACADEMY	FAIL ACADEMY	WITHDRAW/ INCOMPLETE	TOTAL
LOW (SCORE 10)	132 60.3%	65 29.7%	22 10.0%	219 100.0%
MID (SCORE 11-22)	776 55.9%	456 32.9%	155 11.2%	1387 100.0%
HIGH (SCORE 23+)	87 47.3%	69 37.5%	28 15.2%	184 100.0%

A-TRAIT LEVELS	PASS ACADEMY	FAIL ACADEMY	WITHDRAW/ INCOMPLETE	TOTAL
LOW (SCORE 10)	105 62.9%	47 28.1%	15 9.0%	167 100.0%
MID (SCORE 11-19)	797 56.0%	466 32.7%	161 11.3%	1424 100.0%
HIGH (SCORE 20+)	93 46.7%	77 38.7%	29 14.6%	199 100.0%

The three levels of anxiety were used to assess relationships with performance at the FAA Academy; students who passed, failed, or were recorded as withdrawals or incompletes were tabulated by anxiety level (see Table III). For both A-state and A-trait scores, (i) the proportions of students who passed at the Academy decreased as a function of increasing levels of anxiety, and (ii) the proportions of students who either failed or were in the withdraw/incomplete category increased as a function of increasing levels of anxiety. Statistical analyses by chi-square techniques indicated significant differences in FAA Academy performance between the groups high in A-trait and high in A-state scores and their counterparts in the low anxiety groups ($p<.01$ in both cases). For both A-state and A-trait anxiety, Academy pass rates were less than 50% for trainees in the high anxiety groups and their withdrawal rates were over 50% higher than those for the low anxiety groups.

One way to examine the relationship of field training performance to A-state and A-trait scores is to assess field attrition and option switches (the latter refers to those who stay in the air traffic occupation but move to a different option, e.g., from en route to the terminal or flight service station options).

Table IV presents these data and shows that, for those trainees who passed the Academy, the proportions who either attrited or switched options (i) increased with A-trait score levels, (ii) were inconsistent for A-state score levels.

TABLE IV. A-STATE AND A-TRAIT ANXIETY LEVELS AND FIELD TRAINING PERFORMANCE.

A-STATE LEVELS	PASS ACADEMY	FIELD ATTRITION	OPTION SWITCH	FPL OR DEVEL	TOTAL
LOW (SCORE 10)	132 60.3%	20 15.2%	14 10.6%	98 74.2%	132
MID (SCORE 11-22)	776 55.9%	157 20.2%	70 9.0%	549 70.7%	776
HIGH (SCORE 23+)	87 47.3%	14 16.1%	12 13.8%	61 70.1%	87

A-TRAIT LEVELS	PASS ACADEMY	FIELD ATTRITION	OPTION SWITCH	FPL OR DEVEL	TOTAL
LOW (SCORE 10)	105 62.9%	12 11.4%	8 7.6%	85 81.0%	105
MID (SCORE 11-19)	797 56.0%	158 19.8%	75 9.4%	564 70.8%	797
HIGH (SCORE 20+)	93 46.7%	21 22.6%	13 14.0%	59 63.4%	93

The proportions of trainees who reached FPL status or were still active in the developmental process by our July 1988 cut-off date showed the same relationships to anxiety score levels as had been obtained for Academy entrants, i.e. the highest proportions of successful trainees in field training were low in anxiety and the lowest proportions of successful trainees had high anxiety scores for both state and trait, although the relationships were stronger for the trait measure. This finding and the inconsistency of the state measure during field training is not particularly surprising since the state measure was obtained at entry into the Academy program and there existed a considerable opportunity for modification. It is interesting that the state measure would show such a relatively strong effect for the multi-week Academy course; similar results were obtained in studies of Naval aviators in flight training (1, 2, 3).

Another way to examine the same relationships is to use the Academy entrants as the base for assessing both Academy and field training losses or option switches (see Table 5). Presented this way, both higher trait and higher state anxiety levels show the increasing failure ratios at the Academy and decreasing portions of those who reached FPL status (or were continuing as Developmentals). In field training, that inverse relationship of anxiety level with success held only for A-trait scores; A-state scores bore no regular relationship to either option switches or field attrition. The FPL success rates ranged from 50.9% to 39.6% to 29.6% for increasing A-trait levels and from 44.7% to 39.6% to 33.2% for increasing A-state levels.

TABLE V. A-STATE AND A-TRAIT ANXIETY AND OVERALL TRAINING PERFORMANCE.

A-STATE LEVELS	ACADEMY ATTRITION	FIELD ATTRITION	OPTION SWITCH	FPL OR DEVEL	TOTAL
LOW (SCORE 10)	87 39.7%	20 9.1%	14 6.4%	98 44.7%	219 100.0%
MID (SCORE 11-22)	611 44.1%	157 11.3%	70 5.0%	549 39.6%	1387 100.0%
HIGH (SCORE 23+)	97 52.7%	14 7.6%	12 6.5%	61 33.2%	184 100.0%

A-TRAIT LEVELS	ACADEMY ATTRITION	FIELD ATTRITION	OPTION SWITCH	FPL OR DEVEL	TOTAL
LOW (SCORE 10)	62 37.1%	12 7.2%	8 4.8%	85 50.9%	167 100.0%
MID (SCORE 11-19)	627 44.0%	158 11.1%	75 5.3%	564 39.6%	1424 100.0%
HIGH (SCORE 20+)	106 53.3%	21 10.6%	13 6.5%	59 29.6%	199 100.0%

Combinations of state and trait levels into an S-T anxiety index were next examined with regard to Academy performance (see Table VI). Results indicated that (i) trainees with both high A-trait and high A-state scores, had a very low pass rate of only 36.5% and the highest rates of both failure and withdrawals, (ii) the lowest pass rates occurred for trainees who were high in trait or state anxiety, (iii) the highest pass rates occurred for trainees who were low in trait or state anxiety, (iv) the group of trainees with the highest pass rate was in the "mid/high state + low trait" anxiety classification.

TABLE VI. STATE-TRAIT ANXIETY INDEX AND FAA ACADEMY PERFORMANCE.

INDEX	PASS ACADEMY	FAIL ACADEMY	WITHDRAW/ INCOMPLETE	TOTAL
LOW S + LOW T	42 60.0%	19 27.1%	9 12.9%	70 100.0%
MID/HIGH S + LOW T	63 64.9%	28 28.9%	6 6.2%	97 100.0%
LOW S + MID/HIGH T	90 60.4%	46 30.9%	13 8.7%	149 100.0%
MID S + MID T	651 55.7%	385 32.9%	133 11.4%	1169 100.0%
HIGH S + MID T	59 54.1%	35 32.1%	15 13.8%	109 100.0%
MID S + HIGH T	63 51.6%	43 35.2%	16 13.1%	122 100.0%
HIGH S + HIGH T	27 36.5%	34 45.9%	13 17.6%	74 100.0%

Additional analyses were accomplished by separately collapsing the three low S-T index categories and the three high S-T index categories in Table VI into "Low Anxiety" (low A-state or low A-trait) and "High Anxiety" (high A-state or high A-trait) categories while retaining the "Mid S + Mid T" category. That analysis redistributed the number of subjects in each category due to the combining of scores while yielding results by anxiety category not markedly different from those reported in Tables IV and V. Table VII presents S-T anxiety index/training performance data for the three (collapsed) levels of anxiety. Based on this S-T anxiety index, trainees in the "Higher Anxiety" category exhibited significantly higher (by chi-square test) percentages of (i) Academy failures/ withdrawals ($p<.01$), (ii) percentages of option switches ($p<.05$), and (iii) overall field attrition ($p<.05$) than did trainees in the "Lower Anxiety" category.

TABLE VII. STATE-TRAIT ANXIETY INDEX AND PERFORMANCE AT THE ACADEMY AND IN THE FIELD.

S-T INDEX	PASS ACADEMY	FAIL ACADEMY	WITHDRAW/ INCOMPLETE	TOTAL
LOW ANXIETY	195 61.7%	93 29.4%	28 8.9%	316 100.0%
MID ANXIETY	651 55.7%	385 32.9%	133 11.4%	1169 100.0%
HIGH ANXIETY	149 48.9%	112 36.7%	44 14.4%	305 100.0%

S-T INDEX	FIELD ATTRITION	OPTION SWITCH	FPL OR DEVEL	TOTAL
LOW ANXIETY	27 13.8%	18 9.2%	150 76.9%	195 100.0%
MID ANXIETY	135 20.7%	56 8.6%	460 70.7%	651 100.0%
HIGH ANXIETY	29 19.5%	22 14.8%	98 65.8%	149 100.0%

CONCLUSIONS

These results indicate that some personality-related self-selection regarding anxiety occurs among those who qualify for selection into the air traffic control training program. The average anxiety level of ATCS trainees is lower than that of college students and Naval recruits and, by inference based on older STAI scores, lower than that of Naval flight students. Despite the narrower distribution of anxiety scores among ATCSs, both A-trait and A-state scores were significantly related to pass rates at the FAA Academy and to sucess in field training. The relationship to training success of A-trait scores was, as might be predicted, better than that of A-state scores. An index based on combinations of state and trait levels indicated a significant relationship: high anxiety scores yielded high percentages of Academy failures/withdrawals, option switches, and

field attrition.

Thus, the original self-selection implied by the relatively low anxiety among ATCS entrants is reinforced by the higher training failure rates of those with high levels (for ATCSs) of anxiety. That interaction yields an occupational group that has a high trait tolerance for circumstances that might produce anxiety in others. Therefore, we can infer that those who become air traffic controllers are well prepared, psychologically, for the demanding work they perform.

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