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ABSTRACT

This study from the Community College of the Air Force (CCAF) evaluates the effectiveness of occupationally-related degree programs by using criterion-referenced performance indicators to measure the on-the-job performance of graduates. This study is designed to answer the question of whether there is a relationship between educational attainment and on-the-job performance. The study compared the amount of time required to reach the job rank of craftsman among different educational levels. The study sample was 3,767, 4.59% of the approximately 82,800 staff sergeants in the Regular Air Force who were on duty on December 13, 1994 and who had earned a craftsmen level between November 1993 and October 1994. Study results indicated that there were significant differences in the variance between the mean number of years from entry to craftsman skill level when measured by CCAF participation and educational levels. Findings include: (1) members with bachelor's degrees or higher averaged 8.43 years, associate degree holders averaged 8.72 years, those with some college averaged 9.2 years, and those with a high school education averaged 9.3 years; (2) graduates of CCAF programs achieved craftsman level earlier than those who participated in the courses without finishing, and participants reached the level earlier than those who did not participate in courses; (3) the same trend held when testing demographic factors such as race, gender, and marital status. This research project could be useful to civilian community colleges interested in measuring effectiveness of occupational programs. (KP)

USING CRITERION-REFERENCED PERFORMANCE INDICATORS TO MEASURE ON-THE-JOB PERFORMANCE OF GRADUATES

A PAPER

BY

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INTRODUCTION:

The fundamental question for institutional effectiveness researchers who are evaluating occupationally related educational programs is how your graduates perform on the job compared to those who didn't complete your program. Unfortunately, many of the more common measures institutional effectiveness researchers use are, at best, indirect measures of the on-the-job performance of program graduates. At the Community College of the Air Force, one of our recent research projects involved evaluating the effectiveness of our occupationally related degree programs by using criterion referenced performance indicators to measure the on the job performance of our graduates.

In our study, we discovered that graduates of our programs reached a criterion referenced performance level in their career fields significantly earlier than nongraduates or nonparticipants.

The Community College of the Air Force (CCAF) is the largest multi-campus community college in the world, with over 128,000 students and 11,000 graduates annually. It is a 2-year, federally chartered college serving the needs of enlisted personnel in the United States Air Force. CCAF's student body consists of members of the armed forces and the college is composed of over 70 Air Force branch campuses throughout the world. The College evaluates and awards credit for appropriate Air Force professional military and technical training courses. Enlisted members of the Air Force may combine these credits with credit from other accredited institutions and/or credit earned through standardized examinations to earn an associate degree. The College awards the Associate in Applied Science degree and two different certificates to enlisted Air Force members. The College's programs are designed to improve the technological, managerial, and leadership skills of enlisted members of the Air Force. (Air Force Policy Directive (AFPD) 36-23, 1993, paragraph 1.10)

The College's degree and certificate programs support the Air Force mission in three ways. The College's programs contribute to Air Force recruiting efforts, aid in the retention of quality Air Force members, and enhance the mission readiness of individual enlisted members. (Air Force Instruction (AFI) 36-2304, 1994, paragraph 1)

STATEMENT OF THE PROBLEM:

This paper will focus on the relationship between participation and non-participation in the Community College of the Air Force degree programs and other educational programs, and the individual mission readiness status of enlisted members of the Air Force. Specifically I will examine the question of whether or not there is a significant relationship between participation in Community College of the Air Force programs and other educational programs and skill acquisition time. I will attempt to show that active participation in Community College of the Air Force degree programs and other educational programs is linked to shorter times needed for obtaining the craftsman (seven) skill level by Air Force staff sergeants.

SIGNIFICANCE OF THE PROBLEM:

This is a critical problem for study because of the nature of the Community College of the Air Force mission. As stated above, one aspect of the College mission centers on enhancing mission readiness for enlisted members of the Air Force. In the modern, highly technological battlefield environment, the better our forces are trained/educated, the more effective they will be as a fighting force. The complexity of modern combat requires a highly trained, highly disciplined, well educated fighting force. Through 67 degree programs, the Community College of the Air Force provides incentives for enlisted Air Force members to continue their academic and technical studies, and, consequently, to enhance their personal readiness. Each of these degree programs is directly related to an Air Force career field and serves to enhance their professional preparation in that field (Students are automatically enrolled in the degree program for their career field and are not allowed to choose an area of study).

Readiness is an intangible quality, composed of numerous personal, medical, attitudinal, and educational factors. One of these factors is attaining the craftsman (in Air Force jargon, the "7-skill") level.

In the Air Force, enlisted personnel are trained in a variety of different ways and at a number of career points. Typically, a new recruit starts out in basic military training, a six-week course in military fundamentals at Lackland Air Force Base, Texas. From there the new

airman is sent to a technical training school for specialized training in his or her career field. The length of this school varies by career field--ranging from a few weeks to nearly a year--and the student is awarded the apprentice (3-skill) level rating upon graduation. The new technical school graduate is then sent on to his or her first permanent duty assignment and is enrolled in a training program after about six months on the job. This program trains the young airman to the journeyman (5-skill) level and is composed of a structured on-the-job training program linked to a correspondence course and a standardized course completion examination. An airman is typically awarded the journeyman skill level upon assuming the rank of senior airman (around their third year in the Air Force). When an airman is selected for the rank of staff sergeant (with 3 to 12 years' service), he or she is enrolled in another training program for the craftsman (7-skill) level. The craftsman level is awarded upon completion of another structured on-the-job training program and a linked correspondence course.

The craftsman level upgrade program is essentially self-paced in that the staff sergeant completes his or her requirements as fast or as slow as they are able. Some take only the minimum of 18 months while others take longer. It is this difference I want to examine. I want to find out if there is a link between participation in the degree programs of the Community College of the Air Force and/or education levels, and the amount of time required to produce a craftsman-level technician. My theory is that those members who are active participants in post-secondary educational programs will tend to complete their training faster than those who are not taking advantage of post-secondary educational offerings. This difference can have a direct impact on the mission readiness of the Air Force. If better educated personnel take less time to reach the craftsman level of training, the Air Force could reduce the time needed to produce craftsman level technicians by increasing the educational levels of junior enlisted personnel (through incentives, recruiting, etc.). Such a link would also help to justify the amount of money spent on post-secondary educational programs by the Air Force.

DEFINITION OF TERMS:

For the purposes of this paper, the following definitions apply (notes in parentheses indicate the sources for these definitions and/or the codes the USAF personnel (ATLAS) system uses to define the variables):

AFMPC: The Air Force Military Personnel Center. This organization is the central repository of all personnel data on Air Force members. It is located at Randolph Air Force Base, Texas.

CCAF: Community College of the Air Force

PAFSC: Primary Air Force Specialty Code. This code is used in the AFMPC computer system to identify an individual member's career field and skill level. It is a five-character code and can be appended by both single-character prefixes and suffixes to indicate subspecializations. The fourth digit is the one that indicates the skill level of the member (1 = Helper, 3 = Apprentice, 5 = Journeyman, 7 = Craftsman, 9 = Superintendent).

PDS: Personnel Data System, the Air Force master personnel database maintained at the Headquarters, Air Force Military Personnel Center, Randolph Air Force Base, Texas.

High School Education: Individual has a high school education (AFI 36-2305, Atch 2, codes A-D).

Some College: Individual has 12+ semester hours of *civilian* college work, but no associate or higher degree (AFI 36-2305, Atch 2, code E-G; or code J as highest education level with the absence of code H as the second highest level). The reader should note this definition is designed to identify those members who have earned college work in *civilian* institutions (for transfer to CCAF in fulfillment of their general education requirements)--all enlisted members earn college credit through CCAF classes.

Associate Degree: Individual has an associate's degree (AFI 36-2305, Atch 2, code H as the highest education level; or code J as the highest education level with code H as the second highest level).

Bachelor's and above: Individual has a bachelor's degree or higher (AFI 36-2305, Atch 2, codes N-V).

Nonparticipant in CCAF programs: Individual has matriculated in the College and earned military credit, but has not earned or submitted credit from civilian colleges/universities or earned credit by examination (CCAF *Counselor's Handbook*, pp. 15-16, code 0).

Participant in CCAF programs: Individual has matriculated in the College and earned military credit and either has transcribed credit from civilian colleges/universities and/or credit by examination. This individual has not earned an associate degree from the College (CCAF *Counselor's Handbook*, pp. 15-16, codes 1-2).

Graduate from CCAF: Individual has earned an Associate in Applied Science degree from CCAF ((CCAF *Counselor's Handbook* , pp. 15-16, codes 4-5, A-D).

TAFMSD: Total Active Federal Military Service Date. This is the date a member entered active duty.

Years to 7-Level: This is the number of years (expressed in decimal form) between an individual's TAFMSD and the date his/her 7-Skill Level PAFSC was awarded.

Date of Rank: This is the date an enlisted member was promoted to the rank indicated. It is calculated according to AFI 36-2604.

PAFSC Award Date: This is the date an Air Force member was awarded the PAFSC indicated. (It is calculated on the data submitted in accordance with AFI 36-2101).

SYNTHESIS OF THE LITERATURE:

I believe the best way to measure how well an individual member of the Air Force contributes to the accomplishment of his or her unit's mission is in the area of training. Logically, the better trained an individual member of the Air Force is, the more likely he or she is to be a productive and contributing member of his or her squadron, and the more likely he or she is to be able to meet his or her own responsibilities for the accomplishment of the unit's mission. I believe training is the key component in the complex human equation that makes up mission readiness. Measuring a link between training and educational status will

provide a means of evaluating if and how CCAF contributes to the mission readiness of the United States Air Force.

Enlisted training is governed by AFPD 36-22, *Military Training,* and AFI 36-2201, *Developing, Managing, and Conducting Training*. The first of these states: "Trained people are a critical resource with which organizations accomplish their Air Force missions." (AFPD 36-22, 1994, paragraph 1.1) It requires the Air Force to establish training programs for mission-generated training requirements, to use the most efficient training methods possible, to provide the resources necessary for the training, and to use the Instruction Systems Development (ISD) process to develop training programs. (AFPD 36-22, 1994, paragraph 1.2) This directive requires the measurement of training programs based on the percentage of qualified enlisted personnel assigned compared to the skill requirements of their positions. The desired standard is to have over 65% of military personnel qualified for the position they hold. (AFPD 36-22, 1994, Attachment 1) This measure is rooted in the same philosophy as this study--namely the skill levels of individual members of the Air Force is a measure of readiness to accomplish that individual's part of the unit mission. It states, in essence, that if 65% of all the members of the Air Force are trained for the position they are assigned to (i.e. craftsman technicians in a craftsman-level jobs, apprentice technicians in apprentice-level jobs, etc.) the Air Force is likely to be ready to perform its mission.

AFI 36-2201 establishes responsibilities for personnel throughout the Air Force in developing, conducting, and evaluating training. It mandates the development of a *Career Field Education and Training Plan* (CFETP) for every Air Force career field. This document establishes requirements for earning each skill level within a career field. It lists required tasks, performance levels, knowledge areas, etc. Supervisors are the central figures in the Air Force training system. They have numerous responsibilities, including, but not limited to, entering personnel into the craftsman-level training program when they are promoted to staff sergeant, planning and conducting training (arranging trainers, integrating training with work center operational requirements, etc.), counseling airmen on their training progress (or lack

thereof) evaluating skill progression, certifying/decertifying qualifications, and managing the Career Development Course (CDC) correspondence learning program for their subordinates (including setting training timelines and examination dates, administering volume review examinations, evaluating progress and assigning remedial training, etc.) (AFI 36-2201, 1994, paragraph 3.11) This document mandates the enrollment of enlisted personnel into craftsman-level training when they are promoted to staff sergeant. It requires a minimum of 18 months of supervised on-the-job training as outlined in the appropriate CFETP, and completion of a craftsman school and/or Career Development Course (a specialized correspondence course). (AFI 36-2201, 1994, paragraph 3.11.2.3-5)

Other research efforts at the Community College of the Air Force have established a positive link between Air Force promotions and participation in Community College of the Air Force degree programs. Members who were Community College of the Air Force Graduates were promoted significantly earlier to the grades of chief master sergeant, senior master sergeant, master sergeant, and technical sergeant than participants and nonparticipants (based on the above definitions); Participants were also promoted significantly earlier than Nonparticipants in these same studies. (Kyle C. Monson, *Analysis of Promotion to Chief Master Sergeant and CCAF Participation*, *Analysis of Promotion to Senior Master Sergeant and CCAF Participation*, *Analysis of Promotion to Master Sergeant and CCAF Participation*, *Analysis of Promotion to Technical Sergeant and CCAF Participation*, all--Community College of the Air Force (Maxwell AFB, Alabama: 1995)

RESEARCH QUESTIONS AND HYPOTHESES:

This study is designed to answer the question of whether there is an inverse link between educational attainment and the amount of time required to upgrade to the craftsman or 7-skill level. Put simply, do Air Force personnel who have increased educational levels and/or do participants in Community College of the Air Force degree programs take less time to train/upgrade to the craftsman (seven) skill level? To answer these questions, I've developed several hypotheses to test. They are:

Null Hypothesis Number One: The amount of time to produce a craftsman technician will not be significantly less for those personnel who are active participants in Community College of the Air Force degree programs than for those personnel who are not.

Alternate Hypothesis Number One: The amount of time to produce a craftsman technician will be significantly less for those personnel who are active participants in Community College of the Air Force degree programs than for those personnel who are not.

Null Hypothesis Number Two: The amount of time to produce a craftsman technician will not be significantly less for those personnel who earn college degrees at the associate level (or higher) than for those personnel who do not.

Alternate Hypothesis Number Two: The amount of time to produce a craftsman technician will be significantly less for those personnel who earn college degrees at the associate level (or higher) than for those personnel who do not.

LIMITATIONS:

This study is limited to unclassified data and to data available to the Community College of the Air Force through the ATLAS data retrieval system.

DELIMITATIONS:

I delimited the study to staff sergeants who were upgraded to the craftsman skill level between 1 November 1993 and 1 October 1994. These dates were chosen to avoid the administrative change made to all Air Force Specialty Codes on 1 October 1994. This change made the effective date for all PAFSCs 1 October 1994, making this variable a constant for all Air Force personnel and rendering the analysis in this study useless for this group. I further delimited the study to those personnel who were pursuing their first craftsman level PAFSC, reasoning the amount of time for a second or subsequent upgrade to the craftsman level is

likely to be different (nearly always smaller) than the amount of time required for the first upgrade due to factors like maturity, experience with the training system, etc. In addition, since the comparisons in this study involved measuring the difference between a member's entry into the Air Force and their craftsman level award date, it was essential to ensure all cases involved the first craftsman level upgrade. Including those with a second or subsequent craftsman level upgrade would have skewed the data.

POPULATION AND SAMPLE:

The population for this study is the approximately 82,800 staff sergeants in the Regular Air Force who were on duty on 13 December 1994. The sample is 3,767 members selected using the criteria discussed below.

RESEARCH DESIGN:

This study is an analysis of data in the PDS, using the ATLAS system for data retrieval. The data were analyzed using the Statistical Program for the Social Sciences (SPSS) for Windows package.

I coded the ATLAS system to select only those Air Force members who were staff sergeants who had earned a PAFSC with a 7-skill level between 1 November 1993 and 1 October 1994, and who had entered the Air Force after 1 January 1979 (because of longevity ceilings on the promotion of Air Force personnel to staff sergeant, it is impossible for someone to enter the Air Force prior to that date and complete their first 7-skill level upgrade during the time period of this study). I coded the system to print out the date of rank, PAFSC, PAFSC award date, TAFMSD, gender, race, marital status, second AFSC, CCAF Status Code, and Academic Level Codes. This produced a sample of 6,143 cases. I eliminated one individual who had been reduced from technical sergeant and had retrained, and another 1,335

members who were retrainees (those with a previous 7-level in another PAFSC). I retained personnel with a second AFSC in the sample if the second AFSC was a shredout (a subspecialty or suffix of the PAFSC not usually requiring a separate 7-level school/upgrade), or a feeder five-skill level AFSC, or was a special duty identifier. In this case, I was guided by Air Force Instruction 36-2101, *Classifying Military Personnel (Officers and Airmen)*, paragraph 2.24, which defines suffixes (shredouts) as codes that identify positions related to particular equipment and/or functions within an Air Force Specialty--this document directs personnel specialists/classifiers to "consider individuals possessing suffixes of an AFSC proficient in the basic AFSC and use them in either capacity." (AFI 36-2101, 1994, paragraph 2.24) I also eliminated 1,028 cases of members with more than five years as a staff sergeant (who cannot possibly be training to the craftsman level for the first time). This left a total of 3,767 cases in he sample.

As noted above, there were approximately 82,800 staff sergeants in the Air Force on 13 December 1994. The sample, pared down to 3,767, represents 4.59% of all the staff sergeants in the Air Force. There have been approximately 10-12,000 (11,953 in 1994) Air Force members promoted to staff sergeant during each of the past five years, resulting in a maximum of 60,000 staff sergeants who could fit my selection criteria (the figure is undoubtedly less since some have separated from the Air Force in the interval, while others have been promoted and others have been reduced in rank). Using a figure of 60,000, the sample of 3,767 represents 6.28% of the possible total number of personnel promoted to staff

sergeant in the last five years. In Figure One, I've tested the sample size using the data from the mean difference in years between the date the member entered the Air Force (TAFMSD),

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FIGURE ONE: SAMPLE SIZE CALCULATIONS:

The formula for determining sample size is as follows: $N = (z/e)^2 (p) (1-p)$

Where:
- N = Sample size
- z = Standard score for a particular confidence level
- e = Proportion of sampling error in a given situation (standard error of the mean)
- p = Estimated proportion or incidence of cases in the population

The formula for determining the standard error of the mean is: $SE_{\overline{X}}$ = s/ (Square Root of N)

Where: $SE_{\overline{X}}$ = Standard error of the mean
s = Standard deviation
N = Sample size

Using these formulas, the $SE_{\overline{X}}$ computes as follows:

$SE_{\overline{X}}$ = s/ (Square Root of N)
= 1.559 / (61.37)
= .025

The minimum sample size, with a .05 level of significance (one-tailed tests), calculates as follows:

$N = (z/e)^2 (p) (1-p)$
$= (1.64/.025)^2 (.06) (.9373)$
$= 240.12$

From: Paul A. Leedy, *Practical Research Planning and Design*, 4th Ed., Macmillan Publishing Company (New York: 1985), pp. 156-159.

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and the date his or her craftsman PAFSC was awarded using the 60,000 maximum possible population figure. The results of this calculation indicate I would need a minimum sample size

241 (240.12) cases to maintain a 95% confidence level in the results of the study. By this measure, my sample of 3,767 cases is more than adequate.

The percentage distribution of CCAF graduates and the distribution of education levels within the sample closely matches the same percentage distributions of the same factors for all Staff Sergeants in the Air Force. Of the 82,873 Staff Sergeants on active duty on 28 December 1994, 13.75% (n = 11,397) were Community College of the Air Force graduates, 6.07% (n = 5,033) had a high school education, 76.91% (n = 63,738) had some college work, 13.14%(n = 10,894) had an associate degree, and 3.75% (n = 3,115) had a bachelor's or higher degree (including five members with earned doctorates). (Kyle C. Monson, *USAF Education Levels by Rank*, Community College of the Air Force (Maxwell AFB, Alabama: 1995)). In this study, the percentage distribution of the sample was: 13.61% Community College of the Air Force graduates, 7.99% had a high school education, 74.22% had some college, 14.12% had an associate degree, 3.53% had a bachelor's or higher degree.

The variables measured in this study are derived from data entered into the Air Force Military Personnel Center database and are coded in accordance with Air Force Instruction 36-2101, *Classifying Military Personnel (Officers and Airmen)*, August 1994, Air Force Instruction 36-2604, *Service Dates and Dates of Rank*, May 1994, Air Force Instruction 36-2305, *Educational Classification and Coding Procedures*, May 1994 and Air Force Instruction 36-2604, *Service Dates and Dates of Rank*, May 1994.

I grouped the data into my own categories for ease of interpretation and the testing of my hypotheses. The definitions of these categories are listed above. I chose to define the highest educational level category as Bachelor's and above due to the fact that there were only a handful of personnel with educational levels at the post-baccalaureate level--making analysis of their trends meaningless because of the small sample size. Logically, also, since I am examining the relationship between the programs of a community college and readiness, the data about the baccalaureate level and higher are not of prime importance, but only serve to reinforce the findings.

Both hypotheses were tested using analysis of variance (ANOVA). ANOVA is a procedure for testing the hypothesis that two or more population means are equal. (Hinkle 1988, p. 327) In this case I calculated separate One-Way ANOVA statistics using the number of years to earn a craftsman level PAFSC as the dependent variable. The independent variables were the CCAF status codes and the education level codes. ANOVA has three underlying assumptions--random and independent sampling, normal distribution of the population, and homogeneity of variance. The first two assumptions were met as evidenced by the sampling discussion above. For the other assumption, homogeneity of variance, I performed a Levene Test for Homogeneity of Variance using the SPSS program. The results are displayed below. The Levene statistic indicated there was no significant difference in the variances.

PRESENTATION OF THE DATA:

The data indicated there were significant differences in the variance between the mean number of years from entry into the Air Force until awarding of the craftsman skill level when measured by CCAF participation. CCAF Graduates averaged 8.67 years (n = 513) while Participants averaged 9.09 years (n = 2,004) and Nonparticipants averaged 9.56 years (n = 1,250), respectively. The average for the entire sample was 9.19 years (n = 3,767). The ANOVA calculation indicated these differences were significant at the .05 level and the Scheffe' test indicated all three groups significantly differed from each other. Figure 2 displays the summary ANOVA table for the test of the differences between the mean years to the craftsman skill level when compared by CCAF status codes, and Figure 3 is a graphic representation of the differences between the three groups.

The data also indicated there were significant differences in the variance between the mean number of years from entry into the Air Force until awarding of the craftsman skill level when measured by educational levels. Members with bachelor's degrees or higher averaged 8.43 years, members with associate degrees averaged 8.72 years, members with some college work

averaged 9.2 years and members with a high school education averaged 9.3 years to earn their craftsman level PAFSC. The ANOVA calculation indicated this difference was significant at

FIGURE 2: SUMMARY ANOVA OF YEARS TO EARN 7-SKILL LEVEL BY CCAF STATUS CODES

Source	Degrees of Freedom	Sum of Squares	Mean Squares	F Ratio	F Prob
Between Groups	2	327.97	163.98	69.92*	.00*
Within Groups	3764	8827.91	2.34	----	----
Total	3766	9155.89			

* = significant at the .05 level.

GROUP	Number	Mean	Standard Deviation	Standard Error	CI95 for Mean
Nonparticipants	1250	9.56	1.59	.042	9.47, 9.64
Participants	2004	9.09	1.48	.033	9.02, 9.15
Graduates	513	8.67	1.56	.069	8.53, 8.08
TOTAL	3767	9.19	1.55	.025	9.14, 9.24

Levene Test for Homogeneity of Variance:

Statistic:	Degrees of Freedom:	Two-Tailed Significance
2.81	2, 3764	.06

Omega Squared (ω^2) = .926

Scheffe Test:

GROUP	Nonparticipants	Participants	Graduates
Nonparticipants	N/A	*	*
Participants	*	N/A	*
Graduates	*	*	N/A

* = significant at the .05 level.

the .05 level and the Scheffe' test indicated the baccalaureate and associate degree groups did not differ significantly from each other, but differed significantly from the other two groups. The same test indicated the high school and some college groups also did not differ

significantly from each other, but differed with the other two groups. Figure 4 displays the summary ANOVA table for the test of the differences between the mean years to the craftsman skill level when compared by education levels, and Figure 5 is a graphic representation of the same data.

The same trends were present across career fields in the sample--i.e., Graduates achieved their craftsman skill level earlier than Participants, Participants earned theirs earlier than Nonparticipants, etc.. For example, in the largest career field in the sample, PAFSC 2S071 Supply Management, Graduates earned their craftsman skill level in an average of 8.29 years (n = 45), Participants earned theirs in 9.08 years (n = 315), Nonparticipants earned theirs in 9.8 years(n = 194), and all members of this career field earned theirs in an average of 9.27 years. The level of complexity between different academic programs also had no effect on this trend. For example in the Information Management career field (PAFSC 3A071), a field roughly equivalent to an office management program in a civilian college, Graduates achieved their craftsman skill level in an average 8.22 years (n = 24), Participants in 9.07 years (n = 117), Nonparticipants in 9.09 years (n = 56), and all members averaged 8.96 years (n = 197). By contrast, in the Avionics Electronic Warfare Systems career field (PAFSC 2A177), a high-tech. technologically complex field, Graduates achieved their craftsman skill level in an average 10.23 years (n = 40), Participants in 10.29 years (n = 90), Nonparticipants in 11.43 years (n = 55), and all members averaged 10.62 years (n = 185).

I also tested the data to see if demographic factors such as race, gender and marital status affected the totals. What I found was quite fascinating. In every case, the same trend observed in the above analysis (the greater the involvement in educational programs or progress towards CCAF degrees the faster the promotion to staff sergeant and upgrade to the

the amount of time needed to produce a craftsman level technician. Within each of these groups, however, those with higher education levels were upgraded to the craftsman level

FIGURE 4: SUMMARY ANOVA OF YEARS TO EARN 7-SKILL LEVEL BY EDUCATION LEVELS

Source	Degrees of Freedom	Sum of Squares	Mean Squares	F Ratio	F Prob
Between Groups	3	234.69	78.32	33.05*	.00*
Within Groups	3758	8893.88	2.36	----	----
Total	3761	9128.57			

(excludes 4 cases with no designated education level and 1 coded as "other")

* = significant at the .05 level.

GROUP	Number	Mean	Standard Deviation	Standard Error	CI95 for Mean
High School	301	9.37	1.43	.082	9.21 9.53
Some College	2796	9.29	1.54	.029	9.23, 9.35
Associate Degree	532	8.72	1.54	.067	8.58, 8.85
Bachelor's Plus	133	8.43	1.49	.129	8.17, 8.68
TOTAL	3762	9.18	1.55	.025	9.13, 9.23

Levene Test for Homogeneity of Variance:

Statistic:	Degrees of Freedom	Two-Tailed Significance:
.491	3, 3758	.688

Omega Squared (ω^2)= .948

Scheffe Test:

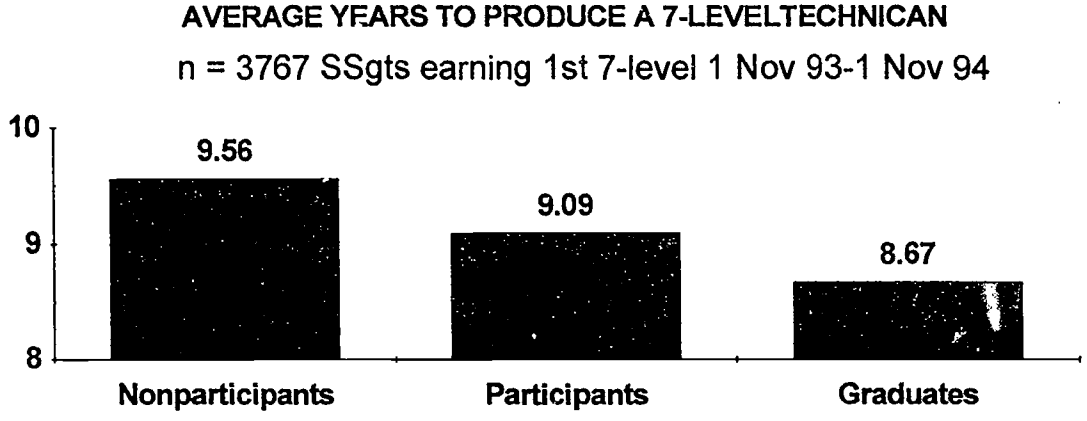
GROUP	High School	Some College	Associate Degree	Bachelor's Plus
High School	N/A		*	*
Some College		N/A	*	*
Associate Degree	*	*	N/A	
Bachelor's Plus	*	*		N/A

* = significant at the .05 level.

earlier than those with lower education levels. The only exceptions to this trend were in the few instances where the sub-group categories had less than 200 members. If the reader will recall, samples of less than 241 are not large enough to generalize the findings to the

FIGURE 3: CCAF Participation and Craftsman Level

- CCAF participation significantly reduces the time to produce a craftsman (7-level) technician



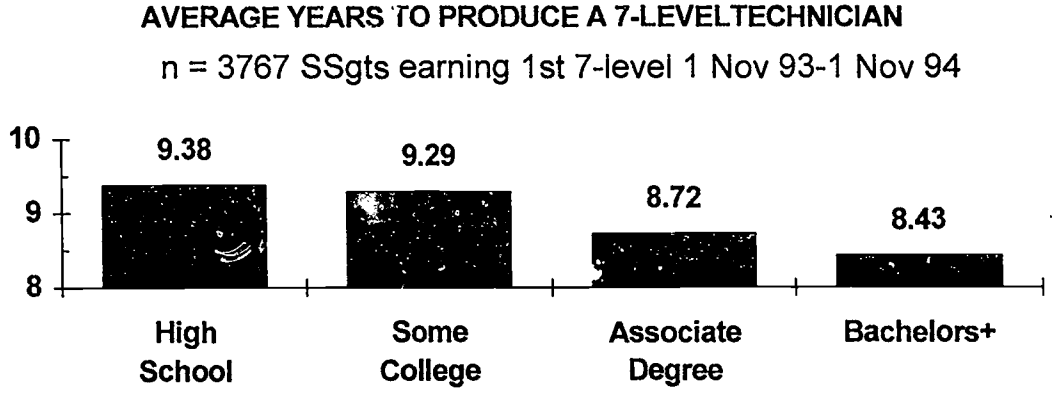
craftsman level) except in those few instances where the subcategories were smaller than 200 cases.

In the analysis of the findings using race as a discriminant factor, I was hampered by the definitions of racial groups used in the ATLAS system. The categories available are Caucasian, African American, Asian American, Native American, and Unknown. Ethnic subgroups such as Hispanics are not listed and I was unable to distinguish them from the other groups. In order to get a large enough sample for comparison I lumped all the groups except Caucasians and African Americans into an "Other" category. Caucasians tended to earn their craftsman levels earlier than African Americans, but later than the Other category. This difference was statistically significant ($F=14.45$, $p=.0001$), indicating a racial difference in

FIGURE 5:

Educational Achievement and Craftsman Level

- Increased education achievement/participation significantly reduces the time to produce a craftsman (7-level) technician

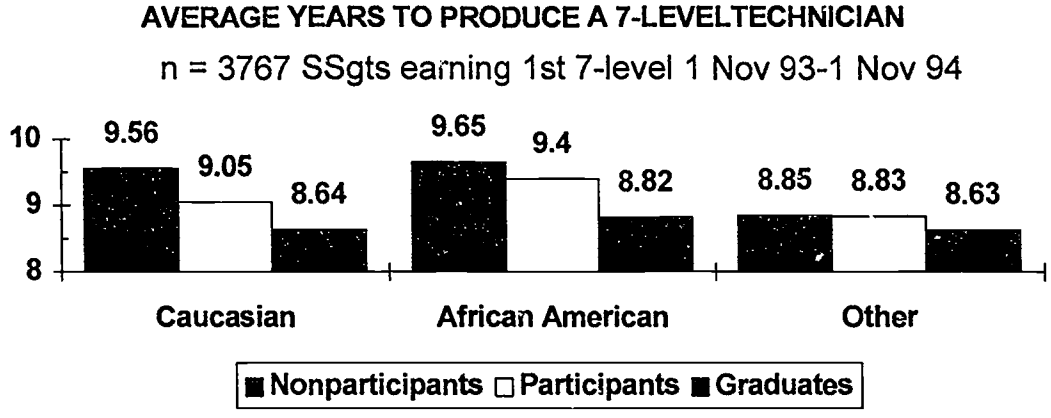


population and I think this may explain these few anomalies. Figures 6 and 7 illustrate this data.

The analysis of the findings using gender as a discriminating factor also produced data that exhibited the overall trend outlined above. Women completed their craftsman level training in 8.96 years while men completed theirs in an average of 9.23 years. This difference was statistically significant ($F = 13.06$, $p = .0003$), possibly indicating a motivational difference between men and women or possibly a level of complexity difference between the male- and female-dominated career fields. Within both of these groups, however, those with higher education levels were upgraded to the craftsman level earlier than those with lower education levels. The only exceptions to this trend were in the few instances where the sub-group categories had less than 200 members. Again, samples of less than 241 are not large enough

FIGURE 6: CCAF Participation and Craftsman Level (by Race)

- CCAF participation significantly reduces the time to produce a craftsman (7-level) technician

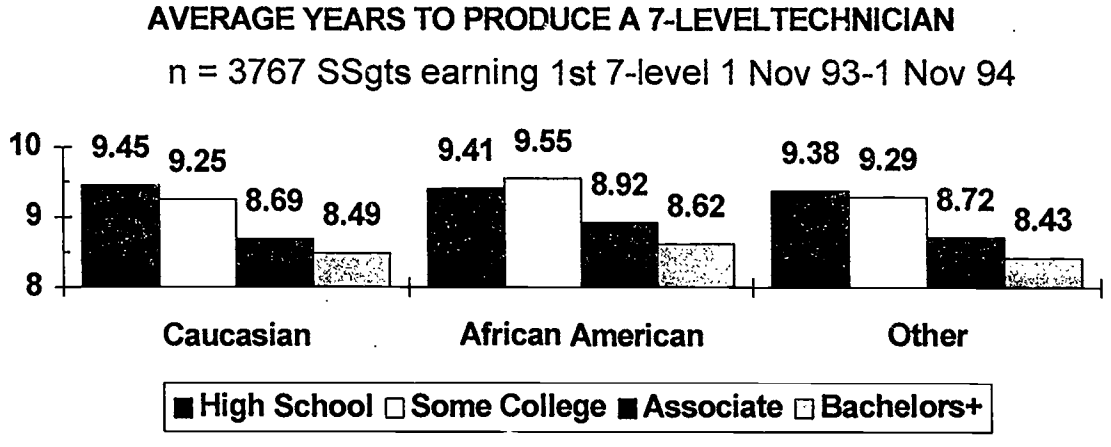


to generalize the findings to the population and I think this may explain these few anomalies. Figures 8 and 9 illustrate this data.

The analysis of the findings using marital status as a discriminating factor also produced data that exhibited the overall trend outlined above. Divorced personnel tended to reach their craftsman skill level later than married personnel, while married personnel tended to reach their craftsman skill level later than single personnel (there was only one widowed member, and this member was lumped with the divorced category for analysis). This difference was statistically significant ($F=15.46$, $p = .0001$). Within each of these groups, however, those with higher education levels were upgraded to the craftsman level earlier than those with lower education levels. The only exceptions to this trend was in the few instances where the sub-group categories had less than 200 members. Again, samples of less than 241 are not large

FIGURE 7: Educational Achievement and Craftsman Level (by Race)

- Educational Achievement significantly reduces the time to produce a craftsman (7-level) technician



enough to generalize the findings to the population and I think this may explain these few anomalies. Figures 10 and 11 illustrate this data.

LEVEL OF SIGNIFICANCE: The level of significance for this study is .05.

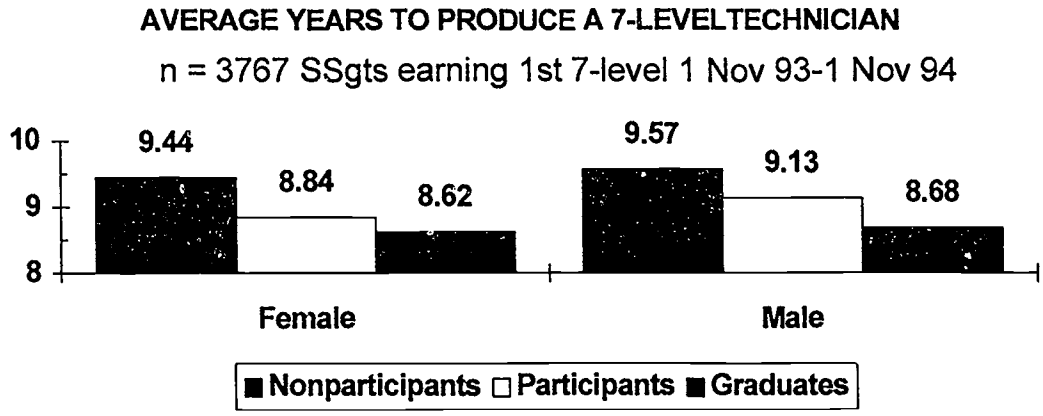
FINDINGS:

The data indicates graduates are likely to reach the craftsman level significantly earlier than personnel who are working towards a degree and personnel who are pursuing a degree will reach the craftsman level significantly earlier than nonparticipants in CCAF programs. Accordingly, I reject both the first null hypotheses and accept the alternate.

The data indicate Air Force enlisted members who earn college degrees at the associate degree level and above are more likely to reach the craftsman skill level than those who do not. I therefore reject the second null hypotheses and accept the alternate.

FIGURE 8: CCAF Participation and Craftsman Level (by Gender)

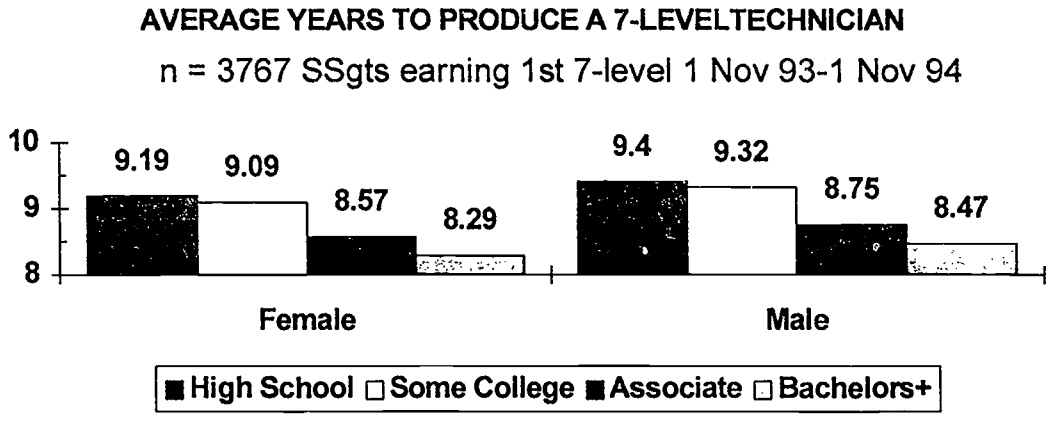
- CCAF participation significantly reduces the time to produce a craftsman (7-level) technician



I must caution readers on the results of this study. This study indicates association between certain variables (education/participation in CCAF program and earlier upgrade to the craftsman skill level, etc.), but does not address the issue of causation. There are numerous variables (motivation, inherent cognitive ability, etc.) which could arguably account for earning a degree, upgrading to the craftsman level earlier and getting promoted earlier. I suspect one or more of these variables in combination with CCAF status are responsible for the phenomena described herein. Until further study is done in this area, I can only say in complete confidence that active participation in the educational programs of the Air Force, and CCAF in particular, is associated with increased individual mission readiness as measured by upgrade time for the craftsman skill level. I suspect, especially given the above data, that the educational programs (and CCAF in particular) are at least partially the driving force behind this phenomena.

FIGURE 9: Educational Achievement and Craftsman Level (by Gender)

- Educational Achievement significantly reduces the time to produce a craftsman (7-level) technician



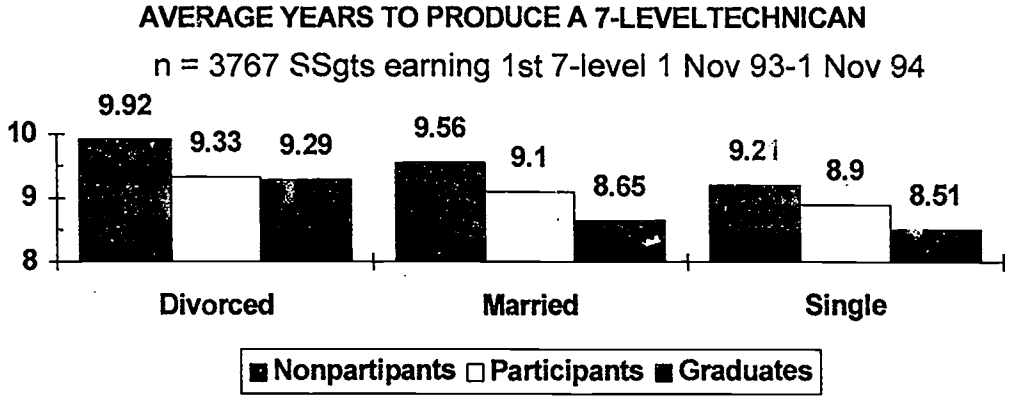
Of particular note, the same trends were noted in the sample regardless of the race, marital status, or gender of the member (although there were significant difference across each factor).

RECOMMENDATIONS:

This particular research project could be quite useful to civilian community colleges and technical schools. If they want to know how effective their occupationally oriented training and degree programs are, researchers at other institutions will want to measure how their graduates compare to others in an occupational specialty using a criterion-referenced skill level description. This would give them a standardized point from which to measure the relative progress of their students in their jobs. While this is quite easy for CCAF (we have basically one customer for our services, and that customer has one standardized training/skill evaluation system), it may not prove all that difficult for a civilian community college. Many business and industries have formalized training programs with criterion-referenced performance standards, selecting one and

FIGURE 10: CCAF Participationand Craftsman Level (by Marital Status)

- CCAF Participation significantly reduces the time to produce a craftsman (7-level) technician



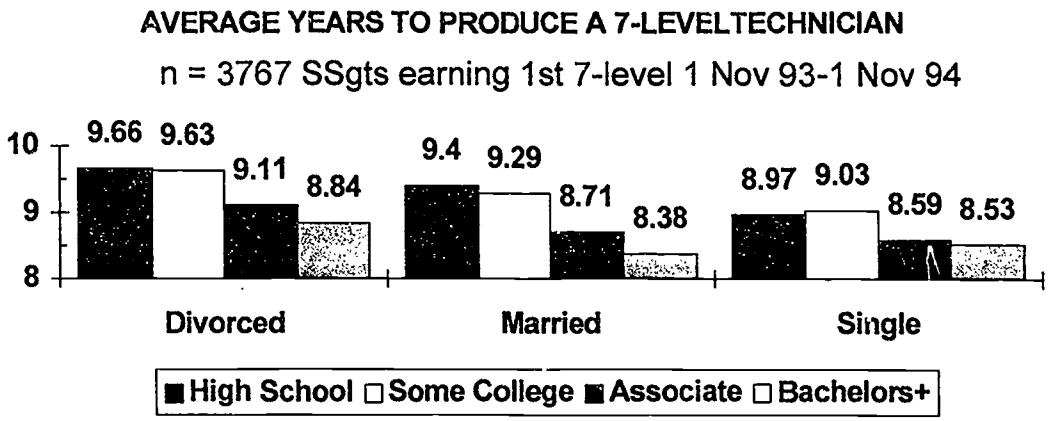
evaluating the length of time it takes to achieve the selected performance level is not a difficult task.

For those schools whose graduates are generally employed by businesses which do not have a formalized evaluation program and/or a criterion referenced system of evaluating the progress of their employees, or if they are employed by a number of businesses with different evaluation systems, this type of research study could still be done. It would require the institutional researcher to devise a criterion referenced instrument for the employer to use in evaluating his/her employees.

One source for such a criterion referenced evaluation standard are the Air Force *Career Field Education and Training Plans*. The Air Force has about 180 different career fields, many of which closely match civilian jobs. Each has a training standard which is developed from extensive occupational surveys and is used to measure training and career progress for every Air

FIGURE 11: Educational Achievement and Craftsman Level (by Marital Status)

- Educational Achievement significantly reduces the time to produce a craftsman (7-level) technician



Force enlisted member throughout most of their career. These could be adopted for use by civilian agencies in measuring comparable civilian college courses.

For example, an institutional researcher who was interested in measuring the effectiveness of his firefighting training program, but was frustrated by the fact that the various fire departments in the local area had a multitude of evaluation systems (ranging, no doubt from very simple in a rural volunteer department, to highly complex in an urban department). The institutional researcher could obtain of copy of the Air Force *Career Field Education and Training Plan* for the firefighting career field and develop a measurement instrument from the criterion referenced standards contained therein. Using this standard, the institutional researcher could compare the performance of his or her institution's graduates against graduates of other programs.

Another advantage of using this type of criterion referenced system of measurement is that it may provide valuable data regarding strong and weak areas in an occupationally related

education program. For example, although an institutional researcher may be measuring the amount of time graduates take to reach a predetermined performance level (like this study), the instruments filled out by supervisors/employers might reveal a criterion referenced weak area in the training/preparation of the graduates. Feedback like this is usually priceless in maintaining the quality of an occupationally related program.

IMPACT:

For the Air Force, producing fully qualified personnel in less time has a direct impact on the readiness of the Air Force to perform its mission. It makes the most important resource we have--our people--better prepared to do the jobs we have to do. It also saves an enormous amount of training dollars as well.

For civilian community colleges, the ability to demonstrate to business and industry that graduates take less time to upgrade to criterion-referenced skill levels can be easily translated into dollars saved, and will help make programs an easy sell to business and to potential students.

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