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FORSCOM/US ARMY MARKSMANSHIP UNIT M16A1 RIFLE AND .45 CAL PISTOL MARKSMANSHIP TRAINING EVALUATION

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Submitted by:
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The FORSCOM/US Army Marksmanship Unit M16A1 rifle and .45 cal pistol training evaluation was conducted to evaluate two candidate programs of instruction (POI) for rifle and pistol training at the field unit level. Performance and attitudinal measures were collected from soldiers of the 1/504th Infantry Bn (Airborne) who participated in the rifle and pistol training programs. The subjects were all males from a combat ready battalion.

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Soldiers in both the rifle and pistol programs who received FULL-AMU treatment performed better and expressed greater confidence in training than did those receiving the PART-AMU, or abbreviated training. Both performed better and expressed greater confidence in training than those in standard annual qualification training treatments. A unit using the AMU POIs for rifle and pistol training could elect to use the FULL or PART POIs based on available training time and resources and expect improved performances over current standard procedures. If time is available the FULL POIs (rifle and pistol) would provide the greatest performance increases in terms of number of soldiers qualified and level of qualification.

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FOREWORD

The research reported here was performed by the Army Research Institute - Fort Benning Field Unit, in collaboration with the US Army Marksmanship Unit, Fort Benning, Georgia. It is part of an ongoing program of research directed toward development of cost effective methods for individual and collective training in M16A1 rifle marksmanship. The overall program addresses M16A1 marksmanship at basic training, advanced individual training and unit training levels. It is concerned with all aspects of training inquiry from problem assessment, through instructional improvement, to study of training aids and devices. The effort involves close coordination and, in some instances, collaboration with various interested organizations, including: The US Army Infantry School (USAIS), US Army Forces Command(FORSCOM), US Army Marksmanship Unit (USAMU), US Army Infantry Board, Army Training Centers, US Marine Corps and US Navy.

This experiment dealt with unit level training within FORSCOM. The FORSCOM/US Army Marksmanship Unit (USAMU) test was a comparative evaluation of training effectiveness of USAMU programs of instruction (POIs) for the M16A1 rifle and the M1911A1, (.45 Cal) pistol with training typically conducted by units during annual weapons qualification exercises.

The ARI staff at the Fort Benning Field Unit was directly involved in all phases of this training evaluation. The Field Unit staff was requested to participate in test design activities, field observations and data analysis by the USAMU, stationed at Fort Benning, Georgia. This report is the result of a highly successful cooperative relationship that developed during the evaluation.

The research was coordinated with the United States Army Infantry School which is the proponent agency for M16A1 rifle marksmanship training program development.

ARI research in training systems development is conducted as an inhouse effort augmented by contracts with organizations selected as having unique capabilities for research in the area. The project was conducted as part of ARMY RDTE Project 2Q163743A773, FY 78 Work Program, and RDTE Project 2Q163743A773, FY 79. It was directly responsive to the requirements of FORSCOM, USAIS and TRADOC.

JOSEPH ZEIDNER
Technical Director

BRIEF

Requirement:

To determine the training effectiveness of US Army Marksmanship Unit (AMU) Programs of Instruction (POIs) for the M16A1 rifle and the M1911A1 (.45 Cal) pistol compared with training typically conducted by units during annual weapons qualification exercises.

Procedure:

The rifle and pistol experiments were conducted within the context of unit refresher training in preparation for annual qualification. The USAMU POIs (FULL-AMU and PART-AMU) for the M16A1 rifle and the .45 Cal pistol were compared with the current training/annual qualification (UNIT) conducted by a typical FORSCOM unit. Rifle marksmanship proficiency in all three POIs was evaluated by means of a common criterion measure (Standard Record Fire Qualification). Pistol marksmanship proficiency in all three POIs was evaluated by means of a common criterion measure (Combat Pistol Qualification Course). In addition, soldiers in both the rifle and pistol experiments were administered opinion and attitudinal questionnaires.

Findings:

Performance differences found among the three rifle POIs indicate that either USAMU rifle program would produce significant improvement in Record Qualification (RQ) performance in FORSCOM Units compared with the current training/annual qualification as represented by the UNIT training provided here.

Data pertaining to confidence in marksmanship skills with the M16A1 rifle indicate that FULL-AMU and PART-AMU soldiers were more confident than UNIT soldiers. The questionnaire data indicate a strong pattern of positive attitudes toward the training with the M16A1 rifle provided by the FULL-AMU and PART-AMU programs compared with the UNIT program.

The primary conclusion reached as a result of the evaluation of the USAMU pistol programs is that either the FULL-AMU program or the PART-AMU program would produce a significant improvement in qualification performance for a FORSCOM unit during annual training/qualification.

The FULL-AMU and PART-AMU soldiers indicated a greater degree of confidence in the training received with the .45 Cal pistol than did the UNIT soldiers.

Utilization of Findings:

The findings of this research indicate that implementation of the AMU programs for M16A1 and .45 Cal pistol training in FORSCOM is desirable. Such implementation should provide improvements in unit level performance. These findings are to be incorporated in USAIS training guidance to be disseminated.

FORSCOM/US ARMY MARKSMANSHIP UNIT M16A1 RIFLE AND .45 CAL PISTOL MARKSMANSHIP TRAINING EVALUATION

CONTENTS PAGE

BACKGROUND 1

PURPOSE 2

METHOD 2
RIFLE 2
PISTOL 4
ANALYSES OF DATA 6

RESULTS 6
RIFLE POI EFFECTIVENESS 6
RIFLE QUESTIONNAIRE RESPONSES 11
PISTOL POI EFFECTIVENESS 12
PISTOL QUESTIONNAIRE RESPONSES 16

DISCUSSION AND CONCLUSIONS 17
RIFLE POI EFFECTIVENESS 17
RIFLE QUESTIONNAIRE RESPONSES 18
CONFOUNDED VARIABLES IN THE RIFLE POIs 19
RIFLE POI CONCLUSIONS 19
PISTOL POI EFFECTIVENESS 20
PISTOL QUESTIONNAIRE RESPONSES 21
CONFOUNDED VARIABLES IN THE PISTOL POIs 22
PISTOL POI CONCLUSIONS 23

BIBLIOGRAPHY 24

APPENDICES
APPENDIX A Tables, Rifle Questionnaire Responses 25
APPENDIX B Tables, Pistol Questionnaire Responses 32
APPENDIX C Rifle Marksmanship Attitude Survey 35
APPENDIX D Pistol Marksmanship Attitude Survey 45

FORSCOM/US ARMY MARKSMANSHIP UNIT M16A1 RIFLE AND .45 CAL PISTOL MARKSMANSHIP TRAINING EVALUATION

BACKGROUND

In February of 1978, the U.S. Army Forces Command (FORSCOM) approved the testing of a rifle and pistol marksmanship training program designed for use as both unit familiarization and annual qualification training. The U.S. Army Marksmanship Unit (USAMU) at Fort Benning developed the Program of Instruction (POI) to represent what was considered to be a two-level program to fill needs found in FORSCOM units for marksmanship training. One level, a three-day intensive program for rifle and a 12-hour pistol program was proposed to meet annual qualification requirements. Less intensive, and less time consuming programs for rifle and pistol, respectively, would be considered for use by FORSCOM units undergoing semiannual familiarization training. Military Police personnel would use the abbreviated pistol POI three times each year for familiarization.

The USAMU in the summer of 1978 requested a review of the proposed POI and related experimental design components by the U.S. Army Research Institute for the Behavioral and Social Sciences Field Unit (ARI-Benning). Since ARI-Benning was already committed to research in the area of rifle marksmanship training effectiveness, the establishment of a working relationship with the USAMU was considered mutually beneficial.[1] The POI training elements were selected by the USAMU to provide, in their professional opinion, an optimum amount of performance enhancement with a minimum expenditure of training time. ARI-Benning assisted in designing adequate data collection procedures to measure performance throughout the test. Training and testing were sequenced within and across programs to fit the needs of the participating unit's training schedule and the constraints of range availability.

The experimental test approved by FORSCOM compared the proposed POI in two levels with the current training annual qualification conducted by a typical unit. The 1/504th Infantry was tasked by XVIII Airborne Corps to serve as the participating unit during the POI test. The test was conducted at Ft. Benning, Georgia, beginning on 25 September 1978. The 1/504th Infantry conducted battalion training at Fort Benning and this test was included as part of its total training cycle. The 1/504th

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[1]The authors wish to acknowledge the substantial assistance and professional ability provided by the USAMU Competitive Divisions - Service Rifle and Pistol teams. Special thanks are extended to LTC Paul Davis, CPT Don Tryce, MSG Sam Hunter, MSG Roger Willis, and SFC Bill Sawvell for their untiring efforts and dedicated support provided during all phases of this research project.

conducted rifle and pistol training for a portion of the battalion in a manner similar to its normal procedures to serve as a base against which the USAMU programs could be compared. The USAMU was responsible for all other marksmanship training.

PURPOSE

The purpose was to compare the training effectiveness (e.g., record fire scores) of the USAMU POIs for the M16A1 Rifle and the .45 Cal Pistol with the current training conducted by a typical unit. In addition, the attitudes and opinions of the troops were measured to evaluate the relative acceptability of the several POIs.

METHOD

RIFLE

The Three POIs were tested within the context of unit refresher training in preparation for annual qualification. Table 1 presents the hours of instruction and rounds of ammunition for the three POIs compared. Table 2 provides the organization and description of the FULL-AMU program. The PART-AMU POI differed only in that it did not contain periods 7 and 8. The 1/504th Infantry was responsible for the design and conduct of the UNIT POI.

Table 1

HOURS OF INSTRUCTION AND ROUNDS OF AMMUNITION BY RIFLE POI[a]

SUBJECT	FULL-AMU HRS	FULL-AMU RDS	PART-AMU HRS	PART-AMU RDS	UNIT HRS	UNIT RDS
Preliminary Rifle Instruction	4	0	4	0	2/3	0
Battle Sight Zero	4	18	4	18	2	9
Known Distance Firing	4	19	--	--	--	--
Infantry Trophy Match	4	64[a]	--	--	--	--
Field Fire (Practice)	4	55	4	55	2	30
Record Qualification	4	40	4	40	4	40
TOTALS	24	196	16	113	8 2/3	79

[a]The number of rounds fired by any squad member during this exercise may vary due to the ammunition allocation made by the squad leader.

Table 2

FULL-AMU ORGANIZATION
AND DESCRIPTION [a]

PERIOD	SUBJECT	TYPE OF INSTRUCTION	SCOPE
1	Marksmanship Fundamentals	Lecture and Demonstration	As a result of this instruction, the individual soldier must be able to explain and employ Aiming, eight Steady Hold Factors, and Positions.
2	Positions (Concurrent w/Period 3)	Practical Exercise	As a result of this instruction, the individual soldier must be able to demonstrate successfully the Foxhole and Prone positions.
3	Target Box and Aiming Exercise (Concurrent w/Period 2)	Practical Exericise	As a result of this instruction, the individual soldier must be able to employ the Target Box properly, successfully; demonstrate Foxhole and Prone Positions, and practice Dry Firing.
4	Effects of Weather	Lecture and Demonstration	As a result of this instruction, the individual soldier must be able to compute wind speed, classify wind valve and compute hold-off in inches.
5	Shot Group Analysis	Lecture and Demonstration	As a result of this instruction, the individual soldier must be able to "call his shot", explain the probable cause of an unsatisfactory shot group using shot group analysis.
6	Battle Sight Zero	Practical Exercise (25 meter range)	As a result of this instruction, the individual soldier must be able to Battlesight Zero his or her individual weapon with six three-round shot groups (18 rounds/man).
7	Known Distance Firing	Lecture and Practical Exercise (KD Range 300 Yd)	As a result of this instruction, the individual soldier must be able to confirm battle-sight zero obtained at 25 meters with three three-round shot groups, employ "call your shot" with ten rounds slow fire prone (19 rounds/man).
8	Infantry Trophy Match (Modified)	Lecture and Practical Exercise	As a result of this instruction, the individual soldier must be able to utilize the combat Infantry Team Match (Modified) to train squad members on fire distribution.
9	Field Fire (Practice)	Lecture and Practical Exercise (Field Fire Range)	As a result of this instruction, the individual soldier must be able to engage single and multiple targets on the Field Fire Range (55 rounds/man).
10	Record Qualification	Lecture and Practical Exercise	As a result of this instruction, the individual soldier must be able to engage single and multiple targets on the Record Fire Range (40 rounds/man).

Rifle marksmanship proficiency in all POIs was evaluated by means of a common criterion measure (Standard Record Fire Qualification). A witness panel count procedure (actual bullet hole count) was used to determine hits and misses. The criterion test scores were collected on a Record Fire range where each soldier fired 40 rounds from the foxhole and prone positions at E and F type pop-up silhouette targets. Targets were presented singly and in combination (2 or 3 targets presented simultaneously) at ranges of 50 to 300 meters (FB Form 37, 1 Sep 78). Additional performance measures were taken during Battle Sight Zeroing, Known Distance Firing, and Practice Field Firing.

Opinion and attitudinal data were gathered through the use of questionnaires. These questionnaires were given in bleachers on the range upon completing 25 meter firing, field firing, and record qualification. USAMU personnel were responsible for range operation as well as data collection.

The sample population for the rifle experiment consisted of 274 male troops from the 1/504th Infantry. These troops were randomly assigned by squads to the three POIs.

PISTOL

The three POIs were tested within the context of unit refresher training in preparation for annual qualification. Pistol marksmanship proficiency in all POIs was evaluated by means of a common criterion measure (Combat Pistol Qualification Course, FORSCOM/TRADOC Supplement 1 to AR 350-6). The criterion test scores were collected on a standard record fire range where each soldier fired 45 rounds (15 rounds in each of three tables) at standard combat pistol qualification silhouette targets (See Table 3). Targets were presented at 25 meters from the firing line with the firers engaging from a prescribed sequence of positions at variable time intervals of exposure (FORSCOM/TRADOC Form 189-R, 1 November 1977).

Additional performance measures were gathered during the PART-AMU and FULL-AMU programs during the Position Firing block of instruction. Performance measures were taken in the FULL-AMU POI only during the Dry Fire (DF), Ball and Dummy (BD), and Practice Qualification exercises.

The Dry Fire exercises were included to develop the soldier's ability to cause the pistol hammer to fall without disturbing sight alignment. A pencil in the pistol bore was driven against a paper to record the performance. These data were recorded on DTD Form 36.

The Ball and Dummy exercise was designed to reveal student errors (flinching) when the pistol hammer fell on an empty chamber. The peer coach method was incorporated into the instruction and one AMU instructor was available for every two firing points to record scores on DTD Form 35 and to critique performance.

Position firing was designed to provide practice with all qualification course firing positions. USAMU personnel recorded scores for the 25 live rounds fired on DTD Form 35.

Practice Combat pistol course firing was the criterion course monitored by peers and assistant instructors. The scores for the 45 rounds fired were recorded on DTD Form 34. All exercise firing was conducted on the criterion 25 meter range.

Table 3

HOURS OF INSTRUCTION AND ROUNDS OF AMMUNITION BY PISTOL POI

SUBJECT	FULL-AMU		PART-AMU		UNIT	
	HRS	RDS	HRS	RDS	HRS	RDS
Orientation, Mechanical Training Review, Safety	1	0	1	0	1*	0
Fundamentals I	1	0	1	0	--	--
Fundamentals II	1	0	1	0	--	--
Dry Fire Exercise	1	0	--	--	--	--
Ball and Dummy, Position	1	15	--	--	--	--
Position Firing	1	25	1	25	--	--
Practice Qualification	2	45	--	--	--	--
Qualification	2	45	2	45	2	45
	10	130	6	70	3	45

*Training covered dominant eye theory, Correct firing positions, and sight alignment, using USAMU published text.

An end-of-training questionnaire was used to assess attitudes and opinions. The data were gathered at the range prior to qualification firing. USAMU personnel were responsible for range operation and firing line data collection.

The sample for the pistol experiment consisted of 89 male soldiers (subjects) from the 1/504th Infantry. The sample subjects assigned to the test were randomly assigned to the three POIs.

ANALYSES OF DATA

The prime data for program comparisons were the record fire scores, with questionnaire and other training data furnishing additional information for explanation and understanding of the results.

Data computations were accomplished with the "SPSS", Statistical Package for the Social Sciences (Nie, et. al., 1975), using the subprograms of Oneway Anova, Frequencies, and Regression. An unequal n's analysis of variance (Anova) was employed to test for differences in record fire scores among training programs. Questionnaire answer differences among subject groups were tested using the Median Split Chi Square procedure.

RESULTS

The results are organized into four major sections: Rifle POI Effectiveness, Rifle Questionnaire Responses, Pistol POI Effectiveness, and Pistol Questionnaire Responses.

RIFLE POI EFFECTIVENESS

A one-way analysis of variance showed the differences among average group scores under the three POIs to be statistically significant. Table 4 presents the results of this analysis. The number of soldiers employed in this analysis for each POI are given in Figure 1. Multiple comparisons of treatment means using "SPSS" Modified Least-Significant Difference procedure showed that both the FULL-AMU POI (28 mean hits) and the PART-AMU POI (26 men hits) produced significantly ($p < .05$) higher mean hit performances on Record Qualification Scores than the UNIT POI (23 mean hits). No significant difference in Record Qualification mean hit performance was found between the FULL-AMU and PART-AMU programs. Figure 1 depicts probability of hit (pH) for Record Qualification as a function of range to target for each program (FULL-AMU, PART-AMU, UNIT). Note that both FULL-AMU and PART-AMU programs yielded higher hit probabilities (pH) than UNIT program at all target ranges. In general, mean pH decreased as range to target increased. The only exception to this relationship was for the UNIT POI at ranges of 50 m and 100 m where pH increased from .84 to .85.

TABLE 4

ANALYSIS OF VARIANCE OF RIFLE RECORD FIRE SCORES

SOURCE	df	MS	F
Between POIs	2	519.40	15.20*
Within POIs	271	34.17	
TOTAL	273		

*p<.001

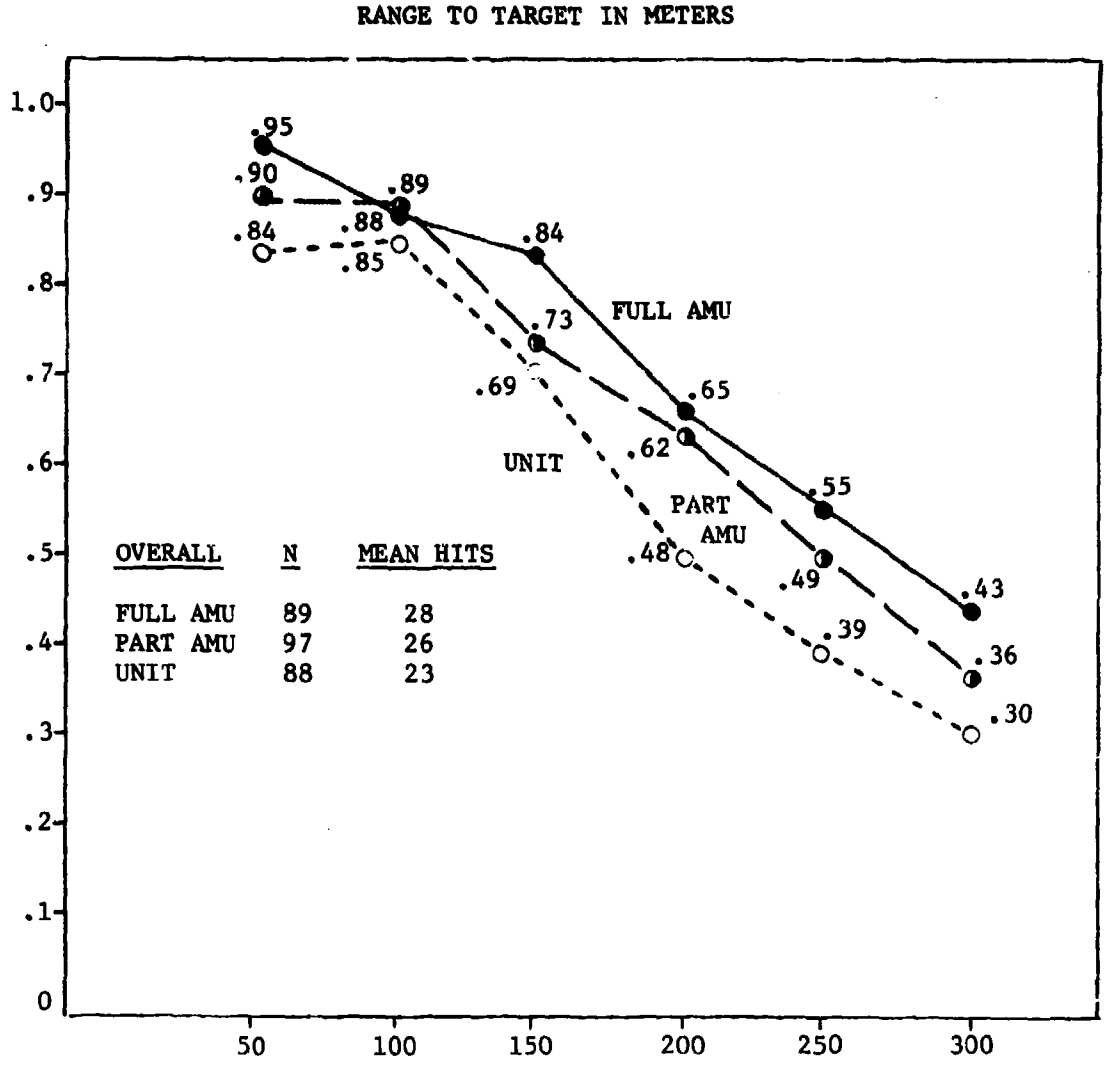

Figure 1. pH for Rifle Record Qualification by Range to target for each POI.

Correlational and regression analyses were used to examine the relative contribution of each training period of the POIs to the Record Fire performance of trained soldiers. Simple correlations of performance for each period (for which data were available) with record fire scores indicate the basic relationship of each period to the qualification score. Multiple regression was then used to examine the sequential contribution of each period to the final qualification score.

Table 5 lists the performance measures taken during preliminary rifle instruction and battle sight zeroing (BSZ) and their relationship with the criterion (Record Qualification Score). The correlations indicate little relationship of these measures to record fire, with the exceptions of total rounds to BSZ, and the sizes of the last shot group and the BSZ shot group. (r= -.19, -.23, and -.14, respectively).

TABLE 5

PRELIMINARY RIFLE INSTRUCTION AND BATTLE SIGHT ZERO FIRING BY POI[a]
(CORRELATIONS ARE WITH RECORD QUALIFICATION)

PERFORMANCE MEASURE	FULL-AMU POI			PART-AMU POI		
	r	Mean	SD	r	Mean	SD
Total Rounds to Battle Sight Zero	-.19	12.8	5.5	-.15	9.5	5.3
Size (mm) 1st Shot Group	-.06	29.8	16.2	-.14	26.5	18.7
Size (mm) Last Shot Group	-.23	27.9	16.1	-.39	25.8	17.8
Size (mm) BSZ Shot Group	-.14	24.2	10.4	-.25	19.3	11.2
Quality of BSZ (mm) (Distance from center BSZ Shot Group to Center of X on target)	.02	11.8	5.9	-.14	11.1	4.8
Attended Remedial Training (Yes= 1, No= 2)	.05	1.8	0.4	.18	1.8	0.4

[a]Measures of performance were not useable for the UNIT POI.

A description of the performance measures taken during Known Distance (KD) firing and Field Firing (FF) is presented in Table 6. The KD correlations indicate only the 2d Shot group size (r= -.35) and the Slow Fire Score (r= .30) are importantly related to record fire. Field Fire is also highly related to record fire performance for both AMU POIs.

Table 6

KNOWN DISTANCE AND FIELD FIRE BY AMU POI[a]
(CORRELATIONS ARE WITH RECORD QUALIFICATION)

PERFORMANCE MEASURE	FULL-AMU POI			PART-AMU POI		
	r	MEAN	SD	r	MEAN	SD
SIZE (cm) 1st Shot Group Known Distance (KD)	.01	47.1	26.3	---	---	---
Size (cm) 2d Shot Group KD	-.35	36.2	25.2	---	---	---
Size (cm) 3d Shot Group KD	-.14	34.8	24.3	---	---	---
Slow-Fire Score KD (0-60) total 10 Shots	.30	35.0	8.1	---	---	---
Attended Remedial KD (Yes=1, No=2)	.04	1.9	0.2	---	---	---
Field Fire (FF) Hit Rate	.41	29.6	4.1	.64	29.0	5.1
Attended Remedial FF (Yes=1, No=2)	.12	1.9	0.1	.19	1.8	0.4

[a]Measures of performance were not useable for the UNIT POI.

Regression analysis was used to evaluate the relative degree of relationship of performance within each training period to record fire performance as the overall criterion. The regression analysis is aimed at explanation rather than prediction. A hierarchical regression procedure was used. The periods of training were entered in their order of occurrence and the change in R^2 (proportion of variance in Record Qualification scores) associated with the period of training was assessed. This regression method (which adjusts for the contribution of prior periods of training) provides a way of evaluating the unique contribution of each period of training to total criterion score (Record Qualification performance-mean hit rate). For evaluation purposes training variables are treated separately or as grouped classes of variables.

Table 7 presents the results of this hierarchical regression analysis, for both the FULL-AMU and PART-AMU POIs. Preliminary Rifle Instruction-BSZ (PRI-BSZ) was found to account for approximately 10% of the variance in criterion performance under the FULL-AMU POI and for about 20% of the variance under the PART-AMU POI. (Variance accounted for by a given variable is indicated by the "Change in R^2" indicated in the table for that variable.) When KD is added to the prediction model for the FULL-AMU group an additional 17% of criterion variance is accountable. Finally, when FF is considered, this training period adds an increment of 7% accountability to the FULL-AMU regression and a 32% increment to the accountability for the PART-AMU POI training group. These yield overall prediction/accountability of 34% of the variance in the FULL-AMU Record Qualification scores and 54% of the variance in the PART-AMU Qualification scores.

Table 7

REGRESSION OF TRAINING PERFORMANCE ON RECORD QUALIFICATION FOR AMU RIFLE POIs[a]

TYPE OF TRAINING	FULL-AMU POI N = 97			PART-AMU POI N = 89		
	Multiple R	R^2	Change in R^2	Multiple R	R^2	Change in R^2
Preliminary Rifle Instruction and BSZ	.32	.10	.10	.45	.20	.20
Known Distance Firing	.52	.27	.17	--	--	--
Field Firing	.58	.34	.07	.72	.52	.32

[a]Training measures of performance were not useable for the UNIT POI.

RIFLE QUESTIONNAIRE RESPONSES

Tables presenting the percentage of respondents choosing each alternative for each item in the rifle questionnaire are located in Appendix A.

Four questions pertained to various aspects of confidence in marksmanship skills; two questions were repeated during the course of training.

At the end of preliminary rifle instruction (PRI) and battle sight zero (BSZ), soldiers trained under the FULL-AMU and PART-AMU programs reported more certainty that their rifle was zeroed than did soldiers trained in the UNIT program ($\chi^2 = 32.11$, df = 2, $p<.01$). Only 23% of UNIT trained soldiers were "extremely sure" their rifle was zeroed as compared with about 60% of AMU trained soldiers. After Field Fire (FF) training and Record Qualification (RQ), both AMU training groups still showed greater confidence in the rifle zero than UNIT trained soldiers (FF: $\chi^2 = 27.8$, df = 2, $p<.01$, and, RQ: $\chi^2 = 17.24$, df = 2, $p<.01$).

Soldiers in the AMU programs were also more confident in their ability to hit targets out to 300 meters than were UNIT trained soldiers after PRI and BSZ ($\chi^2 = 9.86$, df = 2, $p<.01$). After FF and RQ, soldiers in the AMU training programs still reported greater confidence of ability to hit to 300 meters than did the UNIT trained soldiers (FF: $\chi^2 = 17.61$, df = 2, $p<.01$, and, RQ: $\chi^2 = 9.86$, df = 2, $p<.01$).

After RQ all soldiers were asked whether they fired better or worse than they had expected. Soldiers from both AMU groups more frequently responded that they had fired "far better" than expected compared with UNIT trained soldiers ($\chi^2 = 25.99$, df = 2, $p<.01$). However, there was no significant difference among the groups in their reported confidence in their ability to use the M16A1 effectively.

The data indicate a strong pattern of more positive attitudes toward training on the part of soldiers trained under the FULL-AMU and PART-AMU programs as compared with those of soldiers trained with the UNIT program. Soldiers in the FULL-AMU and PART-AMU POIs were more pleased with their training than UNIT trained soldiers ($\chi^2 = 27.07$, df = 2, $p<.01$). Soldier responses about how much they liked firing the M16A1 did not differ significantly across programs. AMU trained soldiers rated instructions given in conduct of training higher in ease of understanding than did UNIT trained soldiers ($\chi^2 = 28.89$, df = 2, $p<.01$). Also, a greater percentage of AMU trained soldiers perceived their instructors as having "a great deal" of knowledge and skill compared with UNIT trained soldiers ($\chi^2 = 96.33$, df = 2, $p<.01$). Finally, a greater percentage of soldiers trained in the FULL-AMU and PART-AMU POIs rated the use of training aids as "extremely effective" as compared with ratings of UNIT trained soldiers ($\chi^2 = 37.5$, df = 2, $p<.01$).

PISTOL POI EFFECTIVENESS

The criteria used in evaluating pistol POI effectiveness were: 1) total number of silhouette hits and 2) total points earned, based on the value of each hit (10 or less). Current standards require 30 hits out of 45 possible hits to qualify. Higher levels of qualification are based on point scores with 300 points for sharpshooter and 350 points for expart required out of a possible 450 points (FM 23-35).

On the record qualification course soldiers in the FULL-AMU training program averaged 34 target hits and 281 total points. While soldiers in the PART-AMU program averaged 31 hits and 252 points, and those who received UNIT training achieved only 26 hits and 206 points. These differences in target mean hit performance of the three groups were found to be statistically significant by a one-way analysis of variance as shown in Table 8.

Table 8

ANALYSIS OF VARIANCE OF PISTOL RECORD FIRE MEAN HITS

SOURCE	df	MS	F
Between POIs	2	597.82	8.1099*
Within POIs	86	73.71	
Total	88		

*$p<.001$

Multiple comparisons of treatment means using Modified Least-Significant Difference procedure showed that both AMU programs produced significantly ($p<.05$) higher mean hit performance than the UNIT program. No statistically significant difference was found to exist between the FULL-AMU and PART-AMU programs.

Analysis of variance of point score totals also shows a significant difference across POIs (Table 9). Multiple comparisons showed that the FULL-AMU POI produced a significantly ($p<.05$) higher average score

performance on the Combat Pistol Qualification course than the UNIT POI. No significant difference in mean point scores was found between the FULL-AMU POI and the PART-AMU POI or between the PART-AMU POI and the UNIT POI.

Table 9

ANALYSIS OF VARIANCE OF PISTOL RECORD FIRE POINT SCORES

SOURCE	df	MS	F
Between POIs	2	44318.03	7.7476*
Within POIs	86	5720.26	
Total	88		

*$p < .001$

Correlational and regression analyses were used to examine the relative contribution of each training period in the POIs to the record fire performance of trained soldiers. Simple correlations of performance for each period (for which data were available) with record fire performance indicate the basic relationship of each period to qualification scores. These are discussed individually below. Multiple regression was then used to examine the sequential contribution of each period to the final qualification score.

The FULL-AMU program provided two (2) hours of practical exercise in marksmanship fundamentals, which included a total of 15 rounds of live ammunition expended during the second hour. The first hour (Dry Fire) consisted of ten 3-round dry fire shot groups from the standing position, using a pencil in the pistol barrel driven forward by the hammer to produce a mark on a scorecard (DTD Form 36). Each shot group was measured, in millimeters, on the subjects' scorecards by data collectors and the mean of the ten shot groups was used as a performance measure. As shown in Table 10 those whose shot groups were smaller tended to fire better in qualification ($r = -.20$).

Table 10

MARKSMANSHIP FUNDAMENTALS FOR FULL-AMU POI
(CORRELATIONS ARE WITH RECORD QUALIFICATION)

PERFORMANCE MEASURE	r	Mean	SD
Dry Fire 10 Shot Groups	-.20	3.77	.98
Ball & Dummy	-.40	282.38	89.34

The Ball and Dummy exercise consisted of 15 live rounds fired by each soldier with a live or dummy round being loaded by a peer coach for each shot taken. There was no specific restriction to sequencing and numbering the live and dummy rounds. An overall time restriction for the exercise was imposed. The size of each five round shot groups was measured and recorded in millimeters on DTD Form 35. The mean of the three measures was used to identify its contribution to qualification performance. Again, the smaller the shot groups fired, the higher the firer's criterion performance was likely to be ($r = -.40$) (Table 10).

Position firing was designed to expose the soldiers of both the FULL-AMU and PART-AMU programs to the firing positions used during the Combat Pistol Qualification Course. Five live rounds were fired from each of the prone, kneeling, crouch, standing (duel), and standing (military rapid fire) positions. A description of the performance measures, position firing and practice record fire and their relationship with the criterion (Record Qualification Hit) is presented in Table 11.

Table 11

POSITION AND PRACTICE RECORD FIRING FOR AMU POIs
(CORRELATIONS ARE WITH RECORD QUALIFICATION)

PERFORMANCE MEASURE	FULL-AMU POI			PART-AMU POI		
	r	Mean	SD	r	Mean	SD
Position Firing	.38	16.89	4.84	.68	15.18	5.82
Practice Record Fire	.72	34.14	6.97	--	--	--

The FULL-AMU program soldiers were given a practice record fire on the criterion course prior to qualification for record. The order, timing and sequencing of target exposures were identical to the qualification course which followed immediately. The simple correlation for this performance is shown in Table 11 also, as seen, the $\underline{r}$ = .72, indicating a high degree of correlation.

Table 12

REGRESSION OF TRAINING PERFORMANCE ON RECORD QUALIFICATION MEAN HITS FOR AMU PISTOL POIs

TYPE OF TRAINING	FULL-AMU POI $\underline{N}$ = 28			PART-AMU POI $\underline{N}$ = 28		
	Multiple R	R^2	Change in R^2	Multiple R	R^2	Change in R^2
Dry Fire	.20	.04	.04	--	--	--
Ball & Dummy	.40	.16	.12	--	--	--
Position Fire (Hits)	.46	.22	.06	.68	.46	.46
Practice Qualification (Hits)	.73	.54	.32	--	--	--

As shown in Table 12 (by the "Change in R^2"), Dry Fire accounted for only 4% of the variance in the record fire mean hits for the FULL-AMU soldiers. Similarly, the Ball and Dummy exercise performance accounted for only an additional 12% of the variance. Adding the Position Fire as a predictor for FULL-AMU record fire performance accounted for an additional 6% of the variance. However, for the PART-AMU group, performance during this exercise accounted for 46% of the variance in final scores. This is partially because for this training POI there were no prior performance scores to regress on record fire. Therefore, this performance score actually represents the accumulated training of all periods up to and including the Position Fire. Finally, in the FULL-AMU model, Practice Record Fire accounts for 32% of the variance in qualification hits. This yields an overall, cumulative, prediction of 54% of the qualification variance by all the training periods in the FULL-AMU program and 46% in the PART-AMU program.

It should be noted that the Practice Record Fire performance and the Qualification Record Fire produced essentially the same performance (34 mean hits) and were highly similar for most soldiers (r = .72, from Table 11).

PISTOL QUESTIONNAIRE RESPONSES

An 18 item questionnaire was completed by all test soldiers after all training was completed. The questionnaire was administered by AMU personnel before qualification firing. Tables presenting the relative frequency percent of responses for the pistol questionnaire are located in Appendix B. Questionnaire contents together with mean responses by program are presented in Appendix D.

Inspection of the post-training questionnaire reveals an expressed confidence in the ability to use the .45 cal pistol effectively. Soldiers trained with the FULL-AMU POI had the highest level of confidence (extremely or very confident 86% as compared to 68% of PART-AMU trained soldiers and only 54% of UNIT trained soldiers). The FULL-AMU soldiers' modal response was much more than enough practice. The PART-AMU soldiers' modal response was about right (amount of practice) and the UNIT soldiers' modal response indicated a need for much more practice.

When asked about expected performance the FULL-AMU POI soldiers' modal response indicated far better firing results than expected. The PART-AMU soldiers fired a bit better than expected and the UNIT POI soldiers responded So-So to the question, with a large spread in responses. These differences were not statistically significant partly due to bimodal responses by the FULL-AMU trained soldiers.

Both the FULL-AMU and PART-AMU soldiers' answers about the training POI in general reflect the positive influence of the Army Marksmanship Unit curriculum. The instruction, in general, was considered good by both FULL-AMU and PART-AMU soldiers. The UNIT soldiers' reactions were to a classroom presentation made by a unit NCO prior to qualification firing.

The FULL-AMU and PART-AMU program soldiers were more pleased with training than the UNIT soldiers. The majorities of both the FULL-AMU and the PART-AMU soldiers responded that they were very pleased, or quite pleased, with training compared with UNIT soldiers.

All groups felt that the qualification training helped their shooting and they all liked firing the .45 cal pistol. The FULL-AMU and PART-AMU soldiers recognized that the instructors seemed to have a great deal of skill and knowledge. The UNIT POI soldiers responded with the majority feeling the same way about the NCO tasked to present a two-hour block of instruction prior to qualification firing.

All groups found the instruction during training fairly easy to understand. And, finally, there were significant differences (χ^2 = 21.08, df = 2. $p<.04$) in soldiers' responses across programs for the question addressing the effectiveness of training aids used in the UNIT program.

DISCUSSION AND CONCLUSIONS

RIFLE POI EFFECTIVENESS

The primary purpose of the rifle experiment was to evaluate two POIs developed by the US Army Marksmanship Unit against the current training/annual qualification conducted by a typical FORSCOM unit. A comparison of the mean hit performances on Record Qualification indicate that both FULL-AMU and PART-AMU trained soldiers were superior to UNIT soldiers. The differences in mean hit performances on RQ achieved with the FULL-AMU POI and PART-AMU POI are of sufficient magnitude to provide considerable support for either POI as compared with the UNIT POI (see Figure 1). However, an important question is whether the somewhat higher mean hit performance achieved by the FULL-AMU POI compared with the PART-AMU POI is sufficient compensation for the additional hours of instruction and rounds of ammunition expended (see Table 1). The issue of POI effectiveness requires a closer examination of the performance measures collected during the conduct of the FULL-AMU and PART-AMU programs.

The FULL-AMU and the PART-AMU programs did not differ with respect to the content of Preliminary Rifle Instruction and Battle Sight Zero training. However, performance data indicate that PART-AMU soldiers fired smaller shot groups and achieved BSZ in fewer rounds compared to FULL-AMU soldiers (see Table 5). Also, more variance in Record Qualification scores was accounted for (six performance measures collectively) by the PART-AMU regression model (see Table 6). This discrepancy may be explained by the sequence of training for these two POIs; the PART-AMU soldiers received instruction in PRI and BSZ subsequent to the FULL-AMU soldiers. These findings suggest that, in their second run through of the training, the USAMU instructors may have improved and thus provided better quality instruction to the PART-AMU soldiers. This is also supported by the .52 (PART-AMU) vs. .34 (FULL-AMU) R^2 change difference (see Table 7). This difference in final R^2 could also have resulted if the PART-AMU trained soldiers were better performers entering the training program. This explanation, however, is not supported by overall final record fire performance (FULL-AMU 28 mean hits and PART-AMU 26 mean hits). In any event, the importance of PRI and BSZ is substantiated by the amount of variance accounted for in RQ scores, regardless of POI.

One of the underlying principles of learning is that meaningful knowledge of results must be provided in order for learning to take place. In rifle marksmanship, this means that soldiers must be given the knowledge of where their rounds hit or miss the target. It is felt that down-range

feedback will help the soldier correct errors in marksmanship fundamentals (aiming point, sight alignment, effects of wind, trigger squeeze, etc.) and help the soldier refine the rifle BSZ (Smith et al., 1980). The FULL-AMU program provided only a modest amount of this kind of instruction, utilizing a Known Distance range at a distance of 300 yards. The results indicate KD made a sizeable contribution to firing proficiency (17% of variance). The entry of Field Fire accounted for little additional variance in RQ scores when added to the FULL-AMU model. In the PART-AMU model (with KD training omitted) FF made a major contribution (32%) to performance. The pattern of results suggests that KD training as well as FF training are of primary importance in accounting for the level of RQ scores.

In summarizing the basic difference between the FULL-AMU and PART-AMU programs, the FULL-AMU POI was designed to provide soldiers with a minimal amount of experience with down-range feedback on a KD range. This emphasis in a POI provides the soldier with an extension of PRI and BSZ training. The PART-AMU program, on the other hand, was not designed to provide this kind of experience with the rifle. This, taken together with the higher record fire performance (28 vs. 26 hits), leads to the conclusion that the FULL-AMU POI provided better mastery of the knowledge and skills required for effective use of the M16A1 rifle.

RIFLE QUESTIONNAIRE RESPONSES

Data pertaining to confidence in marksmanship skills indicate that FULL-AMU and PART-AMU soldiers were more confident than UNIT soldiers. Soldiers from each of the POIs were asked how sure they were that their rifle was zeroed. The statistical comparisons among the three POIs yielded significant differences. Regardless of the phase of training, more than half of the FULL-AMU and PART-AMU soldiers reported that they were "extremely sure" that their rifle was zeroed. The UNIT soldiers were notably less confident. In another item relevant to confidence in marksmanship skills, soldiers in each of the POIs were asked, "how sure are you that you can hit targets out to 300 meters with your M16A1 rifle?" The statistical comparisons revealed that FULL-AMU and PART-AMU soldiers expressed significantly more confidence in their ability to hit targets out to 300 meters as compared with UNIT soldiers. The results on confidence in marksmanship skills indicate that there is considerable contrast between the FULL-AMU and PART-AMU soldiers compared with the UNIT soldiers. Therefore, we conclude that either the FULL-AMU or PART-AMU POIs would be more useful in building and maintaining confidence in marksmanship skills as compared with current training/annual qualification (UNIT POI).

Upon completion of RQ, soldiers were asked a number of questions concerning general reactions to rifle marksmanship training. There were statistically significant differences in responses across POIs for four out of the five questionnaire items. The data reveal that soldiers in the FULL-AMU and PART-AMU POIs were more pleased with their training than UNIT soldiers. Soldiers in the FULL-AMU and PART-AMU POIs rated instruction given during the conduct of training as more easily understood than UNIT soldiers. A greater percentage of soldiers in the FULL-AMU and PART-AMU programs perceived their instructors as having "a great deal" of knowledge and skill compared with UNIT soldiers. Finally, a greater percentage of FULL-AMU and PART-AMU soldiers rated the use of training aids used to teach marksmanship skills as "extremely effective" than UNIT soldiers. These reactions concerning instructional effectiveness provide still further support for the AMU-POIs compared with the UNIT POI.

CONFOUNDED VARIABLES IN THE RIFLE POIs

Table 1 summarizes features of the three POIs. It should be noted that, in terms of hours of instruction and rounds of ammunition the three POIs differed markedly. The three POIs also differed in content of instruction. For example, the FULL-AMU soldiers were the only group that received down-range feedback on the Known Distance (KD) course and participated in the modified Infantry Trophy Match. Further, the quality of instruction differed for each of the programs. USAMU was responsible for the conduct of only the FULL-AMU and PART-AMU programs but not the UNIT program. The effects of these factors (hours of instruction, rounds of ammunition, down-range feedback, and quality of instruction) on RQ performance are confounded in this experiment and cannot be individually examined. Probably all these factors are influential in accounting for RQ performance differences. In further research these factors should be systematically controlled and/or manipulated as independent variables in a multi-factor design.

RIFLE POI CONCLUSIONS

The overall conclusion from this experimental comparison of the three rifle POIs is that providing FORSCOM soldiers with either USAMU rifle program would produce significant improvement in RQ performance compared with the current training/annual qualification. Army Research Institute (ARI) Fort Benning Field Unit is presently engaged in rifle marksmanship research relevant to the areas of down-range feedback and quality of instruction. The results of this and other ARI research should provide still further improvements in rifle marksmanship at FORSCOM unit level.

PISTOL POI EFFECTIVENESS

The purpose of the pistol training experiment was to evaluate two USAMU developed programs against a typical unit annual qualification program. Pistol training is typically given very little command emphasis and little user interest. In this sense the level of involvement shown by the 1/504th Infantry (UNIT) qualification program was probably typical. The performance by this group met the expectations of USAMU data collectors monitoring range activities. Of the 33 soldiers in the UNIT group, only 10 qualified (30%). In comparison, of the 28 PART-AMU soldiers, 19 qualified (68%) and of the 28 FULL-AMU soldiers, 24 qualified (86%). A criterion calling for fully qualified .45 Cal pistol marksmen would support the use of the FULL-AMU program over the PART-AMU program or the UNIT program. The experiment did not determine what additional or different training would be required to achieve total qualification (100% of the subjects) or whether this objective was truly feasible.

The FULL-AMU Program was ten hours of instruction which included two hours of practice for qualification on the Combat Pistol Qualification Course (see Table 3). The PART-AMU POI was six hours long including the Combat Pistol Qualification Course but lacked some of the FULL-AMU program's practical exercise. Both programs provided an intensive classroom presentation of pistol firing fundamentals as well as a one hour practical exercise to familiarize the shooters with the qualification course firing positions. A total of 25 rounds of service ammunition was expended by each soldier during this period (FULL-AMU and PART-AMU). This practical exercise contributed more to the final qualification performance for the PART-AMU soldiers than it did for the FULL-AMU POI soldiers (see Table 12). This finding is accounted for in part by the fact that no other performance measures were taken for the PART-AMU program soldiers prior to the firing of the Combat pistol Qualification Course. The FULL-AMU POI subjects had a one hour dry fire exercise and a one hour ball and dummy exercise during which 15 rounds of service ammunition was expended by each soldier, to detect flinching, prior to the position firing exercise.

Performance in terms of target hits during position firing presents a different view of this exercise (see Table 11). The mean number of target hits for the PART-AMU POI was 15.18 while the FULL-AMU POI mean was 16.89, or nearly 2 additional target hits during the same exercise. The point score, or value, of the average shot for the exercise was identical for both groups (8.12 per shot). The FULL-AMU program scored better because of the additional hits (FULL-AMU POI 137.07, PART-AMU POI 123.25). This performance difference in favor of the FULL-AMU program can reasonably be attributed to the two additional hours of practical exercises received and the 15 rounds of service ammunition fired.

A portion of the recorded contribution made by position firing to the PART-AMU program may have been the result of the USAMU instructors' interest. This was the only practical exercise conducted prior to the Combat Pistol Qualification Course in the PART-AMU POI. A more intense effort to influence soldier performance could have been made during this period since it was the only opportunity for one-on-one instruction and coaching. The FULL-AMU POI included coaching during practice record fire, position firing, dry firing, and ball and dummy exercises. These included a total of five hours of exercises.

The practice record fire exercise, which was the full Combat Pistol Qualification Course with 45 rounds of ammunition expended by each soldier, produced a target hit mean of 34.14 (SD = 6.97). This was the FULL-AMU POI's greatest contributing block to the final performance during record fire (see Table 11). Performance on the record Combat Pistol Qualification Course produced a 34.32 mean hit performance for the FULL-AMU POI (SD = 6.99). The practice record fire scores for the FULL-AMU program showed that 23 soldiers, or 82% had reached qualification minimums before record fire and the final qualification produced 86% qualification. It is possible that the small recorded improvement in performance from practice record fire to qualification is not worth 2 additional hours of training and 45 rounds of ammunition per man. An acceptance of a reduction in practice may, however, have a negative effect. The soldiers knew that the practice did not count for record and therefore did not necessarily feel the emotional pressure to perform that would be present during qualification. The practice may have provided positive feedback for record fire performance. Final performance on the Combat Pistol Qualification Course reflected the amount of practice conducted by each program.

PISTOL QUESTIONNAIRE RESPONSES

The FULL-AMU and PART-AMU soldiers indicated a greater degree of confidence in the training received than did the UNIT soldiers. The PART-AMU and UNIT soldiers did not differ greatly in their confidence in the effective use of the .45 CAL pistol. The PART-AMU soldiers had only a one hour (25 round) practical exercise in which to determine performance differences. This limited practice by the PART-AMU soldiers was not sufficient to increase confidence.

When asked to compare actual performance to expectations both the FULL-AMU and the PART-AMU soldiers responded positively. The UNIT soldiers showed 36% responding to the "bit better" to "far better" choices based on past experiences (FULL-AMU 60%, PART-AMU 61%). Overall, the FULL-AMU and PART-AMU soldiers exceeded their expectations in practice (Table 12, Appendix B). The questionnaire was administered prior to the CPQC and performance expectations reflect experiences preceding record fire.

There were statistically significant differences amoung groups for the question addressing sufficient practice ($\chi^2 = 37.78$, $df = 2$, $p < .01$). The FULL-AMU soldiers (89%) had enough or more than enough practice, as did the PART-AMU soldiers (54%). The UNIT soldiers felt that they had not had enough practice. They felt that they needed more or much more practice (85%).

The general reactions section of the post-training questionnaire addresses the influence of USAMU instruction. Training aids and well prepared and operated range facilities can be provided by field units. Whether field units can conduct the FULL-AMU POI with as much success as the USAMU is uncertain. The FULL-AMU and PART-AMU soldiers responded with confidence toward their training. It is difficult to separate the effects of the programs from the effects of the instructors conducting the training. The influence on training outcomes made by the instructors is unknown. An important consideration is the instructor to student ratio on the firing line for all live fire exercises as well as the individual instructor's abilities to develop peer coach relationships during training. The FULL-AMU POI and the PART-AMU POI had 28 soldiers each. A principal instructor and 6 assistant instructors were on the firing line for live fire periods. Only one half of each program's soldiers were on line at one time yielding a 1 to 2 instructor/student ratio. In addition, the non-firing students were used as peer coaches, particularly during the FULL-AMU ball and dummy exercise. This provided assistance to each instructor. The UNIT soldiers had only the USAMU tower operator and two safety personnel on line while 33 soldiers fired the Combat Pistol Qualification Course. This situation had impact on training comparisons and subsequent performance outcomes and must be considered when reviewing program performances.

CONFOUNDED VARIABLES IN THE PISTOL POIs

Table 3 summarizes the three POIs. They differed greatly in hours of instruction and ammunition expended. The UNIT program was limited to a safety and fundamentals briefing (1 hr) followed by the Combat Pistol Qualification Course (CPQC). The PART-AMU program had a more extensive class (4 hrs) on fundamentals and a 25 round practical exercise preceding record fire (CPQC). The FULL-AMU program had, in addition, a dry fire exercise and a 45 round practice qualification preceding record fire (CPQC). The USAMU conducted all instruction (AMU POIs) and operated the range for qualification (all POIs). The UNIT program, conducted by the 1/504th Infantry, was considered typical of annual training/qualification firing that could be expected from a FORSCOM unit. The impact of USAMU instructor personnel remains a contributing factor that is difficult to fully assess. The effects of these factors (hours of instruction, rounds of ammunition, and quality of instruction) on the CPQC performance are confounded in this experiment and can not be individually examined. Therefore, in further research these should be systematically controlled and/or manipulated as critical independent variables in a multi-factor design.

PISTOL POI CONCLUSIONS

The primary conclusion reached as a result of the evaluation of the USAMU pistol programs is that either the FULL-AMU program or the PART-AMU program would produce a significant improvement in qualification performance compared with the current training/annual qualification.

The programs of instruction prepared by the USAMU should be detailed enough to allow a using FORSCOM unit to train and provide qualified instructors for program presentation. The amount of training time and resources spent using the programs yield significant results in the form of qualified and confident personnel.

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APPENDIX A

Table A-1

PERCENT OF RESPONSES TO:
"How sure are you that your rifle is zeroed?"
AFTER PRELIMINARY RIFLE INSTRUCTION (PRI)
AND BATTLE SIGHT ZERO (BSZ) BY POI

RESPONSE SCALE	FULL-AMU POI	PART-AMU POI	UNIT POI
Extremely Sure	61	59	23
Very Sure	25	27	50
Fairly Sure	9	8	18
So-So	3	2	6
Fairly Unsure	1	0	1
Very Unsure	0	0	2
Extremely Unsure	1	4	0

$\chi^2 = 32.11$, df = 2, $p<.01$

Table A-2

PERCENT OF RESPONSES TO:
"How sure are you that your rifle is zeroed?"
AFTER FIELD FIRE (FF) AND RECORD FIRE (RF) BY POI

RESPONSE SCALE	FULL-AMU POI		PART-AMU POI		UNIT POI	
	FF	RF	FF	RF	FF	RF
Extremely Sure	65	53	67	57	33	29
Very Sure	28	37	26	28	47	38
Fairly Sure	6	7	6	9	10	19
So-So	1	2	1	2	7	9
Fairly Unsure	0	1	0	1	1	3
Very Unsure	0	0	0	0	1	0
Extremely Unsure	0	0	0	3	1	2

$\chi^2 = 17.24$, df = 2, $p<.01$

Table A-3

PERCENT OF RESPONSES TO:
"How sure are you that you can hit targets out to 300 meters with your M16A1 rifle?"
AFTER PRELIMINARY RIFLE INSTRUCTION AND BATTLE SIGHT ZERO BY POI

RESPONSE SCALE	FULL-AMU POI	PART-AMU POI	UNIT POI
Extremely Sure to hit	46	43	24
Very Sure to hit	39	34	30
Fairly Sure to hit	11	14	33
Might hit or Miss	4	6	11
Fairly Sure to Miss	0	0	2
Very Sure to Miss	0	0	0
Extremely sure to Miss	0	3	0

$\chi^2 = 9.86$, df = 2, $p<.01$

Table A-4

PERCENT OF RESPONSES TO:
"How sure are you that you can hit targets out to 300 meters with your M16A1 rifle?"
AFTER FIELD FIRE (FF) AND AFTER RECORD QUALIFICATION (RQ) BY POI

RESPONSE SCALE	FULL-AMU POI		PART-AMU POI		UNIT POI	
	FF	RF	FF	RF	FF	RF
Extremely Sure to hit	53	43	50	41	25	23
Very sure to hit	29	40	30	33	37	29
Fairly Sure to hit	13	10	16	11	20	26
Might hit or Miss	4	7	4	11	13	13
Fairly Sure to Miss	0	0	0	0	1	4
Very Sure to Miss	1	0	0	3	1	1
Extremely Sure to Miss	0	0	0	1	3	4

$\chi^2 = 9.86$, df = 2, $p<.01$

Table A-5

PERCENT OF RESPONSES TO:
"Did you fire better or worse than you expected, as a result of this training?"
AFTER RECORD QUALIFICATION BY POI

RESPONSE SCALE	FULL-AMU POI	PART-AMU POI	UNIT POI
Far Better	28	32	8
A Bit Better	31	30	20
So-so	16	14	28
A Bit Worse	16	14	20
Far Worse	9	10	24

$\chi^2 = 25.99$, df = 2, $p<.01$

Table A-6

PERCENT OF RESPONSES TO:
"How confident are you that you can use your M16A1 effectively?"
AFTER RECORD QUALIFICATION BY POI

RESPONSE SCALE	FULL-AMU POI*	PART-AMU POI	UNIT POI
Extremely Confident	50	51	41
Very Confident	41	35	44
So-So	4	11	10
Not Very Confident	0	1	5
Lack Confidence Completely	0	2	0

$\chi^2 = 3.35$, df = 2, $p<.20$

*5% of the questionnaire respondents failed to answer this question.

Table A-7

PERCENT OF RESPONSES TO:
"Generally, how pleased were you with the requalification training?"
AFTER RECORD QUALIFICATION BY POI

RESPONSE SCALE	FULL-AMU POI	PART-AMU POI	UNIT POI
Very Pleased	43	60	22
Quite Pleased	37	20	13
Somewhat Pleased	12	8	27
So-So	3	5	15
Somewhat Displeased	2	3	11
Quite Displeased	1	1	4
Very Displeased	2	3	8

$\chi^2 = 27.07$, df = 2, $p<.01$

Table A-8

PERCENT OF RESPONSES TO:
"How much do you like firing the M16A1 rifle?"
AFTER RECORD QUALIFICATION BY POI

RESPONSE SCALE	FULL-AMU POI	PART-AMU POI	UNIT POI
Like Extremely	48	44	32
Like Very Much	24	24	23
Like	7	14	19
So-So	12	13	17
Dislike	2	2	3
Dislike very much	2	0	1
Dislike extremely	5	3	5

$\chi^2 = 5.80$, df = 2, $p<.10$

Table A-9

PERCENT OF RESPONSES TO:
"How easy or hard was it to understand the instructions during training?"
AFTER RECORD QUALIFICATION BY POI

RESPONSE SCALE	FULL-AMU POI	PART-AMU POI	UNIT POI
Extremely Easy	52	69	30
Very Easy	39	25	35
Easy	7	3	23
So-So	1	3	11
Hard	1	0	1
Very Hard	0	0	0
Extremely Hard	0	0	0

$\chi^2 = 28.89$, df = 2, $p<.01$

Table A-10

PERCENT OF RESPONSES TO:
"How much knowledge/skill did your Instructor seem to have during your training?"
AFTER RECORD QUALIFICATION BY POI

RESPONSE SCALE	FULL-AMU POI	PART-AMU POI	UNIT POI
A Great Deal	75	92	24
Quite a Bit	23	6	55
Some But Not Much	2	2	19
Very Little	0	0	1
Hardly Any	0	0	1

$\chi^2 = 96.33$, df = 2, $p<.01$

Table A-11

PERCENT OF RESPONSES TO:
"How effective were the training aids used to teach marksmanship skills for the M16A1 rifle?"
AFTER RECORD QUALIFICATION BY POI

RESPONSE SCALE	FULL-AMU POI	PART-AMU POI	UNIT POI
Extremely Effective	47	61	17
Very Effective	43	31	21
Fairly Effective	3	5	31
So-So	5	3	24
Fairly Effective	2	0	1
Very Ineffective	0	0	0
Extremely Ineffective	0	0	6

$\chi^2 = 37.50$, df = 2, $p<.01$

APPENDIX B

Table B-1

PERCENT OF RESPONSES TO MARKSMANSHIP CONFIDENCE QUESTIONS PRIOR TO RECORD FIRE QUALIFICATION

RESPONSE SCALE	FULL-AMU POI	PART-AMU POI	UNIT POI
"How confident are you that you can use your .45 cal pistol effectively?"			
Extremely Confident	57	32	33
Very Confident	29	36	21
So-so	14	25	24
Not very confident	0	7	18
Lack confidence completely	0	0	3
$\chi^2 = 4.74$, $df = 2$, $p < .10$			
"Do you think that you had enough practice firing before qualifying witn this program to do your best?"			
I had much more than enough	36	7	0
More than enough	32	11	0
About right	21	36	9
Not enough	4	21	33
Needed much more practice	7	21	52
Missing	0	4	6
$\chi^2 = 37.78$, $df = 2$, $p < .01$			
"Did you fire better or worse than you expected as a result of this training?"			
Far Better	39	29	15
A bit better	21	32	21
So-so	11	18	33
A bit worse	25	14	12
Far worse	4	7	12
Missing	0	0	6
$\chi^2 = 3.88$, $df = 2$, $p < .20$			

Table B-2

GENERAL REACTIONS TO MARKSMANSHIP
TRAINING PRIOR TO RECORD FIRE QUALIFICATION

RESPONSE SCALE	FULL-AMU POI	PART-AMU POI	UNIT POI
"Generally, how pleased were you with the qualification training?"			
Very Pleased	36	39	30
Quite Pleased	29	39	18
Somewhat Pleased	18	17	15
So-So	11	11	15
Somewhat Displeased	4	4	15
Quite Displeased	0	0	3
Very Displeased	4	0	3
$\chi^2 = 5.41$, $df = 2$, $p < .10$			
"Do you feel that qualification training helped your shooting?"			
Yes	93	86	82
No	7	14	18
"How much do you like firing the .45 caliber pistol?"			
Like extremely	50	46	39
Like very much	39	36	33
Like	7	7	12
So-So	4	7	12
Dislike	0	0	0
Dislike very much	0	4	0
Dislike extremely	0	0	3
$\chi^2 = 0.55$, $df = 2$, $p < .80$			

Table B-2 continued

"How much knowledge/skill did your instructor seem to have during your training?"

A great deal	96	89	64
Quite a bit	4	4	15
Some but not much	0	4	12
Very little	0	4	3
Hardly any	0	0	3
Missing	0	0	3

$\chi^2 = 11.19$, $df = 2$, $p < .02$

"How easy or hard was it to understand the instructions during training?"

Extremely easy	57	43	46
Very easy	32	29	27
Easy	7	25	28
So-so	4	4	6
Hard	0	0	3
Very hard	0	0	0
Extremely hard	0	0	0

$\chi^2 = 1.21$, $df = 2$, $p < .70$

"How effective were the training aids used to teach marksmanship skills for the .45 caliber pistol?"

Extremely effective	50	14	15
Very Effective	32	61	9
Fairly effective	14	21	9
So-so	4	0	30
Fairly ineffective	0	0	9
Very ineffective	0	0	0
Extremely ineffective	0	0	0
Missing	0	4	15

$\chi^2 = 21.084$, $df = 2$, $p < .04$

APPENDIX C

LAST NAME, FI, MI		UNIT	ROSTER NO.
DATE	TIME	POST ZERO	

1. How sure are you that your rifle is zeroed? (Check one)

   1 Extremely sure

   2 Very sure

   3 Fairly sure

   4 So-so

   5 Fairly unsure

   6 Very unsure

   7 Extremely unsure

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
1.63	1.05	1.74	1.31	2.19	1.04

2. How sure are you that you can hit targets out to 300 meters with your M16A1 rifle? (Check one)

   1 Extremely sure to hit

   2 Very sure to hit

   3 Fairly sure to hit

   4 Might hit or miss

   5 Fairly sure to miss

   6 Very sure to miss

   7 Extremely sure to miss

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
1.73	0.81	1.99	1.26	2.37	1.04

LAST NAME, FI, MI		UNIT	ROSTER NO.
DATE	TIME	POST FIELD FIRE	

1. How sure are you that your rifle is zeroed? (Check one)

   1 Extremely sure

   2 Very sure

   3 Fairly sure

   4 So-so

   5 Fairly unsure

   6 Very unsure

   7 Extremely unsure

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
1.43	0.66	1.41	0.65	2.05	1.13

2. How sure are you that you can hit targets out to 300 meters with your M16A1 rifle? (Check one)

   1 Extremely sure to hit

   2 Very sure to hit

   3 Fairly sure to hit

   4 Might hit or miss

   5 Fairly sure to miss

   6 Very sure to miss

   7 Extremely sure to miss

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
1.74	0.98	1.74	0.87	2.45	1.37

RIFLE MARKSMANSHIP

ATTITUDE SURVEY

RECORD FIRE POST-TRAINING

QUESTIONNAIRE

September 1978

LAST NAME, FI, MI	UNIT	ROSTER NO.

DATE	TIME	

1. To lower the strike of the bullet I would move the _____ (front or rear?) sight in a _____ (clockwise or counter clockwise?) direction.

2. To shift the strike of the bullet to the right I would move the _____ (front or rear?) sight of the M16A1 rifle in a _____ (clockwise or counterclockwise) direction.

3. Why is it necessary to zero your rifle? (In your own words) _____

_____

_____

_____

4. Did you have any problems zeroing your rifle? Yes ____ No _____

If yes, what was the problem? _____

_____

_____

5. If there was a wind blowing across the range from the right side where would you aim on your target? (Check one)

__1__ A [illegible] to the right

__2__ A bit to the left

__3__ Dead center

__4__ I don't know

	FULL-AMU		PART-AMU		UNIT	
	Mean	SD	Mean	SD	Mean	SD
	1.38	0.72	1.62	0.88	1.91	0.99

Why? _____

_____

6. How sure are you that your rifle is zeroed? (Check one)

__1__ Extremely sure

__2__ Very sure

__3__ Fairly sure

__4__ So-so

__5__ Fairly unsure

__6__ Very unsure

__7__ Extremely unsure

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
1.62	0.81	1.75	1.25	2.29	1.27

7. How sure are you that you can hit targets out to 300 meters with your M16A1 rifle? (Check one)

__1__ Extremely sure to hit

__2__ Very sure to hit

__3__ Fairly sure to hit

__4__ Might hit or miss

__5__ Fairly sure to miss

__6__ Very sure to miss

__7__ Extremely sure to miss

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
1.81	0.88	2.09	1.32	2.69	1.49

8. Generally, how pleased were you with the requalification training?

__1__ Very pleased

__2__ Quite pleased

__3__ Somewhat pleased

__4__ So-so

__5__ Somewhat displeased

__6__ Quite displeased

__7__ Very displeased

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
1.98	1.29	1.88	1.45	3.23	1.80

9. How much do you like firing the M16A1 rifle?

__1__ Like extremely

__2__ Like very much

__3__ Like

__4__ So-so

__5__ Dislike

__6__ Dislike very much

__7__ Dislike extremely

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
2.21	1.65	2.18	1.44	2.63	1.63

10. How often do you fire the M16A1 at Fort Bragg?

__1__ Very often

__2__ Quite often

__3__ Somewhat often

__4__ Some

__5__ Not too often

__6__ Not much at all

__7__ Hardly ever

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
4.97	1.71	4.34	1.92	4.23	1.93

11. How much training did you have to get ready for this test before you came to Fort Benning?

__1__ A great deal more than usual

__2__ A good deal more than usual

__3__ Slightly more than usual

__4__ About the same as usual

__5__ Slightly less than usual

__6__ A good deal less than usual

__7__ A great deal less than usual

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
4.87	1.53	5.26	1.79	4.78	1.43

12. How much pressure to qualify do you think has been placed on you?

__1__ A great deal more than usual

__2__ A good deal more than usual

__3__ Slightly more than usual

__4__ About the same as usual

__5__ Slightly less than usual

__6__ A good deal less than usual

__7__ A great deal less than usual

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
3.66	1.63	3.31	1.66	3.74	1.35

13. How well or poorly was your time used during rifle requalification program here at Fort Benning?

__1__ Used extremely well

__2__ Used very well

__3__ Used well

__4__ So-so

__5__ Used poorly

__6__ Used very poorly

__7__ Used extremely poorly

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
2.28	1.16	2.31	1.50	3.16	1.30

14. How much knowledge/skill did your instructor seem to have during your training?

__1__ A great deal

__2__ Quite a bit

__3__ Some but not much

__4__ Very little

__5__ Hardly any

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
1.27	0.50	1.10	0.37	2.00	0.77

15. How easy or hard was it to understand the instructions during training?

__1__ Extremely easy

__2__ Very easy

__3__ Easy

__4__ So-so

__5__ Hard

__6__ Very hard

__7__ Extremely hard

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
1.61	0.76	1.40	0.70	2.19	1.03

16. How effective were the training aids used to teach Marksmanship skills for the M16A1 rifle?

__1__ Extremely effective

__2__ Very effective

__3__ Fairly effective

__4__ So-so

__5__ Fairly ineffective

__6__ Very ineffective

__7__ Extremely ineffective

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
1.72	0.90	1.51	0.74	2.93	1.45

17. Was any rifle instruction you received unclear?

Yes _____ No _____

18. If yes, what instruction was unclear?

_____

_____

_____

19. How confident are you that you can use your M16A1 effectively?

__1__ Extremely confident

__2__ Very confident

__3__ So-so

__4__ Not very confident

__5__ Lack confidence completely

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
1.50	0.59	1.69	0.87	1.79	0.83

20. Did you fire better or worse than you expected, as a result of this training?

__1__ Far better

__2__ A bit better

__3__ So-so

__4__ A bit worse

__5__ Far worse

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
2.47	1.30	2.40	1.34	3.32	1.26

21. Do you think that you had enough practice firing before qualifying with this program to do your best?

__1__ I had much more than enough

__2__ More than enough

__3__ About right

__4__ Not enough

__5__ Needed much more practice

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
2.90	1.02	3.22	1.06	3.40	1.03

22. Have you fired a rifle in competition in the last five years before coming to Fort Benning to be in this test?

__5__ Never

__4__ Once

__3__ A few times

__2__ Quite a bit

__1__ Very often

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
4.74	0.62	4.46	1.18	4.50	1.02

23. Was anything wrong with your rifle during the test that might have affected your performance? Yes _____ No _____ If yes, what? _____

24. Please suggest any improvements you would like to make to the rifle program you were given. _____

_____

_____

_____

APPENDIX D

PISTOL MARKSMANSHIP

ATTITUDE SURVEY

RECORD FIRE POST-TRAINING

QUESTIONNAIRE

September 1978

LAST NAME, FI, MI	UNIT	ROSTER NO.

DATE	TIME	

1. If there was a wind blowing across the range from the right side where would you aim on your target? (Check one)

   1 A bit to the right

   2 A bit to the left

   3 Dead center

   4 I don't know

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
2.27	1.05	1.96	1.11	1.97	1.08

   Why?_____

2. Generally, how pleased were you with the qualification training?

   1 Very pleased

   2 Quite pleased

   3 Somewhat pleased

   4 So-so

   5 Somewhat displeased

   6 Quite displeased

   7 Very displeased

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
2.32	1.47	2.00	1.12	2.88	1.73

3. Do you feel that the requalification training helped your shooting?

   Yes_____ No _____

   If yes, what specifically helped the most?_____

4. How much do you like firing the .45 CAL Pistol?

1 Like extremely

2 Like very much

3 Like

4 So-so

5 Dislike

6 Dislike very much

7 Dislike extremely

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
1.64	0.78	1.89	1.20	2.12	1.34

5. How often do you fire the pistolat Fort Bragg?

1 Very often

2 Quite often

3 Somewhat often

4 Some

5 Not too often

6 Not much at all

7 Hardly ever

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
6.27	0.98	5.88	1.42	6.29	1.24

6. How much training did you have to get ready for this test before you came to Fort Benning?

1 A great deal more than usual

2 A good deal more than usual

3 Slightly more than usual

4 About the same as usual

5 Slightly less than usual

6 A good deal less than usual

7 A great deal less than usual

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
5.90	1.37	5.39	1.55	5.72	1.67

7. How much pressure to qualify do you think has been placed on you?

__1__ A great deal more than usual

__2__ A good deal more than usual

__3__ Slightly more than usual

__4__ About the same as usual

__5__ Slightly less than usual

__6__ A good deal less than usual

__7__ A great deal less than usual

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
3.12	1.21	4.04	1.48	4.19	1.52

8. How well or poorly was your time used during pistol qualification program here at Fort Benning?

__1__ Used extremely well

__2__ Used very well

__3__ Used well

__4__ So-so

__5__ Used poorly

__6__ Used very poorly

__7__ Used extremely poorly

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
2.52	0.98	2.15	1.13	3.39	1.73

9. How much knowledge/skill did your instructor seem to have during your training?

__1__ A great deal

__2__ Quite a bit

__3__ Some but not much

__4__ Very little

__5__ Hardly any

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
1.04	0.19	1.21	0.69	1.63	1.04

10. How easy or hard was it to understand the instructions during training?

__1__ Extremely easy

__2__ Very easy

__3__ Easy

__4__ So-so

__5__ Hard

__6__ Very hard

__7__ Extremely hard

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
1.57	0.79	1.89	0.92	1.94	1.09

11. How effective were the training aids used to teach marksmanship skills for the .45 CAL pistol?

__1__ Extremely effective

__2__ Very effective

__3__ Fairly effective

__4__ So-so

__5__ Fairly ineffective

__6__ Very ineffective

__7__ Extremely ineffective

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
1.71	0.85	2.07	0.62	3.68	1.89

12. Was any pistol instruction you received unclear? Yes_____ No_____

If yes, what instruction was unclear? _____

_____

13. How confident are you that you can use your .45 CAL pistol effectively

__1__ Extremely confident

__2__ Very confident

__3__ So-so

__4__ Not very confident

__5__ Lack confidence completely

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
1.57	0.74	2.07	0.94	2.36	1.22

14. Did you fire better or worse than you expected, as a result of this training?

_1_ Far better

_2_ A bit better

_3_ So-so

_4_ A bit worse

_5_ Far worse

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
2.32	1.34	2.39	1.26	2.84	1.24

15. Do you think that you had enough practice firing before qualifying with this program to do your best?

_1_ I had much more than enough

_2_ More than enough

_3_ About right

_4_ Not enough

_5_ Needed much more practice

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
2.14	1.18	3.41	1.19	4.45	0.68

16. Have you fired a pistol in competition in the last five years before coming to Fort Benning to be in this test?

_1_ Never

_2_ Once

_3_ A few times

_4_ Quite a bit

_5_ Very often

FULL-AMU		PART-AMU		UNIT	
Mean	SD	Mean	SD	Mean	SD
4.46	1.29	4.82	0.55	4.79	0.60

17. Was anything wrong with your pistol during the test that might have affected your performance? Yes_____ No_____ If yes, what?_____

18. Please suggest any improvements you would like to make to the pistol program you were given.

_____

_____

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