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A COMPARISON OF THE WHOLE AND PART METHODS OF MARKSMANSHIP TRAINING

July 1953

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ARMY FIELD FORCES
HUMAN RESEARCH UNIT NO. 1
THE ARMORED CENTER
Fort Knox, Kentucky

Under the Technical Supervision of

The George Washington University
HUMAN RESOURCES RESEARCH OFFICE
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INFORMATION REPORT

A COMPARISON OF THE WHOLE AND PART METHODS OF MARKSMANSHIP TRAINING

July 1953

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Dr. Frank J. McGuigan

Approved:

STANFORD C. ERICKSEN
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ABSTRACT

I. PURPOSE

A. To compare M1 marksmanship proficiency under two methods of instruction; one, the currently used Part Method; the other, a Whole Method in which the firing act is taught as a whole, integrated practice unit.

B. To determine whether live firing throughout preliminary rifle instruction, combined with the Whole Method, results in improved marksmanship.

C. To evaluate accuracy of rifle firing toward the conclusion of basic training.

D. To establish the pretraining level of marksmanship proficiency.

E. To study the relationship between intelligence and level of proficiency attained with the Part and Whole Methods.

II. PROCEDURE

The experiment was carried out, using identical procedures, at two installations. A single Infantry basic training company, at each installation, was divided into four matched platoons, which received training according to the following plan:

A. Platoon I – Part Method (standard ATP marksmanship course)

B. Platoon II – Whole-live-fire Method (Whole Method with live firing throughout preliminary rifle instruction)

C. Platoon III – Whole-dry-fire Method (Whole Method with simulated fire throughout preliminary rifle instruction)

D. Platoon IV – No Training (safety precautions, range procedures, etc., only)

Platoons I, II, and III received the same amount of time in training, and each fired the same number of rounds of ammunition.

The criterion of proficiency for each method was the pit scores obtained during four days of firing on the known-distance range.

III. RESULTS AND CONCLUSIONS

A. The Whole-live-fire Method produced greater marksmanship proficiency than did the presently used Part (ATP) Method.

B. When the Whole Method was used, live firing throughout preliminary rifle instruction resulted in greater proficiency than did dry firing during this period.

C. Accuracy of rifle fire tends to increase toward the conclusion of basic training.

D. All of the methods of rifle training used in this study led to significant improvement in marksmanship when compared to the trainee's pretraining proficiency level.

E. High intelligence trainees attain better marksmanship scores when trained by the Whole-live-fire Method than when trained by the Part Method. Low intelligence trainees tend to learn equally well by either method.

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A COMPARISON OF THE WHOLE AND PART METHODS OF MARKSMANSHIP TRAINING

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INFORMATION REPORT[1]

A COMPARISON OF THE WHOLE AND PART METHODS OF MARKSMANSHIP TRAINING

I. PURPOSE

This project seeks to answer the following two questions:

A. Whole vs. Part Methods. Can the proficiency level of rifle marksmanship be increased by using a Whole Method of instruction and practice which combines all relevant aspects of rifle firing into an integrated total act? This method differs from the Part Method of training (as exemplified by the current ATP) in that such separate aspects of the firing act as positions, breathing, sighting and aiming, trigger squeeze, etc., are not taught separately, but are given appropriate emphasis when necessary as the trainee learns and practices the integrated pattern of M1 firing.

For a more detailed description of the Whole and Part Methods as used in this study, see Appendices A and B.

B. Live vs. Dry Firing. When used with the Whole Method of instruction, does live firing throughout preliminary training lead to greater marksmanship proficiency than does dry firing during this period?

In addition to answering these two primary questions, the information collected in this study bears directly on such questions as: What happens to marksmanship accuracy toward the conclusion of basic training? What level of marksmanship proficiency does the trainee bring with him to the training situation? Is the Whole Method of instruction better suited to trainees of high intelligence than is the Part Method? Conversely, is the Part Method better suited to trainees of low intelligence?

[1]This is a preliminary report made available to interested military readers in advance of an official and more complete report to be published by the Human Resources Research Office, Washington, D. C.

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II. METHOD

A. Trainees Tested. The study was first undertaken at Fort Knox, Kentucky, and involved the use of one Infantry company whose members were just beginning basic training. In order to increase the reliability of the findings the experiment was repeated at Fort Jackson using identical procedures with a second company of Infantry basic trainees. Although a few trainees were eliminated from the final comparison because of missing training, lack of scores, etc., complete data were obtained for 148 men from Fort Knox and 200 men from Fort Jackson.

B. Experimental Procedure. Each company was divided into four comparable platoons on the basis of a rifle steadiness test (see Phase 1 of Table 1). This test was specially designed to measure the total amount of rifle muzzle movement in a given period of time, and was administered in two 15-second testing periods. The four platoons then received M1 training according to the following plan (Phase 2 of Table 1):

1. Platoon I - Part Method. This group received the standard ATP marksmanship course which has been classified above as a Part Method of instruction.

2. Platoon II - Whole-live-fire Method. The Whole Method of instruction was employed with live firing interspersed throughout preliminary training.

3. Platoon III - Whole-dry-fire Method. This group was taught by the Whole Method, with live firing occurring for the first time at the end of preliminary instruction.

4. Platoon IV - No-Training. This group received only essential instruction, which included safety precautions, range procedure, etc.

Platoon I was trained on the rifle circle, and moved to the 500" range for its first live firing (Phase 3, Table 1). Platoons II and III were both at the 500" range throughout preliminary rifle instruction (Phases 2 and 3); Platoon III, however, first fired live ammunition during Phase 3. It should be particularly noted that Platoons I, II, and III received the same amount of time in training, and each fired the same number of live rounds throughout the experiment.

C. Procedures for Comparing the Four Platoons. The criterion of proficiency for all platoons was the scores recorded on the known-distance range (Phase 4 of Table 1). Scores were obtained

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Table 1

OUTLINE OF EXPERIMENTAL PROCEDURE FOR WHOLE VS. PART M1 TRAINING

PHASE	Platoon I	Platoon II	Platoon III	Platoon IV
1st - Matching	----------	Rifle Steadiness Test		----------
2nd - Training	Part Method (24 hours)	Whole Method Live Fire (28 hours)	Whole Method Dry Fire (24 hours)	
3rd - Live Firing 500" Range	Firing (4 hours)		Firing (4 hours)	Safety Precautions (2 hours)
4th - KD Range	----------	Practice Firing -- 2 days Record 1 Firing -- 1 day Record 2 Firing -- 1 day		----------

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during two practice days, and two days of firing for record. In order to obtain as accurate scores as possible, they were recorded in the pits by unbiased scorers. Each trainee's pit score was identified by maintaining rosters of point and order numbers at the firing line.

D. Control of Pertinent Variables. In an attempt to assure the reliability of the findings of this study, the following variables were carefully controlled:

1. Procedure during known-distance firing

a. Balanced firing orders. An equal number of trainees from each platoon constituted each firing order, and thus were tested at the same time. As a result, such factors as weather, lighting, wind, etc., were comparable for all groups.

b. Individual coaching. Since it was important that no one group receive more help during known-distance firing than another, the assistance of cadre and instructors was limited to zeroing the rifles and enforcing safety precautions.

c. Alibis. During sustained fire exercises, an attempt was made to restrict alibis to weapon malfunctions.

2. Instructor

In order to equate the factor of instructor differences, the same instructor and assistant instructors were used for all four platoons. Care was taken to reduce or eliminate the bias which an individual instructor might have for one method over another.

3. Intelligence

The effects of slight intelligence differences between platoons were removed by appropriate statistical techniques, making all four platoons comparable in this respect.

4. Other variables

The platoons did not differ significantly with respect to such things as previous firing experience, handedness, visual acuity, education, etc.

III. RESULTS AND INTERPRETATION

The primary findings of this study are given in Figures 1, 2, and 3 (data are given in Appendix C). The marksmanship scores obtained by the two platoons (one at Fort Knox and one at Fort Jackson) who used the same training method were averaged, and this score was plotted for practice firing, and for the two record

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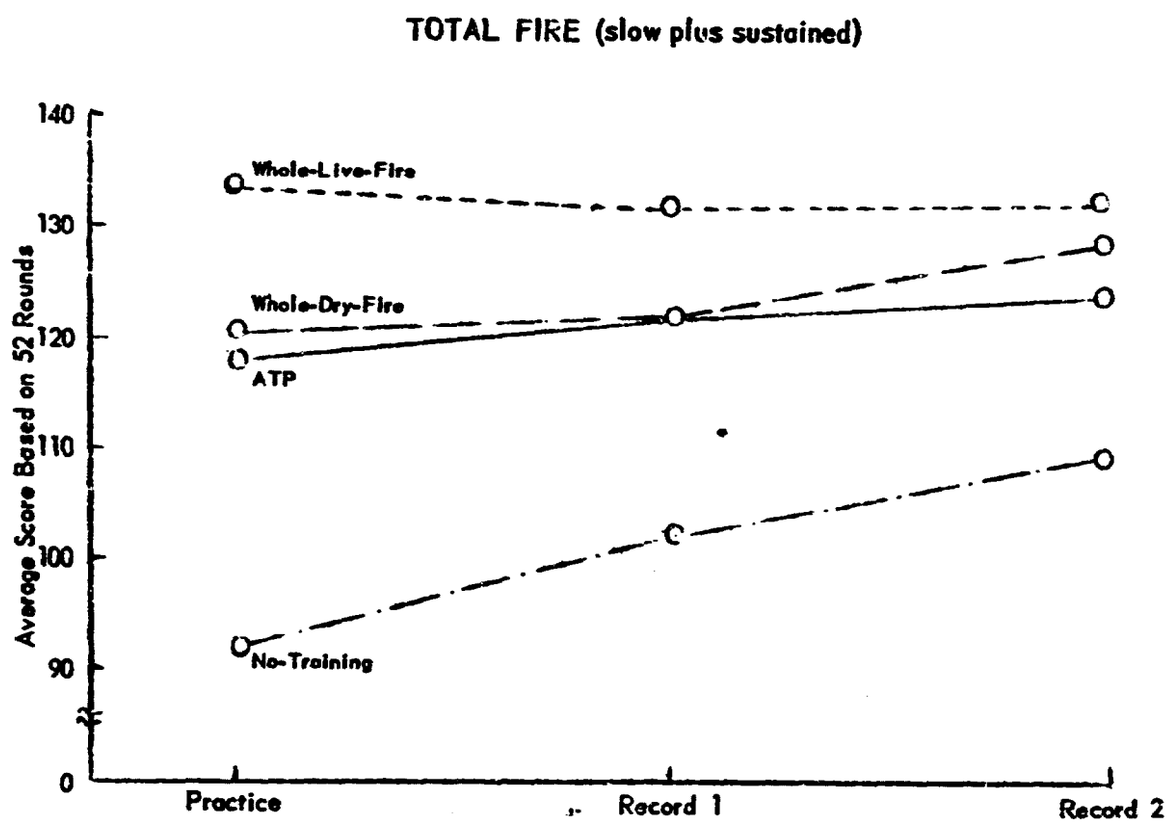

Figure 1—Comparison of average marksmanship scores during practice and record firing on the known-distance range. (Two platoons per training condition.)

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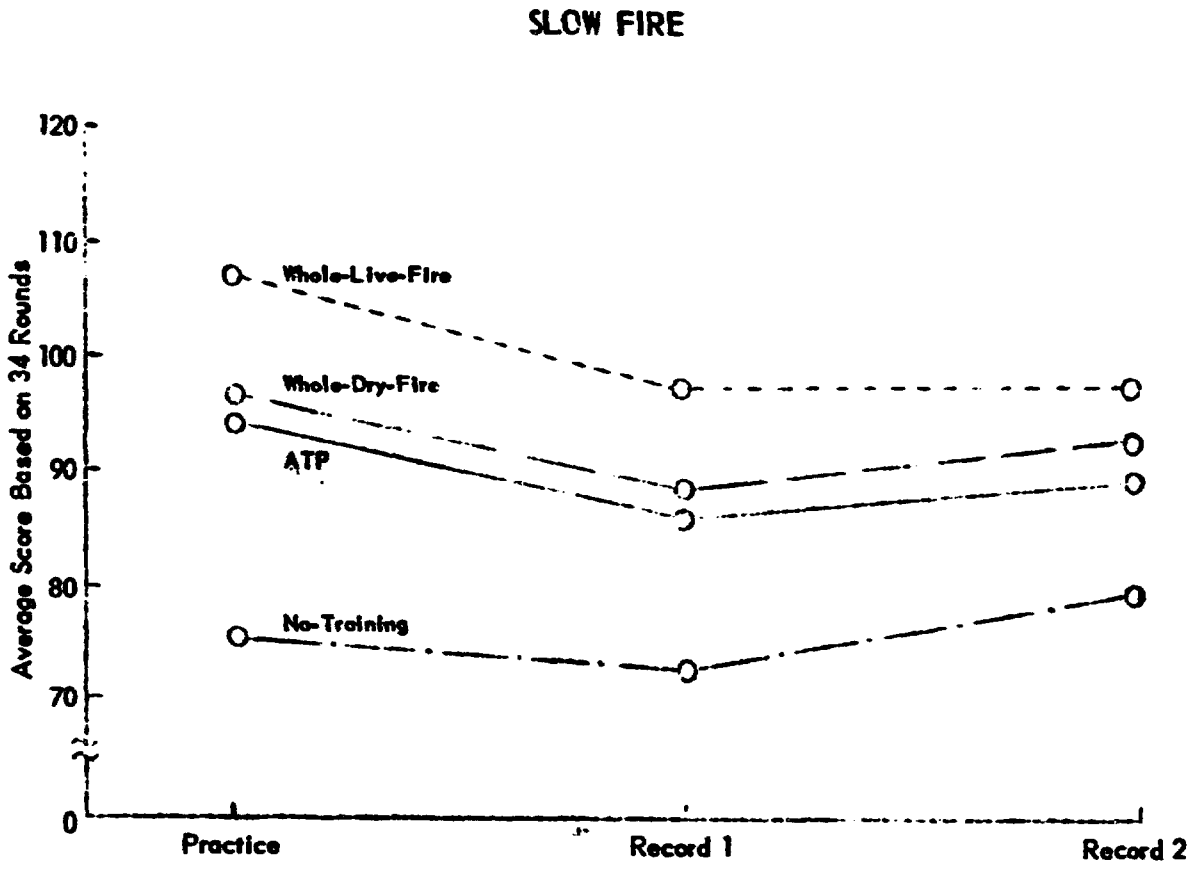

Figure 2—Comparison of average marksmanship scores during practice and record firing on the known-distance range. (Two platoons per training condition.)

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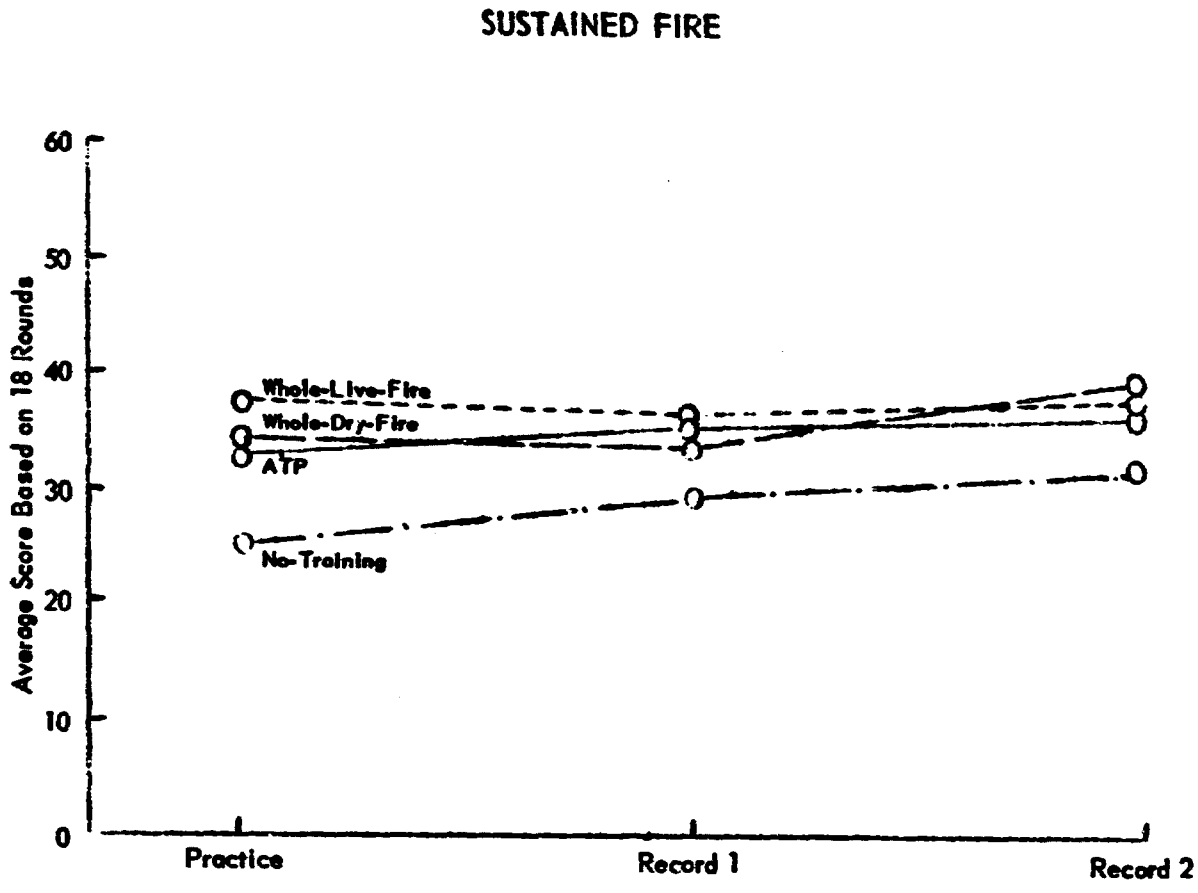

Figure 3—Comparison of average marksmanship scores during practice and record firing on the known-distance range. (Two platoons per training condition.)

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firing periods. Figure 1 presents the total fire scores (slow plus sustained) for each of the firing periods, while Figure 2 and 3 show the slow and sustained fire scores separately. The relative proficiency of the two platoons instructed by each method can be estimated from these figures.

A. Whole vs. Part Methods. An examination of Figure 1 indicates that the Whole-live-fire Method leads to greater proficiency than is attained with the Part Method. When the average scores (based on total points from zero) obtained during four days of known-distance firing (two days for practice and two days for record) were computed, it was found that Platoon II scored 38 points higher than Platoon I. By dividing this average score made by Platoon I into the average score made by Platoon II, it is found that the Whole-live-fire Method led to a 10% improvement in proficiency.

The above procedure for computing the percentage increase in proficiency is not the most appropriate one, however, since it assumes zero marksmanship proficiency prior to Army training. The real question to be answered is how much improvement is made under the Whole and Part Methods relative to how well a trainee can shoot prior to basic training? Thus, the baseline for comparing the relative effectiveness of these two methods should be the proficiency of the No-training Group (Platoon IV); rather than the value of zero. When the amount of improvement over the No-training Method, due to the Whole-live-fire Method, was divided by the similar amount of improvement due to the Part (ATP) Method, it was found that the Whole-live-fire Method led to 61% greater proficiency.

Comparison of the Whole-live-fire and the Part Methods in Figures 2 and 3 indicates that the superiority of the former method is most marked in slow fire, and is considerably less in sustained fire. The differences between Platoons I and II are statistically significant for both total (Figure 1) and slow (Figure 2) fire, i.e., they could not reasonably have occurred by chance. Since the Fort Knox and Fort Jackson experimental companies yielded similar results, the reliability of this finding is confirmed.

Similar comparisons between the Whole-dry-fire and the Part Methods suggest that the former led to slightly higher proficiency. When these differences are tested statistically, however, they are found not to be significant, i.e., they could have occurred by chance. It is entirely possible then that neither of these methods leads to greater proficiency than the other.

B. Live vs. Dry Fire. In order to determine the effect of firing live ammunition (with the Whole Method) throughout preliminary training, trainees who used the Whole-live-fire Method (Platoon II) were compared with those who used the Whole-dry-fire Method (Platoon III). It is evident from Figures 1 and 2 that the Whole-live-fire Method led to greater proficiency than the Whole-dry-fire Method. This difference, in the case of both total and slow fire scores is statistically significant. These data indicate that proficiency can be increased by allowing trainees to fire live ammunition throughout preliminary training when instructed by the Whole Method. This improvement in learning is probably due to an increase in trainee interest, and to the knowledge of performance furnished by firing live rounds. Live firing throughout preliminary rifle instruction with the Whole Method also should allow the trainee to adjust gradually to the startling effect of firing.

C. Marksmanship Accuracy in the Twelfth Week of Training. For the Fort Jackson experimental company, Record 2 firing was completed during the fourth week of training. It was possible to refire this company for the record course on the known-distance range during their twelfth week of training, approximately two months later. During the period between the fourth and twelfth weeks each trainee fired approximately 850 rounds of ammunition on such weapons as the BAR, Carbine, Light and Heavy machine guns, and the M1 itself. By examining the scores obtained from record firing during the twelfth week (Record 3 in Figure 4), it was possible to determine what happens to marksmanship accuracy toward the conclusion of basic training.

It will be noted that there is an apparent increase in marksmanship accuracy during this interval, particularly by the No-training Platoon. This increase in proficiency is likely due to the positive transfer effect of training and firing on other small arms. It is of particular interest that the Whole-live-fire Platoon continues to show a superiority over the other three groups.

D. Pretraining Proficiency. Figures 1, 2, and 3 indicate that trainees who received no preliminary rifle instruction (Platoon IV) performed consistently poorer than those who received training regardless of the method used. These differences, in all cases, are statistically significant. It can be concluded, therefore, that all of the methods of preliminary rifle instruction lead to significant improvement when compared to the proficiency level with which the trainee begins Army rifle instruction.

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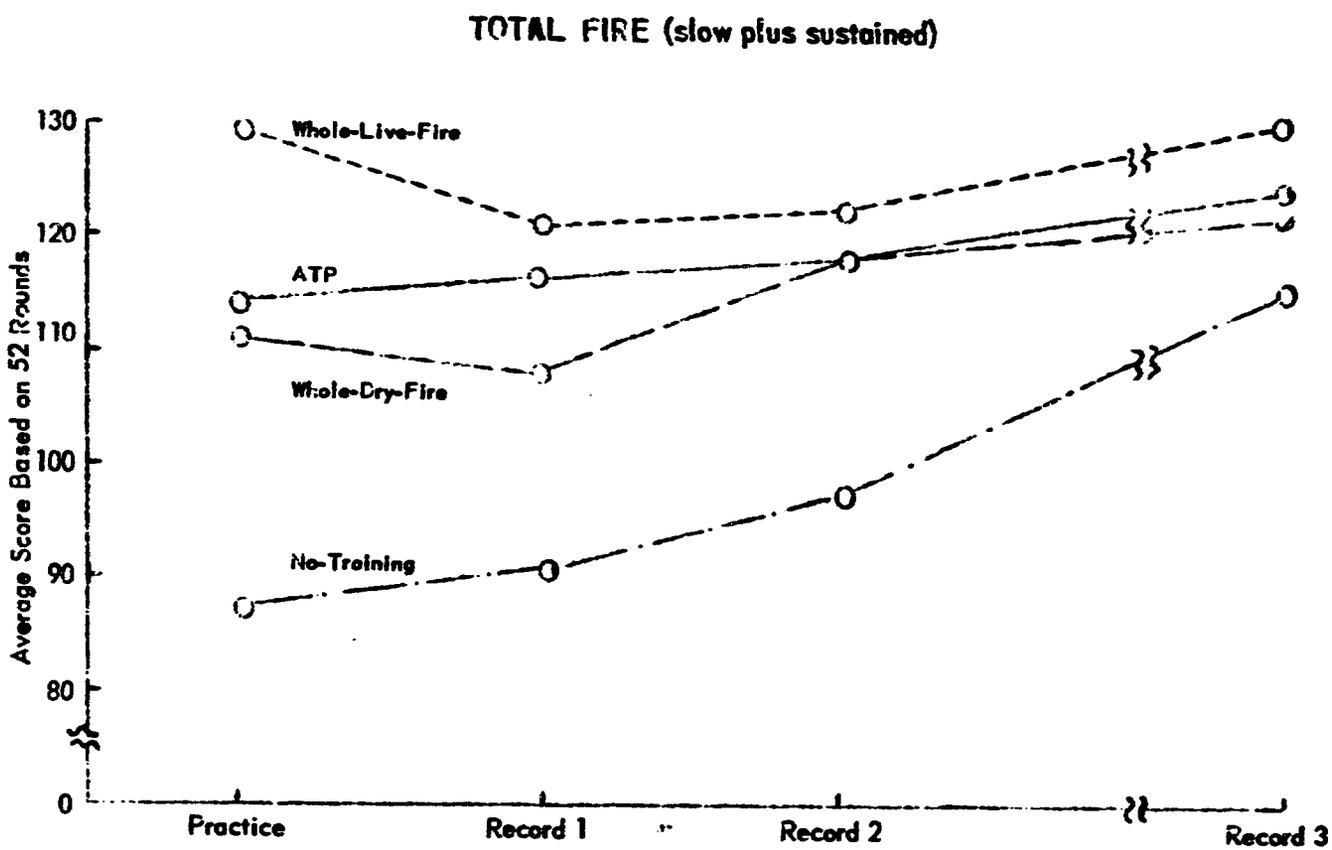

Figure 4—Comparison of average marksmanship scores during practice and record firing on the known-distance range. Record 3 was taken 2 months after Record 2. (One platoon per training condition.)

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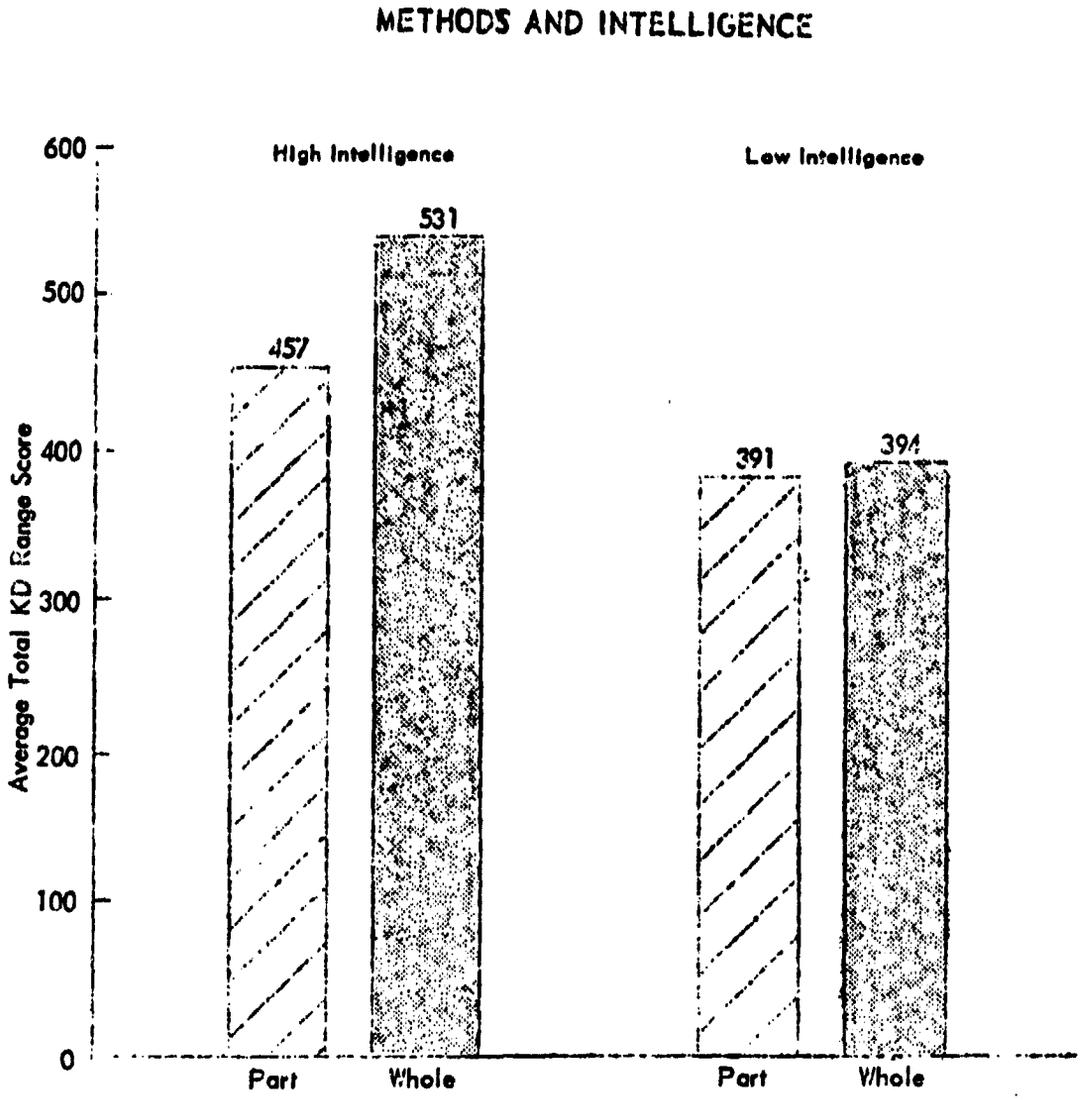

Figure 5—Comparison of marksmanship scores in terms of intelligence for Part vs. Whole Methods of rifle training.

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E. Methods and Intelligence. The relative effectiveness of the different methods of rifle instruction was studied with reference to the intelligence level of the trainee. This was done in order to determine whether the Whole Method is better suited to high intelligence trainees, and the Part Method better suited to low intelligence trainees. Figure 5 presents these comparisons, using Aptitude Area I of the Army Classification Battery as an index of intelligence. From this figure it can be seen that high intelligence trainees (Aptitude Area I score of 100 or higher) profit more from the Whole-live-fire Method than from the Part Method, this difference being statistically significant. On the other hand, when trainees of low intelligence are classified by the method they used, the difference in marksmanship proficiency is slight, and can be interpreted as a chance difference. It appears probable that low intelligence trainees do not profit more from one method than the other.

In view of these findings, it seems likely that the proficiency level of high intelligence trainees can be raised by using the Whole Method of teaching marksmanship, and that trainees of low intelligence do not become less proficient because of its use.

IV. CONCLUSIONS

A. The Whole-live-fire Method led to greater marksmanship proficiency than the presently used Part (ATP) Method.

B. Live firing throughout preliminary rifle instruction, when using the Whole Method of instruction, led to greater proficiency than did dry firing during this period.

C. Accuracy of rifle fire tends to increase toward the conclusion of basic training (two months after the standard known-distance firing) probably as a result of training on other small arms.

D. All of the methods of rifle training used in this study led to significant marksmanship improvement when compared to the trainee's pretraining proficiency level.

E. High intelligence trainees attain higher marksmanship scores when trained by the Whole-live-fire Method than when trained by the Part Method. Low intelligence trainees tend to learn equally well by either method.

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APPENDIX A

BACKGROUND OF THE STUDY

ADVANTAGE OF THE WHOLE METHOD

Numerous laboratory and classroom studies have indicated that a meaningful and continuous skill is acquired more efficiently when practiced as a whole, integrated unit, than when broken down into separate parts in which each segment is studied and practiced in isolation. This principle of human learning should be applicable to the problem of learning to fire the M1 rifle. It is predicted that if the trainee's attention is directed to the entire integrated process of rifle firing, he will acquire maximum proficiency in less time than if he is required to break down this total act into arbitrary segments requiring the learning of the first segment, then the second, then the third, etc., plus the additional task of integrating these separate parts into smooth and efficient marksmanship performance.

THE PART AND WHOLE METHODS APPLIED

The currently used rifle training program calls first for an isolated three-hour period devoted to sighting and aiming. A day or so later, the trainee spends a four-hour period in the use of the sling and the different positions, i.e., prone, standing, etc. In a similar manner follows a three-hour period of instruction on the correct trigger squeeze, then two hours of simulated sustained fire, etc. (see Appendix B). This standard preliminary rifle instruction sequence can be thought of as a prototype of the Part Method applied to the learning of a complex skill.

The application of the Whole Method to the teaching of marksmanship may be illustrated as follows: during the first hour the trainee is presented with a demonstration of the complete firing sequence, i.e., proper sling, proper position, importance of a good sight picture, controlled breathing, gradual trigger squeeze, and concluding with the demonstrator firing several blank rounds. During the remaining four hours of this day, the trainee is occupied

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in practicing the basic pattern of firing which has been demonstrated, including firing several live rounds. On subsequent days, this group continues to practice the complete sequence on firing, with live rounds being fired at appropriate points during the instruction. In general, the Whole Method employed in this study consists of a presentation of the entire sequence involved in the process of firing, followed by several repetitions of this entire sequence during which varying aspects of the act are emphasized, clarified, or concentrated upon as their importance to the whole act demands.

LIVE VS. DRY FIRING

Adoption of the Whole Method of instruction should lead to improved motivation and trainee interest. With the segmented practice method currently employed, the trainee spends considerable time practicing each step of rifle marksmanship but receives little information in return concerning his progress or understanding of the relationship which each separate component bears to the total firing act. Interviews with instructors and trainees indicate that continued practice on a single aspect of rifle marksmanship, e.g., sighting and aiming, without knowledge of one's progress or an appreciation of the importance of that component for accurate firing, reduces the motivation to become a skilled marksman. This low degree of motivation may be responsible not only for a low level of learning, but also for some negative learning, poor attitudes, and low standards.

On the other hand, if practice includes actually firing the weapon, it is likely that the trainee will maintain a higher level of interest and will become more self-critical during his practice sessions. The separate components of the firing act, such as sighting and breathing, would have greater meaning for him since these aspects would cease to be ends in themselves and would become means to the immediate goal of accurate firing.

In order to evaluate the effect of live firing throughout preliminary training, two forms of the Whole Method were used. In one variation, the Whole-live-fire Method, the live firing began on the first day of preliminary training and took place during every training session thereafter. This method was compared with a Whole-dry-fire Method, in which live firing did not occur until the end of preliminary training, the trainees engaging in dry fire until that time. Any difference between the effectiveness of these methods should then be attributed to the manner of implementing the Whole Method of instruction, i.e., through the use of live or dry firing.

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APPENDIX B

OUTLINE OF EXPERIMENTAL COURSES

(1) PART (ATP) METHOD

Period	No. Hours	Subject
1	3	Sighting and Aiming
2	4	Slings, Positions
3	3	Trigger Squeeze
4	2	Sustained Fire
5	2	Positions
6 & 7	4	Sustained Fire, Loading
8	2	Sight Changes
9	1	Zeroing
10	1	Safety Precautions, Range Procedure
11	1	Scoring
12	1	Examination
13	4	Range Firing, 500"
	28	

(2) WHOLE METHOD

Period	No. Hours	Subject
1	1/2	Preliminary Orientation—presenting the Whole Act
2	4 1/2	The Whole Act—preliminary instruction, including triangulation
3	4	The Whole Act—the prone position, emphasizing sight adjustment, trigger squeeze
4	4	The Whole Act—all positions
5	4	The Whole Act—sustained fire
6	4	The Whole Act—review all positions, slow and sustained fire
7	4	The Whole Act—review all positions, etc.
8	1	Range Procedures
9	1	Scoring
10	1	Examination
	28	

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APPENDIX C

STATISTICAL RESULTS

TOTAL FIRE—AVERAGE (Figure 1)
(Slow Plus Sustained)

		Practice	Record 1	Record 2	Record 3
Platoon I	Based on 52 Rounds	114.92	116.48	117.52	124.28
Platoon II	Based on 52 Rounds	130.00	121.68	123.76	130.00
Platoon III	Based on 52 Rounds	111.80	108.68	117.52	123.24
Platoon IV	Based on 52 Rounds	87.88	91.00	97.76	115.44

SLOW FIRE (Figure 2)

		Practice	Record 1	Record 2
Platoon I	Mean Score 34 Rounds	94.86	86.70	89.42
Platoon II	Mean Score 34 Rounds	107.10	97.92	97.92
Platoon III	Mean Score 34 Rounds	96.90	88.74	92.82
Platoon IV	Mean Score 34 Rounds	76.16	73.44	79.90

SUSTAINED FIRE (Figure 3)

		Practice	Record 1	Record 2
Platoon I	Mean Score 18 Rounds	33.66	35.64	36.72
Platoon II	Mean Score 18 Rounds	37.98	36.36	37.98
Platoon III	Mean Score 18 Rounds	34.20	34.92	38.34
Platoon IV	Mean Score 18 Rounds	25.38	29.88	31.32

TOTAL FIRE (Figure 4)

		Practice	Record 1	Record 2
Platoon I	Mean Score 52 Rounds	118.04	121.16	124.80
Platoon II	Mean Score 52 Rounds	133.64	132.08	133.64
Platoon III	Mean Score 52 Rounds	120.12	121.68	128.96
Platoon IV	Mean Score 52 Rounds	92.04	102.44	109.72

METHODS AND INTELLIGENCE (Figure 5)

Method	High Intelligence	Low Intelligence
Part	457	391
Whole	531	394