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ABSTRACT

As part of the Army's adoption of performance-oriented instruction in Army Training centers, a study was conducted to determine the feasibility of using sefl-paced instruction without programed texts in a clerical and computational skills course. Course organization, course management, and effective instructional techniques for self-paced training were the principal areas of study. A seven-week Supplyman course was selected for the experiment. There were 19 performance tests for the course, each constituting a station at which an instructor provided an overview of the material and information on where the required reference documents and practice materials were located. Students were allowed to take each of the 19 Supplyman performance tests whenever they felt qualified to do so. Performance and attitude data were collected on approximately 135 baseline (lock-step) students and 200 self-paced students. Findings indicate the self-pacing is feasible to implement and operate, can be used effectively in cognitive skill training, and is well-received by students and instructors. Appended are two student attitude surveys with responses statistically expressed, one instructor information questionnaire with response scores, and another instructor questionnaire for which responses are not shown. (Author/MS)

Technical Report 75-20

HumRRC-TR-75-20

HumRRO

Self-Paced Instruction in a Cognitively Oriented Skills Course: Supplyman, MOS 76Y10

Jacklyn E. Hungerland and John E. Taylor

HUMAN RESOURCES RESEARCH ORGANIZATION
300 North Washington Street • Alexandria, Virginia 22314

Approved for public release; distribution unlimited.

June 1975

Prepared for

U.S. Army Research Institute for the Behavioral and Social Sciences
1300 Wilson Boulevard
Arlington, Virginia 22209

The Human Resources Research Organization (HumRRO) is a nonprofit corporation established in 1969 to conduct research in the field of training and education. It is a continuation of The George Washington University Human Resources Research Office. HumRRO's general purpose is to improve human performance, particularly in organizational settings, through behavioral and social science research, development, and consultation. HumRRO's mission in work performed under Contract DAHC19-73-C-0004 with the Department of the Army is to conduct research in the fields of training, motivation, and leadership.

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PERI-P

July 2, 1975

SUBJECT: Self-Paced Instruction in a Cognitively Oriented Skills Course: Supplyman, MOS 76Y10 (ATC-PERFORM)

TO:

1. As part of a research program in connection with the Army's adoption of performance-oriented instruction in Army Training Centers, a study was conducted to determine the feasibility of using self-paced instruction without programed texts in a clerical and computational skills course.

2. The Supplyman Course, MOS 76Y, a seven-week course conducted at the U.S. Army Training Center, Fort Ord, was selected for the experiment. Course organization and management, and effective instructional techniques for conducting self-paced training were the principal areas of study. The course was organized into three major job-related subject areas: Unit and Organization Supply, Stock Control and Accounting, and Warehousing. Students were allowed as much time for skill practice as they needed and were allowed to take each of the 19 Supplyman performance tests whenever they felt qualified to do so. Performance data were collected on approximately 135 baseline (lock-step) students and 200 self-paced students. Findings indicate that self-pacing is feasible to implement and operate, can be used effectively in cognitive skill training, and is well-received by students and instructors.

3. This report will interest those concerned with instructional techniques, performance-based training, and self-pacing with applications to different types of skills.

Arthur J. Drucker

ARTHUR J. DRUCKER
Chief, Plans and Operations

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

As part of the Army's adoption of performance-oriented instruction in Army Training Centers, a study was conducted to determine the feasibility of using self-paced instruction without programed texts in a clerical and computational skills course. Course organization and management, and effective instructional techniques for the conduct of self-paced training were the principal areas of study. The Supplyman Course (MOS 76Y), a

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seven-week course conducted at the U.S. Army Training Center, Fort Ord, California, was selected for the experiment. Data were collected on approximately 135 baseline (lock-step) students and 200 self-paced students. Findings indicate that self-pacing is feasible to implement and operate, can be used effectively in cognitive skill training, and is well-received by students and instructors.

SUMMARY AND CONCLUSIONS

PURPOSE

This research effort was conducted to determine the operational feasibility of using self-paced instruction in a cognitively oriented skills course and to develop course organization procedures and instructional techniques for the conduct of self-paced training in a job-performance approach.

APPROACH

The Supplyman Course, MOS 76Y, a seven-week course conducted at the U.S. Army Training Center, Fort Ord was selected for the experiment. Based on the ASubjScd the course was organized into three major job-related subject areas: Unit and Organization Supply (UOS), Stock Control and Accounting (SC), and Warehousing. There are 19 performance tests for the course, each test constituting a subject matter station. Stations were aggregated by subject area so that there were eight stations in UOS, four in SC, and seven in Warehousing.

At each station in the self-paced program an instructor provided an overview of what was to be learned at that station and where the required reference documents and practice materials were located. Students were allowed as much time for skill practice as they needed and were allowed to take each of the 19 Supplyman performance tests whenever they felt qualified to do so. Instructional materials and tests were aggregated into three major job-related subject areas. Following course completion, graduates who could not go on to their unit assignments had the option of reporting for locally conducted on-the-job training (OJT) or remaining in the course to act as peer instructors.

Performance and attitude data were collected for approximately 135 baseline (lock-step) students and 200 self-paced students. Instructor attitude data were collected prior to and following the phase-in of self-pacing. Management and feasibility data were collected throughout and following the experimental program.

FINDINGS

Self-paced course completion. Self-paced students completed the Supplyman Course in an average of 25 training days (with a range of 13 to 44 days). Percentage of graduates by week was as follows:

	3d week	4th week	5th week	6th week	7th week	8th week	9th week
Percent graduates	4%	21%	36%	21%	11%	6%	1%

Trainee attitudes. The lock-step course did not meet students' expectations as well as did the self-paced course. The self-paced group had more positive perceptions of the course and its value and relevance to what they expected to encounter on the job. On all items related to individualized progression through the course and on the thoroughness of tests, the self-paced group was significantly more positive than the baseline group.

Instructor attitudes. Instructors' initial attitudes toward the self-paced program were not positive. Time and familiarity with the program brought about a change in attitude to one of support for the flexibility of the program. In fact, instructors came to view

self-pacing as a solution for the problems generated by fluctuating student input to the course.

Management. Course management and student control procedures were within normal operational range. No major problems were encountered during the phase in or operation of self-pacing.

Cost of Program Introduction. Except for the one-time cost for reproduction of newly-developed instructional materials and guidelines, phasing-in of the self paced program did not incur major costs. No increase was required in facilities, equipment, or personnel allocations.

CONCLUSIONS

(1) Self-pacing is feasible to implement and operate. The approach permits more efficient utilization of facilities, personnel, equipment, and instructional time, and facilitates management of student input fluctuations.

(2) Self-pacing using job-related skill practice is effective in cognitive skill training.

(3) Self-pacing is well received by students and instructors.

PREFACE

HumRRO Work Unit ATC-PERFORM was initiated in 1972 to assist the Army in a continuing review, evaluation, refinement, and implementation of performance-based training at training centers. As part of ATC-PERFORM, a study was conducted to determine the feasibility of self-pacing a cognitive skill course. The Supplyman Course, MOS 76Y, was selected for this experiment. Work was accomplished at the U.S. Army Training Center, Fort Ord, California, between January and December 1974.

Work Unit ATC-PERFORM has been conducted by HumRRO Western Division, at the Presidio of Monterey, California, with Dr. Howard H. McFann as Director. Dr. John E. Taylor was the Work Unit Leader. This self-pacing study was conducted by Jacklyn E. Hungerland with SP4 David Martinelli and SP4 William Tierney assisting in the data collection and John T. McGiveran assisting in the analysis of data.

Administrative and logistical support for the study was provided by the U.S. Army Research Institute Field Unit, Presidio of Monterey, whose chief is COL Ullrich Hermann.

This research was conducted under Department of the Army, U.S. Army Research Institute for the Behavioral and Social Sciences Contract DAHC19-73-C-0004, with Dr. Otto Kahn serving as technical monitor. Training Research is conducted under Army Project 2Q062107A745.

Meredith P. Crawford
President
Human Resources Research Organization

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The self-pacing project in the Supplyman Course was given major proponent support by the U.S. Army Quartermaster School, Fort Lee, Virginia. Continuing cooperation and guidance were received from the DCTE, COL S. Weisinger, his predecessor, COL P.J. Jacques, and their staffs.

Fort Ord personnel facilitated the conduct of the project. COL John G. Hill, Commanding Officer, 4th AIT Brigade, exhibited continued interest and provided command emphasis throughout the project. Successive battalion commanders, LTC Peter C. Salmonsen and LTC James J. Cortez, provided invaluable support in the planning and execution of the project and in the data-collection effort.

Special mention is due to the Supplyman Course chiefs—first CPT John Merkel, succeeded by CPT Thomas Mancini—who lived more closely with the research effort and contributed their ingenuity, resourcefulness, and patience.

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BACKGROUND

The research described in this report was a subeffort of Work Unit ATC-PERFORM, a three-year project which had as its objective the providing of assistance to the Army in the review, evaluation, and refinement of performance-based training in Basic Combat Training (BCT) and Advanced Individual Training (AIT), both combat and combat-support programs.[1]

In January 1973, Headquarters TRADOC (then U.S. Continental Army Command) distributed a directive, "Self-Paced Instruction in AIT," which asked all Army schools to determine which of their Army Training Center courses were adaptable to self-pacing. As a result of this request, two courses were formally designated by TRADOC in November 1973 as contexts for a self-pacing experiment to commence during the third quarter FY74. One course was the Crawler Tractor Operator Course (MOS 62E20) at Fort Leonard Wood, Missouri, a motor skills course.[2] The other course was the more cognitively oriented Supplyman Course (MOS 76Y10) at Fort Ord, California.

The selection of these two courses provided opportunity for study of differing types of skills—heavy equipment operation in the one, and application of clerical and mathematical skills in the other. In each study, the responsibility of the U.S. Army Training Center (USATC) was primarily to provide support, while proponent school responsibility was oriented toward specifying course content. HumRRO was responsible for instructional technology, organization for training, experimental design, analysis of data, and report writing. The goals of the separate studies were to determine the optimum course organization and the most effective instructional techniques for the conduct of self-paced training in a job-performance approach rather than through programed texts. Of particular concern to TRADOC in this subeffort was the use of self-pacing and peer instruction in courses with fluctuating inputs, to investigate the operational feasibility of a free-flow peer-instructional system which had been developed in another HumRRO study.[3]

PREPARATION FOR SELF-PACING AND INSTRUCTOR TRAINING

A revision of the Army Subject Schedule (ASubjScd) for the Supplyman Course (MOS 76Y10) which incorporated the principles of performance-based training had been developed and issued late in 1973, just prior to the initiation of the self-pacing study.

[1] See *Establishing the Concepts and Techniques of Performance Oriented Training in Army Training Centers. A Summary Report*, by John E. Taylor and Staff, ATC PERFORM, HumRRO Technical Report 75-21, June 1975, for an omnibus report of activities and accomplishments of the overall ATC-PERFORM project.

[2] See *Self-Pacing a Gross Motor Skills Course. Crawler Tractor Operator, MOS 62E20*, by Mark F. Brennan and John E. Taylor, HumRRO Technical Report 75 19, June 1975, for the findings of this study.

[3] See *A Career-Oriented, Free-Flow, Peer-Instructional System*, by Jacklyn E. Hungerland, HumRRO Professional Paper 6-73, June 1973, and *Development and Pilot Test of a Career Oriented, Peer Instructional Model in the Office Cluster of Business Occupations*, by Jacklyn E. Hungerland, Eugene R. Michaels, and John E. Taylor, HumRRO Technical Report 72-28, October 1972.

Before the self-pacing experiment could begin, the course at Fort Ord had to be converted from the lecture-centered techniques prescribed by the ASubjScd then in force, to the performance-based techniques prescribed by the new ASubjScd. This conversion was completed by the end of May 1974, the major change being the institution of performance tests with a Pass/Fail criterion and the conduct of training in a more functional, job-related context.[1]

Once the new ASubjScd was implemented, preparations for the introduction of self-pacing were undertaken as a joint effort of Supplyman Course instructors and HumRRO personnel. In each of the three major sections of the course, these preparations included:

(1) Orientation of instructor personnel
(2) Preparation of instructional materials
(3) Training and rehearsal of instructor personnel
(4) Organization of facilities.

Each of these activities will be discussed separately.

ORIENTATION OF INSTRUCTOR PERSONNEL

Before any activities related to self-pacing began, a HumRRO staff member met with the key instructors from each section to brief them on the upcoming project—its purpose, their roles and responsibilities, and the necessary preparations, and general procedures for phasing-in the self-paced program. A discussion session followed during which the instructors had an opportunity to ask questions and clarify their understanding of the project and of self-pacing as it would be introduced in the Supplyman Course.

At this general briefing, the instructors were told that there would be additional training sessions for them before their sections phased-in self-pacing. The general self-paced "lesson plan" was outlined (i.e., brief orientation to students, supervised study, and performance testing to criterion) and instructors were requested to start working on their student briefings and study materials.

PREPARATION OF INSTRUCTIONAL MATERIALS

The course was to be organized around 19 stations, each station representing the material covered by one of the performance tests contained in the ASubjScd. For each of these stations instructor personnel prepared (a) a brief orientation (not to exceed five minutes) to be given to students when they entered that station; (b) all of the supportive individualized instructional materials to guide the students through the acquisition of the skills to be learned at that station; and (c) several alternative forms of test content.[2] The Supplyman Course content is highly cognitive, requiring the performance of paper-and-pencil activities by the students in almost every station, and also requiring the use of complicated regulations and manuals. Consequently, most of the individualized instructional materials were step-by-step instructions for student use in practicing and acquiring the skills of form completion, mathematical computations, use of regulations, and so forth.

[1] For an account of the development and implementation of the revised 76Y10 ASubjScd, see *Establishing the Concepts and Techniques of Performance Oriented Training in Army Training Centers: A Summary Report*, by Taylor and Staff. ATC-PERFORM, *op. cit.*

[2] Although the procedures to be tested remained constant throughout test repetitions, different form entries (e.g., stock items) were used to prevent compromise of the tests.

The instructors had some difficulties in preparing these written materials. As a rule, they included too much information and considerable amounts of written instruction, which tended to be overly long, too detailed, and at a very difficult reading level. At these initial stages the instructors could not be persuaded to take a simpler approach. In essence, they translated their existing lectures into written form for the student to read and added even further detail to "compensate for" the fact that the students would be without step-by-step lecture presentations. As a result, most of the original instructional materials and guidelines developed for the self-pacing study were difficult for the average Supplyman student. Later, where difficulties in the course could be attributed to these complicated materials, they were simplified for more effective use.

TRAINING AND REHEARSAL OF INSTRUCTOR PERSONNEL

Prior to the phase-in of self-pacing in each section of the course, training sessions were held for the instructors assigned to that section. At these training sessions the instructors were given the opportunity to rehearse their student briefings and to review and discuss the procedures they intended to follow during the supervised study periods. A HumRRO staff member worked closely with the instructors on these activities and no section was converted to the self-paced mode until all the instructors understood their roles and the procedures.

ORGANIZATION OF FACILITIES

Facilities at the course consisted of six classrooms (50-person capacity), one test center building (two classrooms), and two warehouses located approximately one-half mile from the main course area. There was a good deal of concern on the part of all course personnel as to whether or not these facilities (especially the classrooms) would be adequate for self-pacing. It was difficult to convince them that self-pacing calls for a more flexible use of facilities with classrooms or work space openly available rather than being permanently assigned to specific course sections. Until they had had some experience with this flexible arrangement, course personnel retained a skeptical attitude.

The only re-organization of facilities was conceptual. Rather than maintaining the idea that each classroom would be used for instruction in one subject area, a "study hall" idea was adopted. While students would receive their orientations in given areas, their practical work could take place in any room where the materials required for study and skill practice were available. In this kind of arrangement, several students in the same room might be studying different subjects. Since the number of students in the course area would not be any greater than that normally handled by the facilities, no serious problems were anticipated by the research staff. As a result, no actual modifications were made in the facilities—only their use was changed. In each section, the chief instructor worked out the management scheme to facilitate movement of students from station to station within that section.

THE SELF-PACED PROGRAM

The Supplyman Course curriculum is divided into three functional subject areas: Unit and Organizational Supply (referred to as the "B" Section); Stock Control and Accounting (the "C" Section), and Warehousing (the "D" Section). Figure 1 presents the course organization and schedule as it was prior to the introduction of self-pacing. While

	Monday	Tuesday	Wednesday	Thursday	Friday
1st Week	In-processing and DMT		← UOS →		
2nd Week	← UOS →			Admin.	UOS
3rd Week	← UOS →		← UOS →		
4th Week	← SC →				PT Test
5th Week	← SC →	Admin	← SC →		← Warehouse →
6th Week	← Warehouse →				
7th Week	← Warehouse →	End-of-Course Test	Admin.	Graduation	Out-process

UOS = Unit and Organization Supply (B Section)
SC = Stock Control and Accounting (C Section)
Warehouse = Storage and Shipping (D Section)

Figure 1. **Course Organization Before Self-Pacing (MOS 76Y10)**

performance tests were being used, instruction was presented in a lock-step manner, mostly via lecture.

Self-pacing was introduced—section by section—from the end of the course toward the beginning.[1] Phasing-in of self-pacing took place between 8 July and 2 October 1974. A brief description of the self-paced program follows.

Within each section there are subsections or stations—in the D Section there are seven stations, in C there are four, and in B there are eight. Each station is defined by one of the course performance tests. For example, the term B-4 identifies the station where the student learns about issue and turn-in of supplies. It also identifies Performance Test B-4 which measures the student's ability to prepare and process requests for issue and turn-in. This structuring of sections into stations facilitates management of student input and student flow through the course. Students arrive at the course as a class group, all starting at the same time. The B Section (which is scheduled first) has no required sequence of stations, so the class group can be spread out and assigned to different initial stations. They then rotate, county-fair style, through the B Section until they have completed all stations. By the time students have gone through three or four stations, the self-pacing mode takes effect and the class group spreads out on the basis of individual achievement so that the students flow into the next station or into the next section of the course at different rates and times.

At each station an instructor gives a brief orientation, providing an overview of what is to be learned at that station and where the required reference documents and practice materials are located. These orientations range in duration from 5-to-15 minutes. For practical administrative reasons the orientations are given only twice a day—at the

[1] This approach facilitates student management and avoids the interruption of course output which would result from shutting down the course and phasing-in from beginning to end.

beginning of the morning and afternoon training hours. At most a student might be delayed half of a training day waiting for his orientation to a new station. (This was not a common occurrence.)

After the orientation, students are given the study guides, reference documents, and materials for individual study and practice. Instructors are available at all times to assist students, answer questions, check student progress, and administer performance tests as students are ready to take them. Peer coaches (students who have completed the course and are awaiting orders) are also usually available, although acting as a peer coach is an option, not a requirement.[1]

As students complete all stations of the B Section, they move into and through the D Section.[2] As in the B Section, no fixed sequencing of stations is required and students can flow freely through stations on a county-fair, space-available basis.

The final section of the course (the C Section) is different—sequencing of stations is necessary because each station builds on the outcome of the preceding one. Consequently, this section cannot be operated in county-fair manner. An additional problem is that the subject matter is difficult and includes bookkeeping procedures. For many students this is the hardest section to complete. The difficulty level combined with station sequencing causes "bottlenecks" or "bunching" of students at some of the stations in the C Section. It is in this section that the management techniques for handling fluctuating inputs via peer instruction are used.[3] These techniques will be described briefly.

Within the section there are four subject matter areas (i.e., four stations) presented in a set sequence. When students "bunch up" at a station, more physical space, materials, and supervisors are needed until the bunching is eliminated. In addition, the students are usually at different stages of skill acquisition within the station and need even more individualized supervision and assistance than they would receive under normal circumstances. To handle the situation, additional replications of the bottleneck station are activated, drawing from facilities and personnel of other, less-heavily populated stations within that section. When the additional stations of that type are no longer necessary, the added stations revert to their former use and identification.

During the activation of the additional stations, peer instructors are available to provide supervision and assistance—particularly to the slow learners. Since this section is the last in the course, the peer instructors (who are students waiting to take their end-of-course test or waiting for orders) have just completed the section and still have the procedures fresh in their minds. Figure 2 (A and B) presents an example of the described technique in operation.

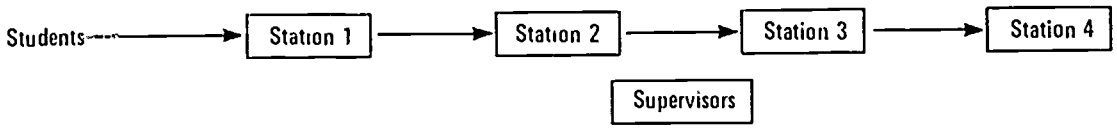
Students have bunched at Station 3 in the situation presented in Figure 2. At the same time, there is a low student population at Station 4, so some of the space normally allocated to Station 4 is assigned to Station 3 and peer instructors are brought in to help alleviate the pressure. If the student population at Station 3 is extremely large, portions of the facilities and personnel at Stations 1 or 2 might also be separated and activated at temporary Station 3. Once the bottleneck is relieved, temporary stations revert to their normal use as shown in Figure 2A.

[1] The other alternative is enrichment training—assignment to a supply room on post for on-the-job training (OJT).

[2] Because the B and C Sections are entirely paper-work oriented and are demanding on the abilities of the average input, the training schedule was arranged so that the physically active D Section follows the B Section and precedes the difficult C Section. This arrangement allows for a break in bookwork activities and provides additional motivation to complete the C Section, because students know that getting through that section means graduation and exit from AIT.

[3] Hungerland, *op. cit.*

A. The section with normal student flow



B. The section with bottleneck at Station 3 and low student population at Station 4

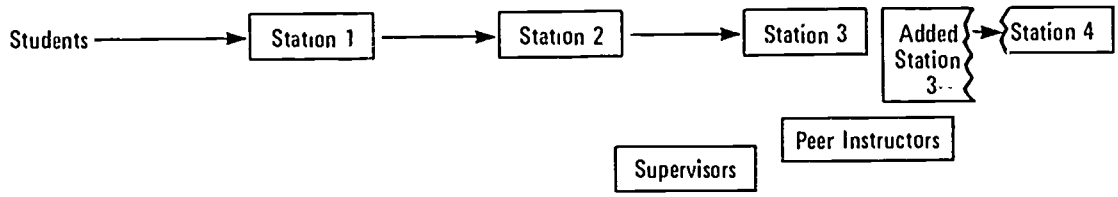


Figure 2. Management of Rise in Station Input

DATA COLLECTION

DATA CATEGORIES

The data collection plan provided for the collection of:

Student descriptive data - Age, years of schooling, general aptitude and skill-specific aptitude area scores

Attitude data - Students and instructors

Administrative data - Recycle rates, attrition rates, management and student control

Performance data - Time to course completion and end-of-course test scores

Feasibility data - Time savings, utilization of facilities, personnel and equipment.

DATA COLLECTION PROCEDURES

The descriptive and feasibility data were collected by HumRRO staff members. All other data were collected by Fort Ord personnel. Except for administration of the attitude surveys, the data for which Fort Ord had responsibility were those collected in the normal course operation.

Baseline data were collected on four classes of students (N = 135) receiving conventional lock-step instruction under the new ASubjScd. Comparative data were collected on four classes of students (N = 200) receiving instruction also under the new ASubjScd but presented on an entirely self-paced basis.[1]

[1] Because of attrition and nonavailability of record information, the numbers of subjects fluctuated on different dimensions. The range of Ns for the baseline group was 104-138; for the self-paced group the range was 193-227. A fifth class, which entered the course in mid-November provided additional data for part of their Supplyman training. Because of some pressure to graduate most, if not all, of this class prior to the Christmas break in training, this class progressed through the course on an accelerated group training basis. Since this class was not entirely self-paced and their course completion rates inflated the data, they are not included in the analyses reported here.

Student descriptive data. These data were collected from each student's personnel file from his Department of the Army Form 20. Data included each person's CL (Clerical) score (minimum required for the course = 90) from the Army Classification Battery, age, years of schooling, Armed Forces Qualification Test (AFQT) score, General Technical (GT) score, math test score, and reading test score. (The math and reading tests are prescribed by the ASubjScd and are administered locally. The minimum reading level recommended by the ASubjScd is 6th grade.)

Attitude data. Two sets of attitude questionnaires were prepared by HumRRO staff for administration to students and to instructors.

Each student in the baseline and self-paced groups completed a pre-course questionnaire after reporting to the course but prior to receiving any instruction. At the end of the course each student in the baseline and self-paced groups completed a post-course questionnaire. These instruments were intended to sample student expectations and perceptions of the course.[1]

A pre-self-pacing questionnaire was completed by each instructor assigned to the Supplyman Course. After the course was completely self-paced, instructors completed a post-self-pacing questionnaire. These instruments were intended to sample instructor expectations and perceptions of self-pacing in the course.[2]

Administrative data. The data related to recycle and attrition rates were derived directly from course records. Information on management and student control was collected by HumRRO personnel from observations of course operations and discussions with course personnel.

Performance data. Time-in-course data were derived from the regular student grade cards on which instructors were requested to note the date on which each student completed a station. End-of-course test scores are normally entered on the grade cards and were readily available.

Feasibility data. Utilization of facilities, personnel, and equipment were evaluated jointly by HumRRO and course personnel throughout the project.

FINDINGS

STUDENT DESCRIPTIVE DATA

Table 1 presents descriptive profiles for the baseline and self-paced groups based on the dimensions described in the preceding section. Except for a difference in Math score ($p<.05$), the two groups were essentially alike.

Table 2 presents correlations of the several descriptive scores with total time in course for the self-paced group. All these correlations were significantly different from zero.

ATTITUDE DATA

Student attitudes. Results of the student survey before the course indicated, with no significant differences, that students in both the baseline and the self-paced groups approached their Supplyman training with positive expectations. They expected that they would like the course, that their training would help them in their next assignments, that they would probably be allowed to go through the course as fast as they could learn, and that they would probably have the opportunity to help other students with their work.

[1] Copies of these instruments are contained in Appendix A.
[2] Copies of these instruments are contained in Appendix B.

Table 1

Self-Pacing, Supplyman Course:
Comparative Student Descriptive Profiles

Dimension	Baseline			Self-Paced		
	Mean	SD	N	Mean	SD	N
CL score	101.64	11.62	137	101.89	11.48	211
Age	20.06	3.47	137	19.51	2.79	214
Years of schooling	11.38	1.59	138	11.20	1.12	216
AFQT score	43.50	17.56	136	41.94	19.22	210
GT score	95.95	13.72	137	96.52	14.26	211
Math score	25.04	8.64	135	22.98	8.05	193
Reading score	28.11	10.28	136	26.70	10.15	193

Table 2

Correlations of Descriptive Profile Scores With Total Time in Course

	Self-Paced	
CL	-.27	<.01
AFQT	-.29	<.01
GT	-.27	<.01
Math	-.39	<.01
Reading	-.37	<.01

Following the course, responses of the baseline group indicated that the course did not meet their expectations. In contrast, the self-paced group had more positive perceptions of the course and its value and relevance to what they expected to encounter on the job. Significant differences were found (in favor of the self-paced group) on all items related to individualized progression through the course ($p < .001$) and on the completeness of the performance tests—that is, students reported that they were tested thoroughly on what they had learned ($p < .01$). For ease of comparison, item response data are presented on the instruments contained in Appendix A.

Instructor attitudes. For reasons external to the course operation, the instructor turnover rate was very high during the conduct of the self-pacing experiment.[1] There were only 13 instructors who completed questionnaires both prior to and following the introduction of self-pacing in the Supplyman course. These instructors had consistently more positive perceptions of the "old training program." However, their definition of "old training program" deserves some discussion.

It was the intention of the survey to distinguish between instructor perceptions of performance-oriented training (lock-step) and performance-oriented training (self-paced). The introduction of the new ASubjScd was very quickly followed by the introduction of self-pacing. To the general instructor population these two steps may have seemed to be one. Consequently, responses of instructors have been interpreted as comparing the conventional, non-performance, lecture-oriented training program to the performance-oriented training program (with or without self-pacing).

Significant negative changes were found between the instructors' perceptions before and after the introduction of self-pacing in regard to how much of, and how well students learned supply procedures ($p < .01$), instructor motivation and morale ($p < .05$), and efficient use of facilities and resources ($p < .001$). Item response data are presented on the instruments contained in Appendix B.

[1] The main cause of turnover was the local reassignment of NCOs to the 7th Division ( ) which was beginning activation of its Support Command at that time. Division assignments tended to attract the more career-oriented personnel.

ADMINISTRATIVE DATA

Recycle rates. For the seven months preceding the introduction of the performance-oriented ASubjScd, the course reported a 10.4% recycle rate. In the baseline classes 15 recycles were recorded (a rate of 10.8%). These 15 people spent a total of 40 extra weeks in the course. In the self-paced classes there were no formal recycles of personnel. Delayed graduations under self-pacing—for whatever reasons—are reflected in course completion data presented in Figure 3 and Table 3.

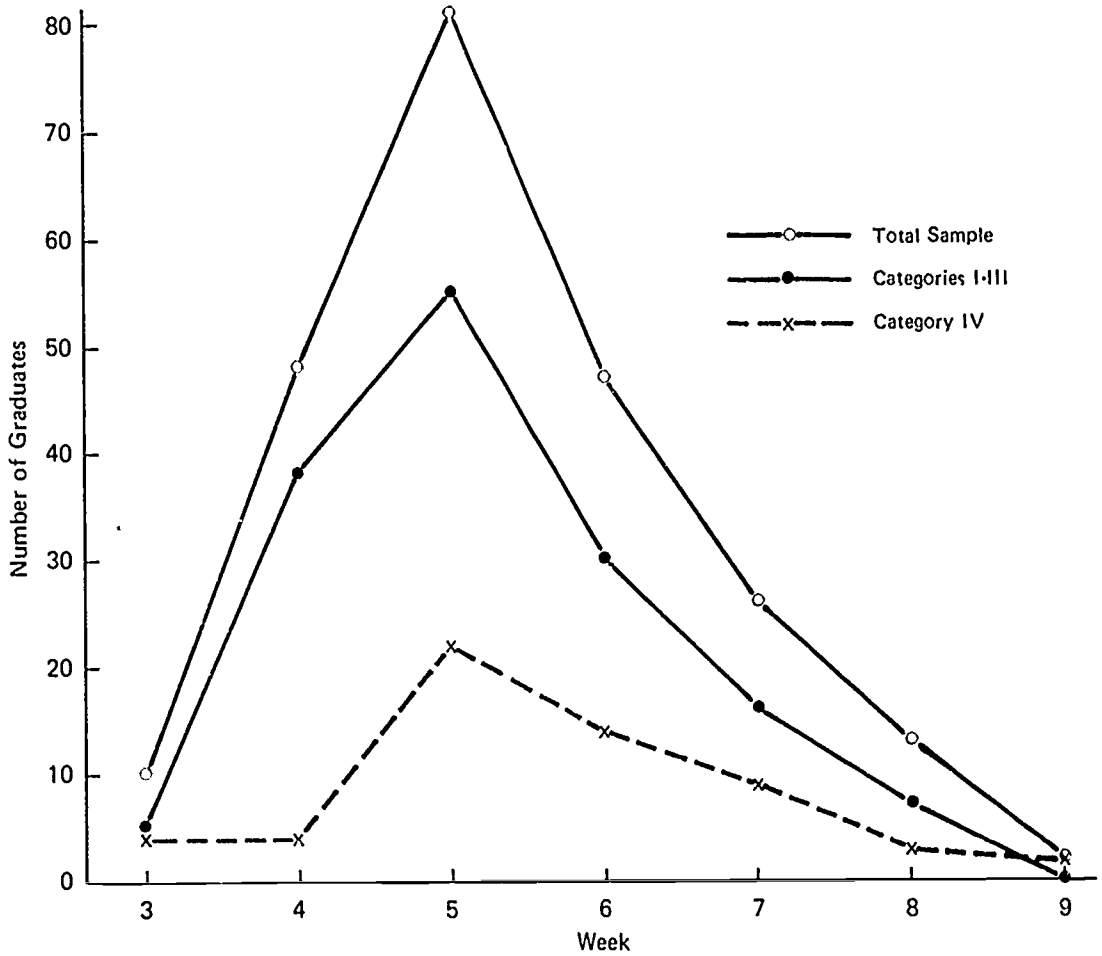


Figure 3. Self-Paced Numbers of Graduates Per Week, By Aptitude Categories

Attrition rates. There are three categories of actions used for dropping students from the course—administrative, academic, and unfit-for-service. Although there are guidelines for assigning these action categories, there is a good deal of room for local and individual interpretation. These actions are not, therefore, reported separately. Of the students entering the four baseline classes, 17% failed to graduate. Of the students entering the reported self-paced classes, 25% failed to graduate. This increase in attrition resulted—at least in part—from a local management decision which will be discussed in a later section of the report.

Table 3

Self-Pacing, Supplyman Course:
Percentage of Graduates by Week

	Week Graduated						
	3	4	5	6	7	8	9
Percent graduated	4	21	36	21	11	6	1

There were no significant differences between the number of Category IV personnel and the number of non-IV personnel dropped from either the self-paced (19 Cat IV; 37 non-IV) or the baseline (8 Cat IV; 15 non-IV) groups.

Management and student control. The major issue in regard to self-paced, performance-oriented instruction is whether or not an operational course can—within its normal resources and capabilities—cope effectively with individualized student progression. In order to assess the effects of "real-life" stress on the system, no specific student flow management scheme was initially prescribed by the research staff. The strategy was to see what problems arose and how the course personnel proposed to deal with them.

Student control systems were worked out without difficulty. A control board in the administrative office presented a record of where each individual was in the course on a day-by-day basis. Student movement between instructional and testing areas was controlled by use of "report to . . . ." instructions to students and copies of student grade cards. When a student reported to a new section, he presented his grade card copy to the instructor. The grade card indicated which sections and stations the student had already completed. By visual check the instructor could see whether the student was in the right place and either sign him in to the section or redirect him to his proper location.

The management scheme in the C Section (described earlier in the text and Figure 2) evolved spontaneously from the section instructors. This approach was an essential part of the research plan for accommodating fluctuating student input. The fact that the idea was also generated independently by course personnel was serendipitous.

At the outset of the self-pacing experiment the responsibilities of the course test center personnel were expanded to include administration of all tests (rather than just the end-of-course—EOC—test). This procedure presented management problems—too frequent student movement, and stress on test center personnel and facilities. When all except EOC test responsibility was returned to the section instructors, these problems were resolved with no threat to testing integrity.

Arrangements were made at brigade level to accelerate the processing of orders for unit assignments of students who were graduating early and were not subject to the restrictions of Public Law 82-51.[1] Graduates who could not go on immediately to their unit assignments (because of the law, delay in orders, etc.) were given the option of pursuing "enrichment" training (assignment to a local unit for OJT) or doing peer coaching in the Supplyman Course.

[1] This law prevents the assignment of soldiers to overseas units before they have had 16 weeks of training.

PERFORMANCE DATA

Overall performance. Performance criteria were the same for the baseline and self-paced groups, since both groups were governed by the new ASubjScd. Under the lock-step program students were held in the course for seven weeks (35 training days) recycles somewhat longer. The average time in the course for self-paced students was 25.1 days with a range of 13 to 44 days.

Figure 3 presents course completion data for students in the self-paced program. Numbers of graduates per week are presented for aptitude Category IV personnel, for non-IV personnel, and for the combined total self-paced group. The self-paced group was 28% Category IV (in the baseline group, 21%). However, it should be noted that the remaining self-paced population was only 2% Category II, and the remainder were Category III. As indicated in Figure 3, the self-paced performance of Category IV personnel followed the same general pattern as that of non-IV personnel except for the graduation rate between Weeks 3 and 4. Apparently Category IV personnel take slightly longer to adapt to an instructional system that relies on their personal motivation and allows for repeated attempts at test success.

Not included in these data are three individuals who were allowed, at their request, to complete the course work entirely independently using locally developed audio-visual aids and course documents. One of these individuals (a prior service person) completed the course in one and one-half weeks, another took two and one-half weeks, and the third took four weeks.

End-of-course test performance. The ASubjScd for the Supplyman specifies the composition of the EOC test but does not specify a test criterion. Local policy dictated a 70% criterion for the test. Every graduate in the baseline and self-paced groups met or surpassed this criterion.

FEASIBILITY

Facilities, equipment, and personnel. In terms of facilities, equipment, and personnel, the self-paced program levied no requirements beyond normal allocations. There was an initial need for additional supplies and reproduction of instructional materials which was accommodated within brigade resources. These were not beyond the usual requirements for the introduction of a new instructional program.

Course completion rates. Table 3 presents the percentages of self-paced graduates during each week. As indicated in the table, substantial numbers of self-paced students completed the Supplyman Course in fewer than the prescribed seven weeks.

DISCUSSION AND IMPLICATIONS

INSTRUCTOR ATTITUDES

It is not clear why the instructors perceived that self-paced students did not learn Supplyman skills as well as students under the non-performance-oriented ASubjScd. Under the performance-oriented ASubjScd, the standard test criterion is 100%, pass/fail, which means that the students in the self-paced program learned all of the required skills in each station. The instructors may have been reacting to their loss of absolute control over the presentation of instruction. They may have assumed that students could not acquire as much information on their own as they would get from lectures.

The reported decline in instructor motivation and morale probably resulted from several causes—the primary cause being the disturbance experienced when one is faced with major changes in role and procedures. In the self-paced program the instructors were removed from the familiar lecture-classroom paradigm and cast into the roles of instructional facilitators, training managers, and quality-control supervisors. These roles may have been somewhat uncomfortable because they were unfamiliar. In addition, testing responsibility was taken away from the instructors initially and given to the course test center, so that the instructors felt a serious lack of feedback on their students' progress. It was at about this time (early September 1974), that the second ("after self-pacing") survey was completed by the instructors. When testing responsibility was returned to the instructors (in early October), their roles became more meaningful and their attitudes became more positive. By late October the self-paced program had had time to "settle in" and the instructors began to feel more at ease and expressed attitudes in favor of self-pacing.[1]

Instructor perceptions of use of facilities and resources also are attributed to their discomfort with change. In the self-paced program there are times when some stations are not in operation because there are no students at that stage of the course. This does not occur often nor for long periods of time. Whenever a station is unoccupied, it becomes a resource facility for other stations where students may be "bunched." This semblance of lack of use fostered a negative impression on the part of the instructors.

However, in the lock-step program there were also times when one or more stations were not in use because of fluctuating inputs. A zero input would cause a one-week gap between classes for the seven weeks of the course, creating a standardized fluctuation in facility use. This gap also created a convenient hiatus for the instructors—a given time when they knew, reliably, that they would have a week off from classroom duties. This is not the case in the self-paced program—fluctuation in facility use is unscheduled and is keyed to the students' instructional needs.

Another expressed point of instructor dissatisfaction with the new program was that it created a heavier workload for them. This point has been a common thread throughout the several efforts of Work Unit ATC-PERFORM.[2] The introduction of performance-oriented training places demands of time and knowledge on instructors which are not excessive, but which are greater than those to which they are accustomed under the lecture-centered approach. In performance-based programs, instructors conduct training on a continuing daily schedule, they must have a broad spectrum of expertise in their fields, and they have the responsibility for quality control of training. When self-pacing is added, instructors must also participate in training management. In the lecture-centered approach, instructors are often actively involved in training for only part of each training day, leaving several hours per week during which they are present but not involved in instruction. Overall, better utilization is made of instructors' time and expertise during the training day in the performance-oriented, self-paced approach.

Another factor contributing to uneasiness on the part of instructors was the sizable and continuing turnover in their ranks. Aside from the underlying turmoil created by the turnover, the instructors on hand had to carry heavier workloads while newly assigned instructors were being trained.

Overall, it is felt that instructors' initial negative perceptions of the self-paced program largely reflected an expected resistance to change. In time, as they became more familiar with the new procedures, their attitudes became positive.

[1] See Management, Discussion and Implications section, page 21.

[2] Taylor and Staff, ATC-PERFORM, *op cit.*

ATTRITION RATES

Of the overall attrition rates reported in the data, discussion will involve only the academic and administrative drops from the course.[1] The reported administrative drop rate for the baseline group was 10%; for the self-paced group it was 4%. These types of drops are for early discharge requests and other nonacademic reasons and, therefore, vary from class to class depending on students' needs and circumstances. The academic drop rate increased from 3.5% for the baseline group to an average of 17% for the self-paced group, and it is this increase which will be the focus of discussion.

For the first of the four self-paced classes, the academic drop rate was 11%; for the second class, 20%, third class, 23%; and fourth class, 11%. The sharp rise is attributed to a local management inference that if a student failed five or more test attempts prior to entering the C Section, he would fail the end-of-course test. For each test a student is allowed three attempts to pass. To illustrate the point, a student might fail his first and second attempts to pass the first station test and pass that test on his third attempt. This would be counted as two "test failures." If the same pattern emerges on the second station test, he would approach the third station with a running total of four "test failures." One failing attempt to pass the third station test would put him into the potential drop category if the locally determined criterion was applied.

The practice of dropping students after five test attempt failures was introduced by the course personnel during the time the second self-paced class was in the course. The practice was discontinued at the request of the research staff, but not before it temporarily inflated the academic attrition rate.[2] This attrition rate began to recede prior to the completion of data collection. The academic attrition rate was reported to be even further reduced (to 4%) and the administrative drop rate increased (to 12%) some months after the experiment.[3]

MANAGEMENT

The requirements for preparation and phasing-in of self-pacing were not excessive. As noted earlier, preparation of instructional materials was the greatest demand—as would be the case in introducing any new instructional program—but this is a one-time effort. Only minor changes were required in the procedures for student control and maintenance of class records.

No serious stress was placed on the system because of the introduction of self-pacing. In fact, while the course was normally geared for an input of 50 students per week, they were receiving anywhere from 80 to 100 students per week during the self-pacing phase-in. It was later the general consensus of instructors and course administrative personnel that, had the course been completely self-paced at that time, they would have been able to handle this large rise and variation in input more efficiently. This expressed opinion was the first indication that the instructor attitude problem was being resolved. Class size between 6 January and 15 April 1975 (post-experimental) has fluctuated from a low of 10 to a high of 76 without causing any

[1] The unfit-for-service category is more formalized and is not subject to local interpretation. The drop rate in this category for the Supplyman Course is stabilized at about 4%.

[2] One of the premises of a performance-based system is that test failure is not a stigma but is a means of providing detailed feedback to students and instructors. The drop procedure interfered with this principle and the course manager was requested to discontinue the practice until the completion of data collection.

[3] Information provided through personal communications from Fort Ord to the research staff.

management problems. In fact, as predicted by course personnel during the phase-in of self-pacing, these variations in size of inputs are accommodated more efficiently in the self-paced program.

The only difficulty reported in the alternative methods of dealing with early graduates was in the the enrichment training. Graduates apparently were not given OJT nor allowed to practice their Supplyman skills, they wery more often used as errand-runners or served on work details. Subsequent to the experiment, action was taken by the brigade to solve this problem. Graduates' OJT is now monitored to insure that they are being utilized in Supplyman duties.

STUDENT PERFORMANCE

The overall accelerated accomplishment of course objectives by the students in the self-paced course (again see Figure 3) was not entirely expected, considering (a) the cognitive nature of the course content, (b) the high proportion of Category IV input, and (c) the clearly understood ground rule that the trainees were free to take as long as they needed. Only 7% of the trainees needed additional time (beyond seven weeks) to complete the course requirements. It should be noted that this is one of the important aspects of self-pacing—self-pacing does not necessarily mean that all students will graduate early: It means that those who need reasonable amounts of additional time to complete requirements can be allocated that time. The investment is small considering the time and training dollars already invested in these individuals up through the seventh week if, with a small amount of additional training, such slower learners can complete the course and go to the field qualified in their MOS.

FEASIBILITY

At the outset of the project, there was a firm expectation that many students would complete the course work in fewer than seven weeks. However, the extent of early completion, with graduations peaking in the fifth week, was not entirely expected. This finding, considered in light of the program's ease of management, efficient utilization of resources (facilities and personnel), and acceptance by students and (eventually by) instructors, indicates its feasibility for implementation and operation.

APPENDICES

Appendix A

STUDENT ATTITUDE SURVEYS NO. 1 AND NO. 2

For scoring purposes, responses were assigned scores of 1 through 5, with the first alternative equal to 5 and the last alternative equal to 1 on each item except item #3, for which frequency data only are reported.

HumRRO Supplyman Course

Student Survey No. 1

(Baseline N = 91
Self-Paced N = 205)

Name _____
Last First MI

Social Security No. _____

Class No. _____

Check one answer for each question which is closest to the way you feel about your Supplyman training.

	$\bar{X}$ Response Score		Significance Level
	Baseline	Self-Paced	
1. How do you think you will like learning Supplyman duties?			
Quite a lot Some About average Not much Very little	4.30	4.13	—
2. Do you think what you will learn will help you in your next assignment?			
Quite a lot Some About average Not much Very little	4.59	4.46	—

		$\overline{X}$ Response Score		Significance
		Baseline	Self-Paced	Level
3.	Where do you think you will get the most help in learning your Supplyman job?			
	My buddy	5	21	
	Another (more advanced) student	7	27	
	The Assistant Instructors	29	46	
	The NCO in charge	22	58	
	My duty assignment	28	53	
4.	How hard do you usually find tests?			
	Very hard Somewhat hard Average Easy Too easy	3.09	3.25	—
5.	Do you think you will be allowed to go through the course as fast as you can learn?			
	Yes Maybe Not sure I doubt it No	4.19	4.37	—
6.	Do you think you will get a chance to help another student and tell him what he is doing right or wrong?			
	Yes Maybe Not sure I doubt it No	4.10	4.19	—

HumRRO Supplyman Course

Student Survey No. 2

(Baseline N = 97
Self-Paced N = 220)

Name_____
Last First MI

Social Security No. _____

Class No._____

Check one answer for each question which is closest to the way you feel about your Supplyman training.

	$\bar{X}$ Response Score		Significance Level
	Baseline	Self-Paced	
1. How did you like learning Supplyman duties?			
Quite a lot Some About average Not much Very little	3.76	4.00	—
2. Do you think what you learned will help you in your next assignment?			
Quite a lot Some About average Not much Very little	4.10	4.36	—
3. Where did you get the most help in learning your Supplyman job?			
My buddy	8	9	
Another (more advanced) student	38	67	
The Assistant Instructors	39	123	
The NCO in charge	7	19	
Got no help	3	2	
4. How hard did you find the performance tests?			
Very hard Somewhat hard Average Easy Too easy	3.43	3.28	—

	$\bar{X}$ Response Score		Significance
	Baseline	Self-Paced	Level
5. Are the things you have to do in the performance tests about what you think you would have to do on the job? Definitely Somewhat Average Not quite Not at all	2.72	3.77	—
6. Were you allowed to take a performance test when you thought you were ready? Always Almost always Average Seldom Never	3.20	4.03	.001
7. Were the performance tests complete checks on what you were taught? Very complete Somewhat complete Average Very poor Incomplete	4.09	4.41	.01
8. Were you allowed to go through the course as fast as you could learn? Always Almost always Average Seldom Never	2.26	3.94	.001
9. Do you feel other students were allowed to go through the course as fast as they could learn? Always Almost always Average Seldom Never	2.33	3.82	.001

	$\bar{X}$ Response Score		Significance Level
	Baseline	Self-Paced	
10. Did you get a chance to help another student and tell him what he was doing right or wrong? All the time Quite often Usually Seldom Never	3.26	3.36	—
11. How often do students move ahead by themselves rather than as a group? Always Almost always Average Seldom Never	2.82	3.38	.001
12. Is the student who needs more time to learn given the additional time to get ready for the performance tests? Always Almost always Average Seldom Never	3.45	4.01	.001

Appendix B

INSTRUCTOR INFORMATION QUESTIONNAIRES NO. 1 AND NO. 2

For scoring purposes, responses were assigned scores of 1 through 5, with the first alternative equal to 5 and the last alternative equal to 1 on each item.

HumRRO Instructor Information Questionnaire No. 1

Please Print Date_____

Name_____ Rank _____ Unit _____

SSN_____ Years of service_____

Primary MOS_____ Years in Primary MOS_____

Secondary MOS_____ Years in Secondary MOS_____

Present job_____ How long?_____

Age_____Years of schooling_____

Where did you learn to be a Supply specialist? School_____

OJT_____

As an NCO in a unit have you supervised supplymen working on a job? Yes____ No____

In the following statements, please check the one answer which is closest to the way you feel or is closest to the correct information.

	$\bar{X}$ Response Score		Significance
	Pre	Post	Level
1. Students learn and are able to do well on Supply procedures in this course.			
Agree completely Agree moderately Undecided Disagree moderately Disagree completely	3.54	2.00	.01
2. Student motivation and morale are high in the Supplyman Course.			
Agree completely Agree moderately Undecided Disagree moderately Disagree completely	3.08	2.54	—
3. In the Supplyman Course, the NCOs have a heavy work load.			
Agree completely Agree moderately Undecided Disagree moderately Disagree completely	4.08	4.08	—
4. Motivation and morale of the NCOs are high in the Supplyman Course.			
Agree completely Agree moderately Undecided Disagree moderately Disagree completely	3.39	2.15	.05
5. The Supplyman Course makes efficient use of facilities and resources			
Agree completely Agree moderately Undecided Disagree moderately Disagree completely	4.08	2.15	.001

	$\bar{X}$ Response Score Pre	$\bar{X}$ Response Score Post	Significance Level
6. If I were in a unit in the field, I would like to have a graduate of this Course assigned to my platoon. Agree completely Agree moderately Undecided Disagree moderately Disagree completely	3.46	2.62	—
7. Most of what is taught in the Supplyman Course is need-to-know information. Agree completely Agree moderately Undecided Disagree moderately Disagree completely	3.92	3.23	—
8. Once a trainee has passed a test, he should be used to help another trainee who is having trouble. Agree completely Agree moderately Undecided Disagree moderately Disagree completely	4.00	3.00	—
9. Trainees could get a lot out of helping each other to learn. Agree completely Agree moderately Undecided Disagree moderately Disagree completely	4.08	3.31	—
10. Trainees should not be allowed to go on and learn a new skill in the course until they have mastered the one they are working on. Agree completely Agree moderately Undecided Disagree moderately Disagree completely	4.62	4.31	—

HumRRO Instructor Information Questionnaire No. 2

Please Print

Date _____

Name _____ Rank _____ Unit _____

SSN _____ Years of service _____

Primary MOS _____ Years in Primary MOS _____

Secondary MOS _____ Years in Secondary MOS _____

Present job _____ How long? _____

Age _____ Years of schooling _____

Where did you learn to be a Supply specialist? School _____

OJT _____

As an NCO in a unit have you supervised supplymen working on a job? Yes ____ No ____

In the following statements, please check the one answer which is closest to the way you feel or is closest to the correct information.

1. How does the new training program compare with the old training program as far as the amount of Supply procedures students actually learn or are able to do?

—— Students learn much more in the new program
—— Students learn a little more in the new program
—— Students learn about the same amount in both programs
—— Students learn a little less in the new program
—— Students learn much less in the new program

2. How does the new program compare with the old program as far as motivation and morale of students?

—— Student motivation and morale are much higher in the new program
—— Student motivation and morale are a little higher in the new program
—— Student motivation and morale are about the same as in the old program
—— Student motivation and morale are a little lower in the new program
—— Student motivation and morale are much lower in the new program

3. How does the new program compare with the old program as far as work load of the NCOs?

—— The NCO's work load is much heavier in the new program
—— The NCO's work load is a little heavier in the new program
—— The NCO's work loads are about the same as in the old program
—— The NCO's work load is a little lighter in the new program
—— The NCO's work load is much lighter in the new program

4. How does the new program compare with the old program as far as the motivation and morale of NCOs?

—— NCO's motivation and morale are much higher in the new program
—— NCO's motivation and morale are a little higher in the new program
—— NCO's motivation and morale are about the same in both programs
—— NCO's motivation and morale are a little lower in the new program
—— NCO's motivation and morale are much lower in the new program

5. How does the new program compare with the old program as far as the efficient use of facilities and resources?

—— The new program is far more efficient
—— The new program is a little more efficient
—— They are about equally efficient
—— The new program is a little less efficient
—— The new program is far less efficient

6. If I were in a unit in the field, I would like to have a graduate of this Course assigned to my platoon.

—— Agree completely
—— Agree moderately
—— Undecided
—— Disagree moderately
—— Disagree completely

7. Most of what is taught in the Supplyman Course is need-to-know information.

—— Agree completely
—— Agree moderately
—— Undecided
—— Disagree moderately
—— Disagree completely

8. Once a trainee has passed a test, he should be used to help another trainee who is having trouble.

—— Agree completely
—— Agree moderately
—— Undecided
—— Disagree moderately
—— Disagree completely

9. Trainees get a lot out of helping each other to learn.

—— Agree completely
—— Agree moderately
—— Undecided
—— Disagree moderately
—— Disagree completely

10. Trainees should not be allowed to go on and learn a new skill in the course until they have mastered the one they are working on.

—— Agree completely
—— Agree moderately
—— Undecided
—— Disagree moderately
—— Disagree completely