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Front-end Analyses of Three Navy Electrical/Electronics Technical Schools in the Model Schools Program

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91-08585



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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE August 1991	3. REPORT TYPE AND DATE COVERED Final--1 Oct 89-30 Sep 90	
4. TITLE AND SUBTITLE Front-end Analyses of Three Navy Electrical/Electronics Technical Schools in the Model Schools Program		5. FUNDING NUMBERS Program Element 0603720N Work Unit R1772- ET003	
6. AUTHOR(S) Barbara A. Morris, Ray E. Main, Josephine M. Randel, George E. Seymour			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Navy Personnel Research and Development Center San Diego, California 92152-6800		8. PERFORMING ORGANIZATION REPORT NUMBER NPRDC-TN-91-19	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Chief of Naval Operations (OP-01) Navy Department, Washington, DC 20350-2000		10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.		12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) Front-end analyses were conducted at three electrical/ electronics Model "A" schools. Structured interviews identified aspects of "A" school training that impact on student performance. These interviews with administrators, faculty, and students provided information about: (1) facilities, (2) instructor preparation and performance, (3) training methods, materials, and methodologies, and (4) student abilities, motivation, and performance deficiencies. High failure-rate tests and test items and the uncommon vocabulary words associated with high failure-rate test items were identified and documented for segments of the course associated with deficiencies in student performance. Analysis of responses to a Study Factors Survey associated a variety of study factors with test performance. The five study factors with the greatest number of significant correlations with achievement scores were Competition, Concentration, Memorization, Motivation, and Questioning.			
14. SUBJECT TERMS Front-end analysis, technical schools, study factors, technical training, student performance		15. NUMBER OF PAGES 37	
		16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT UNLIMITED

FOREWORD

This research and development effort was conducted under advanced development program element 0603720N (Education and Training), project R1772 (Education and Training Development, work unit ET003 (Skill Enhancement Program) and was sponsored by the Chief of Naval Operations (OP-01). The objective of this work unit is to identify and develop instructional technologies and techniques that effectively correct identified skill/knowledge deficiencies for broader use in Navy technical training.

The objective of this effort was to conduct front end analyses of three electrical/electronics technical schools to determine those aspects of "A" school training that impact on student performance.

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SUMMARY

Background

The Chief of Naval Education and Training established the Model Schools program during 1987. A model school is an improved technical training school that serves as an example for other schools.

During FY90, Navy Personnel Research and Development Center (NPRDC) was tasked to conduct front-end analyses of three electrical/electronics Model "A" schools. Front-end analyses of Navy technical schools are conducted to examine and understand student performance problems. In conducting these front-end analyses, information is gathered concerning the optimal performance and standards, current student performance or knowledge, and the opinions of students and staff about existing problems, their causes, and possible solutions to the problems.

Objective

The objective of this effort was to conduct front-end analyses of three electrical/electronics technical schools to identify aspects of "A" school training that impact on student performance.

Approach

Front-end analyses were conducted at three electrical/ electronics Model "A" schools. Data for the front-end analyses were gathered by: (1) conducting structured interviews, (2) examining high failure-rate tests and test items, and (3) administering a Study Factors Survey. Structured interviews with administrators, faculty, and students provided data on topics concerned with facilities; instructor preparation and performance; training methods, materials, and methodologies; and student abilities, motivation, and performance deficiencies. Course attrition, setback, and performance data were reviewed to determine segments of the course where students experience problems. Uncommon vocabulary words, which can cause students difficulty, were selected from high failure-rate tests and test items. A Study Factors Survey was administered to students to identify study skills that are related to school performance.

Findings

Interview Questionnaire

Aviation Electrician's Mate (AE), Fire Control Technician (FC), and Electronics Technician (ET) Phase I students rated the quality of their instruction as high. A variety of needs for better training media were expressed by school administrators, instructors, and students. All of the schools provide voluntary and mandatory night study, but no remedial study materials. Generally, higher level math skills, such as those involving algebra and trigonometry, were said to be a problem for students.

Student motivation appeared to be influenced by instructor attitude and support, the length of the school day and course, the pace of the course, noncourse military demands on time, and incentives.

High Failure-rate Tests

Ten of 16 AE tests, 10 of 33 FC tests, and 5 of 9 ET Phase I tests were found to have failure rates of more than 10 percent.

Uncommon vocabulary words associated with high failure-rate test items were listed and forwarded to each school (140 words for the AE school, 75 words for the FC school, and 72 words for ET Phase I school).

Study Factors Survey

Based on student responses to the Study Factors Survey, a wide variety of study factors were found to correlate with test performance at one or more of the three schools. Five study factors with the greatest number of significant correlations with test performance were Competition, Concentration, Memorization, Motivation, and Questioning. Anxiety and Mastery Beliefs had the next largest number of significant correlations. The greatest number of significant correlations occurred at the beginning of the course.

Conclusions

Structured interviews identified the following aspects of "A" school training that impact on student performance: inadequate heating and cooling systems, insufficient space available for classroom and laboratory instruction, out-dated training media, excessive student-to-instructor ratios, low student motivation, inadequate prerequisite skills (especially higher-level math), and inadequate remedial study programs.

High failure-rate tests and test items, and associated uncommon vocabulary words were identified for segments of the course with deficiencies in student performance.

Analysis of the Study Factors Survey responses associated a variety of study factors with test performance. The greatest number of significant factors appeared to correlate with student performance during the early segment of each course.

Specific Recommendations

It is recommended that Chief of Naval Technical Training (CNTECHTRA) continue to investigate the improvement of conditions found to cause training problems at technical schools. These include:

1. Training Facilities

Heating and cooling systems need to be maintained in order to assure appropriate climatic conditions for learning.

2. Instructor Preparation and Performance

Lower student-to-instructor ratios should be maintained during class and organized study periods.

New instructors should consistently be given an opportunity to observe effective experienced instructors teaching. (This process has already been found effective in those schools providing the observation experience.)

Efforts should be made to maintain positive instructor attitudes to support positive student motivation.

3. Training Methods, Materials, and Methodologies

Improved audio/visual equipment, presentations, and projection surfaces are needed.

Visual displays are needed for creating student interest. (Posters and interactive displays have been provided to the EM school by NPRDC; other displays have been generated by school staff.)

Instructional texts and corresponding test items need to be written more clearly and better coordinated.

Different versions of tests need to be equated in terms of difficulty and subject matter.

Effective remedial instruction with feedback on test errors need to be provided, rather than simple repetition of previously covered material.

4. Course Length and Pace

Slow tracks for marginal students should be investigated at schools where attrition or setback rates are excessive. (A slower track of instruction is being implemented at the AE school.)

Use of shorter school days should be investigated at schools where there are complaints of student burnout due to excessively long study periods. (Use of a shorter school day is being investigated at the ET Phase I school.)

5. Noncourse Demands

It should be ensured that nonschool military demands do not interfere excessively with satisfaction of course requirements. This is especially true for marginal students at difficult schools.

6. Incentives

Aversive or negative incentives for poor performance should be avoided.

General Recommendations

It is also recommended that CNTECHTRA continue to use methods found effective in this study for assessing Navy school deficiencies. These include:

1. TRAINTRACK and ISS Databases

While both databases provide student attrition and setback rates, ISS, in addition, provides student test scores, a critical parameter for assessing school effectiveness and determining areas of the course with high test failure rates.

2. The RIGHTWRITER Vocabulary Recognition Program

The RIGHTWRITER program was found effective for identifying unfamiliar vocabulary words associated with high failure-rate test items. (This program has since been used to establish vocabulary requirements for the Jobs-oriented Basic Skills (JOBS) Strand IV school.)

3. Interview Questionnaire

This was the survey questionnaire used to extract information from administrators, instructors, and students concerning the adequacy of facilities; instructors; training methods, materials, and methodologies; and student abilities, motivation, and performance deficiencies.

4. The Study Factors Survey

This instrument was found effective for identifying study skills and related factors that contribute to effective performance in Navy schools. (This instrument has since been used for establishing study skills training requirements for the JOBS Strand IV school. Resulting study skills course work is being considered for application in other Navy schools.)

Finally, it is recommended that quantitative indices of school effectiveness obtained in the present study (attrition rates, setback rates, and test scores) be combined into a single index of school productivity that can be used by school administrators in assessing training effectiveness. (A prototype formula for combining attrition rates, setback rates, and test scores into a single index of school productivity has since been developed by NPRDC.)

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INTRODUCTION

Background

The Chief of Naval Education and Training (CNET) established the model school program during 1987. This program establishes improved technical training schools to serve as examples for other Navy technical schools. The first technical school to be designated as a model school was the Electrician's Mate (EM) "A" school. A learning resource center was established at the EM school where computer programs, visual aids, study workbooks, and video tapes were made available to students. School administrators reported a decrease in student attrition and setback rates. As a result of success at the EM "A" school, CNET and the Chief of Naval Technical Training (CNTECHTRA) designated six additional schools to be included in the model school program during FY90. These "A" schools are: Interior Communications Electrician, Machinist's Mate, Radioman at Groton, Aviation Electrician's Mate (AE), Fire Control Technician (FC), and Electronics Technician (ET).

Designing and developing a model school is an on-going process that involves incorporating lessons learned from previous model school experiences. Part of this process includes identifying the aspects of selected "A" school training that impact on student performance. Investigators conduct front-end analyses of Navy technical schools to examine and understand student performance problems. In conducting these front-end analyses, information is gathered concerning the optimal performance standards, current student performance or knowledge, and the opinions of students and staff about existing problems, their causes and possible solutions.

During FY90, Navy Personnel Research and Development Center (NPRDC) received tasking to conduct front-end analyses of three electrical/electronics Model "A" schools--AE, FC, and ET Phase I. The ET course consists of two phases. The second phase of the ET "A" school is not taught at a model school and was, therefore, not included in this study.

Objective

The objective of this effort was to conduct front-end analyses of three electrical/electronics technical schools to identify aspects of "A" school training that impact on student performance.

METHOD

The front-end analyses consisted of: (1) conducting structured interviews, (2) examining high failure-rate tests and test items, and (3) administering a Study Factors Survey.

Subjects

Three school administrators, five instructors, and five students participated in structured interviews at each of three Navy electrical/electronics technical training schools (AE, FC, and ET Phase I), for a total of 39 subjects. The administrators were asked to select students with a representative range of abilities to be interviewed.

A total of 797 Navy enlisted students responded to a written Study Factors Survey to assess their study skills. These students were selected from classes in attendance during this study.

Quantitative Data Sources

To establish a profile of these schools for the year before this study (1989), course statistics such as graduation, attrition, and setback rates and length of setback were obtained from the Enlisted Training Tracking File (TRAINTRACK).¹ TRAINTRACK is a data base (maintained by NPRDC) of individual enlisted training episodes. Course lengths in days (AE = 110, FC = 180, ET = 85) were obtained from the school Master Course Schedule.

Current student test scores, test item analyses, and Armed Services Vocational Aptitude Battery scores for the previous six months were obtained from the Instructional Support System (ISS) data base, which is maintained by the Naval Education and Training Program Management Support Activity for some Navy technical schools. ISS contains student test scores, information that is not provided by TRAINTRACK.

FC school data were obtained verbally from FC personnel because these data were not in the ISS data base.

Interview Questionnaire

An interview questionnaire, developed by NPRDC and reviewed by CNTECHTRA, provided data on: (1) facilities, (2) instructor preparation and performance, (3) training methods, materials, and methodologies, and (4) student abilities, motivation, and performance deficiencies. Appendix A presents the faculty and student versions of the interview questionnaire.

After the initial contact was made with a school, the NPRDC team visited the school to:

1. Meet with school administrators to explain the purpose of our visit and tasks to be completed.
2. Obtain the Master Course Schedule for an overview of topics covered during the course.
3. Conduct structured interviews with the administrators, faculty, and students.

High Failure-rate Tests

Standardized test scores from August 1989 through January 1990 provided information about recent student performance. High failure-rate tests were characterized as those in which 10 percent or more of the students failed to reach criterion. High failure-rate test items were characterized as items on high failure-rate tests that 20 percent or more of the students answered incorrectly. Identified high failure-rate test items were analyzed to determine the cause for the high failure rate. These items were categorized by content area and test number.

¹Nakada, M. K., Milczewsky, W., & Wax, S. R. (1989). *Enlisted Training Tracking File (TRAINTRACK)* (NPRDC-TN-90-2). San Diego: Navy Personnel Research and Development Center. (AD-A214 984)

A computer program, RIGHTWRITER² (published by RightSoft), was used to identify uncommon vocabulary words in the high failure-rate test items. This computer program identifies words that are not commonly recognized by populations of Army and Navy personnel. A list of uncommon vocabulary words was prepared for each school.

Study Factors Survey

Study Factors include all clearly definable elements that affect learning and can be influenced by training. A Study Factors Survey (Appendix B), developed by NPRDC, was designed to determine which study factors the students possess and how these relate to test performance. The 98 statements in the survey examined the following 16 study factors: anxiety, competition, concentration, elaboration, graphic study aids, group study, mastery beliefs, memorization, motivation, organization, questioning, review, self-monitoring, study resources management, test anticipation, and test strategy.

Students responded to the survey using a Likert scale, where 4 = almost always, 3 = usually, 2 = sometimes, and 1 = almost never.

A total of 900 Study Factors Surveys was provided to the three schools. Instructors administered the Study Factors Survey to 271 FC students, 264 AE students, and 262 ET Phase I students. The completed surveys (797) were returned to NPRDC by mail, with a high return rate of 89 percent.

Samples of student test performance were obtained before the beginning, middle, and end of the course on one to four tests that 10 percent or more of the students failed (high failure-rate tests). For each segment of the course, individual tests were combined into a single score, using the following procedures. First, all scores were converted into standardized scores. Then, each student's test scores within each course segment were averaged. If more than three test scores were available, only the first three scores were averaged.

Student responses to the Study Factors Survey were analyzed and related to their performance on high failure-rate tests.

FINDINGS

Findings based on interview and quantitative data are discussed below. Table 1 presents graduation, attrition, and setback rates for 1989 to provide a performance profile of the schools prior to this study.

²Identification of the software is for documentation only and does not imply endorsement.

Table 1

Model "A" Schools: Profile for 1989

School	Academic Attrition	Nonacademic Attrition	Graduation Rate	Academic Setbacks	Nonacademic Setbacks
AE (N = 937)	12%	6%	81%	32%	11%
FC (N = 1004)	13%	12%	76%	47%	22%
ET I (N = 1238)	12%	10%	78%	15%	9%

Note: AE = Aviation Electrician's Mate, FC = Fire Control Technician, ET I = Electronics Technician, Phase I.

Interview Questionnaire

Information from the interviews has been reviewed and summarized in the following paragraphs.

Facilities

A common remark made by school administrators, instructors, and students concerned the inadequacy of the heating and cooling systems, which made it difficult to train students effectively at certain times of the year. ET Phase I school instructors also stated that their rooms and labs could not accommodate the number of students that they receive at various times during the year. Sound insulation was said to be poor and student noise presented a problem. These environmental problems could interfere with student learning.

FC and ET Phase I administrators reported having trouble supplying enough instructors to maintain a reasonable student-to-instructor ratio during class and during organized study periods. When recruitment levels increase significantly, this becomes more of a problem.

School administrators, instructors, and students expressed a variety of needs for better training media. The schools have outdated overhead projectors, films, and projection equipment. The instructors would like to have VCRs and more recent films, including motivational films. They expressed an interest in having the capability to develop their own videotapes for classroom use. The instructors would like to replace blackboards with larger white boards, to obtain nonglare surfaces for projecting visuals, and to have motivational posters and display boards to create an interest in electronics.

At the time the interviews were conducted, computers were used only for administrative purposes.

Instructor Preparation and Performance

AE, FC, and ET Phase I instructors reported they spend many hours per week preparing for their classes. Suggestions they made for improving their teaching included (1) slowing the pace of instruction, (2) updating classroom and lab equipment, (3) stating the test questions in clearer

terms, (4) having a smaller student-to-instructor ratio for labs and remedial study, (5) sharing ideas with other instructors, and (6) improving the instructor and student guides.

The AE school maintains high instructor motivation by giving new instructors an opportunity to observe experienced instructors teaching, by using student comments, by providing instructor training, and by involving instructors in social activities.

AE, FC, and ET Phase I students rated the quality of their instruction as high. FC students pointed out that quality varies considerably from one instructor to another.

Training Methods, Materials, and Methodologies

At the time of this study, no major curriculum changes had been made since 1989. Students and instructors considered the curriculum adequate, but noted that schematics and illustrations could be improved. Learning aids used during lecture periods consisted of transparencies, test equipment, simulators, and films.

Major complaints about the instruction and testing dealt with the clarity and appropriateness of tests and training materials, and the pace of training. Schools often use several versions of a test, which are not always equated in difficulty. According to FC and ET Phase I school personnel, portions of their tests, and student and instructor guides were not clearly written or did not follow what was to be taught.

AE and FC students commented that, because instructors did not review missed test items, they did not always know what concepts were causing them problems. ET Phase I instructors reviewed commonly missed test items with classes but did not give answers to specific items.

All schools provide voluntary and mandatory night study, but no remedial study materials. The level of support provided by the instructors varies greatly. For instance, FC instructors stated that classroom space for night study was generally adequate but sometimes there were only 2 instructors for 60 students. FC students said they could not get to voluntary night study because of military requirements. ET Phase I students complained that mandatory study started at 5:30 in the morning. The ET Phase I school provided a formal peer tutoring program at the barracks area which some of the students considered helpful. The AE school had an instructor available to students in the barracks area. AE students considered these instructors to be very helpful.

AE school personnel recognized a need for training in basic study skills and were developing study skills instruction. The FC school provided 2 hours of indoctrination training which includes study skills. FC students said they need instruction in note taking, test taking strategies, and coping with learning at a fast pace. ET Phase I school provided pamphlets on study skills and was planning to add study skills training to their course.

Student Abilities, Motivation, and Performance Deficiencies

Abilities. Generally, higher level math skills, such as those involving algebra and trigonometry, were said to be a problem for students. All of the school personnel expressed a need

for better student preparation in math. AE students stated they had problems with technical vocabulary.

Motivation. Student motivation appeared to be influenced by instructor attitude and support, the length of the school day and course, the pace of the course, noncourse military demands on time, and incentives. The FC students indicated that instructors try to enhance motivation by telling them stories about their experiences in the Navy. All of the instructors told them learning the course material would benefit them in the fleet.

Students who are failing may be assigned to mandatory night study, brought before an examination board, or required to sign disenrollment forms. Students felt that strong negative policies make them anxious, lower morale, and do little to enhance motivation or improve performance.

Instructor Attitude. Student motivation was generally high at the AE school where instructors are enthusiastic and provide a great deal of instructional and moral support during both the regular class time and remedial study periods. AE, FC, and ET Phase I students preferred civilian instructors, claiming they were more supportive.

Course Length and Pace. FC instructors and students rated motivation generally low although students rated motivation high at the start of the course. Instructors felt that low student motivation was a result of the fast pace of instruction and the length of the course. FC and AE administrators stated that a longer course might save time by reducing setbacks. At the time of this study, the AE school was preparing to experiment with a second track for marginal students.

ET Phase I school personnel indicated motivation was low because of the fast pace of instruction and the long school day (8 hours of instruction plus 2 hours of remediation). ET Phase I instructors felt students would learn just as much with a shorter instructional day. Motivation appeared to decline toward the end of the course.

Noncourse Demands. FC and ET Phase I students stated that watchstanding and excessive nonschool military requirements did not leave enough time for studying or for themselves.

Incentives. FC students stated they were "stressed out" by the material in the course, and fear of failure and reclassification. The schools attempt to maintain student motivation by rewarding high performers with time off, excusing them from some military requirements, giving them a choice of duty stations, and promoting them.

Performance Deficiencies. AE instructors stated that most attrition occurred during the early course segments, which involve combination series and parallel circuits, and voltage dividers, and during later course segments, which involve magnetic field and compass systems, and generators.

FC instructors identified the first 10 weeks of the course, which cover basic electricity/electronics, and specific topics such as basic linear circuits, resonance, and complex circuits, as the most difficult for students.

ET Phase I instructors identified the course segments on alternating current (AC) circuits, wave shaping circuits, and wave generating circuits as causing students the most difficulty.

High Failure-rate Tests

All tests for the AE, FC, and ET Phase I courses were examined to determine student failure rates. The subject matter and uncommon vocabulary words associated with the high failure-rate test items were identified.

The AE high failure-rate tests (10 of 16 tests) covered Ohm's Law, direct current (DC) series and parallel circuits, magnetism, AC generators, and electrohydraulics. The FC high failure-rate tests (10 of 33 tests) were mostly those given during the first 10 weeks of the course. These tests covered introduction to matter and energy, DC series and parallel circuits, AC generation and waveforms, inductors and inductance circuits, capacitors, transformers, and amplifiers. The ET Phase I high failure-rate tests (5 of 9 tests) covered AC theory, inductance, capacitance, transistors, transformers, wave shaping circuits, wave generating circuits, oscillators, and transmitters.

Uncommon vocabulary words, associated with high failure-rate test items, were compiled and listed for each school. The AE school list contained 140 words, the FC school list contained 75 words, and the ET Phase I school list contained 72 words.

A sample of these uncommon vocabulary words are: alternator, analog, azimuth, ammeter, cathode, capacitor, coefficient, conductance, discrete, electrolytic, electromotive, electrostatic, emitter, excitor, flux, impedance, inductive, inertial, ohms, orientation, photoelectric, potentiometer, proportional, rectifier, resistance, resonant, retraction, schematic, stepdown, and symmetry.

Study Factors Survey

The five study factors with the greatest number of significant correlations with achievement scores (Table 2) were Competition, Concentration, Memorization, Motivation, and Questioning. Anxiety and Mastery Beliefs had the next largest number of significant correlations. Correlations between Anxiety and student achievement were negative, as expected. Other negative correlations were not predicted.

The greatest number of significant study factors appeared in the early segment of each course. Six significant correlations were found for the AE school; 18 significant correlations, for the FC school; and 25 significant correlations, for the ET Phase I school. These results suggest students could benefit from study skills training.

Table 2
Model "A" Schools: Correlations Between Study Factor Scales
and School Performance

Study Factor	S ^a	Correlation		
		AE	FC	ET Phase I
Anxiety	1	-.16*	-.25**	-.10
	2	-.10	-.04	-.02
	3	-.01	-.01	-.08
Competition	1	.09	.28**	.30**
	2	.18*	.28**	.20**
	3	.18	.38**	.08
Concentration	1	.16*	.23*	.31**
	2	.13	.37**	.14*
	3	.21*	.29**	.22**
Elaboration	1	-.05	-.05	.17**
	2	.09	.09	.10
	3	-.04	.19*	.11
Graphic Study Aids	1	-.07	.00	.15**
	2	.10	-.05	.13*
	3	.05	.09	.08
Group Study	1	-.13	-.11	-.13*
	2	-.10	.04	-.07
	3	-.02	.02	-.07
Mastery Beliefs	1	.07	.05	.23**
	2	.16*	-.04	.11*
	3	.11	.24	.07
Memorization	1	.08	.12	.27**
	2	.10	.25**	.24**
	3	.08	.37**	.19**

Note: AE = Aviation Electrician's Mate, FC = Fire Control Technician., ET Phase I = Electronics Technician, Phase I.

*Course segment: 1 = beginning, 2 = middle, 3 = end.

* $p < .05$.

** $p < .01$.

Table 2 (Continued)

Study Factor	S ^a	Correlation		
		AE	FC	ET Phase I
Motivation	1	.08	.15	.31**
	2	.18*	.18*	.18**
	3	.12	.22*	.11
Organization	1	-.05	-.04	.19**
	2	.07	.02	.11
	3	-.06	.11	.06
Questioning	1	-.03	.08	.22**
	2	.05	.35**	.17**
	3	.02	.33**	.21**
Review	1	-.02	.02	.14*
	2	.10	.15	.10
	3	-.03	.21*	.08
Self-monitoring	1	.06	-.04	.21**
	2	.10	.12	.16**
	3	.02	.07	.06
Study Resources Management	1	-.05	-.04	.11*
	2	.03	-.01	.04
	3	.10	.07	.02
Test Anticipation	1	.06	-.10	.14*
	2	.09	.12	.11
	3	.10	.26**	.00
Test Strategy	1	-.07	-.42**	.02
	2	-.07	-.13	-.05
	3	.01	-.01	.05
Number of Significant Correlations per School		6	18	25
Number of Significant Factors per School		5	11	14

Note: AE = Aviation Electrician's Mate, FC = Fire Control Technician, ET Phase I = Electronics Technician, Phase I.

^a Course segment: 1 = beginning, 2 = middle, 3 = end.

* $p < .05$.

** $p < .01$.

CONCLUSIONS

Structured interviews identified the following aspects of "A" school training that impact on student performance: inadequate heating and cooling systems, insufficient space available for classroom and laboratory instruction, out-dated training media, excessive student-to-instructor ratios, low student motivation, inadequate prerequisite skills (especially higher-level math), and inadequate remedial study programs.

High failure-rate tests and test items, and associated uncommon vocabulary words documented segments of the course with deficiencies in student performance. Despite instructor emphasis on early course failure, high failure-rate tests were found for all segments of all courses. Ten of 16 AE tests, 10 of 33 FC tests, and 5 of 9 ET Phase I tests were found to have failure rates of more than 10 percent. The uncommon vocabulary words identified were electronics/electricity technical terms.

Analysis of the Study Factors Survey responses associated a variety of study factors with test performance. The greatest number of significant factors (Anxiety, Competition, Concentration, Elaboration, Graphic Study Aids, Mastery Beliefs, Memorization, Motivation, Organization, Questioning, and Self-monitoring) appeared to correlate with student performance during the early segment of each course. Therefore, students would benefit most if they received study skills training early in the course or before the course begins.

SPECIFIC RECOMMENDATIONS

It is recommended that Chief of Naval Technical Training (CNTECHTRA) continue to investigate the improvement of conditions found to cause training problems at technical schools. These include:

1. Training Facilities

Heating and cooling systems need to be maintained in order to assure appropriate climatic conditions for learning.

2. Instructor Preparation and Performance

Lower student-to-instructor ratios should be maintained during class and organized study periods.

New instructors should consistently be given an opportunity to observe effective experienced instructors teaching. (This process has already been found effective in those schools providing the observation experience.)

Efforts should be made to maintain positive instructor attitudes to support positive student motivation.

3. Training Methods, Materials, and Methodologies

Improved audio/visual equipment, presentations, and projection surfaces are needed.

Visual displays are needed for creating student interest. (Posters and interactive displays have been provided to the EM school by NPRDC; other displays have been generated by school staff.)

Instructional texts and corresponding test items need to be written more clearly and better coordinated.

Different versions of tests need to be equated in terms of difficulty and subject matter.

Effective remedial instruction with feedback on test errors need to be provided, rather than simple repetition of previously covered material.

4. Course Length and Pace

Slow tracks for marginal students should be investigated at schools where attrition or setback rates are excessive. (A slower track of instruction is being implemented at the AE school.)

Use of shorter school days should be investigated at schools where there are complaints of student burnout due to excessively long study periods. (Use of a shorter school day is being investigated at the ET Phase I school.)

5. Noncourse Demands

It should be ensured that nonschool military demands do not interfere excessively with satisfaction of course requirements. This is especially true for marginal students at difficult schools.

6. Incentives

Aversive or negative incentives for poor performance should be avoided.

GENERAL RECOMMENDATIONS

It is also recommended that CNTECHTRA continue to use methods found effective in this study for assessing Navy school deficiencies. These include:

1. TRAINTRACK and ISS Databases

While both databases provide student attrition and setback rates, ISS, in addition, provides student test scores, a critical parameter for assessing school effectiveness and determining areas of the course with high test failure rates.

2. The RIGHTWRITER Vocabulary Recognition Program

The RIGHTWRITER program was found effective for identifying unfamiliar vocabulary words associated with high failure-rate test items. (This program has since been used to establish vocabulary requirements for the JOBS Strand IV school.)

3. Interview Questionnaire

This was the survey questionnaire used to extract information from administrators, instructors, and students concerning the adequacy of facilities; instructors; training methods, materials, and methodologies; and student abilities, motivation, and performance deficiencies.

4. The Study Factors Survey

This instrument was found effective for identifying study skills and related factors that contribute to effective performance in Navy schools. (This instrument has since been used for establishing study skills training requirements for the JOBS Strand IV school. Resulting study skills course work is being considered for application in other Navy schools.)

Finally, it is recommended that quantitative indices of school effectiveness obtained in the present study (attrition rates, setback rates, and test scores) be combined into a single index of school productivity that can be used by school administrators in assessing training effectiveness. (A prototype formula for combining attrition rates, setback rates, and test scores into a single index of school productivity has since been developed by NPRDC.)

APPENDIX A
INTERVIEW QUESTIONNAIRES

Front-End Analysis for Model Schools
(Faculty Version)

School _____

Date _____

Facilities

1. Are the classrooms adequate for instruction or are improvements needed?

If improvements are needed, explain.

Are the following adequate:

- heat
- lighting
- location
- computers (if used)

2. Are there areas set aside for night study or remediation?

If so, are they adequate, or are improvements needed?

If improvements are needed, explain.

Is it quiet at night study?

Are adequate instructors available at night study?

What is the instructor to student ratio at night study?

3. Are there quiet areas where the students can study?

Describe these areas?

Are they adequate, or are improvements needed?

If improvements are needed, explain.

Instructor Preparation and Performance

4. How long is the teaching day?
5. How much time do the instructors have to spend outside the classroom on:
- preparation
 - remediation
6. Are there improvements that you could suggest to assist instructors in their teaching?

If you listed several improvements, what is their order of importance?

7. Are external incentives (rewards, awards) used to motivate the students?

8. Are internal incentives (value of doing well) used to motivate?

Training Methods, Materials, and Methodologies

9. Is the Instructor Guide good, adequate, or could improvements be made?

If improvements are needed, what are these?

10. Is the Student Guide good, adequate, or could improvements be made?

If improvements are needed, what are these?

11. When was the curriculum reviewed last?

Were changes made as a result of the review?

If so, what changes?

12. What type of media are used in the school:

- films
- video
- computers
- other (list)

Are there media not used in the course which you would like to use?

13. Do you use an automated system for tracking testing?

If so, describe that system.

14. Describe your remediation process.

15. Have remediation materials been developed for the course?

16. Does the school provide any training in study skills?

If so, describe the training.

Student Abilities, Motivation, and Performance Deficiencies

17. Are the students lacking in prerequisite skills?

If so, which skills and what percentage of students lack these skills?

18. In general, is the motivation of the students:

___ high ___ average ___ low

Can you explain the reason for the motivation level of the students?

19. What is the passing criteria for tests?

Is it the same for all tests?

20. What are the main reasons for academic and non-academic attrition?

21. In which phase does most attrition occur?

22. What subject areas are the most difficult for the students?

23. Over the past year, what was your rate of:

___ attrition ___ academic attrition ___ setback

Front-End Analysis for Model Schools

(Student Version)

Facilities

1. Are the classrooms adequate for instruction or are improvements needed?

If improvements are needed, explain.

Are the following adequate:

- heat
- lighting
- location
- computers (if used)

2. Are there areas set aside for night study or remediation?

If so, are they adequate, or are improvements needed?

If improvements are needed, explain.

Is it quiet at night study?

Is it orderly at night study?

3. Are there quiet areas where the students can study?

Describe these areas?

Are they adequate, or are improvements needed?

If improvements are needed, explain.

How many instructors per students are available at night study?

Instructor Preparation and Performance

4. Are the instructors usually prepared for class?
5. Do the instructors make an effort to ensure everyone understands the material taught?
6. Can you get extra help outside of regular classroom hours if needed?
7. In general, would you say that the quality of instruction is:
___ very high ___ high ___ average ___ low ___ very low
8. Do most instructors encourage questions from the students?
9. Do most instructors review tests and quizzes with the students?

Training Methods, Materials, and Methodologies

10. Is the Student Guide good, adequate, or are improvements needed?

If improvements are needed, what are these.

11. What happens when you fail a test?

12. Does the school provide any training in study skills?
If so, describe the training.

13. Are there any changes that you would recommend to make this a model school?

Student Abilities, Motivation, and Performance Deficiencies

14. Are there some skills you needed to be better prepared in before starting this school?

If so, which skills?

15. In general, is the motivation of the students:

___ high ___ average ___ low

Can you explain the reason for the motivation level of the students?

16. What subject areas are the most difficult for the students?

APPENDIX B
STUDY FACTORS SURVEY

Almost
 A = Always, U = Usually, S = Sometimes,

Almost
 N = Never

	A	U	S	N
9. I outline my course materials.....	—	—	—	—
10. Reading something once without review is enough.	—	—	—	—
11. I have trouble paying attention when reading my text books.....	—	—	—	—
12. How well I do in this course depends on how well I try.....	—	—	—	—
13. I look over a chapter before I read it.....	—	—	—	—
14. My ability to pass the tests in this course depends on other student's grades.....	—	—	—	—
15. If it's noisy, then I can't study.....	—	—	—	—
16. I feel anxious just before a test.....	—	—	—	—
17. I look to see how things I study are similar and different from each other.....	—	—	—	—
18. When I study I imagine how to use what I read..	—	—	—	—
19. I prefer to study alone.....	—	—	—	—
20. I have trouble reading charts and diagrams.....	—	—	—	—
21. I review my course materials for a test.....	—	—	—	—
22. I ask questions in class.....	—	—	—	—
23. I write possible test questions before the test	—	—	—	—
24. Do you get together with other students when you study?.....	—	—	—	—
25. Doing my best in school is very important.....	—	—	—	—
26. When I do poorly in a course it is because I have a poor instructor.....	—	—	—	—
27. I try to relate new information to what I already know.....	—	—	—	—
28. It's hard for me to ask questions in class.....	—	—	—	—

(Continue to the next page)

Almost
A = Always, U = Usually, S = Sometimes,

Almost
N = Never

	A	U	S	N
29. I am able to memorize important facts.....	—	—	—	—
30. I'm tired when studying because I study at the wrong times.....	—	—	—	—
31. I draw diagrams to help me understand what I am studying.....	—	—	—	—
32. I study at a regular time and place.....	—	—	—	—
33. Class work and homework come before party time..	—	—	—	—
34. I avoid asking questions in class.....	—	—	—	—
35. I put forth my best effort in school	—	—	—	—
36. I associate things that I want to remember.....	—	—	—	—
37. Studying with others is a waste of time.....	—	—	—	—
38. I have trouble reading or understanding tables.	—	—	—	—
39. My ability to pass the tests in this course depends on how hard I study.....	—	—	—	—
40. I try to see relationships between things I study	—	—	—	—
41. When I make an error I try to find out why.....	—	—	—	—
42. If a textbook has a self-test, I answer the questions.....	—	—	—	—
43. Studying with others helps me to learn.....	—	—	—	—
44. I study the tables in my course materials.....	—	—	—	—
45. When I do well in a course it is because I have a good instructor.....	—	—	—	—
46. How often do you read course material without really understanding what you are reading.....	—	—	—	—
47. I rewrite course information in my own words....	—	—	—	—
48. When answering multiple choice questions, I try to eliminate some answers first.....	—	—	—	—

(Continue to the next page)

Almost
 A = Always, U = Usually, S = Sometimes, Almost
 N = Never

	A	U	S	N
49. Are you concerned about competing with classmates	___	___	___	___
50. Taking a test makes me nervous.....	___	___	___	___
51. When working a math problem I have an idea about the size of the answer	___	___	___	___
52. I allow enough time to study for exams.....	___	___	___	___
53. I use a specific memory method for studying.....	___	___	___	___
54. When studying I reword things my own way.....	___	___	___	___
55. I try to complete all school assignments.....	___	___	___	___
56. I go over my notes or outlines until I know them	___	___	___	___
57. How hard I work in school does not seem to affect how well I learn.....	___	___	___	___
58. I try to figure out what will be on each test...	___	___	___	___
59. I repeat things over and over to remember them..	___	___	___	___
60. I check to see if what I am learning agrees with what I already know.....	___	___	___	___
61. Studying is more important than being with friends.....	___	___	___	___
62. How often can you tell if your studying is not being effective or useful.....	___	___	___	___
63. I can concentrate even when its noisy.....	___	___	___	___
64. To get high grades on a test in this course I have to do better than most of my classmates...	___	___	___	___
65. I would rather study in a small group than study alone.....	___	___	___	___
66. Studying charts and tables is a waste of time..	___	___	___	___
67. I study the key points of a textbook.....	___	___	___	___
68. Taking notes in class is important to me.....	___	___	___	___

(Continue to the next page)

Almost
 A = Always, U = Usually, S = Sometimes, N = Never

	A	U	S	N
69. When I do well in a test it is because of an easy grading system.....	—	—	—	—
70. I try to compare what I am studying to other material in the course.....	—	—	—	—
71. I learn new information when I review a chapter	—	—	—	—
72. When an answer doesn't look right to me I recheck my work.....	—	—	—	—
73. I can picture in my mind what I want to remember	—	—	—	—
74. Before studying, I ask myself what I am supposed to learn.....	—	—	—	—
75. When taking a test I skip hard questions and work on them later.....	—	—	—	—
76. While studying my eyes wander around the room...	—	—	—	—
77. I can tell when I make an error while working a problem.....	—	—	—	—
78. When I take multiple choice tests there are honest methods I use to improve my score.....	—	—	—	—
79. I find it difficult to pay attention in class...	—	—	—	—
80. When taking a test my mind goes blank and I can't think.....	—	—	—	—
81. I tend to read test questions incorrectly.....	—	—	—	—
82. I have little idea of what is going to be asked on a test.....	—	—	—	—
83. I can tell when I've done something that is not logical.....	—	—	—	—
84. I get together with classmates to study.....	—	—	—	—
85. I memorize school work without understanding it.	—	—	—	—
86. I wish I were assigned to another school.....	—	—	—	—
87. I try to study where I won't be distracted.....	—	—	—	—

(Continue to the next page)

Almost
A = Always, U = Usually, S = Sometimes, N = Never

	A	U	S	N
88. I write a summary about what I have just studied.	___	___	___	___
89. In general, it is a bad idea to guess at a test answer.....	___	___	___	___
90. I study the charts and diagrams that appear in my course materials.....	___	___	___	___
91. I tend to worry about my school performance.....	___	___	___	___
92. When studying for a course I think about what may be on the test.....	___	___	___	___
93. I become bored if I have to review course materials I have already covered.....	___	___	___	___
94. I tend to put off studying until I don't have enough time.....	___	___	___	___
95. I worry about failing courses I take.....	___	___	___	___
96. On tests, I answer the easy questions first.....	___	___	___	___
97. I try to pay special attention to what is emphasized by the instructor.....	___	___	___	___
98. I look to see how things I study are similar and different.....	___	___	___	___

Please go back and check to see if every question has been answered. Thank you for your cooperation in completing all of the questions in this Survey.

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