Training Program Review:
Theater Battle Management Core Systems
(TBMCS)
Training Program Evaluation

i.1.1

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

Electronic Systems Center (ESC)/AC, Battle Management Command, Control, and Communications (BMC3) System Program Office (SPO) evaluated the training provided on the Theater Battle Management Core Systems (TBMCS) v1.0.1 in 1999-2000, and i1.1 in 2001-2002. The primary purpose of the training evaluations were to provide an in-depth analysis in assisting future Command and Control (C2) decision makers in determining under what conditions distributed learning is likely to be effective for future C2 systems, and to identify if any positive or negative trends exist between v1.0.1 training vs. i1.1. Both evaluations focused on measurable learning and student perception of learning.

To demonstrate the effectiveness and value of the training programs, Kirkpatrick's theory of evaluation was used. Data was collected through a series of end-of-course critiques, focus groups, observations, and student self-assessments. During TBMCS v1.0.1 training, end-of-course critiques suggested students were not "satisfied" with the concept of self-paced distributed learning; however, measurable pre-/post-test scores revealed that students understood facts and concepts, suggesting that knowledge "achievement" resulted from the training.

Data gathered from the i1.1 training indicated that changing the web-based instruction to mobile training team (MTT) instruction resulted in a significant increase in overall student satisfaction; however, a cumulative average gain between pre and post-tests suggests that there was not a significant difference in knowledge gained between the two implementation styles.

1.0—INTRODUCTION

1.1 BACKGROUND

DODI 5000.2, the Defense Acquisition System states that the SPD shall ensure that the design and acquisition of systems will be cost effectively supported and shall ensure that these systems are provided to the user with the necessary support infrastructure for achieving the user's peacetime and wartime readiness requirements.[1] Support resources include operator and maintenance manuals, tools, equipment, and training. Furthermore, the SPD shall consider the use of embedded training and maintenance techniques to enhance user capability and reduce life cycle costs. Air Force Instruction (AFI) 63-123, Evolutionary Acquisition for Combat and Control Systems, states that prior to system fielding, the SPD shall ensure sufficient training is complete to fulfill approved operational concepts of employment and sufficient support in place to fix failures and sustain the system.[2]

In accordance with (IAW) the policies stated above, the SPD for TBMCS fielded v.1.0.1 during FY 01-FY02. To ensure the adequacy of v.1.0.1 TBMCS training evaluation criteria was defined as follows:

- *Context evaluations* that serve as planning decisions to determine what needs are to be addressed
- *Input evaluations* to serve structuring decisions in determining what resources are available and what training strategies should be considered
- *Process evaluations* to serve as implementing decisions such as how well the plan is being implemented and what barriers threaten its success
- *Product evaluations* to serve future product decisions

The goals of the v.1.0.1 training review were to provide:

- A summative evaluation that identifies strengths, weaknesses, lessons learned, and best practices of the TBMCS training program
- An in-depth analysis in assisting future C2 decision makers in determining under what conditions distributed learning is likely to be effective for future C2 systems
- A holistic view (context, input, process, product evaluation) of TBMCS training that shows the impact of training, not only on the individual but on the United States Air Force (USAF) as well

1.2 SYNOPSIS OF TMBCS 1.0.1 TRAINING

1.2.1 Purpose

The TBMCS 1.0.1 Training Program Review dated May 2002 provided an in-depth analysis to assist future C2 decision makers in determining the conditions necessary for effective distributed learning for future C2 systems. A synopsis of findings are presented in terms of (a) a summative evaluation that identifies strengths, weaknesses, lessons learned; (b) best practices of the TBMCS training program; and (c) a holistic view (context, input, process, and product evaluation) of the TBMCS distributed training program that shows the impact of training, not only on the individual but on the USAF as well.

1.2.2 Advanced Distributed Learning (ADL) Initiative

The Department of Defense (DOD) Strategic Plan for ADL, dated April 30,1999, identifies an ADL initiative intended to implement the Secretary of Defense's "anytime, anywhere, anyplace" training vision. ESC was proactive in meeting the learning and technology needs identified in the ADL initiatives and the DOD Strategic Plan when developing TBMCS 1.0.1 training material. A great deal of progress was made in shifting from a paper-based, instructor-led training program established in 1995, to a distributed, web-based training program led by facilitation upon fielding in 2001. Meeting the requirements of anywhere, anytime, and anyplace learning requires solutions to many technical, security, and financial barriers. As users from locations worldwide attempted to access TBMCS materials located on distributed servers, three problems emerged. The first problem was accessing materials from remote locations; the second NIPRNET bandwidth; and the third local computer security initiatives hindering the use of web servers at user locations.

1.2.3 Data Collection Techniques

Due to the numerous training baseline changes conducted during the overall software development evolution, inconsistencies of data collection, and lack of raw data, this study did not lend itself to a hypothesis testing approach. Instead, an exploratory research methodology was chosen to support SPD concerns. Seven research questions presented in the May 2002 report were identified by the SPD as the basis for determining the effectiveness of the TBMCS distributed training program. Kirkpatrick's theory of evaluation (satisfaction, learning, transfer, and ROI) was used to categorize the data collected. Overall data was gathered using four collection methods: surveys, focus groups, pre-/post-tests, and a student self-assessment.

1.2.4 TBMCS v.1.0.1 Findings

A major goal of the May 2002 study was to determine the impact of training. For purposes of the study impact was viewed as "measurable learning" and "student perception" of learning. Spiral development encourages user participation and involvement and assessment of software and training development. A major emphasis placed on military and industry training evaluations are student reactions known as "happiness indicators". These are categorized as user perception. Perception drives motivation and emotion. Emotion is often a more powerful influence on behavior than logic or empirical data. Thus, it is an important indicator of course satisfaction. End-of-course critiques suggested that students were not "satisfied" with the concept of self-paced distributed learning with little human interaction; however, measurable pre-/post-test scores revealed that students understood facts and concepts, suggesting that knowledge "achievement" resulted from the training. Focus groups revealed that students perceived training would be greatly enhanced if the implementation approach reverted back to the traditional use of MTTs. This requirement was identified to the Training Planning Team (TPT) for validation, and ESC was requested to shift from a distributed learning environment back to a traditional, instructor-led, "hands-on" approach to training. The change in scope was a costly decision to the SPD.

1.2.5 Recommendations for Future ADL Training

Seven barriers were identified as impediments to a successful implementation of the TBMCS distributed learning program. They were: inconsistent funding, change of training requirements, lack of established evaluation criteria, inconsistent OJT programs after fielding, lack of technology planning, unknown factors for determining ROI, lack of local distance learning policy and management enforcement, and lack of awareness and understanding of changing roles and responsibilities for students and instructors in distance learning environments. These can be overcome if known in advance by the SPD and emphasis is placed on establishing processes to overcome these barriers.

2.0—TRAINING PROGRAM REVIEW FOR TBMCS i.1.1

2.1 TBMCS I.1.1—FIELDING AND TRAINING PROCESS

The primary objective of TBMCS training is to attain and maintain the capability to operate and administer the system. A secondary objective is to develop advanced skills that facilitate increased effectiveness of the system. These objectives are met through type-1 training. AFI 36-2201 identifies type-1 training as "contract training" or "factory training" that Air Education Training Command (AETC) arranges for Air Force and other DOD personnel and contractors to conduct at either the contractor's location or a DOD facility.[3] Due to large numbers of geographically dispersed personnel requiring TBMCS training, surge training of 100 percent of the TBMCS user population was not economically or physically possible. Thus, a train-the-trainer philosophy was chosen and approved by the Joint Air Operations (JAO) Training Planning Team (JAOTPT). Initial train-the-trainer training for TBMCS i.1.1 was provided for personnel with v.1.0.1 system experience. In theory, this approach provides training to a core cadre of personnel from all locations, which then relied on those students to train remaining unit personnel through OJT.

Limited initial cadre training was provided to operators and system administrators via MTTs at selected regional sites worldwide based on the train-the-trainer concept. Training was targeted for TBMCS v.1.0.1 experienced legacy operators and system administrators. The degree of training was constrained to differences between the TBMCS v.1.0.1 and TBMCS i.1.1 software release. A fielding decision + 180 days was anticipated for the services to complete installation, training, system accreditation, OJT, and system cutover. Type-1 training for system administrators and operators began at selected locations 45 days after the System of Record (SOR) decision. Upon completion of system administrator training, operators were trained. Type-1 training also included PSS installation and training for network administrators. TBMCS i.1.1 fielding schedule is shown in Figure 2.1-1.

Day + x From Fielding Decision	Date	Event	Comment
1	10 May 02	Fielding Decision	Joint Configuration Control Board Decision to Field TBMCS i.1.1
+30	7 Jun 02	Software Kit distribution Starts	30 kits per wk, 6 wks total
+33	10 Jun	Software Installation Starts	Waterfall schedule
+45	24 Jun	Training Starts	Includes training for Systems Administrator Operators and PSS
+72	19 Jul	Software Kit Completion	
+116	2 Aug	Software Load Completion	
+181	4 Nov 02	Training Completion	
+181	4 Nov	System Ready for Cutover	Cumulative

Figure 2.1-1. Training Process

TBMCS System Administrator Training—The five-day TBMCS System Administrator Type 1 training focused on providing an orientation on the differences between TBMCS v1.0.1 and TBMCS i1.1 and highlighted more advance system administrator duties. System Administrators were expected to load the TBMCS i.1.1 software prior to system administration training. Trainees are also expected to assist in establishing a local training program to train remaining unit system administrators. All users will maintain proficiency through OJT or other subsequent training.

TBMCS Force Level Operator Training—TBMCS Force level Type 1 operator training consisted of five days of facilitator-led lessons, practical exercises, pre-/post-tests, and critiques. The class was MTT personnel (1 plans, 1 operations, and 1 intelligence). During this time units are encouraged to utilize previously trained personnel and/or local Subject Matter Experts (SMEs) to assist with the onsite training. This training focuses on the functionality required to perform joint air operations in the Air Operations Center (AOC) and consisted of three separate tracks. Service training representatives reserve the option of separating students into operations, plans, and intelligence tracks and choosing between high-level training students to learn all tasks within a track, or break down the tracks into job- specific/tasked-based approach. The tracks focused on a job-specific/tasked-based approach as follows:

Force-level Combat Operations—Specific positions within the operations cell were grouped together into the following training categories that focused the training on applications and concepts of employment required to perform their positional duties in an AOC. Force-level combat operations training tasks were mirrored with their respective TBMCS application with supporting operations checklists to assist operators.

- Director/Chief Combat Operations (DCO/CCO), Deputy CCO, and Senior Offensive Duty Officer (SODO)
- Offensive Duty Officer
- Time Sensitive Targeting/Time Critical Targeting
- Defensive Duty Officer
- Air Tasking Order (ATO) Re-planning
- Weather
- Reports
- Airspace

Force-level Combat Plans—Specific positions within the plans cell were grouped together into the following training categories that focused the training on applications and concepts of employment required to perform their positional duties in an AOC. Force-level combat plans training tasks were mirrored with their respective TBMCS application with supporting plans checklists to assist operators.

- Chief Combat Plans/Deputy Chief Combat Plans
- ATO Production
- ATO Planner
- ATO MAAP Development
- Airlift
- Airspace

Force-level Combat Intelligence—Specific positions within the intelligence cell were grouped together into the following training categories that focused the training on applications and concepts of employment required to perform their positional duties in an AOC. Force-level combat intelligence training tasks have been mirrored with their respective TBMCS application with supporting intelligence checklists.

- Analysis Cell
- Operations Intelligence
- Imagery Intelligence
- ELINT/Analyst

- Data Base Manager
- Plans Intelligence
- Combat Assessment
- Targeteer/Plans
- ATO Execution Intelligence
- ELINT/ATO Execution
- Targeteer/ATO Execution
- Analyst/ATO Execution

Perimeter Security System Training — Type 1 difference training for PSS sites consisted of five days of training. PSS installation and training is targeted at 1.0.1 experienced network administrators. Training was a combination of lecture and hands-on installation. All users were expected to maintain proficiency through OJT or other subsequent training.

2.2 Data Gathering

The purpose of this section is to describe:

- Research questions answered in this study
- Population of this study
- Evaluation model used in this study
- Instruments used to collect data relevant to the study
- Procedures used to collect the data

Due to the numerous training baseline changes conducted during the overall software development evolution this study did not lend itself to a hypothesis testing approach. Instead, an exploratory research methodology was chosen to support the following research questions.

2.2.1 Research Questions

- *Research Question 1:* Will students attending the i.1.1 training possess a higher level of experience than the students attending the v.1.0.1 training?
- *Research Question 2:* Were more i.1.1 students satisfied at the completion of training compared to those students who attended v.1.0.1 training?
- *Research Question 3:* Will there be a difference in the knowledge gained between students attending i.1.1 and those students who attended v.1.0.1 training?
- *Research Question 4:* Will users perceive the course to contain a sufficient mix of instructor vs. hands-on time?

- *Research Question 5:* Will students attending i.1.1 training perceive that the course covered the key TBMCS skills specific to their work center compared to those students who attended v.1.0.1?
- *Research Question 6:* Will students attending i.1.1 training perceive that their units provided a workspace that supported a successful training environment compared to those students who attended v.1.0.1 training?
- *Research Question 7:* Will students agree that the 1.1 difference training objectives could be met in a distance learning environment?

2.2.2 **Student Population**

Upon system fielding, the total TBMCS user population is anticipated to be 5,000 multi-service system administrators, operators, and network administrators. The train-the-trainer methodology trained a limited cadre of approximately 500 with MTTs at 21 locations. The trainees are geographically dispersed throughout multiple locations in the Continental United States (CONUS), and Pacific and European countries. AFI 131-AOC, Volume 3, identifies the duty positions associated with the force-level operation of an air operations system. TBMCS operators, system administrators, and network administrators include contractors, military enlisted personnel, and officers. Students are both female and male, and range in age from 20-45 years with various educational backgrounds and experience levels. Training was conducted at the students' home stations. A force-level operator course, system administrator course, and PSS course were taught at 21 locations. The total Trained Personnel Requirement (TPR) for total joint operators is approximately 1350, the joint system administrators total is 300, and the joint network administrators total is 100.

2.2.3 **Data Collection Model and Instrumentation**

The reason for evaluation is to determine the effectiveness of a training program. To demonstrate the effectiveness and value of the TBMCS distributed training program, Kirkpatrick's theory of evaluation was used. Kirkpatrick's model was designed for practitioners in the training field who plan, implement, and evaluate training programs. It was primarily chosen over the other models due to high usage rates, and validity for use by industry and Government. Figure 2.2-1 shows the Kirkpatrick IV Levels of Evaluation.

Level	Evaluation	Explanation	TBMCS Data Gathering
I	Reaction	Assesses participants' initial reactions to a course. This in-turn, offers insights into participants satisfaction with a course, a perception of value.	A questionnaire was used to gather quantitative data. A focus group was conducted to gather qualitative data
II	Learning	Assesses the amount of information that participants learned.	A knowledge-based pre- and post-test was used to assess the amount of information learned.
III	Transfer	Assesses the amount of material participants actually use in everyday work after taking the course.	A questionnaire was used to gather quantitative data. A focus group was conducted to gather qualitative data
IV	Business Results	Assesses the financial impact of the training course on the bottom line of the organization six months to two years after course completion.	Collecting data to identify experience levels, turnover rates, changing experience levels during test, and operational readiness inspection results is a longitudinal study not included in this report.

Figure 2.2-1. Kirkpatrick IV Levels of Evaluation

Overall data was gathered using four collection methods:

- Surveys
- Focus Groups
- Pre-tests
- Post-tests

2.2.1 Survey

Instructors were tasked to prepare an End-of-Course (EOC) survey to collect data on the effectiveness of the training program. This survey can be found in Appendix 1 of this document. The specific objectives of the survey were to obtain:

- valuable feedback to help evaluate the program
- comments and suggestions for improving the program
- quantitative information that can be used to establish standards of performance for future programs as explained in Kirkpatrick's Level I Evaluation-Reaction

2.2.1.1 Gathering Procedures of the Survey

At the beginning of training, MTT facilitators requested students annotate their reactions to training on an EOC critique. The students were informed of the location of the critique and encouraged to document their comments for the duration of the course. Instructors informed students that their input provides feedback on the effectiveness of the course and their comments/suggestions help to plan future courses to meet the students' needs and interests. At the end of the course, MTT facilitators again informed students of their obligation to provide feedback as to the effectiveness of the TBMCS training.

2.2.2 Focus Group

Focus groups are moderated group discussions designed to encourage free-flowing disclosures between students. TBMCS focus groups included ESC training representatives and students. Focus groups collect qualitative data and offer rich insights into the subject matter. Group dynamics and shared ideas provide results not obtainable from other research methods.

Specific objectives of this focus group were to

- obtain qualitative feedback to be used with the Survey to validate user satisfaction as explained in Kirkpatrick's Level I Evaluation-Reaction
- identify user expectations, satisfaction level, problems, and areas for improvement.

2.2.2.1 Data Gathering Procedures of the Focus Group

1. The TBMCS training representative met with the instructors whose classes where selected for the study to introduce the project as well as to inform the instructor what questions were to be asked during the focus group.
2. TBMCS training was given to all students, thus the focus group included all students participating in the course. MTT facilitators were asked to leave the room.
3. The TBMCS training representative met with the students and asked: a) what their learning expectations were, b) to provide feedback on the course, and c) to provide areas for improvement (if any) for follow-on courses. These questions were open ended to allow for student collaboration.

2.2.3 Pre-test

Standardized tests are designed to fairly measure student achievement in different academic subjects. TBMCS test questions supporting training objectives were originally identified in the design phase as the TBMCS training material was developed.

The specific objectives of the pre-test were to

- obtain initial data to compare with the post-test to validate the transfer of knowledge as explained in Kirkpatricks Level II Evaluation–Learning
- help instructors determine the strengths and needs of students in order to work with them to improve their individual academic skills

- provide information to instructional designers to help determine how well training assisted users in learning

2.2.3.1 Data Gathering Procedures of the Pre-Test

1. ESC met with the instructors whose classes were selected for the study to introduce the project as well as to verify how the instructor will administer the instrument.
2. MTT facilitators administered computer-generated pre-tests to all the students participating in the course.
3. Answers to pre-test questions were collected electronically for each student involved in TBMCS training.

2.2.4 Post-test

At the completion of training, the pre-test, administered prior to the training, was re-administered as a post-test to all students to determine if the students' knowledge had improved.

The specific objectives of the survey were to:

- Correlate pre- and post-test scores to validate if a learning transfer took place as explained in Kirkpatrick's Level III–Learning

2.2.4.1 Data Gathering Procedures of the Post-test

The same procedure followed during the pre-test was followed to administer the post-test.

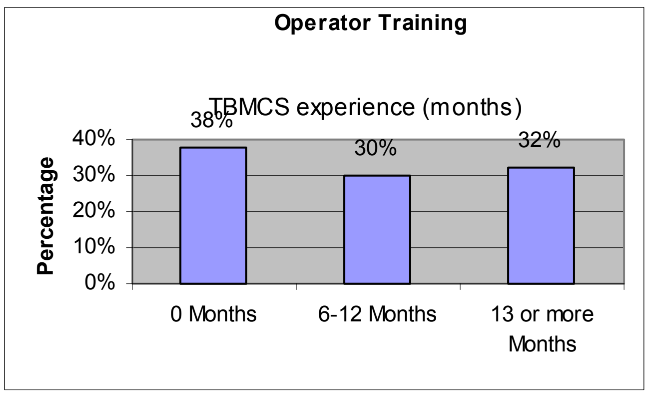
3.0—PRESENTATION OF DATA

A sample of n = 468 Air Force, Marine and Navy force-level operators, system administrators, and PSS personnel participated in the courses. A total of 415 surveys were received. Response rate was 89%. The EOC survey responses for operator, system administrator, and network administrator courses are listed below:

3.1 EXPERIENCE LEVEL RESPONSES TO SURVEYS

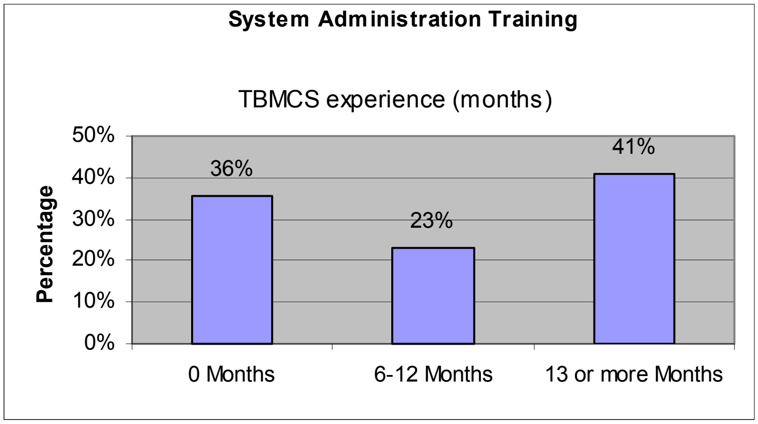
Tables 3.1-1 through 3.1-3 represent responses to experience level survey questions

Table 3.1-1 TBMCS Operator Experience



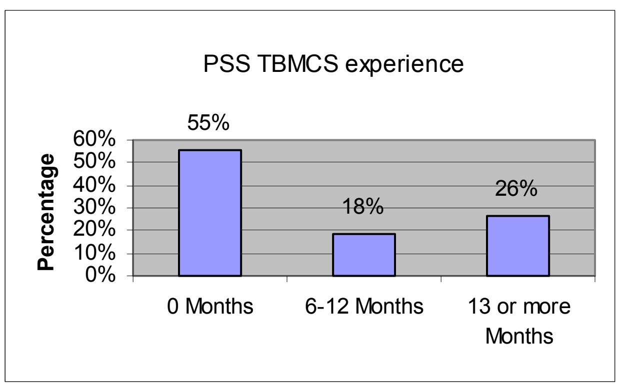
Note: Table 3.1-1 reveals operator TBMCS experience. A total of 239 students participated in the 1.1 course compared to 474 who attended in v.1.0.1 training. Response rate to this survey was 85%. An average of 68% of the students had less than one year of TBMCS experience compared to 53% from those who participated in v.1.0.1 training. An average of 32% of the students possessed more than one-year experience compared to 12% who attended v1.0.1 training. With a cumulative total of 68% of students who possessed less than 12 months TBMCS, it is apparent that most operators did not meet the minimum course prerequisite of one-year, TBMCS experience prior to attending the course.

Table 3.1-2 TBMCS System Administrator Experience



Note: Table 3.1-2 reveals system administrator TBMCS experience. A total of 108 students participated in this course compared to 169 who attended in v 1.0.1 training. Response rate to this survey was 91.6%. An average of 59% of the students had less than 12-months TBMCS experience compared to 29.52 % of those who participated in v.1.0.1 training. An average of 41% of the students possessed over 12 months TBMCS experience compared to 8.8% who attended v1.0.1 training. With a cumulative total of 59% of students who possessed less than 12 months TBMCS, it is apparent that most system administrators did not meet the minimum course prerequisite of one-year TBMCS experience prior to attending the course.

Table 3.1-3 TBMCS PSS Experience

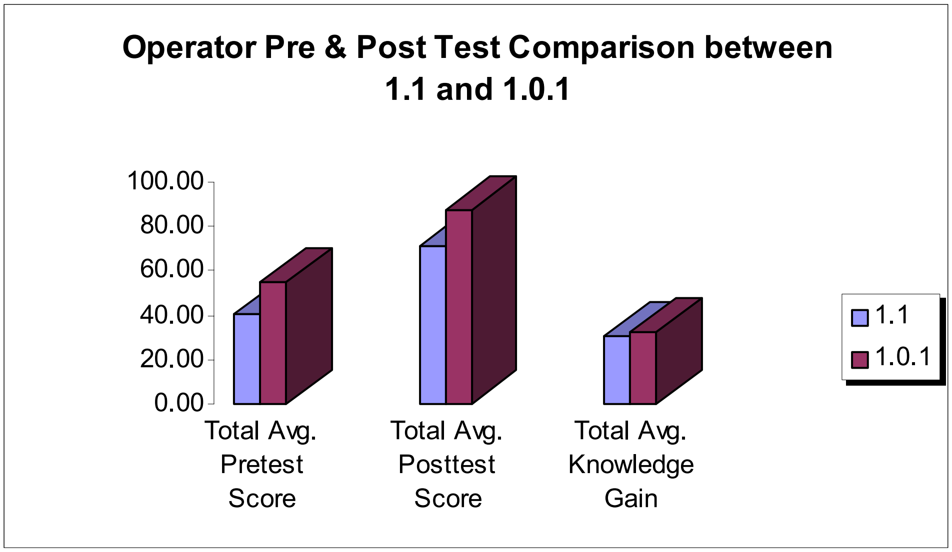


Note: Table 3.1-3 reveals PSS TBMCS experience. A total of 121 students participated in this course compared to 175 who attended in v 1.0.1 training. Response rate to this survey was 100%. An average of 73% of the students had less than 12-months TBMCS experience. This course was a new application last year; therefore, there was not a course experience prerequisite to compare experience levels from those who participated in v.1.0.1 training. An average of 26.4% of the students possessed over 12-months TBMCS, experience. With a cumulative total of 73% of students who possessed less than 12 months TBMCS it is apparent that most PSS administrators are still highly inexperienced.

3.2 PRE AND POST TEST QUESTIONS RESPONSES TO SURVEYS

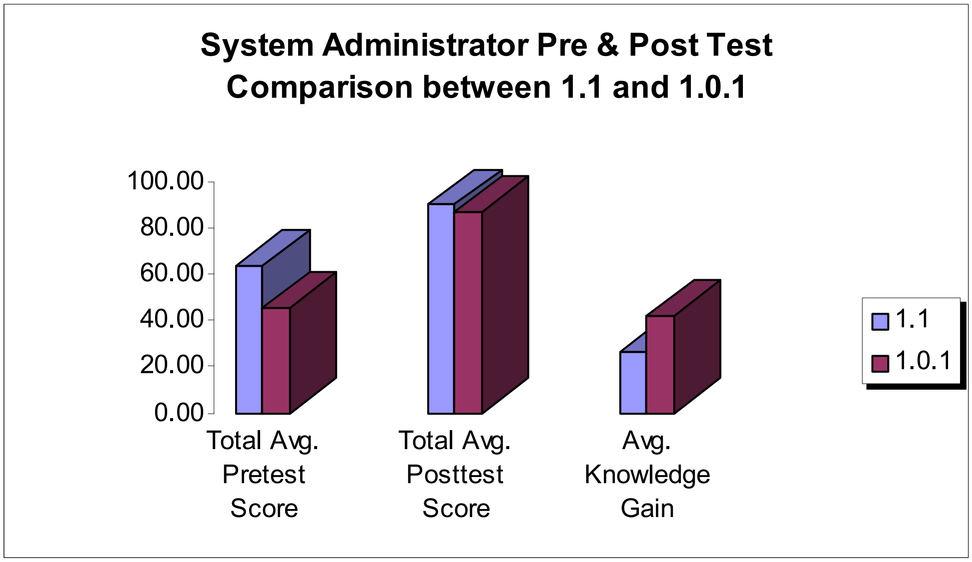
Tables 3.2-1 through 3.2-2 represent responses to pre- and post-test questions

Table 3.2-1 Operator Responses to Pre-/Post-Test



Note: Table 3.2-1 reveals differences between i.1.1.and v.1.0.1 operator pre- and post-test scores. Cumulative pre-test average for i.1.1 was 40.20% compared to 54.87% for those who participated in v. v.1.0.1 training. Cumulative post-test score for i.1.1 was 71.20% compared to 87.62% for those who participated in v.1.0.1 training. Cumulative average gain for i.1.1 was 30.84% compared to 32.7% for those who participated in v.1.0.1 training. Although data suggests that students did gain a significant amount of knowledge between pre- and post-tests during i.1.1 training, a minimal passing score of 75% was not met. Thus, it cannot be presumed that learning objectives were met as a result of the instruction.

Table 3.2-2 System Administrator Responses to Pre/Post Test

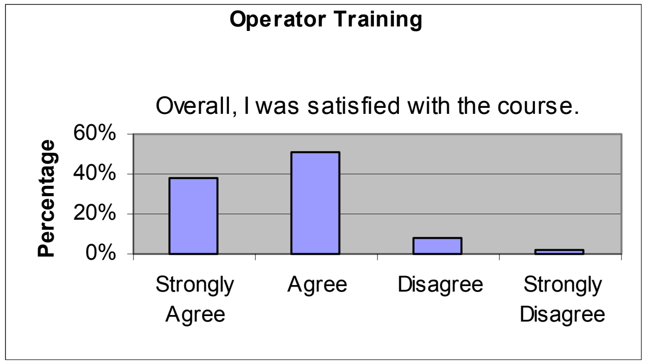


Note: Table 3.2-2 reveals differences between i.1.1.and v.1.0.1 system administrator pre- and post-test scores. Cumulative pre-test average for i.1.1 was 63.6% compared to 45.5% for those who participated in v.1.0.1 training. Cumulative post test score for i.1.1 was 90.92% compared to 87.5% for those who participated in v 1.0.1 training. Cumulative average gain for i.1.1 was 27.32% compared to 42% for those who participated in v. 1.0.1 training. Although data suggests that students did not experience as large a knowledge transfer between i.1.1 pre- and post-tests as revealed between v1.1.1 pre- and post-tests, a minimal passing score of 75% was still met. Thus, it can be presumed that learning objectives were met as a result of the instruction.

3.3 END-OF-COURSE SATISFACTION RESPONSES TO SURVEYS

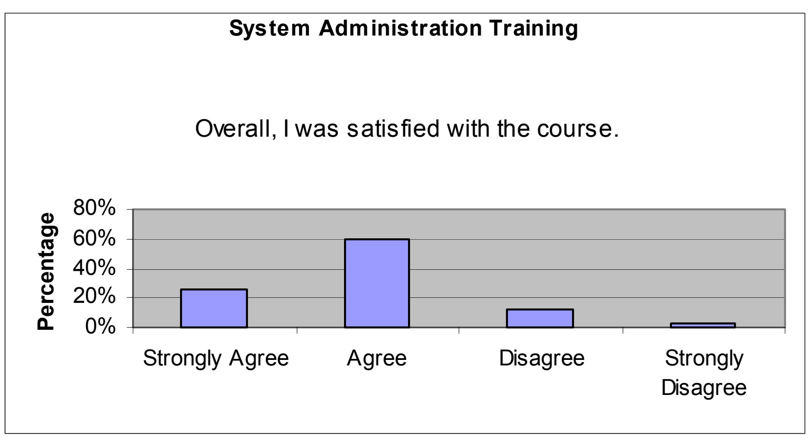
Tables 3.3-1 through 3.3-3 represent responses to course satisfaction survey questions

Table 3.3-1 Operator Course Satisfaction



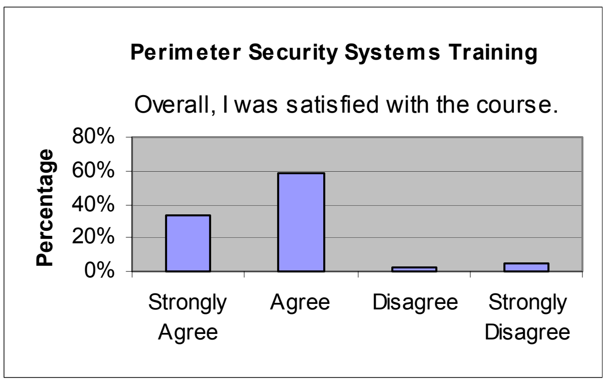
Note: Table 3.3-1 reveals force-level operator, end-of-course satisfaction results. An average of 39% of the students strongly agreed that they were satisfied with the course. An average of 52% of the students agreed that they were satisfied with the course. An average of 2% strongly disagreed that they were satisfied with the course. An average of 8% disagreed that they were satisfied with the course. With a cumulative total of 91% of students who strongly agree or agree that they were satisfied with the course versus a cumulative total of 11% of students who strongly disagree or disagree that they were satisfied with the course, this information suggests that the majority of students perceived that they were satisfied with the course. EOC satisfaction of TBMCS training has significantly improved in comparison to TBMCS v.1.0.1 where only a cumulative total 53.57% of students strongly agreed or agreed that they were satisfied with the course and 22.02% strongly disagreed or disagreed that they were satisfied with the course.

Table 3.3-2 System Administrator Course Satisfaction



Note: Table 3.3-2 reveals force-level system administrator end-of-course satisfaction results. An average of 26% of the students strongly agreed they were satisfied with the course. An average of 60% of the students agreed they were satisfied with the course. An average of 2% strongly disagreed they were satisfied with the course. An average of 12% disagreed they were satisfied with the course. With a cumulative total of 86% of students who strongly agree or agree they were satisfied with the course versus a cumulative total of 14% of students who strongly disagree or disagree they were satisfied with the course, suggests that the majority of students perceived they were satisfied with the course. EOC satisfaction of TBMCS training has significantly improved in comparison to TBMCS v.1.0.1 where only a cumulative total 69.76% of students strongly agreed or agreed they were satisfied with the course and 10.23% strongly disagreed or disagreed they were satisfied with the course.

Table 3.3-3 PSS Course Satisfaction

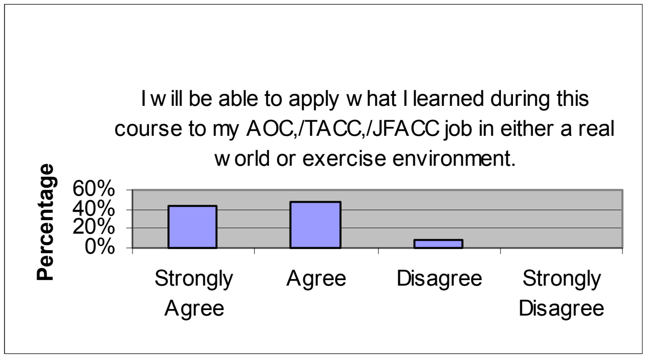


Note: Table 3.3-3 reveals force-level operator end-of-course satisfaction results. An average of 34% of the students strongly agreed they were satisfied with the course. An average of 59% of the students agreed they were satisfied with the course. An average of 5% strongly disagreed they were satisfied with the course. An average of 2% disagreed they were satisfied with the course. With a cumulative total of 93% of students who strongly agree or agree they were satisfied with the course versus a cumulative total of 7% of students who strongly disagree or disagree they were satisfied with the course, suggests that the majority of students perceived they were satisfied with the course. EOC satisfaction of TBMCS training has significantly improved in comparison to TBMCS v.1.0.1 where only a cumulative total 65.7% of students strongly agreed or agreed they were satisfied with the course and 4.26% strongly disagreed or disagreed they were satisfied with the course.

3.4 RESPONSES APPLICATION OF TRAINING OBJECTIVES TO WORK SETTING

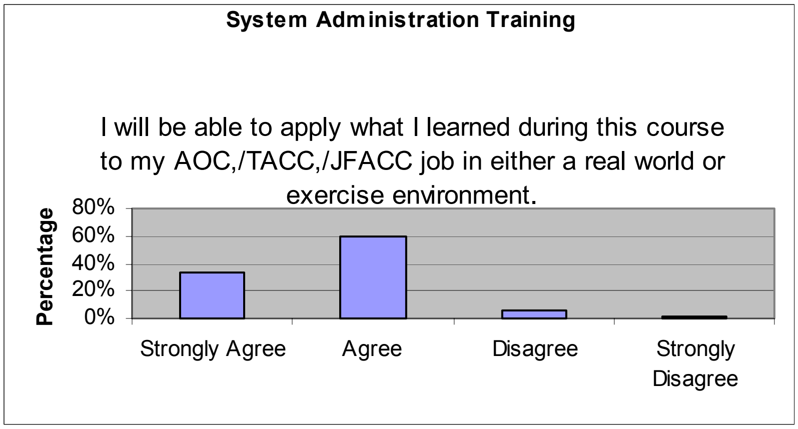
Tables 6.4-1 through 6.4-3 represent responses application of training objectives to work setting survey questions

Table 3.4-1 Operator perspective in applying training objectives to work setting



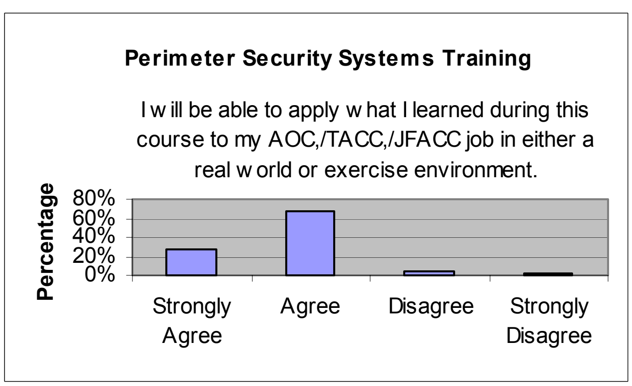
Note: Table 3.4-1 reveals force-level operator perceptions regarding TBMCS training applicability specific to an operator's duty center. An average of 43% of the students strongly agreed the training provided was specific to their duty center. An average of 48% of the students agreed the training provided was specific to their duty center. An average of 1% strongly disagreed the training provided was specific to their duty center. An average of 9% disagreed the training provided was specific to their duty center. With a cumulative total of 91% of students who strongly agree or agree the training provided was specific to their duty center versus a cumulative total of 10% of students who strongly disagree or disagree the training provided was specific to their duty center, the information suggests that most students perceived that the training provided was specific to their duty center. EOC application of TBMCS training to the work center has significantly improved in comparison to TBMCS v.1.0.1 where only a cumulative total 54.62% of students strongly agreed or agreed the course was applicable to their duty center and 22.17% strongly disagreed or disagreed the course was applicable to their work center.

Table 3.4-2 System Administrator perspective in applying training objectives to work setting



Note: Table 3.4-2 reveals force system administrator perceptions regarding TBMCS training applicability specific to their duty center. An average of 34% of the students strongly agreed the training provided was specific to their duty center. An average of 59% of the students agreed the training provided was specific to their duty center. An average of 1% strongly disagreed the training provided was specific to their duty center. An average of 6% disagreed the training provided was specific to their duty center. With a cumulative total of 93% of students who strongly agree or agree the training provided was specific to their duty center versus a cumulative total of 7% of students who strongly disagree or disagree the training provided was specific to their duty center, the information suggests that most students perceived that the training provided was specific to their duty center. EOC application of TBMCS training to the work center has significantly improved in comparison to TBMCS v.1.0.1 where only a cumulative total 64.86% of students strongly agreed or agreed the course was applicable to their duty center and 14.86% strongly disagreed or disagreed that the course was applicable to their work center.

Table 3.4-3 PSS perspective in applying training objectives to work setting

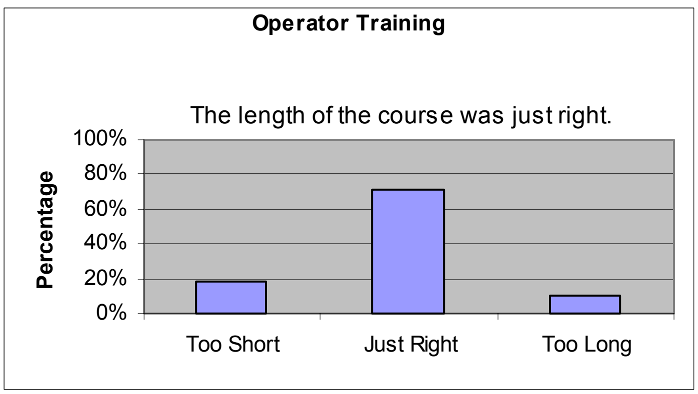


Note: Table 3.4-3 reveals force-level PSS administrator perceptions regarding TBMCS training applicability specific to their duty center. An average of 28% of the students strongly agreed the training provided was specific to their duty center. An average of 66% of the students agreed the training provided was specific to their duty center. An average of 2% strongly disagreed the training provided was specific to their duty center. An average of 4% disagreed the training provided was specific to their duty center. With a cumulative total of 94% of students who strongly agree or agree the training provided was specific to their duty center versus a cumulative total of 6% of students who strongly disagree or disagree the training provided was specific to their duty center, the information suggests that most students perceived the training provided was specific to their duty center. EOC application of TBMCS training to the work center has significantly improved in comparison to TBMCS v.1.0.1 where only a cumulative total 62.9% of students strongly agreed or agreed the course was applicable to their duty center and 6.03% strongly disagreed or disagreed that the course was applicable to their work center.

3.5 RESPONSES TO LENGTH OF COURSE

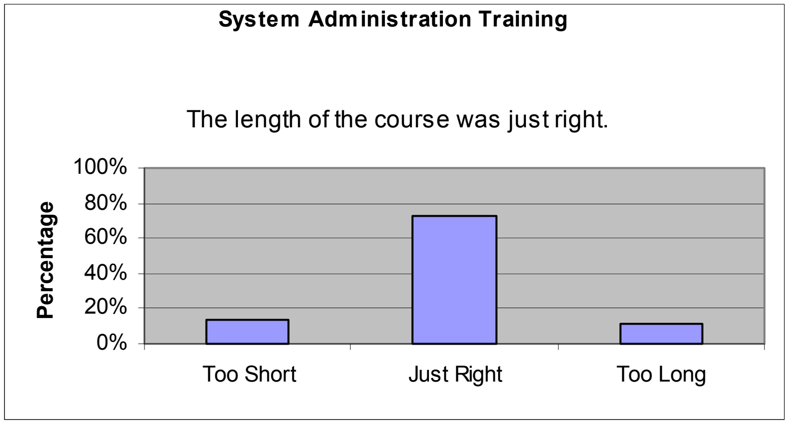
Tables 3.5-1 through 3.5-3 represent responses to length of course survey questions

Table 3.5-1 Operator response to length of course



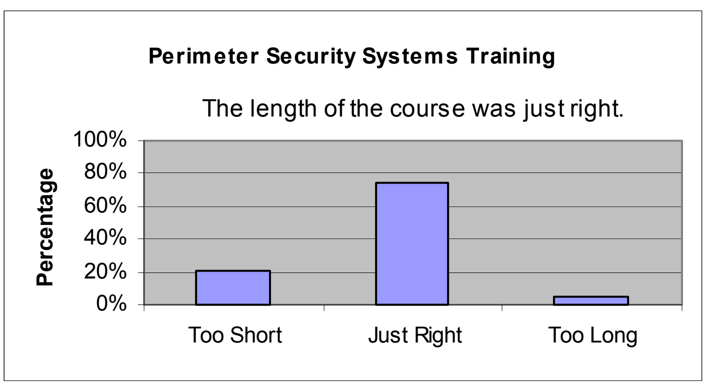
Note: Table 3.5-1 reveals force-level operator perceptions about the overall course length. An average of 72% of the students agreed the length of the course was appropriate. An average of 19% of the students agreed the length of the course was too short. An average of 10% agreed the length of the course was too long. TBMCS 1.1 perception of the length of the course has improved significantly compared to TBMCS v.1.0.1 training where the cumulative average of 38.39% of students strongly agreed and agreed the length of course was appropriate versus a cumulative total of 38.22% of students who strongly disagree or disagree the length of the course was appropriate suggesting that there was equal “disagreement” on the course length.

Table 3.5-2 System Administrator response to length of course



Note: Table3.5-2 reveals force-level system administrator perceptions about the overall course length. An average of 73% of the students agreed the length of the course was appropriate. An average of 14% of the students agreed the length of the course was too short. An average of 12% agreed the length of the course was too long. TBMCS i.1.1 perception of the length of the course has improved significantly compared to TBMCS v.1.0.1 training where the cumulative average of 56.23% of students strongly agreed and agreed the length of course was appropriate versus a cumulative total of 23.46% of students who strongly disagree or disagree the length of the course was appropriate.

Table 3.5-3 PSS response to length of course

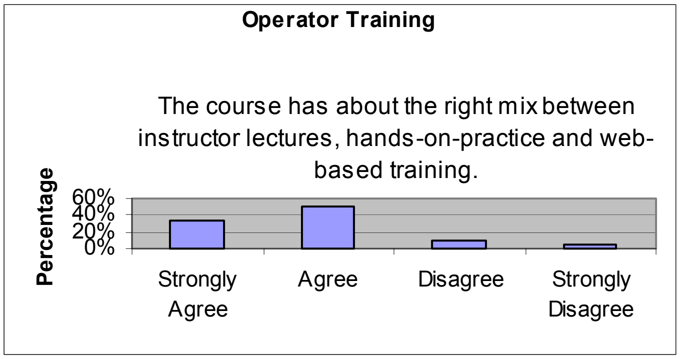


Note: Table 3.5-3 reveals force-level PSS administrator perceptions about the overall course length. An average of 75% of the students agreed the length of the course was appropriate. An average of 20% of the students agreed the length of the course was too short. An average of 5% agreed the length of the course was too long. TBMCS i.1.1 perception of the length of the course has improved significantly compared to TBMCS v.1.0.1 training where the cumulative average of 59.43% of students strongly agreed and agreed the length of course was appropriate versus a cumulative total of 9.79% of students who strongly disagree or disagree the length of the course was appropriate.

3.6 RESPONSES TO MEDIA MIX

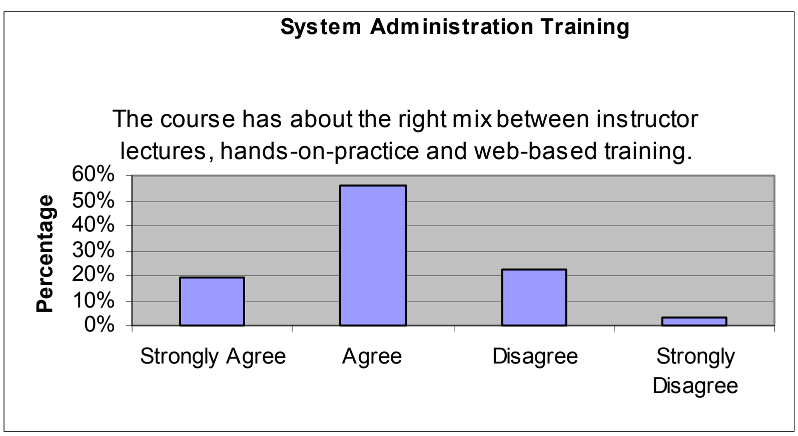
Tables 3.6-1 through 3.6-3 represent responses to the balance of classroom and hands-on survey questions

Table 3.6-1 Operator response to classroom and lab time



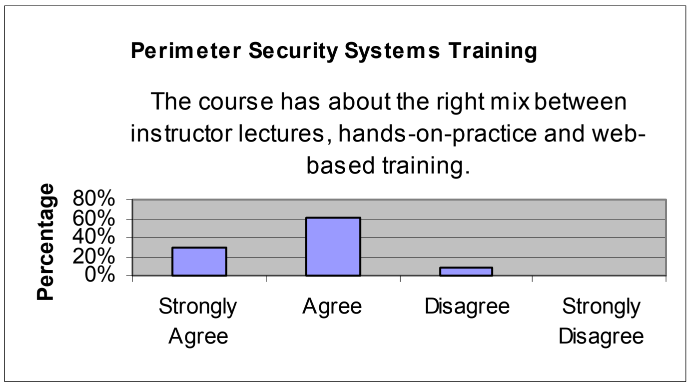
Note: Table 3.6-1 reveals force-level operator perceptions about the mix of instructor lectures, hands-on, and web-based training media. An average of 34% of the students strongly agreed the course has about the right mix of instructor time vs. material time. An average of 52% of the students agreed the course has about the right mix of instructor time vs. material time. An average of 4% strongly disagreed the course has about the right mix of instructor time vs. material time. An average of 10% disagreed the course has about the right mix of instructor time vs. material time. The cumulative total of 86% of students who strongly agree or agree the course has about the right mix of instructor time vs. material time versus a cumulative total of 14% of students who strongly disagree or disagree the course has about the right mix of instructor time vs. material time suggests the majority of students perceive the course to contain a sufficient and satisfactory mix of instructor vs. material time.

Table 3.6-2 System Administrator response to classroom and lab time



Note: Table 3.6-2 reveals force-level system administrator perceptions about the mix of instructor lectures, hands-on, and web-based training media. An average of 19% of the students strongly agreed the course has about the right mix of instructor time vs. material time. An average of 56% of the students agreed that the course has about the right mix of instructor time vs. material time. An average of 3% strongly disagreed the course has about the right mix of instructor time vs. material time. An average of 22% disagreed the course has about the right mix of instructor time vs. material time. The cumulative total of 75% of students who strongly agree or agree the course has about the right mix of instructor time vs. material time versus a cumulative total of 25% of students who strongly disagree or disagree the course has about the right mix of instructor time vs. material time suggests the majority of students perceive the course to contain a marginal mix of instructor vs. material time.

Table 3.6-3 PSS response to classroom and lab time

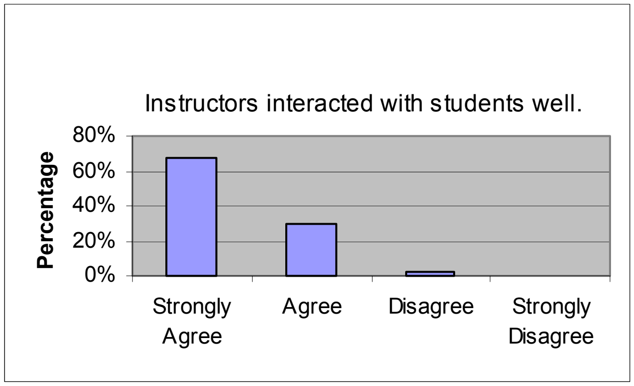


Note: Table 3.6-3 reveals force-level PSS administrator perceptions about the mix of instructor lectures, hands-on, and web-based training media. An average of 30% of the students strongly agreed the course has about the right mix of instructor time vs. material time. An average of 61% of the students agreed the course has about the right mix of instructor time vs. material time. An average of 1% strongly disagreed the course has about the right mix of instructor time vs. material time. An average of 8% disagreed the course has about the right mix of instructor time vs. material time. The cumulative total of 91% of students who strongly agree or agree the course has about the right mix of instructor time vs. material time versus a cumulative total of 9% of students who strongly disagree or disagree the course has about the right mix of instructor time vs. material time suggests the majority of students perceive the course to contain a sufficient and satisfactory mix of instructor vs. material time.

3.7 RESPONSES TO INSTRUCTOR INTERACTION TO STUDENTS

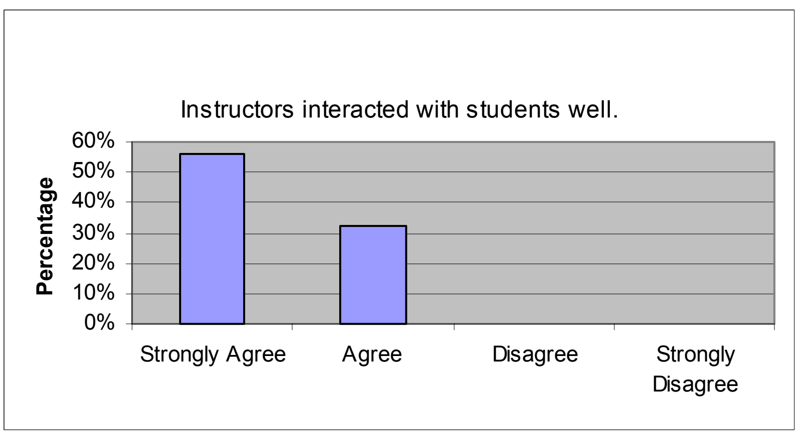
Tables 3.7-1 through 3.7-3 represent responses to student perception of instructor interaction.

Table 3.7-1 Operator response to instructor interaction



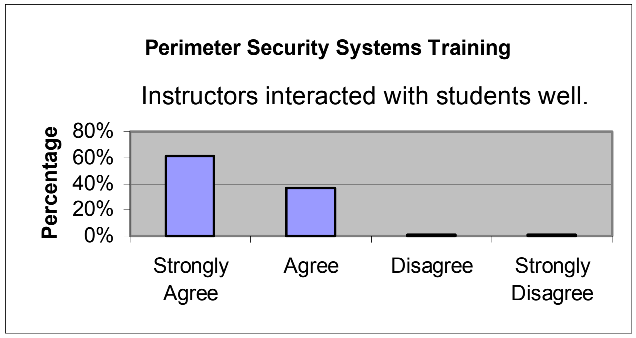
Note: Table 3.7-1 reveals force-level operator perceptions about instructor interaction with students. An average of 68% of the students strongly agreed the instructors interacted with students well. An average of 30% of the students agreed the instructors interacted with students well. An average of 1% strongly disagreed the instructors interacted with students well. An average of 3% disagreed that the instructors interacted with students well. The cumulative total of 98% of students who strongly agree or agree the instructors interacted with students well versus a cumulative total of 4% of students who strongly disagree or disagree the instructors interacted with students well suggests the majority of students perceive the course to contain sufficient and satisfactory mix of instructor to student time.

Table 3.7-2 System Administrator response to instructor interaction



Note: Table 3.7-2 reveals force-level system administrator perceptions about instructor interaction with students. An average of 56% of the students strongly agreed the instructors interacted with students well. An average of 33% of the students agreed the instructors interacted with students well. An average of 0% strongly disagreed or disagreed that the instructors interacted with students well. The cumulative total of 89% of students who strongly agree or agree that the instructors interacted with students well versus a cumulative total of 0% of students who strongly disagree or disagree that the instructors interacted with students well clearly indicates the majority of students perceive the course to contain sufficient and satisfactory mix of instructor to student time.

Table 3.7-3 PSS response to instructor interaction

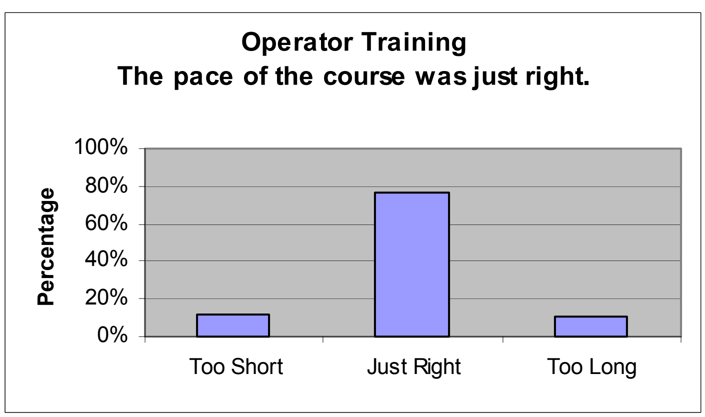


Note: Table 3.7-3 reveals force-level PSS administrator perceptions about instructor interaction with students. An average of 61% of the students strongly agreed the instructors interacted with students well. An average of 37% of the students agreed the instructors interacted with students well. An average of 1% strongly disagreed the instructors interacted with students well. An average of 1% disagreed the instructors interacted with students well. The cumulative total of 98% of students who strongly agree or agree the instructors interacted with students well versus a cumulative total of 2% of students who strongly disagree or disagree the instructors interacted with students well clearly indicates the majority of students perceive the course to contain sufficient and satisfactory mix of instructor to student time.

3.8. RESPONSES TO PACE OF COURSE

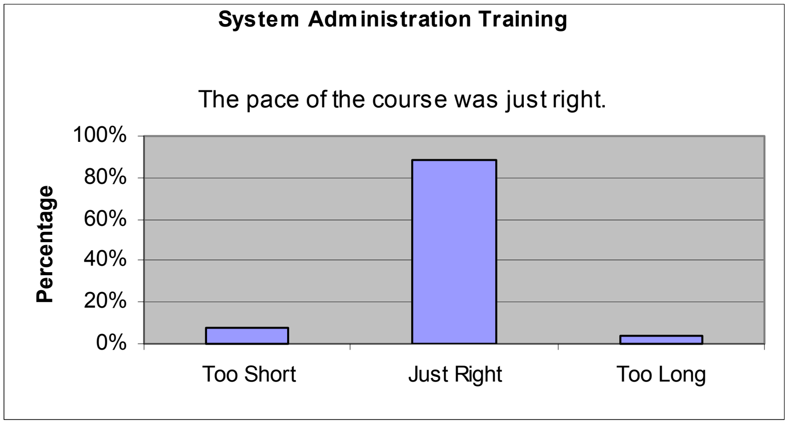
Tables 3.8-1 through 3.8-3 represent responses to pace of course survey question

Table 3.8-1 Operator response to pace of course



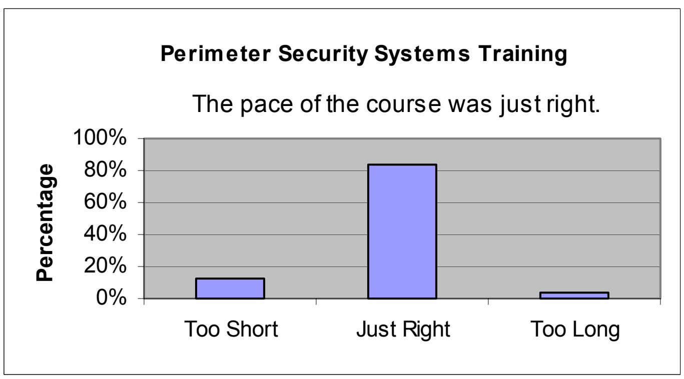
Note: Table 3.8-1 reveals force-level operator perceptions about the overall pace of the course. An average of 77% of the students agreed the pace of the course was appropriate. An average of 12% of the students agreed the pace of the course was too fast. An average of 11% agreed that the pace of the course was too slow.

Table 3.8-2 System Administrator response to pace of course



Note: Table 3.8-2 reveals force-level system administrator perceptions about the overall pace of the course. An average of 88% of the students agreed the pace of the course was appropriate. An average of 7% of the students agreed the pace of the course was too fast. An average of 4% agreed the pace of the course was too slow.

Table 3.8-3 PSS response to pace of course

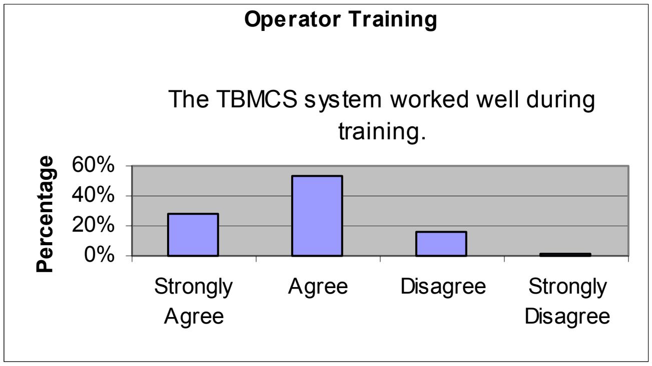


Note: Table 3.8-3 reveals force-level PSS administrator perceptions about the overall pace of the course. An average of 84% of the students agreed the pace of the course was appropriate. An average 13% of the students agreed the pace of the course was too fast. An average of 3% agreed the pace of the course was too slow.

3.9 RESPONSES TO TBMCS SYSTEM STABILITY

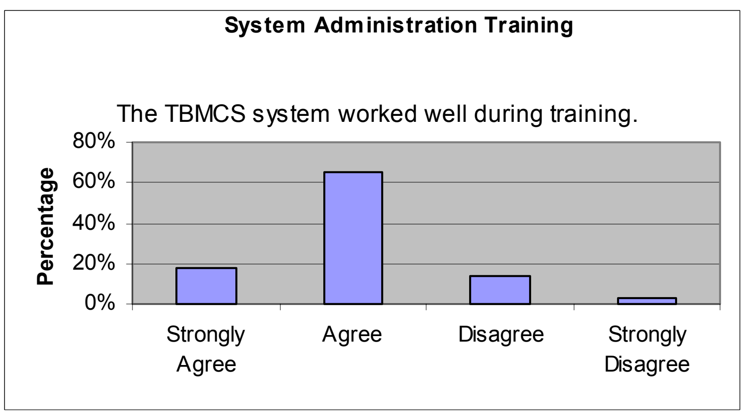
Tables 3.9-1 through 3.9-3 represent responses for system stability during training

Table 3.9-1 Operator Response to system stability during training



Note: Table 3.9-1 reveals operator perceptions regarding TBMCS system stability during training. An average of 28% of the students strongly agreed the TBMCS system worked well during training. An average of 54% of the students agreed the TBMCS system worked well during training. An average of 3% strongly disagreed the TBMCS system worked well during training. An average of 14% disagreed the TBMCS system worked well during training. With a cumulative total of 82% of students who strongly agree or agree the TBMCS system worked well during training versus a cumulative total of 19% of students who strongly disagree or disagree the TBMCS system worked well during training, suggests that most students perceived the TBMCS system was stable during training.

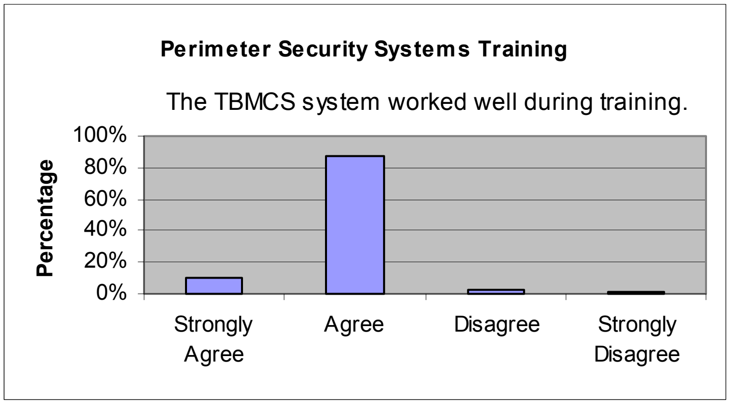
Table 3.9-2 System Administrator Response to system stability during training



Note: Table 3.9-2 reveals system administrator perceptions regarding TBMCS system stability during training. An average of 18% of the students strongly agreed the TBMCS system worked well during training. An average of 65% of the students agreed the TBMCS system worked well during training. An average of 3% strongly disagreed the TBMCS system worked well during training. An average of 14% disagreed the TBMCS system worked well during training. With a cumulative total of 83% of students who strongly agree or agree the TBMCS system worked well during training versus a cumulative total of

17% of students who strongly disagree or disagree the TBMCS system worked well during training, suggests that most students perceived the TBMCS system was stable during training.

Table 3.9-3 PSS Response to system stability during training

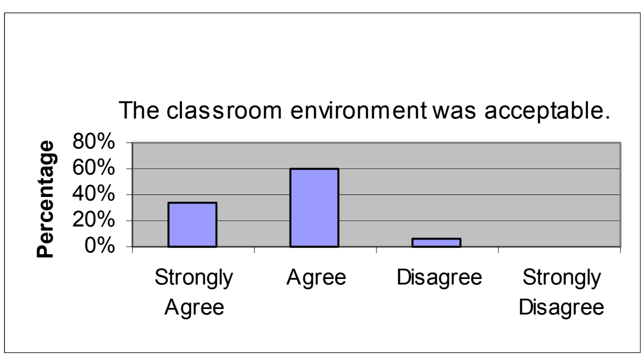


Note: Table 3.9-3 reveals PSS administrator perceptions regarding TBMCS system stability during training. An average of 10% of the students strongly agreed that the TBMCS system worked well during training. An average of 87% of the students agreed the TBMCS system worked well during training. An average of 1% strongly disagreed the TBMCS system worked well during training. An average of 2% disagreed the TBMCS system worked well during training. With a cumulative total of 97% of students who strongly agree or agree the TBMCS system worked well during training versus a cumulative total of 3% of students who strongly disagree or disagree the TBMCS system worked well during training, suggests that most students perceived the TBMCS system was stable during training.

3.10 RESPONSES TO CLASSROOM ENVIRONMENT

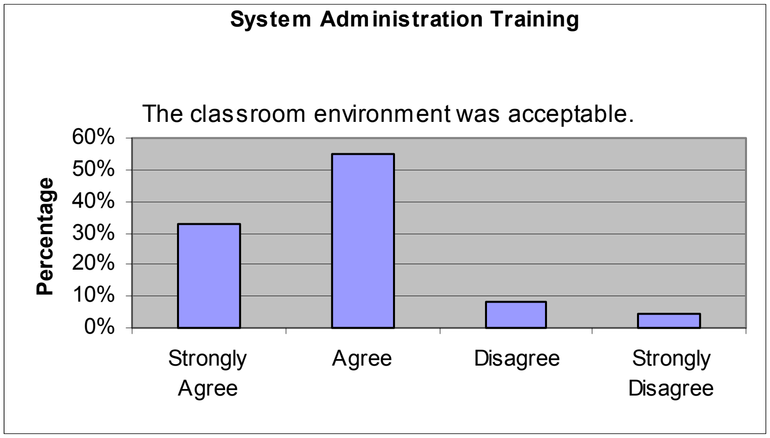
Tables 3.10-1 through 3.10-3 represent responses to adequacy of classroom enviornment

Table 3.10-1 Operator Response to Classroom Environment



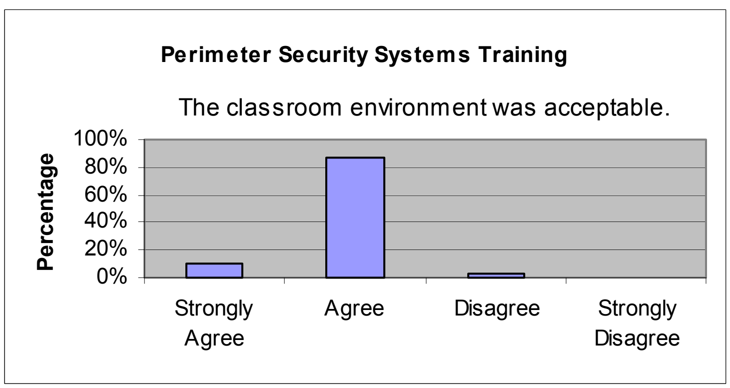
Note: Table 3.10-1 reveals force-level operator perceptions about the course environment (equipment, network connection, temperature, noise level, and work space). A cumulative average of 94% of the students strongly agreed or agreed the course environment was acceptable compared to 56.74% who participated in TBMCS v.1.0.1 training. A cumulative average of 7% of the students agreed that the course environment needed improvement compared to 13.54% who participated in TBMCS v.1.0.1 training.

Table 3.10-2 System Administrator Response to Classroom Environment



Note: Table 3.10-2 reveals force-level system administrator perceptions about the course environment (equipment, network connection, temperature, noise level, and work space). A cumulative average of 88% of the students strongly agreed or agreed the course environment was acceptable compared to 68% who participated in TBMCS v.1.0.1 training. A cumulative average of 12% of the students agreed the course environment needed improvement compared to 10% who participated in TBMCS v.1.0.1 training.

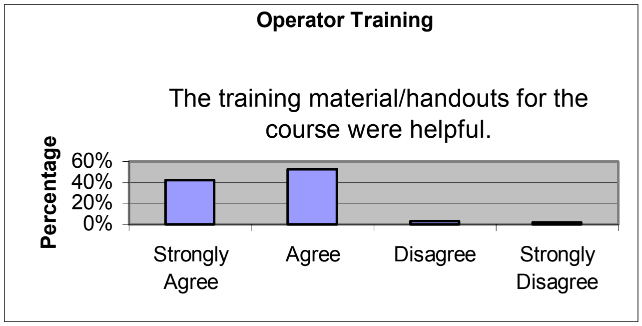
Table 3.10-3 PSS Response to Classroom Environment



Note: Table 3.10-3 reveals force-level PSS administrator perceptions about the course environment (equipment, network connection, temperature, noise level, and work space). A cumulative average of 97% of the students strongly agreed or agreed the course environment was acceptable compared to 48.84% who participated in TBMCS v.1.0.1 training. A cumulative average of 3% of the students agreed the course environment needed improvement compared to 9.9% who participated in TBMCS v.1.0.1 training.

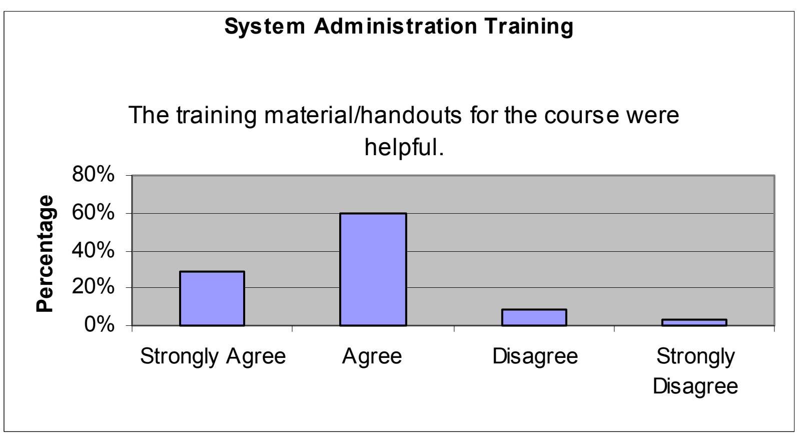
3.11 RESPONSES TO TRAINING MATERIALS

Table 3.11-1 Operator Responses to Training Materials



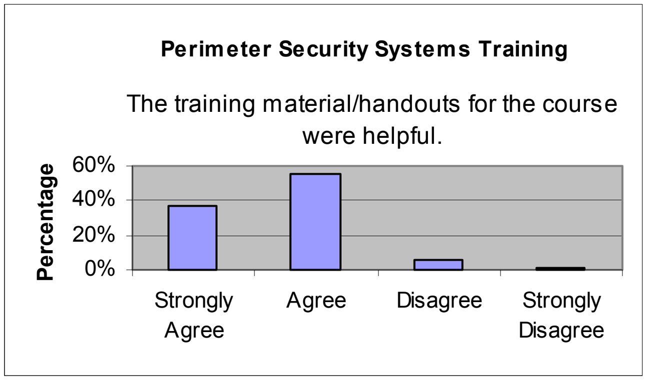
Note: Table 3.11-1 reveals operator perceptions regarding TBMCS training materials. An average of 42% of the students strongly agreed the TBMCS training materials were helpful. An average of 53% of the students agreed the TBMCS training materials were helpful. An average of 2% strongly disagreed the TBMCS training materials were helpful. An average of 3% disagreed the TBMCS training materials were helpful. With a cumulative total of 95% of students who strongly agree or agree the TBMCS training materials were helpful versus a cumulative total of 5% of students who strongly disagree or disagree the TBMCS training materials were helpful suggests that most students perceived the TBMCS training materials to be helpful during training.

Table 3.11-2 System Administrator Responses to Training Materials



Note: Table 3.11-2 reveals system administrator perceptions regarding TBMCS training materials. An average of 28% of the students strongly agreed the TBMCS training materials were helpful. An average of 60% of the students agreed the TBMCS training materials were helpful. An average of 3% strongly disagreed the TBMCS training materials were helpful. An average of 8% disagreed the TBMCS training materials were helpful. With a cumulative total of 88% of students who strongly agree or agree the TBMCS training materials were helpful versus a cumulative total of 11% of students who strongly disagree or disagree the TBMCS training materials were helpful suggests that most students perceived the TBMCS training materials to be helpful during training.

Table 3.11-3 PSS Responses to Training Materials

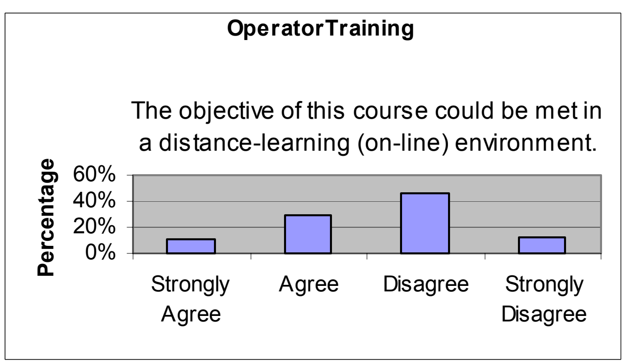


Note: Table 3.11-3 reveals PSS administrator perceptions regarding TBMCS training materials. An average of 37% of the students strongly agreed the TBMCS training materials were helpful. An average of 56% of the students agreed the TBMCS training materials were helpful. An average of 2% strongly disagreed the TBMCS training materials were helpful. An average of 6% disagreed the TBMCS training materials were helpful. With a cumulative total of 92% of students who strongly agree or agree the TBMCS training materials were helpful versus a cumulative total of 8% of students who strongly disagree or disagree the TBMCS training materials were helpful suggests that most students perceived the TBMCS training materials to be helpful during training.

3.12 RESPONSES TO DISTANCE LEARNING (DL)

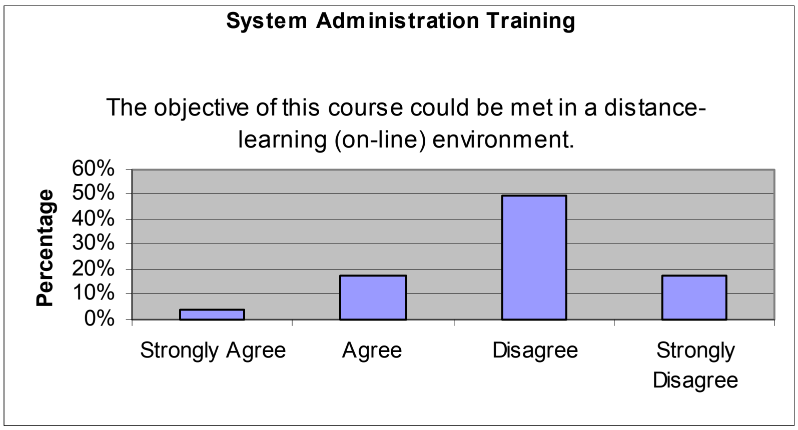
Tables 3.12-1 through 3.12-3 represent responses to applicability of distance learning survey questions

Table 3.12-1 Operator Response to DL perspectives



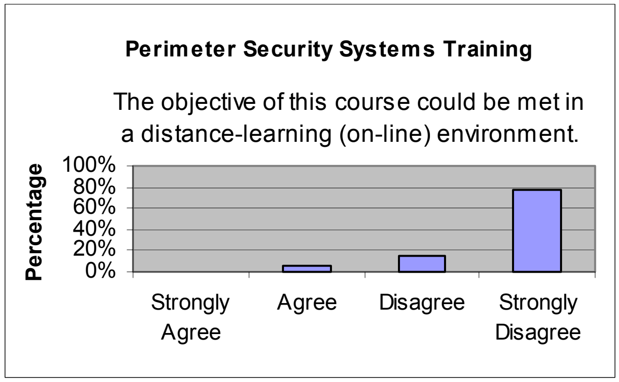
Note: Table 3.12-1 reveals operator perceptions regarding the use of DL to achieve training goals. An average of 11% of the students strongly agreed the TBMCS training objectives could be met in a DL environment. An average of 30% of the students agreed the TBMCS training objectives could be met in a DL environment. An average of 13% strongly disagreed the TBMCS training objectives could be met in a DL environment. An average of 46% disagreed the TBMCS training objectives could be met in a DL environment. With a cumulative total of 41% of students who strongly agree or agree the TBMCS training objectives could be met in a DL environment versus a cumulative total of 59% of students who strongly disagree or disagree the TBMCS training objectives could be met in a DL environment suggests that most students perceived that the TBMCS training objectives could not be met in a DL environment.

Table 3.12-2 System Administrator Response to On-line learning perspectives



Note: Table 3.12-2 reveals system administrator perceptions regarding the use of DL to achieve training goals. An average of 4% of the students strongly agreed that the TBMCS training objectives could be met in a DL environment. An average of 18% of the students agreed the TBMCS training objectives could be met in a DL environment. An average of 18% strongly disagreed the TBMCS training materials were helpful. An average of 49% disagreed the TBMCS training objectives could be met in a DL environment. With a cumulative total of 22% of students who strongly agree or agree the TBMCS training objectives could be met in a DL environment versus a cumulative total of 67% of students who strongly disagree or disagree the TBMCS training objectives could be met in a DL environment suggests that most students perceived the TBMCS training objectives could not be met in a DL environment.

Table 3.12-3 PSS Response to On-line learning perspectives



Note: Table 3.12-3 reveals PSS security administrator perceptions regarding the use of DL to achieve training goals. An average of 1% of the students strongly agreed the TBMCS training objectives could be met in a DL environment. An average of 7% of the students agreed the TBMCS training objectives could be met in a DL environment. An average of 77% strongly disagreed the TBMCS training objectives could be met in a DL environment. An average of 16% disagreed the TBMCS training objectives could be met in a DL environment. With a cumulative total of 6% of students who strongly agree or agree the TBMCS training objectives could be met in a DL environment versus a cumulative total of 93% of students who strongly disagree or disagree the TBMCS training objectives could be met in a DL environment suggests that most students perceived the TBMCS training objectives could not be met in a DL environment

4.0—FINDINGS

A major goal of this study was to determine the impact of training. For purposes of this study impact is viewed as "measurable learning" and "student perception" of learning. An important aspect of this study was to identify if any positive or negative trends exist between TBMCS v.1.0.1 training provided in 2000-2001 vs. TBMCS i.1.1 training provided in 2002. The research questions below have been supported with quantitative data from the end of course critique, pre-/post-test scores, focus groups, and observable behavior by the program office.

- ***Research Question 1:*** **Will students attending the i.1.1 training possess a higher level of experience than those students who attended the v.1.0.1 training?**

  A total of 239 operations, plans, and intelligence personnel were trained on i.1.1 compared to 474 operations, plans, and intelligence personnel who were trained on v.1.0.1. A total of 68% of the 1.1 students responding to the survey possessed less than one-year prerequisite experience, compared to 53% of the v.1.0.1 students. A total of 32% of the i.1.1 students met the one-year or more prerequisite experience level required compared to 13% of the v.1.0.1 students who met the one-year or more prerequisite experience level. A total of 108 system administrators were trained on i.1.1 vs. 169 who were trained on v.1.0.1. A total of 59% of the 1.1 students responding to the survey possessed less than the one-year prerequisite experience compared to their v.1.0.1 counterparts of which 66% who possessed less than the one-year prerequisite experience. A total of i.1.1 students 41% met the one-year or more prerequisite experience level compared to the v.10.1 students of which only 9% met the one-year or more prerequisite experience level required. PSS was a new training effort during v.1.0.1 therefore there was not an experience prerequisite. However, a total of 121 PSS personnel were trained on i.1.1. Of the network administrators responding to the survey, 73% did not possess the minimal one-year prerequisite v.1.0.1 experience, while 26% met the one-year or more prerequisite experience level. The results of the end-of-course critiques indicate that the majority of the students still do not meet the minimal one-year prerequisite level of experience. This infers that there is minimal, service-level accountability in selecting experienced personnel to attend training.

- ***Research Question 2*: Were more i.1.1 students satisfied at the completion of training compared to those students who attended v.1.0.1 training?**

  Data gathered from TBMCS i.1.1 training revealed 89% of operators, 86% of system administrators, and 87% of PSS network administrators agreed they were satisfied with the course. The TBMCS v.1.0.1 training report identified that 54% of operators, 70% of system administrators, and 66% of PSS network administrators agreed they were satisfied with the course. This data, combined with the information obtained from focus group sessions, suggest that the improvements made in student materials, classroom implementation, and instructor experience resulted in a significant increase in overall student satisfaction with the course.

- ***Research Question 3:* Will there be a difference in the knowledge gained between students attending i.1.1 and those who attended v.1.0.1 training?**

  Cumulative operator *pre-test* average for i.1.1 was 40% compared to 55% for those participating in v.1.0.1 training. Cumulative *post-test* score for i.1.1 was 71% compared to 88% for those who participated in v.1.0.1 training. Cumulative *average gain* for i.1.1 was 31% compared to 33% for those who participated in v.1.0.1 training. Data suggests that although students attending both i.1.1 and v.1.0.1 averaged similar cumulative gains from one training session to the next, the i.1.1 students average pre-test score was significantly lower than that of their v.1.0.1 counterparts. Cumulative system administrator *pre-test* average for i.1.1 was 63% compared to 46% for those who participated in v.1.0.1 training. Cumulative system administrator *post-test* score for i.1.1 was 90% compared to 88% for those who participated in v.1.0.1. Cumulative system administrator *average gain* for i.1.1 was 26% compared to 42% participating in v.1.0.1 training. In reviewing the system administrator experience level data, there appears to be a correlation between the system administrator experience level (of those attending i.1.1, 41% possessed more than one-year experience vs. 9% of those attending v.1.0.1 who possessed more than one-year experience) and pre-/post-test results.

- ***Research Question 4*: Will users perceive the course to contain a sufficient mix of instructor vs. hands-on time?**

  Qualitative data obtained during focus groups during v.1.0.1 training revealed that students were strongly dissatisfied with the mix of hands-on vs. instructor time. Students were clearly not receptive to a self-paced oriented training in which instruction was primarily web-based. During v.1.0.1 MTTs were limited to establishing user accounts on the learning management system and answering questions as students navigated through the web-based material. In preparation for i.1.1 training, instructors were required to prepare practical exercises, instructor lesson guides, and spend a minimum of 80 hours of self-learning on the TBMCS training suite prior to instructing. As a result of the changes, instructors were able to provide more hands-on training to the users. A cumulative response of 86% of force-level operators, 75% system administrators, and 91% PSS network administrators perceived the i.1.1 course to contain a sufficient mix of instructor vs. hands-on time. System administrator focus groups revealed that there was still too much lecture, and not enough hands-on troubleshooting.

- ***Research Question 5:*** **Will students attending i.1.1 training perceive that the course covered the key TBMCS skills specific to their work center compared to those students who attended v.1.0.1?**

  A cumulative total of 91% of force-level operators attending i.1.1 training agreed the training provided was specific to their duty center compared to 55% of students attending v.1.0.1 training. The increase in operator student perception between v.1.0.1 and i.1.1 version releases is speculated to be caused from the change from web-based training to instructor-led training. The design of web-based training provided in v.1.0.1 focused on "buttonology" vs. instructor-led training, which was position-based training. The i.1.1 instructor-led training allowed the students to understand how and why the task was performed in relation to their job. A cumulative total of 93% of system administrators attending i.1.1 believed the training provided was specific to their duty center compared to 65% of students attending v.1.0.1 training. A possible reason for the increase in system administrator perception of training between v.1.0.1 and i.1.1 training is the change in training objective from focusing how to build the system vs. how to troubleshoot and maintain the system. Lastly, a cumulative total of 94% of PSS network administrators attending i.1.1 training agreed that the training provided was specific to their duty center compared to 62% of students attending v.1.0.1 training.

- ***Research Question 6:*** **Will students attending i.1.1 training perceive that their units provided a workspace that supported a successful training environment compared to those students who attended v.1.0.1?**

  Observation of training provided in v.1.0.1 resulted in a mixture of classroom settings and facility preparation. Many times the facilities did not meet prerequisites to support TBMCS classroom training. Efforts to alleviate this problem consisted of instructors reviewing checklists with the unit to be trained 30-60 days prior to arrival, and instructors arriving at the facility 2-4 days prior to training. A cumulative total of 58% of students attending v.1.0.1 training perceived their units provided a workspace that supported a successful training environment compared to 93% of students attending i.1.1 training. The increase in facility preparation between v.1.0.1 and i.1.1 training suggests that units were more prepared in supporting their personnel and meeting facility prerequisites.

- ***Research Question 7:*** **Will students agree that the training objectives could be met in a DL environment?**

  Discussions and observations from focus groups during v.1.0.1 training concluded that students were not motivated to learn TBMCS through a self-paced, web-based environment. TBMCS has many geographically dispersed users. MTT training–although very popular–is very costly. The TBMCS System Program Office (SPO) has a responsibility to provide the most effective and efficient training to the users. This includes investing in technology. The use of the web as a training media provides for an environment that allows students to access training "anytime, anywhere, or any place". At the completion of i.1.1 training, students were asked if they perceived training objectives could be met in a DL environment. A cumulative total of 41% of force-level operators agreed that TBMCS training objectives could be met on-line vs 59% who opposed the idea. Only a small amount (22%) of force-level system administrators believed training objectives could be met on-line vs. an overwhelming 67% that opposed the idea. An even smaller amount (6%) of PSS network administrators believed that training objectives could be met on-line vs. 93% who opposed the idea. Although a larger percentage of force-level operators vs. system administrators or network administrators felt the course objectives could be met on-line, the majority of users did not support the idea.

5.0—TBMCS TRAINING v.1.0.1 COMPARED to i.1.1

5.1 SUMMARY OF V.1.0.1 TRAINING

The goals of the v.1.0.1 training review were to provide: a) a summative evaluation that identifies strengths, weaknesses, lessons learned, and best practices of the TBMCS training program, b) an in-depth analysis in assisting future C2 decision makers in determining what conditions distributed learning is likely to be effective in for future C2 systems, and c) a holistic view (context, input, process, and product evaluation) of TBMCS training that shows the impact of training, not only on the individual but on the USAF as well. A recap of the findings are listed below.

5.1.1 <u>Summative Evaluation v.1.0.1</u>

A summative evaluation that identifies strengths, weaknesses, lessons learned, and best practices is best summarized as follows. Strengths are identified as having a flexible contract and training development contractor. The TBMCS procurement strategy was a cost plus contract with a best effort clause. Although this acquisition strategy resulted in considerably more risk to the Government, it allowed for changes in scope as more Commercial-Off-the-Shelf (COTS) technology became available. A fundamental weakness was managing the contract due to the high attrition of military personnel from Permanent Change of Station (PCS) rotations and in-house transfers. The Air Force does not maintain a training Air Force Specialty Code (AFSC) for officer personnel. As a result, most Air Force personnel lacked skills in applying the ISD process and evaluating the various products. A significant lesson learned was in the evaluation of the course. To avoid controversy and scrutiny from the services, neither the developing contractor nor the office responsible for managing the contract should be in the position to administer and assess survey results. It would be advantageous to all services if an independent party conducted the evaluation of a multi-service training program. Best practices are identified as utilizing the Instructional Systems Development (ISD) process as the basis to obtain requirements and to design/develop the most cost-effective and efficient training to meet users' needs. It allows for user validation of requirements, multiple reviews of templates, prototypes, demos, and end products, and opportunities for stakeholder decisions when technical and cost trade offs are required.

5.1.2 DL Environment v.1.0.1

Determining the best condition for a DL environment is challenging. A C2 SPD can have adequate funding, the best training materials, and deliver a quality product on time to all users in a traditional training environment. However, there are a myriad of obstacles that can contribute to the failure of the same training in a DL environment. Prior to establishing a DL environment decision makers must do their homework. The following questions are guides in determining if a supportive environment exists. Negative responses can quickly change a supportive environment into a hostile learning environment.

- Do DL policies exist at national and local levels?
- Does my senior leadership embrace a vision that supports DL?
- Do I have adequate and experienced personnel to administer and execute a training program in a DL environment?
- Does my training contractor have experience in developing training and administering DL programs?
- Do I have control over the training budget?
- What is my commitment to a DL initiative if my budget is cut?
- Does my network infrastructure support anytime, anywhere, any place learning?
- What are the network bandwidth, security constraints, and latency rates at the distributed locations?
- Does the military culture support DL environments?
- Do the training managers at the distance locations have a process in place to support a DL environment?
- What organizations can I collaborate with, share lessons learned and best practices of DL?

5.1.3 Holistic View of Training v.1.0.1

A model for a holistic view of training is best described by Deming (2000). He identified a systems theory as "a network of interdependent components working together to achieve a common aim." Figure 5.1-1 tailors the systems theory to the training process. Input is defined as the requirements and regulations that feed the system. The ISD and MTT process is defined as the key processes to training during fielding. Process owners are defined as, AC2ISRC to ensure personnel receive an Initial Qualification Test (IQT) prior to arriving at their duty station; ESC training contractor to design, develop, and implement type-1 training; and the Major Commands (MAJCOMs) to ensure processes are in place for OJT and continuation training after type-1 training. Output is defined as a qualified C2 warfighter. Feedback is defined as qualitative and quantitative data provided by students after a course that is used to enhance future courses. The key to the systems theory is accountability. All process owners must complete their respective portion of the process in order to support the overall aim of the system. The aim of the system is defined as "a qualified C2 warrior". When process owners are not accountable, the system becomes dysfunctional and training objectives are not met. Without a proper training infrastructure the system as a whole cannot survive.

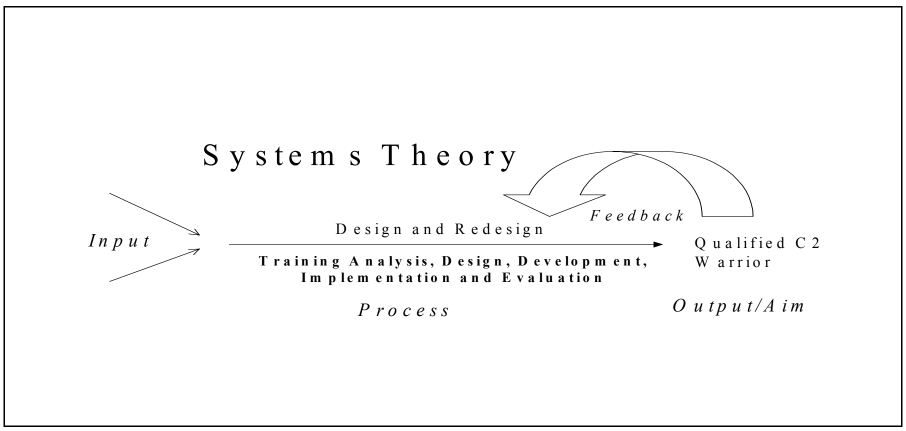


Figure 5.1-1. Deming System Theory as it Applies to Training

5.1.4 Barriers and Issues to DL v.1.0.1

A major goal of the v.1.0.1 study was to provide an in-depth analysis to assist future C2 decision makers in determining what conditions distributed learning is likely to be effective for future C2 systems. Based on the experience in managing TBMCS training, ESC identified: funding, evaluation, lack of OJT, policy and management, technology planning, effective design and changing roles of instructors and students, and ROI, as obstacles for an effective implementation of a distributed learning environment. It is recommended that C2 program managers understand the respective impacts and consequences of these limitations as part of their decision making progress when allocating training budgets, identifying resources, and establishing processes.

5.2 SUMMARY OF TBMCS I.1.1 TRAINING

TBMCS i.1.1 training resulted in a significant increase to student satisfaction from v.1.0.1. Enhancements to training materials, shifting to MTT implementation, instructor preparation, and instructor knowledge between v.1.0.1 and i.1.1 clearly contributed to a successful training event. MTTs, however, are expensive to maintain, dependent upon knowledge levels of instructors, and limited in resources to respond to real-world high operations tempo. DOD has identified a strategic plan for anytime, anywhere, and any place type learning [4]. Defense Planning Guidance for FY03-FY07 directs the Under Secretary of Defense for Personnel and Readiness to work with services to develop a plan to transform training to meet the mission readiness needs of the CINCs [5]. For the Air Force the need for just enough, just-in-time, and deployable learning to support Air and Space AEF mission, along with the explosion of information and learning technologies provides the opportunity to transfer the military training and education from an enhancer to an enabler [6].

5.2.1 The Need for Change

While TBMCS MTT met the expectations of the users attending the 1.1 training, pre- and post-test data suggests there was no significant difference in learning transfer between v.1.0.1 training via web-based delivery and the ever so popular MTT for i.1.1 training. For v.1.0.1, the cost to prepare web-based training material was $2,470, and the MTT facilitation was $6,046 to train 812 students. During i.1.1 the same costs were $4,054 and $6,970 respectively to train 468. Due to real-world issues a high operational tempo has been established between the services. There is a high probability that fewer and fewer personnel will be available for formal classroom training in the future, resulting in overall higher costs for instructor-led training. An alternative means of training is needed to preserve the Subject Matter Expert (SME) knowledge, to take advantage of re-usable content, decrease cost of instruction, and the ability to train one to twenty-five students any time, anywhere, and any place. A significant challenge to the training community is how to meet the future battlefield work and sustain readiness.

5.2.2 The Future of Training

Digitization applies to information technologies to acquire, exchange, and employ timely data throughout the battlespace, which will allow all friendly forces to share a constantly updated view of the entire battlefield, no matter what the mission, to penetrate the enemy's decision loop and act faster than he can react. Training must evolve so technology changes the way soldiers fight from the airman to the highest level of command. Most importantly, research is necessary on how to train soldiers and teams of soldiers to: a) seek out, identify, and analyze information, b) cope with information overload, c) operate as components in networks of digital systems, and d) make wise individual or collective decisions.[7] We need to determine how to best train, who, where, and when. The best utilization of personnel is to prepare them with the necessary proficiencies at the right time and place. To do this we need to change traditional methods of training that tend to segregate the elements of learning. A weapon system is created using a systems engineering approach and best commercial practices. From a strategic position, learning is like a weapon system–it is based on operational needs and requirements, it contains instructional systems, experiences, exercises, and processes that require development, integration, and management to efficiently and effectively develop the necessary operational proficiencies in Air Force personnel. The Air Force workplace is changing and a learning revolution is necessary to meet future warfare requests.[8]

The Office of the Secretary of Defense tasked the Defense Science Board to assess the current state of training within the DOD. A 2001 report revealed "the acquisition and testing process pay little attention to how a weapon system will be provided with trained operators and maintainers (p 1)", and the "acquisition community treats training as an "ility" and is usually viewed as a nuisance or a block checked off (pg 11)".[9] The 2001 Quadrennial Defense Review recognizes that transformed training is the key enabler to achieving the operational goals of the overarching transformation of the DOD. The defense planning guidance for FY 2003-2007 directs the Under Secretary of Defense for Personnel and Readiness to work with the Services the Chairman of USD to develop a plan for transforming DOD training. The Defense Planning Guidance mandates that the plan ensure: training ranges and devices are modernized and sustainable; interoperability training is measured and reported; networked training capabilities are designed into operational systems and requirements; and *distributed learning technologies are used to reengineer training and job performance*. The strategic goals include: a) providing a robust, networked, live, virtual, and constructive training and mission rehearsal, and b) revising acquisition and other supporting processes to identify interfaces between training systems and acquisition, logistics, personnel, military education, and C2, and ensure that these processes and systems are integrated. Near-term actions to be completed by October 2003 include developing a common operational architecture that provides interoperability of live, virtual, and constructive training systems across DOD. This will include accelerated development of common standards, implementation guidelines, and digital libraries for advanced distributed learning and job performance technologies. Distance learning is the best solution to address the training problems of time, availability, and accessibility. It requires a redirection of USAF training mission and strategy. Organizational leaders have significant influence on the perception and form of new learning technologies. Institutional support in terms of influences or perceptions of DL meaningfulness and significances is critical for change. Institutional support has symbolic as well as practical value – it tells others that the organization believes DL is important.[10]

The development of the internet has provided a plethora of opportunities to teach at a distance. The Training and Doctrine Command (TRADOC) defined distance learning as "the delivery of standardized individual, collective, and self-development training to soldiers and units anywhere and anytime through the application of information technologies".[7] Investing in DL technologies is critical to mission readiness. Implementation of DL supports Executive Order 13111, the Secretary of Defense Advanced Distributed Learning Initiative, the DOD Strategic Plan for Transforming DOD Training, and many other service DL strategies. There are paradigms to break that can be facilitated by organizational change, policy, and implementation guidelines. What are we waiting for?

6.0—GLOSSARY

ADL	Advanced Distributed Learning
AEF	Air Expeditionary Force
AETC	Air Education Training Command
AFDLO	Air Force Distance Learning Office
AFI	Air Force Instruction
AFSC	Air Force Specialty Code
AOC	Air Operations Center
ATO	Air Tasking Order
BMC3	Battle Management Command, Control & Communications
C2	Command and Control
CCO	Chief Combat Operations
CONUS	Continental United States
COTS	Commercial-Off-the-Shelf
DCO	Director Combat Operations
DL	Distance Learning
DOD	Department of Defense
EOC	End of Course
ESC	Electronic Systems Center
IAW	In Accordance With
IQT	Initial Qualification Training
ISD	Instructional Systems Development
JAO	Joint Air Operations
JAOTPT	*JAO* Training Planning Team
LMMS	Lockheed Martin Mission System
MAJCOM	Major Command
MTT	Mobile Training Team
OJT	On the Job Training
PCS	Permanent Change of Status

PSS	Perimeter Security System
ROI	Return On Investment
SME	Subject Matter Expert
SODO	Senior Offensive Duty Officer
SOR	System of Record
SPD	Systems Program Director
SPO	System Program Office
TBMCS	Theater Battle Management Core System
TPR	Trained Personnel Requirement
TPT	Training Planning Team
TRADOC	Training and Doctrine Command
USAF	United States Air Force

7.0—REFERENCES

[1] Department of Defense Acquisition related references such as DOD 5000.2 can be located on line at http://deskbook.dau.mil/

[2] Secretary of the Air Force. Air Force Instruction 63-123 Evolutionary Acquisition for C2 Systems. 2000.

[3] Secretary of the Air Force (1997). Air Force Instruction 36-2201. *Developing, managing and conducting training.* [On line] http://afpubs.hq.af.mil/pubfiles/af/36/afi36-2201/afi36-2201.pdf. Accessed October 6, 2000

[4] Report to the 106th congress (1999). Department of Defense Strategic Plan for Advanced Distributed Learning.

[5] Office of the Under Secretary of Defense for Personnel and Readiness (2001). *Strategic Plan for Transforming DOD Training*. Director, Readiness and Training Policy and Programs.

[6] Baskin, R., and Schneider, D. (2001). *Learning as a Weapon System*. Air Education and Training Command, Randolph Air Force Base, TX.

[7] Moses, F. (2001). *Training Challenges for Digitization*. Army Research Institute for the Behavioral and Social Sciences. Special Report 47.

[8] Office of the Undersecretary of Defense for Acquisition, Technology and Logistics (2001). *Report of the Defense Science Board Task Force on Training Superiority and Training Surprise*.

[9] Suchan, J., and Crawford, A. (1998*). Factors that create Learner Engagement in the Network-based Instruction*. Thesis submission to the Naval Postgraduate School, Montery, CA.

[10] US Army (1999). Total Army Distance Learning Program. *Operational concept document for a modernized training system*.

APPENDIXES

APPENDIX 1

EXAMPLE OF POST TEST

Student ID: Student
Name :

1. In i1.1 to assign control to a single mission, you can pair the air mission to the control

    A Mission in the Air Battle Planning window.
    B Call sign in the Mission Planning window.
    C Call sign in the Control Mission Assignment window.
    D Mission in the Mission Planning window.

2. A close escort request will appear in which Air Battle Planning window?

    A EC
    B ESC
    C Air Location
    D Close Escort Support

3. In the refueling request, to plan for a refueling receiver to depart the refueling track when full, select

    A Drag
    B Drop
    C Drop or Drag

4. A detached support request will appear in which Air Battle Planning window?

    A EC or ESC
    B ESC or Air Location
    C EC or Air Location
    D EC or Detached Support

5. Schedule Unfiyable means the mission

    A Needs refueling and cannot meet the desired time.
    B Cannot meet the desired times.
    C Will not approve.
    D Needs refueling.

6. In i1.1, the preferred way to begin planning an AETACS mission is to

    A Click on Mission → New → AETACS on the Air Battle Planning window.

    B Click on the AETACS request in the top table of the Air Battle Planning window.

    C Double click on the control agency call sign in the top table of the Air Battle Planning window.

    D Double click on the control agency call sign in the middle table of the Mission Planning window.

7. Given an 24 hour ABP period which starts at 0600Z on 22nd of March 2002, you enter 0300 in the Scheduled field and the system enters,

   A 200203220300.
   B 03220300.
   C 0300
   D 200203230300

8. When the planning of a mission is complete, its status is

   A TSK
   B SCH
   C MOD
   D PLN

9. When planning a Wide Area Geographic (WAG) mission, what data must be entered before you save the mission?

   A Location and time.
   B Configuration and Location.
   C Unit and Activities.
   D Activities and Configuration.

10. When requesting a Mid Refueling, if no Bingo Amount is entered, the system will plan for the mission to arrive on the tanker with

    A No fuel
    B RTB fuel
    C Divert fuel
    D Reserve fuel

11. In 11.1 TAP or EMR, if the system chart is not running, to plot airspaces, routes or targets on the chart, you must first

    A Insure the Sdt Map was started when TAP or EMR started and is still running.
    B Double click on the Sdt icon in the Application Manager.
    C Click on Chart → Start Chart on the GCCS Menu Bar.
    D Connect TAP or EMR to the Chart by clicking on Map → Start Map.

12. In order to plan missions, TAP or EMR must be in the

    A Planning State
    B Execution Model
    C Planning Mode
    D Execution State

13. When a mission is approved, its status is

    A PLN
    B SCH
    C MOD
    D TSK

14. Upon saving a mission in TAP or EMR, the first thing you should check for is

    A Flyability
    B ABP Ref Number
    C Refueling needs.
    D Mission !D

15. When planning missions with TAP or EMR, the mission planning data is pulled from the

    A Air Operations Database (AODB)
    B Modernized Integrated Database (MIDB)
    C TAP and EMR private databases.
    D Public databases.

APPENDIX 2

EXAMPLE OF END OF COURSE CRITIQUE

Directions:

Please answer all questions.

Enter up to 250 characters in text entry fields.

When answering a question select the one button that best expresses your opinion.

When you have finished, press the Submit button to register the completed critique. You may reset the form (clear it) by pressing the Reset button.

I was satisfied with the overall conduct of the class.

- strongly agree
- agree
- disagree
- strongly disagree

I will be able to apply what I learned during this training to my job within the AOC, TACC, JFACC.

- strongly agree
- agree
- disagree
- strongly disagree

After completing this training, I can accomplish the essential tasks of my assigned mission if I was placed in a real world exercise or contingency.

- Could accomplish without help
- Could accomplish w/on-line help

- Could accomplish w/over-the-shoulder help
- Could not accomplish

The length of the course training was about right.

- strongly agree
- agree
- disagree
- strongly disagree

The course has about the right combination of WBT, instructor lectures, and hands-on-practice.

- strongly agree
- agree
- disagree
- strongly disagree

Instructors interacted well with the students.

- strongly agree
- agree
- disagree
- strongly disagree

The pace of the course training was appropriate.

- strongly agree
- agree
- disagree
- strongly disagree

The TBMCS system worked well during training.

- strongly agree
- agree
- disagree
- strongly disagree

The training material/handouts were helpful.

- strongly agree
- agree
- disagree
- strongly disagree

I will be able to use the training material/handouts at my unit for future training.

- strongly agree
- agree
- disagree
- strongly disagree

The objectives of this training can be met using a distance-learning simulation environment.

- strongly agree
- agree
- disagree
- strongly disagree

Comments:

Submit Reset