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DESKTOP DECISION TRAINING (DDT) SYSTEM REQUIREMENTS DOCUMENT

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This paper has been reviewed and is approved for publication.

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This paper describes the system design requirements for the Desktop Decision Training (DDT) system. It is designed to be a pragmatic guide for DDT developers.

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PREFACE

This paper describes the system design requirements of the Desktop Decision Trainer (DDT) developed in support of "Desktop Training for Logistics Command and Control (LC^2)." This project is being accomplished under Contract No. F33615-91-C-0007, with Systems Engineering Associates (SEA), San Diego, CA. Management of this project is being provided by the Human Resources Directorate, Technical Training Research Division, Instructional Systems Branch (AL/HRTD).

SUMMARY

Logistics Command and Control (LC^2) units must ensure that core and augmentee personnel are fully trained in the critical combat skills of decision making. At present, existing training capabilities are inadequate. They consist primarily of expensive and manpower-intensive exercises, which afford only sporadic training opportunities. These opportunities are considered insufficient to achieve and maintain the skill levels required for successful combat operations. The need for more accessible, more affordable, and less manpower-intensive training continues to exist.

In 1991, the USAF Logistics Plans and Concepts Directorate (USAF/LGXX) tasked the Human Resources Directorate (HR) to develop an improved training technology for Logistics Command and Control Centers throughout the United States Air Force. The objective was to provide a means of training logistics personnel in the combat-critical task of decision making. In response, HR let a contract with Systems Engineering Associates (SEA) to produce a desktop decision trainer which would provide individual instruction and enable students to practice solving realistic logistics problems within a simulation environment. The project began in February 1992, and will conclude in February 1997.

This paper describes the system design requirements of the Desktop Decision Trainer (DDT). It is a companion document to the previously published paper entitled, "Desktop Decision Trainer (DDT) System Design Document," (Van de Wetering & Garcia, 1995).

1. PURPOSE AND SCOPE

This paper describes the objectives and requirements of the Desktop Decision Trainer[1] (DDT). It is prepared in support of contract F33615-91-C-0007. This document is a pragmatic guide for the DDT's developers. It presents the system requirements for the decision trainer based on an instructional methodology, and system design architecture developed for implementation of decision-making training.

2. SYSTEM OBJECTIVES

The DDT is a prototype system with two primary objectives:

1. Provide **training** for decision-making skills in Logistics Command and Control (LC^2).
2. Facilitate **research** to determine the effectiveness/efficiency of variations in *instructional strategy*.

3. HARDWARE CONSTRAINTS

The DDT was designed to operate on at least a 80386-based personal computer (PC) with the following minimum attributes:

- Four megabytes of random access memory.
- Sixty-megabyte hard disk.
- 25-megahertz clock speed.
- 800 x 600 16-color, super-VGA graphics adapter and monitor.
- Two- or three-button mouse (Microsoft-compatible).
- Keyboard.
- One floppy disk drive.

The DDT's hardware and software organization does not preclude future use multimedia capabilities such as digital audio and digital video, but the DDT does not employ such advanced media at this time.

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[1] Special terms in this document are italicized when first used and are defined in section 9.

4. USER INTERFACE REQUIREMENTS

User interface requirements for the DDT consist of the following features:

- The DDT employs a direct-manipulation user interface that provides "point-and-click" control of system features.
- The DDT employs a standard window-oriented paradigm (as exemplified by such products as Microsoft Windows or Motif) for presenting lesson material.
- Protocols for user interaction are as consistent as possible across program modules.
- The user interface is designed to be responsive; when its features require more than three seconds of computation, the DDT displays a message or an icon that informs the operator of the ongoing processing.
- The DDT is designed to provide training in the use of the system for three types of system users: *students*, *researchers,* and *system managers*.

5. CLASSES OF SYSTEM USERS AND REQUIRED SYSTEM CAPABILITIES

The DDT accommodates three classes of system users:

- Students.
- Researchers.
- System managers.

The DDT provides students with capabilities for:

- Training in decision-making skills.
- Training in "how to use the DDT for training."

The DDT provides researchers with capabilities for:

- Design of instructional treatments.
- Subject/treatment assignment.
- Data collection.
- Result reporting.
- System demonstration.
- Training in "how to use the DDT for research."

The DDT provides system managers with capabilities for:

- Personnel access control.

- System configuration control.
- Report production.
- System demonstration.
- Training in "how to use the DDT to manage the DDT."

System requirements for the capabilities enumerated above are addressed below under three separate headings: System Requirements for Training (Section 6); System Requirements for Research (Section 7); and System Requirements for Management (Section 8).

6. SYSTEM REQUIREMENTS FOR TRAINING

6.1. Training in Decision Making Skills

6.1.1. Course of Instruction

The DDT provides a *baseline course* of instruction in decision-making skills. It is capable of providing variations of the baseline course. However, each variation is a separately named course.

Researchers are able to generate course variations by altering its training objectives and/or subject matter content and/or instructional strategy (see details in Section 7).

6.1.2. Training Objectives

The baseline course was designed to enable students to reach a *Terminal Training Objective* (TTO) by way of a hierarchically ordered set of *Enabling Objectives* (EO's). The objectives in the baseline course are referred to as the baseline set of training objectives.

The DDT is capable of maintaining an electronic record of all objectives. The electronic record contains:

- The full technical statement of each objective.
- *Prerequisite relationships* to predecessor and successor objectives.

6.1.3. Subject Matter

The DDT presents two types of subject matter:

- *Technical subject matter.*
- *Metacognitive subject matter.*

The technical subject matter for the DDT consists of facts, concepts, procedures, rules, and principles explaining the operational context of a logistical decision-making domain. The

top layer of the technical subject matter is represented by the abstract *Demand and Supply Model.*

The technical subject matter represents an *artificial logistical domain.* The artificial domain is:

- Sufficiently similar in concept to the real working environment of the target population to promote conceptual *transfer of training.*
- Sufficiently dissimilar in vocabulary to prevent literal transfer of training.
- General enough to permit application to a broad range of LC2 positions.

The metacognitive subject matter for the DDT consists of facts, concepts, procedures, rules, and principles explaining generic principles of human decision making and learning. Metacognitive subject matter comes in four categories:

- A generic *model of human decision making.*
- Characteristics of human decision makers.
- Management of cognitive resources during decision making.
- Advice on how to learn decision making.

The DDT baseline contains metacognitive subject matter dealing with the generic model of human decision making. Future versions of the DDT will be capable of presenting metacognitive subject matter related to the other three topics enumerated above.

6.1.4. Organization

A course on the DDT is partitioned into one or more *levels of elaboration.* The first level is called the *epitome* level. Subsequent levels are referred to as Level 2, 3, etc. The epitome level is designed to train elementary decision making skills in the simplest possible version of the decision-making domain. Subsequent levels will be designed to train increasingly complex decision-making skills in increasingly complex versions of the decision-making domain. Students will always proceed from lower to higher levels in sequence.

On each level, instruction is presented in two types of environments:

- A *presentation environment*: a learning environment providing *lessons* in the form of "canned" CAI.
- A *practice environment*: a learning environment providing *exercises* in a dynamic simulation of a decision-making domain.

Students are required to proceed through the presentation environment on a given level before proceeding to instruction in the practice environment on the same level. Each level's presentation environment is partitioned into one or more lessons. The sequence in which students proceed through lessons depends on the instructional strategy defined for the course.

Each level's practice environment is partitioned into one or more exercises. The sequence in which students proceed through exercises also depends on the instructional strategy defined for the course.

Lessons on the DDT are partitioned into one or more *lesson segments*. The sequence in which students proceed through lesson segments (if there is more than one lesson segment) is dependent upon the instructional strategy defined for the course. Lesson segments on the DDT are partitioned into one or more *segment elements*. The sequence in which students proceed through segment elements (if there is more than one segment element) depending on the instructional strategy defined for the course, except in test segments: In any segment that contains only test elements, the sequence in which the student proceeds to answer the test elements is up to the student.

Segment elements on the DDT come in five types:

- *Static display elements.*
- *Dynamic display elements.*
- *Practice and feedback elements.*
- *Test elements.*
- *Test result elements.*

Segment elements are displayed in windows. Whether these windows can be opened, closed, moved, or sized by the student depends on the instructional strategy defined for the course. Windows stay open either indefinitely or a limited amount of time, depending on the type of element.

Static display elements display text and or graphics. Dynamic display elements display animation sequences or dynamic models with which a student can interact (mini-simulations).

Practice elements consist of a strict sequence of components that presents a practice problem to the student, accepts a student's response and evaluates it, and then presents feedback

to the student. Practice elements on the DDT come in a variety of types. These types include as a minimum:

- Multiple choice.
- True/false.
- Fill-in-the-blank.
- *Drag-and-leave.*

A lesson or lesson segment that contains only test elements is a test. Test elements are the same as practice elements and they are of the same four types. The only difference between the two kinds of elements is that test elements do not present feedback to the student. Test result elements display feedback for all items in a test simultaneously to the student.

Exercises are partitioned into three successive phases:

- Orientation phase.
- Operations phase.
- Debriefing phase.

Orientation Phase

The Orientation phase provides the student with the opportunity to:

- Inform themselves of the initial conditions of a conflict scenario.
- Formulate a structured Situation Assessment (SA).
- Formulate a structured Plan of Action (POA).

To give the student an opportunity to inform themselves of the initial conditions of a conflict scenario, the DDT makes available the following types of information resources:

- Commander's situation briefing.
- Orders of the day.
- Status boards.
- Map(s).

Information resources depict a scenario that represents a concrete and particular instance of the demand and supply model. The scenario covers the period of build up prior to armed conflict, a period of armed conflict, or a period that includes both. The information contained in the information resources has been scripted by a researcher during scenario development.

The structured SA consists of a form. The student is able to select entries for each field from a menu of possible entries. The structured POA also consists of a form. The student is able to select entries for each field from a menu of possible entries.

The DDT has the capability to evaluate whether the student has correctly assessed the situation and whether they have formulated an appropriate POA. For comparison, the evaluation uses an SA and POA generated by a researcher during scenario development.

The DDT displays the results of this critique to the student. After presenting the critique, the DDT has the capability to present the following options:

- Edit SA and/or POA and resubmit for critique.
- Accept the student's SA and POA and use it as input for the subsequent operations phase.
- Present the DDT's (researcher-generated) SA and POA and use them as input for the subsequent operations phase.

Which of these options is displayed by the DDT depends on the instructional strategy defined for the course. The amount of time the student can spend in the orientation phase is determined by the instructional strategy.

Operations Phase

The operations phase takes place within a developing, dynamic environment starting from the scenario whose initial conditions were assessed during the orientation phase. The operations phase provides the student with multiple opportunities to:

- Make specific logistics decisions in response to particular logistics requirements arising during the build up prior to an armed conflict and during a conflict.
- Make general logistics decisions by changing their initial SA and POA in response to changes in the situation during the build up prior to an armed conflict and during a conflict.
- Experience the effects of specific and general logistics decisions on the course/outcome of the conflict.

Specific Logistics Decisions

During the operations phase, the DDT presents opportunities for specific logistics decisions in response to particular logistics requirements by providing:

- Messages and/or reports that indicate the need and opportunity for logistical or administrative decisions.
- A means for student input that the need/opportunity for a decision has been recognized, i.e., that the *recognition point* has occurred.
- A means of prioritizing *uncertainty reduction* requirements by classes of uncertainty.
- Feedback on prioritized uncertainty reduction requirements.
- Access to information resources to reduce classes of uncertainty.
- Feedback on the suitability of the accessed information resource for reducing a class of uncertainty.
- Structured template workspace for formulating decision options.
- The option of having decision options evaluated by the DDT prior to implementation.
- A feedback assessment of the implemented decision option.
- A means to explicitly indicate the *decision point.*
- A means to explicitly indicate the *implementation point.*
- For messages indicating that the *default point* is imminent or has occurred.
- For operational consequences of the implemented decision options.
- For a timed transcript of all student actions during an entire exercise.

Indications of the need and opportunity for decisions is provided by means of:

- Messages from resource users indicating needs for particular items in certain numbers and by certain need dates.
- Reports of resource consumption over certain time periods structured to resemble *EARFLAP* reports.

The DDT also presents messages and reports that do not require logistics decisions but do require administrative decisions. The student is given the following three options to deal with them:

- Pass a message or report on to someone else.
- Throw it away.
- File it for future reference.

The frequency and the relative proportion of messages and reports requiring logistical versus administrative decisions is controlled by scenario authors. Student input indicating that the need/opportunity for a decision has been recognized, consists of a single input action that indicates the student intends to make a decision with regard to a particular message or report. This input feature is always available, regardless of instructional strategy.

A means for prioritizing uncertainty reduction requirements by classes of uncertainty is available by way of uncertainty profiles. The profiles allow the student to generate an uncertainty profile, which indicates graphically, the relative amount of perceived uncertainty with regard to:

- The situation.
- The decision objectives.
- The option set.
- The option effects.
- Option feasibility.

If the student prioritizes uncertainty reduction requirements, feedback is made available. Such feedback consists of a DDT-generated uncertainty profile, called the system uncertainty profile.

Researchers are able to set the system uncertainty profiles for the operations phase of an exercise in accordance with the training objectives selected for the course.

Access to information resources to reduce classes of uncertainty depends on the instructional objectives defined for the course and shall include access to:

- Status boards.
- POA.
- Orders of the day.
- Commanders' situation briefing.
- Reference manuals.
- Agencies.

Feedback on the suitability of accessed information resources for reducing uncertainty is available if the instructional strategy defined for the course calls for it. It is presented after the

student has chosen to implement a decision option and shall inform the student whether they have:

- Accessed information resources in the order of priority indicated by the system uncertainty profile.
- Spent or allocated his time according to the relative amounts of uncertainty in the system uncertainty profile.

A template for formulating decision options is provided to the student by first enabling the student to select a template from a set of five templates. Such access shall always be provided, regardless of instructional strategy. The student is able to make entries in each field of the decision option template. The entries are: (1) selected from predefined choices, (2) made by copying and pasting field contents from messages or reports, or (3) consist of numerical entries. Each completed template represents a defined decision option. The number of options a student can generate depends on the instructional strategy but never exceeds five in any case.

Depending on instructional strategy, the student is able to rate each option in terms of the following parameters:

- Confidence that the option is appropriate to the situation.
- Confidence that the option's effects shall satisfy the decision objectives and/or the POA.
- Confidence that the option is feasible.

Depending on instructional strategy, the student is able to rank-order the defined options by arranging them on a scale of optimality from 1 to 10, where 10 represents an optimal decision and anything less than 10 represents lesser degrees of optimality. The system provides feedback to the student for each defined decision option either (1) when requested by the student prior to implementation or (2) immediately after implementation.

Ideally, feedback on defined decision options should contain:

- A comparison of the student's confidence ratings with the system's confidence ratings and brief statements of reasons for any divergence between the two.
- A comparison of the student's rank-ordering with the system's rank-ordering and brief statements of reasons for any divergence between the two.

Feedback on decision options are combined with feedback on information access when the instructional strategy calls for both. Regardless of instructional strategy, the DDT provides for an explicit student input to signify that the decision point has been reached. The student indicates that they have decided on one of one or more defined decision options. This is a single action similar to the one used for the recognition of the need and opportunity for a decision (i.e., for the recognition point). The time between the recognition point and the decision point constitutes the actual decision time.

The DDT provide for an explicit input signifying implementation of a chosen decision option. This implementation action occurs immediately after the decision point or later. If the implementation action occurs after the default point, the system will display whatever feedback the instructional strategy calls for (i.e., feedback on suitability of accessed information sources and/or feedback on defined decision options or no feedback at all) and precede that feedback with a message that the decision-making process has taken too long.

Depending on the instructional strategy, the system displays messages indicating that the default point is imminent or has occurred. The content of these messages indicates that depletion of resources below a critical threshold is imminent or has occurred.

The DDT provides plausible feedback on the operational consequences of the implemented decision, i.e., logistics goods must be transferred from resource pools to resource users by the specified means of transportation; the transfer must take appropriate amounts of time and be subject to influences of weather, threats, or mechanical breakdowns; and once transfer is accomplished, the resource user shall regain combat strength.

General Decisions

All specific decisions should be in agreement with the POA. From time to time during an exercise, the DDT provides information to the student that the situation has changed drastically enough to make the current SA and POA obsolete. When this occurs, the student has to make general decisions resulting in a new POA. During the operations phase, the student has access to the SA and POA developed during the orientation phase and is able to edit each.

Debriefing Phase

The debriefing phase supplies the student with summary feedback on the student's performance over the course of an exercise. The student is able to enter the debriefing phase

after completing an exercise or any time after starting the operations phase. The summary feedback provided during the debriefing phase consists of two types:

- Technical feedback.
- Decision feedback.

Technical feedback is provided regardless of instructional strategy. It informs the student of the degree to which they have satisfied the logistical demands established during the exercise. It consists of two parts:

- A list.
- Measures of effectiveness (MOEs).

The list show for each demand the degree to which it was satisfied in terms of quantity and timeliness. MOEs are numerical scores that summarize demand satisfaction across all demands on the list.

Decision feedback consists of a Part 1 that is always provided, regardless of instructional strategy, and a Part 2 that is only provided when the instructional strategy includes explicit training on the decision-making model.

Part 1 shows the student:

- How many times they should have produced an SA and a POA.
- How many times the student actually produced an SA and a POA.
- How many mistakes were made in the SAs.
- How many mistakes were made in the POAs.
- How many specific logistics decisions the student was supposed to make.
- How many specific logistics decisions they actually made.
- How many times the default point was exceeded.

Part 2 is designed to show the student the following items:

- How well they assessed uncertainty reduction requirements.
- How well they stuck to the priorities indicated by the system uncertainty profiles.
- How well the student allocated their time in accordance with the system uncertainty profile.
- How appropriate each decision was to the situation at the time.
- How well each decision satisfied the objectives and/or the POA.

- How feasible each decision was.
- Average recognition time.
- Average decision time.

6.1.5. Instructional Strategy

Each course of instruction is characterized by an explicitly defined instructional strategy. Each instructional strategy consists of a macro-strategy and a micro-strategy. The DDT prototype contains the baseline macro- and micro-strategies and provides facilities to edit the baseline macro- and micro-strategies and/or define entirely new macro- and micro-strategies.

Macro-Strategy

The macro-strategy specifies the sequence of training for each level, environment, lesson and exercise by assigning each of the selected objectives to a level and an environment, and to a lesson or an exercise. A macro-strategy therefore consists of:

- An assignment that assigns each objective to a level and to either the presentation or the practice modules on that level.
- An assignment that assigns each presentation objective to a lesson, and each practice objective to an exercise.
- Sequence constraints between lesson segments within each lesson.

Micro-Strategy

There are two types of micro-strategy:

- Micro-strategy for lessons.
- Micro-strategy for exercises.

A micro-strategy for lessons specifies:

- Sequence constraints between segment elements within any lesson segment.
- Type, form, and number of segment elements for each lesson segment.

The micro-strategy for exercises specifies what is presented to the student in each of the three phases of an exercise. The strategy for the orientation phase specifies:

- Which options shall be made available to the student after they have received feedback on their SA and POA.

The micro-strategy for the operations phase always specifies:

- How many options (between one and five) the student can generate prior to implementation of one.
- Whether the student can receive feedback on an option prior to implementation.
- Whether default point messages shall be displayed.

When metacognitive training on the decision-making model is included, the micro-strategy automatically includes the following interactions:

- Prioritizing uncertainty reduction requirements with feedback.
- Feedback on the suitability of accessed information sources.
- Student assessment of defined decision options (parameters and overall rank order).

The micro-strategy for the debriefing phase is predetermined. If the macro-strategy includes explicit metacognitive training on the decision-making model, then Part 2 of the decision feedback will automatically be included.

6.1.6. Student Interface Requirements

Log On/Off

The student is able to log-off at any time. When the student has logged off after completing a lesson or an exercise, their next log-on will position them at a review options menu. When the student has logged off before completing a lesson, their next log-on will position them at the start of the lesson segment where they left off. When the student has logged off before completing an exercise, the next log-on will position them to choose either to resume exactly where they left off or to first review the current SA and POA and then resume where they left off. When the student logs off after completing the entire course, the DDT print out a certificate of completion.

Navigation

Whenever the student is logged on to the system and is working in any module, the DDT is capable of displaying information that indicates where in the course the student is (i.e., it must display the level, the environment, the lesson, or the exercise). If the student is in a lesson, the DDT will indicate the lesson segment. If the student is in an exercise, the DDT will indicate the phase.

The DDT will display, upon student request, a graphic course map, with a resolution down to lessons and exercises. By color coding, the map indicates the lessons or exercises that have been completed, which ones are in progress, which ones are open to be taken next, and which are not yet accessible.

When the student clicks once on a lesson symbol or icon, a lesson map is produced with all segments and their active and inactive prerequisite relationships. By color coding, the map indicates the lesson segments that have been completed, those in progress, lessons to be taken next, and lessons not yet accessible.

The DDT enables the student to enter lesson segments and exercises that are in progress or that are open to be taken next by double clicking on the respective symbols or icons on the map.

Review Features

The DDT permits the student to review or revisit any completed lesson at any time. It enables the student to review their scores on each completed lesson and exercise. This type of review is available after any log-on (but never on the first log-on) and after completion of any lesson or exercise.

Printouts

The DDT will enable the student to obtain hard-copy printouts of the following:

- Static display elements in lesson segments.
- Course maps.
- Lesson maps.
- Scores of completed lessons and/or exercises.
- Completion certificate.

6.2. Training in System Employment

6.2.1. General Requirements

The DDT provides built-in training on how to use the DDT system for each of the three classes of system users.

6.2.2. Tutorial for Students

The student tutorial enables students to competently operate the DDT during training for decision-making skills.

The instruction includes the following topics:

- Purpose of the DDT.
- Levels of training and training environments.
- Navigating through the decision training course.
- Learning in the presentation environment.
- Learning in the practice environment.
- Leave and resume feature.
- Obtaining printouts.
- Graduation.

The student tutorial is designed to require no more than 60 minutes to complete.

6.2.3. Tutorial for Researchers

The researcher tutorial is designed to enable the researcher to competently operate the DDT as a research platform. The instruction includes the following topics:

- Purpose of the DDT.
- System overview.
- Defining courses.
- Subject/treatment assignment.
- Data collection.
- Reports.
- System demonstration.

The researcher tutorial is estimated to require no more than 120 minutes to complete.

6.2.4. Tutorial for Managers

The manager tutorial permits system managers to competently perform all management and support functions for the DDT. The instruction includes the following topics:

- Purpose of the DDT.
- Student functions.
- Researcher functions.
- Support and management functions.
- Personnel access control.
- System configuration control.

- Reports.
- System demonstration.

The manager tutorial requires, on average, no more than 120 minutes to complete.

7. SYSTEM REQUIREMENTS FOR RESEARCH

7.1. Design of Course Variations

7.1.1. General Requirements

The DDT provides features to generate course variations by a method that requires researchers to go through a series of steps in sequence. If a researcher generating a course variation decides to do nothing in a given step, the system will use the training objectives, subject matter content, or instructional strategy of the baseline course as the default. The steps and their order are:

1. Editing training objectives.
2. Altering subject matter content.
3. Editing instructional strategy.

The DDT provides a convenient means to number and name course variations in a systematic fashion. The DDT also provides a feature to generate a course overview for each course variation. The course overviews:

- Consist of several labeled fields that can accept typed descriptive inputs.
- Be limited to a single screen display.
- Be accessible for review via a list that identifies courses at a minimum by course number, course name, date of creation, and name of responsible researcher.
- Be researchable.

7.1.2. Editing the Training Objectives

The DDT provides a feature to:

- Edit the baseline objectives hierarchy.
- Label and save an edited objectives hierarchy.
- Assign the edited objective hierarchy to one or more new courses.

Editing of an objectives hierarchy consists of designating an objective in the baseline hierarchy as inactive (not to be trained). Future versions of the DDT shall provide features to edit any saved objective's hierarchy and editing functions for :

- Adding objectives.
- Changing an objective by changing the ACTION, CONDITIONS, and/or STANDARD statements.
- Installing a prerequisite link (sequence under system control).

7.1.3. Altering the Subject Matter Content

The DDT provides features for editing any segment element contained in the baseline course. The DDT provides features for:

- Authoring new segment elements.
- Classifying new segment elements.
- Assigning new segment elements to an existing objective.
- Saving new segment elements.

The DDT provides features for editing the scenario for any exercise contained in the baseline course. These editing features include defaults for incomplete fields.

The DDT provides editing features for:

- Authoring new exercises by generating new scenarios from scratch or by editing the scenario for any existing exercise.
- Checking a new scenario for completeness.
- Assigning each new scenario to an existing objective.
- Saving new scenarios.

7.1.4. Editing the Instructional Strategy

The DDT permits editing of the instructional strategy of the baseline course. Researchers will be able to edit either the macro-strategy, the micro-strategy, or both. The DDT's features for editing the macro strategy will allow researchers to change the following:

- Assignments of lessons and exercises to a level.
- Assignments of objectives (lesson segments) to lessons.
- Sequence constraints between lessons and between exercises.
- Sequence constraints between lesson segments within lessons.

- Time limits for test lessons.

The DDT's features for editing micro-strategies within lesson segments will allow researchers to do the following:

- Change the sequence constraints between segment elements.
- Set time limits for segment elements of the practice and feedback type.
- Set time limits for test segments.
- Set window mobility.

Further, the researcher will be able to change the following:

- The options that is made available to the student after feedback has been received on their SA and POA.
- The number of options the student can generate prior to implementation of one of them.
- Whether the student can receive feedback on an option prior to implementation.
- Whether default point messages shall be displayed.
- Whether prioritizing uncertainty reduction requirements with feedback is included.
- Whether feedback on the suitability of accessed information sources is included.
- Whether student assessment of defined decision options (parameters and overall rank order) is included.
- The time limits for the orientation phase.
- The clock speed for the operations phase.

7.2. Subject/Course Variation Assignment

The DDT provides a means to assign a particular course to a particular enrolled student. The default assignment is the baseline course.

7.3. Data Collection

The DDT is capable of collecting the following four types of data during any student session:

- Time data.
- Performance data.
- Transcripts.

- Questionnaire data.

The DDT provides researchers with a feature to select the types of data to be collected during the student sessions of a particular student with a particular course variation or the baseline course. The default selection is performance data.

7.3.1. Time Data

The DDT collects the elapsed time between the start of a course and the finish of a course by a student. The DDT collects the cumulative time during which a student has been logged on to a course. Time data collected by the DDT while a student is in the presentation environment consists of:

- Elapsed time between the appearance of each practice and feedback segment element on the screen and the completion of the student answer.
- Elapsed time between the start and finish of each lesson segment.
- Elapsed time between the start and finish of each lesson.
- Elapsed time between the start and finish of each module.

When a student logs off during a lesson segment, lesson, or module, the time they stay away from the lesson segment, lesson, or module is subtracted from the elapsed times between the start and finish of a lesson segment, lesson, or module. Time data to be collected by the DDT while a student is in the practice environment consists of:

- Elapsed time for each exercise.
- Elapsed times for each of the phases of an exercise.
- Elapsed time between the start of an SA and the finish of the POA.
- Elapsed recognition time for each decision opportunity.
- Elapsed decision time between each recognition point and decision point.
- The above-listed elapsed times minus elapsed times spent on taking care of administrative messages.
- Average elapsed recognition time.
- Average elapsed decision time (everything included).
- The above-listed average elapsed times minus time for administrative messages.

7.3.2. Performance Data

The DDT is capable of collecting the following performance data in the presentation environment:

- For each practice and feedback element: whether the student answered correctly on the first, second, or third attempt.
- For each test segment or test lesson: which items were failed and the percentage of items failed.

Ideally, the DDT will be capable of collecting the following performance data in the practice environment:

- Number of opportunities for logistics decisions presented to the student.
- Number of opportunities for logistics decisions recognized by the student.
- Number of logistics decisions made prior to default point.
- Number of logistics decisions where the student's confidence ratings were significantly different from the system's confidence ratings.
- Number of logistics decisions where the student's rank orderings were significantly different from the system's rank orderings.

7.3.3. Transcripts

The DDT is designed to be capable of collecting a record showing the following in chronological order, identified by a Date-Time Group (to the second):

- Start and finish of each
  - course,
  - level, module,
  - lesson,
  - lesson segment,
  - exercise, and
  - phase of an exercise.
- All messages and reports presented to the student.
- The following student-system interactions:
  - decision problem presentation,
  - recognition point student input,

- student uncertainty profile completion,
- system uncertainty profile feedback,
- which information sources were accessed, when, and for how long,
- when decision templates were selected,
- when feedback was requested for a decision option,
- decision point student input,
- implementation point student input.

7.3.4. Questionnaire Data

The DDT is designed to enable researchers to do the following:

- Enter a questionnaire of no more than two pages or 20 questions in length.
- Assign the questionnaire to one or more course variations.
- Define at what point during a course the questionnaire shall be presented to the student.
- Accept and collect student responses (keyboard, verbal, and numerical) to the questionnaire.

7.4. Data Evaluation

The DDT will provide researchers with the capability to select a range of data by student, course variation, data type, and data item (numerical data only) and to calculate the following for that range of data:

- The mean.
- The median.
- The standard deviation.

The data collected by the DDT will be in a format that allows direct input into SPSS software.

7.5. Result Reporting

The DDT provides the capability to print standard hard-copy reports, for a single student or a range of students, for each type of data that can be collected. The DDT also provides a capability to custom-format reports to show subsets of a type of data and/or combinations of data from different data types.

7.6. System Demonstration

The DDT provides a system demonstration emphasizing the training and the research capabilities of the DDT, which can run either like a movie in a non-interactive, automatic mode or in an interactive mode.

The interactive mode is designed to be used either to demonstrate the system to others or to provide novices with an opportunity to learn about the system by themselves. The system demonstration is accessible to users who are enrolled as researchers or as system managers. The system demonstration in the interactive mode and the student tutorial will be as similar as possible.

8. SYSTEM REQUIREMENTS FOR MANAGEMENT

The DDT provides facilities to support system management. These facilities shall assist system managers with the following:

- Personnel access control.
- System configuration control.
- Report production.

8.1. Personnel Access Control

The DDT provides a function to enroll/disenroll students, researchers, and system managers. The DDT will prevent log-on to the system for any user who is not enrolled; however, users who are not enrolled shall have access to the non-interactive system demonstration.

The DDT restricts access of enrolled students to their assigned courses. Users enrolled as researchers or system managers have unrestricted access to the system; however, only users registered as system managers will have access to the enrollment function. The DDT is capable of displaying a list of currently enrolled users (students, researchers, system managers).

8.2. System Configuration Control

The DDT provide a function to assist system managers to maintain configuration control over the system. The system maintains a displayable log where all configuration changes are described and recorded.

Installment of the DDT on a user hardware platform or installment of system updates is automated and prompted in the same way the installment of commercial applications is automated and prompted.

8.3. Report Production

The DDT provides facilities to collect data for and produce the following types of reports:

- System usage reports.
- System performance reports.
- User feedback reports.

System usage reports will indicate hours and minutes of system usage by individual users and/or user classes over selectable periods of time. System performance reports will show a dated and timed record of all error messages displayed by the system.

User feedback reports are generated from user feedback forms. These forms are available from an icon whenever a user is logged-on to the DDT. The forms permit free-form verbal keyboard input. The DDT provides a convenient, simple, and user-friendly procedure by which researchers or system managers can transfer all accumulated user feedback data for a selectable time span to a disk.

9. GLOSSARY

A

artificial logistical domain

a fictional, invented logistics world that is structurally similar to the real logistics world but is explicitly not a high-fidelity replica of it.

B

baseline course

the original course of instruction contained in the system to be delivered.

D

decision point

the point in time where the decision maker commits himself to one of the available options.

default point

the point in time where the decision window ends and where the default course of events begins to take place.

demand and supply model

an abstract model representing the essence of the logistics function.

Desktop Decision Trainer

a system to train decision making skills using a desktop computer.

drag-and-leave

a practice element where the student has to drag labels to the appropriate parts of a figure or diagram.

E

EARFLAP

a particular type of report used in logistics.

environment, practice

an instructional environment where the student can practice applying the knowledge he has acquired in the presentation environment.

environment, presentation

an instructional environment where the student is presented with knowledge he must remember.

epitome

the simplest, concrete form of a task that incorporates the basic task elements.

exercises

chunk of instruction in the practice environment that takes several hours to go through.

I

implementation point

the point in time where the decision maker begins to implement the course of action to which they have committed themselves.

instructional methodology

a method of instruction defined by the instructional strategy and the media used for delivering the instruction.

L

lesson

chunk of instruction in the presentation environment that takes about an hour to go through.

lesson segment

part of a lesson dedicated to training a single objective.

level of elaboration

partition of a course of instruction into parts or levels in such a way that each level is more complex or "elaborate" than the preceding level.

M

metacognitive subject matter

generic knowledge required to perform a given type of task in any technical domain.

model of human decision making

a theoretical model that explains the decision making task and how humans perform this task.

O

objective, enabling

intermediate training goals that must be achieved prior to the terminal training objective.

objective, terminal training

goal statement of what the student will be able to do upon termination of training.

P

prerequisite relationship

objective A is prerequisite to objective B if the learner cannot learn objective B unless he has learned objective A.

R

recognition point

the point in time at which a person recognizes the need and opportunity for a decision.

researcher

personnel at AL/HRTC who will use the DDT for research on optimal methods to train decision making skills.

S

segment element

smallest instructional "building block".

segment element, dynamic display

an element that shows an animated sequence, an interactive model, a video clip, or some such dynamic and/or interactive sequence.

segment element, practice and feedback

an element that makes the student practice and that provides feedback on that practice.

segment element, static display

an element that displays static text and/or graphics.

segment element, test

same as a practice and feedback element but without the feedback.

segment element, test result

an element that provides feedback to a test element.

students

military and civilian personnel employed in Air Force Logistics positions with significant decision making functions.

system managers

personnel responsible for the DDT systems installed at a given site.

T

technical subject matter

the technical knowledge required to perform tasks in a specific technical domain.

transfer of training the ability to apply skills learned in a training environment to tasks occurring in the actual job environment.

U

uncertainty

the equivalent of "lack of information".

uncertainty reduction

prior to making a decision, the decision maker seeks to reduce uncertainty as much as possible by acquiring information.

REFERENCES

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