Next-generation Expeditionary Warfare Intelligent Training (NEW-IT)

Status Summary October 2010
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**NEW-IT Program Details at a Glance**
- **Contract:** N00014-08-C-0186  
- **Duration:** Three-year contract (FY08-FY11)  
- **Program Manager:** Dr. Roy Stripling  
- **Sponsor:** Office of Naval Research (ONR), Capable Manpower Future Naval Capability (FNC)

Transition: The NEW-IT program has established a formal Technology Transition Agreement (TTA), Level A, with ONR, the USMC Program Manager for Training Systems (PMTRASYS), and the USMC Training and Education Command (TECOM). The Level-A TTA was signed June 2009. NEW-IT products will transition to the Marine Corps Ground Combat Supporting Arms System, a family of training systems including the Deployable Virtual Training Environment (DVTE).

Naval S&T Focus Areas Addressed:  
- Asymmetric and Irregular Warfare (AIW)  
- Distributed Operations (DO)  
- Naval Warrior Performance and Protection

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Background

This technical report provides a status update on the Next-generation Expeditionary Warfare Intelligent Training (NEW-IT; N00014-08-C-0186) initiative. NEW-IT is a 3-year research contract (FY08-FY11) sponsored by the Office of Naval Research (ONR). NEW-IT research and technology deliverables are intended to support the US Marine Corps (USMC) by improving the effectiveness and efficiency of simulation-based training. Specifically, NEW-IT will deliver a software prototype Instructional Support System (ISS) driven by empirically-evaluated instructional theories and methodologies, which will integrate with the USMC’s Deployable Virtual Training Environment (DVTE), a multi-user laptop-based simulation suite fielded world-wide.

Instructional Support System (ISS)

The NEW-IT ISS is a software program that allows instructors to better plan and execute training via the DVTE-CAN simulation. The ISS instantiates “SBT-AID,” a theory derived under NEW-IT that extends the Scenario-Based Training, or SBT, paradigm to include Adaptive, Intelligent, and Dynamic mechanisms.

How to Improve SBT?

SBT is difficult to effectively administer. It must be carried out manually by highly-expert instructors, which is time-consuming, expensive, and limits deployability. NEW-IT’s SBT-AID approach improves upon the status quo. First, it maintains those components that already work well: the Training and Readiness (T&R) manuals and existing virtual environments (such as DVTE). Next, NEW-IT automates the traditional SBT steps, such as scenario generation and selection; this helps expert instructors be more efficient and less experienced instructors be more effective.

Finally, NEW-IT extends the SBT paradigm to include new automated functions that reflect the best-practices of expert instructors, such as personalizing instruction to individual trainees and analyzing longitudinal performance data.

Through application of SBT-AID, the ISS software makes simulation-based training more effective and efficient. Colloquially this approach “puts the instructor in the box.”

Technology Transition Agreement

Representatives from ONR, USMC Program Manager for Training Systems (PM TRASYS), and the USMC Training and Education Command (TECOM) signed a Level-A TTA in June 2009. The TTA specifies two primary exit criteria.

01. Decrease time for facilitators/instructors to appropriately use the functionality of DVTE-CAN.

02. Provide the ability to select training scenarios to meet Training and Readiness (T&R) objectives based upon explicit linkages between scenarios and T&R manual events.

These metrics have been tracked throughout the duration of the NEW-IT effort through interim field testing. (Results are discussed in a later section.)

2009 NEW-IT Status Report

This technical report is the second in a series of project status updates. The first report, published in 2009, provided an overview of the NEW-IT effort, the gaps it addresses, its research and design approach, and a summary of the tasks that had been completed to date. The 2009 report, numbered IST-CR-09-06, is available through the Defense Technical Information Center (DTIC). The contents of previous report are summarized below.

Practical Challenges

NEW-IT investigators are exploring a range of learning science and computer science research in order to address the following practical gaps in
USMC simulation-based training:
- Generally focuses on lower-level training
- Limited throughput
- Partial effectiveness
- Limited deployability

Marine Corps Science & Technology Gaps
More specifically, NEW-IT addresses the following Marine Corps Science and Technology Objectives (STOs), identified in the Human Performance Training and Education (HPT&E) section of the Marine Corps Science and Technology (S&T) Strategic Plan:
- STO-1: Warfighter Cognition
- STO-4: Warrior Technology Training
- STO-6: Experiential Learning Tech & Pedagogy
- STO-8: Automated Performance Assessment

Conceptual Design: SBT-AID
The organizing concept for NEW-IT research is “SBT-AID,” which stands for Scenario-Based Training: Adaptive, Intelligent, Dynamic. The SBT-AID approach combines intelligent tutoring components, scenario-based instructional simulations, dynamic scenario generation capabilities, content authoring support, and an integrated pedagogical framework. The 14 steps of the SBT-AID model are as follows:
01. Conduct task analysis (e.g., T&R Manuals)
02. Build or access trainee profiles
03. Select training objectives
04. Select and apply an instructional strategy
05. Deliver pre-task instruction
06. Generate a relevant training scenario
07. Deliver the scenario via a virtual simulation
08. Assess and diagnose process performance
09. Adapt the training scenario
10. Deliver during-execution extrinsic feedback
11. Assess and diagnose outcome performance
12. Deliver post-task instruction (e.g., AAR)
13. Record meta-data on training session
14. Record trainees’ performance history

Prototype Software: ISS
SBT-AID is the organizing concept for NEW-IT, and it translates into a high-level architectural design for the NEW-IT prototype software solution, the Instructional Support System (ISS). The ISS couples with DVTE. A high-level architectural diagram of the ISS is shown in Figure 1.

Impact Assessment
The NEW-IT team is conducting a two-pronged Training Effectiveness Evaluation, focusing on both operational effectiveness (i.e., immediate Marine Corps needs) and instructional effectiveness (i.e., longer-term goals identified by science and technology standards).

First, the operational effectiveness testing aims to measure the impact of the ISS software against immediate Marine Corps needs identified in the TTA. In 2009, initial results were available from early operational effectiveness impact assessment, and they were very promising. In 2009, a 25% improvement in “facilitator performance” was found when using ISS V1.0 versus using DVTE alone, and a 71% improvement was found in “instructional quality” when using ISS V1.0 versus using DVTE alone.

Second, the instructional effectiveness testing (which had not begun in 2009) planned to measure the impact of the ISS software on instructors and trainees via a series of four ablative studies as well as a comprehensive concluding study.
Research Approach: 2010 Update

The NEW-IT team is continuing to address Marine Corps SBT gaps through a range of learning science and computer science research and technology. These efforts can best be categorized across a spectrum, ranging from mainly learning-focused research to mainly computer-focused research:

01. Metacognition
02. Instructional Strategies for Guided Practice
03. SBT-AID
04. Human–Systems Integration (HSI)
05. Scenario Generation

When NEW-IT began in 2008, the Technology Readiness Levels (TRLs) of these areas ranged between 0–4. Upon completion of the project, the TRLs will be between 4–6. Lower level capabilities are explored by the NEW-IT research sub-team, while capabilities that reach TRL 4 are integrated into the prototype ISS software and further developed by the technology team. Figure 2 shows the incoming and outgoing TRLs by research area. The striped boxes below some of the bars indicate that those technologies had already achieved the specified TRL when NEW-IT began.

Each of these research areas, as well as the deliverables associated with them, is discussed in the following subsections. Additionally, Table 1 summarizes the “punch lines” from each of the six research areas.

1. Metacognition

Metacognition is a multidimensional construct comprised of the knowledge and regulation of cognition (Brown, 1987; Schraw, 1998; Schraw & Dennison, 1994). Knowledge of cognition refers to individuals’ knowledge of their personal skills and abilities, their ability to employ effective learning and problem solving strategies, and their knowledge of when and why to use these strategies. Alternatively, the regulation of cognition involves monitoring or elaborating upon learning experiences and can occur before, during, or after a learning cycle.

NEW-IT investigators have focused on the regulatory component of metacognition. Specifically, we have investigated strategies for encouraging trainees to actively engage in self-regulation throughout the training cycle. Strategies for pre-training, during-training, and post-training were developed and empirically tested, initially within a controlled laboratory setting, and then (when laboratory tests supported further development) they were tested in field settings.

Pre-Training Metacognition Strategies

In this experiment, metacognitive prompts will be used as pre-training framing experiences. This experiment will be conducted in FY11.

During-Training Metacognition Strategies

In this experiment, the differential use of procedural versus conceptual, and high versus low complexity, metacognitive prompts during simulation-based training was explored. Specifically, their impact on the acquisition and application of knowledge within a scenario-based training context was measured. Data suggest differential outcomes are dependent upon the level of prompting, with metacognitive-supported training at the conceptual level leading to significantly better integration and application of knowledge compared to learners receiving procedural-level prompts. These results suggest that this strategy is well-suited for further development (see the Field Test section).
Post-Training Metacognition Strategies

In this experiment, metacognitive prompting was provided post-training, as a reflection activity, to participants (novices) in a military simulation. Analyses revealed that the prompts did not initially enhance performance, but as the participants gained knowledge and the task increased in complexity, high-level prompts became helpful.

Generalization Study

Finally, metacognitive prompting was provided during an unmanned aerial system (UAS) simulation-based training exercise. This study was designed to show generalization of the metacognitive prompts effects, beyond the Call For Fire domain. Data collection for this study is on-going.

2. Instructional Strategies for Guided Practice

This research concerns the range of instructional techniques that instructors can (and in some cases already do) use to support guided-practice instruction, such as SBT. The goals of this investigation are to analyze and operationalize instructional strategies so that they can be supported through instructional technology.

Instructional Strategies Review

First, we conducted an extensive review to identify the established instructional strategies that support experiential learning. We then categorized these strategies into a framework (based upon recommendations from the work of Kolb, Klein, Marshall, and others). From insights gained through the review, we categorized the strategies in terms of how they support pre-, during- and/or post-training periods; the competency-level of trainees who may benefit most from each strategy; and the type of unique learning outcomes that may be expected when the strategy is used. In the end, 16 strategies were included in the final taxonomy. Table 2 lists these strategies as well as the best-use criteria associated with each one.

Details of the taxonomy are included in manuscript, entitled “The Effects of Instructional Strategies Guidance on Instructor Knowledge and Quality of Instruction,” which is currently under review at Journal of Educational Psychology. The taxonomy content was also used to develop a one-page guide for military instructors, called the “Devil Dog Cheat Sheet” (see Figure 3), and it informed the following two empirical inquiries.

Strategy Use by Military Personnel

With the instructional strategies taxonomy in hand, NEW-IT investigators approached Marines at schoolhouses and simulation centers to learn which, if any, of the strategies they regularly use when they train fellow personnel.

USMC instructors (N=12) were asked to describe the instructional techniques that they use to support the pre-, during- and post-practice periods of hands-
Sixty-six (66) descriptions of strategies were reported by the instructors, and as a whole, this suggests that trainers employ a range of strategies that are related to good learning, including those related to exercise preparation and feedback. However, few of the reported strategies were aimed at manipulating the nature of the practice provided to trainees. In addition, there was little mention of tailoring strategies to fit student needs or adjusting strategies based upon student experience levels, even though one of the questions prompted participants for this information. Finally, there were few examples of strategies reported that would promote experimenting or framing. These results suggest that, although military instructors do employ some effective strategies, they could potentially make better use of a wider and more adaptive range of instructional approaches.

While we interviewed the Marine instructors, we also asked for their opinions on the Devil Dog guide. The participants found the guide easy to use, agreed that it provided useful instructional techniques, and indicated that they would use it to get instructional ideas. The weakest rating was obtained for the usefulness of the examples provided in the guide. Participants indicated that examples pertinent to their own domain would be more beneficial; we have since attempted to address this weakness.

Complete details on this study and its results can be found in Fowlkes, Schatz, & Stagl (2010).

### ISD Approach vs. Strategy Use: Outcomes

When the goal of instruction is to promote advanced learning, it is essential that experiential, hands-on training is utilized. The purpose of this research study was to determine whether the succinct instructional guide (i.e., the Devil Dog Training Cheat Sheet) would enhance participants’ facilitation of experiential training,

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**Table 2. Taxonomy of instructional strategies, created through literature review of empirically validated guided practice strategies. Organized by training phase, level of trainee, and type of outcome benefit expected.**

<table>
<thead>
<tr>
<th>STRATEGY</th>
<th>TRAINING STAGE</th>
<th>STUDENT EXPERIENCE</th>
<th>COGNITIVE ACTIVITIES</th>
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<td></td>
<td>PRE</td>
<td>DURING</td>
<td>POST</td>
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<td>Give a Framework</td>
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<td>Direct Attention</td>
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<td>Identify Misconceptions</td>
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<td>Compare and Contrast</td>
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<td>Demonstrate</td>
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<td>Mentally Simulate</td>
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<td>Create Disequilibrium</td>
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<td>Design Event-based Training</td>
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<tr>
<td>Provide Complexity</td>
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<tr>
<td>Vary Practice</td>
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<tr>
<td>Encourage Self-Regulation</td>
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<td>Link Training</td>
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<tr>
<td>Use Stories</td>
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<td>What If</td>
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<tr>
<td>Give Homework</td>
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<td>Encourage Self-Correction</td>
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as compared to those who used only the Instructional Systems Design (ISD) approach or no instructional development strategy (control). We hypothesized that the guide would: (1) Increase the repertoire of instructional strategies used by participants, (2) Increase the quality of instruction designed, and (3) Better enable instructors/participants to tailor training to the skill level of the trainee.

Seventy-nine students (N=79) from the University of Central Florida participated in this study. They were divided into one of three experimental cohorts, as previously described. One experimental group received internet access and an ISD guide, while the other experimental group received internet access, an ISD guide, and the Devil Dog Training Cheat Sheet. The control group received no instructional support materials. All participants were asked to appropriately implement instruction in response to situational essays. Objective performance was measured with open-ended responses to questions regarding three hypothetical training scenarios, administered after the intervention.

Results indicate that, as hypothesized, the ISD experimental group performed superior to the control group, and the Devil Dog Cheat Sheet group outperformed both other groups. This suggests that the use of validated instructional strategies, in addition to the use of traditional ISD principles, leads to superior instructional planning as compared to the use of ISD principles alone. For military trainers, this result suggests that their efforts could be enhanced by the systematic employment of validated instructional strategies—such as those that have been built into the ISS.

A detailed description of this study is included in the manuscript, entitled “The Effects of Instructional Strategies Guidance on Instructor Knowledge and Quality of Instruction,” mentioned in the prior section on “Instructional Strategies Review.”

Effects of Domain Ontology Use

NEW-IT investigators also explored the use of domain ontologies (DOs), which are structured training objective frameworks that can be used to model content for training system design and for use in training performance decisions. DOs provides several advantages, for training advanced skills: They are based on task representations that reflect the flexibility that real-world problems demand; they are able to flexibly capture performance over a wide variety of scenarios and situations; the multiple levels of functional interactions which this type of model represents situate a learner in the appropriate context at all stages of skill acquisition; and finally, they link skilled performance, to which trainees aspire, to critical organizational goals.

We hypothesized that using domain ontologies to support teaching and learning would improve the quality of instruction, the amount of retention, as well as the similarity of students’ mental models. To test this hypothesis, we conducted theoretical research, developed a domain ontology for Call For Fire tasks (for use within the ISS), and tested our hypothesis through a laboratory-based empirical study. The study is still ongoing, but pilot results are promising. Details of this effort were presented at the 2010 Human Factors & Ergonomics Society meeting by Fowlkes, Schatz, Stagl, and Norman.

3. SBT-AID

SBT-AID is a novel concept developed under NEW-IT that formally specifies an approach to combine the best features of Scenario-Based Training (SBT) with
the most effective facets of Intelligent Tutoring Systems (ITS). Hypothetically, this combination creates a training technology that mitigates many of the limitations of either standalone approach, and consequently supports the effective, efficient training of complex skills. As mentioned in the Background Section, SBT-AID provided the organizing concept for NEW-IT’s development efforts and informed the architectural design of the ISS. Several articles and presentations on SBT-AID have been made throughout the duration of NEW-IT; however, the most representative article is likely Schatz, Bowers, & Nicholson (2010).

4. Human–Systems Integration

Typical military training systems lack embedded instruction support. Beyond the launching and running of scenarios, current simulated environments rely primarily on manual instructor inputs to support the training cycle. As such, instructors have little to no support in identifying gaps in a trainee’s skill or knowledge base, selecting pre-training materials, selecting exercises or lessons that are built to support targeted training objectives, selecting and utilizing training strategies tailored to objectives, and identifying performance measures focused on those objectives, which may negatively impact training effectiveness.

In order to address these needs, researchers have worked closely with Marines, Marine instructors, DVTE facilitators, and Marine transition customers using Knowledge Acquisition and Engineering (KA&E) processes and documenting the Systems Requirements Specifications (SRS) to establish performance standards and requirements.

Best practices were identified through observation and knowledge elicitation with stakeholders regarding how they interact with each other and trainees during training phases. From this research, targeted capabilities have been developed to support instructors via usable automated systems. Further, to assess the effectiveness of these spirally developed capabilities, ongoing empirical evaluations were also conducted and subject matter expert input was continuously gathered (See Impact Assessment section, later in this report).

5. Scenario Generation

For the purposes of this research, scenario generation describes the design and development of training episodes for simulation-based instruction. Traditionally, this process is carried out by one or more subject-matter experts, who manually plan out the scenario and then carefully program their plan into a simulation system. Consequently, developing scenarios for simulation-based training is generally time-consuming and expensive. Unfortunately, such inefficiency often results in only a small number of scenarios being developed and constantly reused. Not only does this reduce the scope of training, but the loss of variety and limited range of scenarios also diminishes training effectiveness (Martin, Schatz, Bowers, Hughes, Fowlkes, & Nicholson, 2009).

To help mitigate these limitations the NEW-IT team has investigated a unique scenario generation and adaptation conceptual design, novel theory and operational of “scenario complexity,” and developed prototype software to automatically generate scenarios within the framework of the ISS and DVTE.

Scenario Generation Conceptual Design

The conceptual approach we developed is based upon the notion of selected “training objectives,” coupled with the use of “baseline scenarios” and “scenario vignettes” that offer complexity modifications. Given a trainee profile, the system can assemble combinations of baseline and vignette scenarios that support specific training objectives, reach appropriate levels of complexity, and provide adaptive training opportunity for the trainee(s) to further their understanding and performance.

Scenario Complexity Operationalization

Scenario complexity is the objective calculation of the subjective notion of difficulty. Subjectively, a scenario that is perceived “hard” by a novice may be perceived as “easy” by an expert. However, this information is un-actionable for a computational system because the subjective term difficulty is not interpretable by software. To ensure trainees receive scenarios appropriate to their skill level, while efficiently and effectively
advancing their training toward desired performance outcomes, scenario complexity must be defined and formalized in numeric terms so the software can calibrate and assemble appropriate SBT episodes.

To this end, scenario complexity is defined as the objective quality of a scenario, which interacts with individual characteristics (such as trainees' expertise) to yield an individual's perception of the scenario's difficulty (Lum et al., 2008). Most importantly, scenario complexity is calculated based upon scenario elements that are extrinsic from rather than intrinsic to trainees (Dunne et al., 2010).

As part of the NEW-IT effort, researchers have been refining this formula, which has been integrated into the prototype “COGS” software in order to align scenario sequencing to trainee performance, while also presenting varied situations and experiences increasing decision preparedness.

“COGS” Software
The ISS software contains a scenario generation component, called the CAN-oriented Objective-based Generator of Scenarios (COGS). CAN stands for “Combined Arms Network,” and it refers to the specific military simulation suite with which the prototype software is being integrated. In order to implement the COGS software, the authors needed to objectively define and components of a scenario and how they interrelate (discussed above). Then, these constructs needed to be translated into functional software designs.

Automated scenario generation can be conceptualized via an Input → Process → Output model (e.g., Hofer & Smith, 1998). For the prototype COGS software, the inputs include a preselected training objective, an optional recommended pedagogical approach, and information about the trainees, including the number of trainees, the functional roles they will play in the simulation, and their levels of expertise. These data are sent to COGS from the master ISS application, which reads them from an existing database; however, the data can also be manually entered by an operator.

Once inputs are received or input, the COGS software uses Functional Lindenmayer systems (known as FL-systems) to construct a unique, valid scenario that emphasizes the given training objective and is tailored to the specific trainees' instructional needs. The output composite scenario definition is automatically assembled from pre-existing scenario baselines, vignettes, and pedagogical templates. Specific instances of each are selected based on their goodness-of-fit relative to the training inputs. In the COGS software, the output file is written in XML, which maximizes flexibility and makes COGS extensible to different simulation platforms.

Inquiry Modeling
Inquiry modeling is a novel theoretical concept developed under NEW-IT. This theory suggests that information on trainees can be captured or “modeled” automatically by analyzing the form, timing, and content of questions they pose during the instruction. This line of investigation is based on the observation that although current-generation intelligent tutoring systems are effective, they are still less effective than human tutors. One important qualitative difference between computer and human tutors is the human's ability to answer learners’ questions. To address this gap, we are investigating the capacity of a new inquiry-response module to (1) facilitate answering trainees’ questions, (2) leverage questions to improve the learner model and make tutoring more adaptive, and (3) give instructors useful information about questions trainees ask.

Inquiry Modeling Machine Learning Innovations
A practical software implementation is currently exploring some potential challenges and rewards of the new inquiry modeling theory, as well as intelligent tutors in general. The new module represents a novel application of machine learning to develop intelligent plans under uncertain conditions such as an intelligent tutor must face. The development process has led to innovations that may, with future research, let machine learning components better assist human designers and reduce intelligent tutors’ current inflexibility and high initial costs.
Technology Development

The primary NEW-IT prototype, the Instructional Support System (ISS), automates instructor tasks, supports content generation, and integrates lessons-learned from intelligent tutoring research. The ISS serves as a central hub for instructors to create and manage training. In brief, the current version of the ISS (V2.5) offers the following primary capabilities:

01. **Content Library**: An organized training content library helps instructors review, combine, and select among scenarios, supportive materials, and prepackaged lessons (see Figure 4).

02. **Content Linked to Requirements**: Training content is explicitly linked to training requirements, allowing instructors to rapidly select appropriate lessons to meet trainees’ needs.

03. **Technology Launch Support**: The ISS facilitates one-touch simultaneous launching of training content, including simulation scenarios, on all distributed trainee systems. This includes the ability to start simulator/software applications on multiple networked computers, stop applications, and power-on or off networked computers.

04. **Training Technology Usability**: The ISS user interface guides instructors through the training set-up, execution, and after-action processes. Even novice users can easily deploy structured, effective training.

05. **Status Monitoring**: The ISS allows instructors to configure and monitor multiple computers on same network. This includes technological configuration, such as monitoring a system’s operating system or network status, as well as instructional supervision, such as monitoring trainees’ real-time actions in a virtual environment (see Figure 5).

06. **Performance Metrics**: The ISS helps instructors collect appropriate, role-based performance metrics, which are linked to training objectives (see Figure 6).

![Figure 4. Content library and lesson editor screen capture](image1)

![Figure 5. A DVTE facilitator uses the ISS to monitor training during a FITE JCTD demonstration (Dec. 2009)](image2)

![Figure 6. Review screen capture](image3)
07. **Assessment Checklists**: Built-in performance assessment checklists articulate performance criteria to instructors and recommend remediation based upon trainees’ scores.

08. **Integrated “Traditional” Testing**: Instructors can automatically distribute (via the network), monitor, recollect, and grade pre-defined questionnaires during any part of training.

09. **Trait Assessment Tests**: Similarly, the ISS can administer trainee trait assessment tests, which provide input to trainee profiles and can help guide instructional interactions.

10. **Robust Trainee Profiles**: Detailed trainee profiles that include training-relevant information, such historical performance data, are integrated into the ISS. The instructor—or the automated software—can use these data to personalize instruction to trainees’ unique needs.

11. **Suggested Training Progression**: The ISS suggests training content based upon the specific trainees who are participating and their current training needs (i.e., their profiles).

12. **Trainee Rosters**: Trainee rosters and groups (e.g., by class) can be created to facilitate rapid training set-up, monitoring, and review.

13. **Distributed Messaging**: Text-messaging capabilities allow distributed instructor–trainee interactions before/during/after the training, even during simulation-based learning.

14. **Assisted Scenario Generation**: The ISS includes a prototype module, called COGS, that partially automates the scenario generation process. COGS helps users combine pre-made mission elements (called “scenario vignettes”) into full-fledged scenarios that are tailored to trainees’ instructional needs (see Figure 7).

15. **Assisted Lesson Creation**: The ISS includes a prototype module, called TIPS, that partially automates the lesson creation process. TIPS helps users combine lesson items, such as tests and scenarios, into complete lesson plans. TIPS also recommends instructional strategies and
Field Testing and Impact Assessment

NEW-IT’s goal is to develop a holistic model for impact assessment that can be potentially generalized to other training systems as well as applied to the assessment of the ISS software. Towards this end, the NEW-IT team is conducting research in the science of impact assessment. The team is also conducting a two-pronged Training Effectiveness Evaluation (TEE), focusing on both operational effectiveness (i.e., immediate Marine Corps needs identified in the TTA) and instructional effectiveness (i.e., longer-term goals identified by science and technology standards).

Operational Effectiveness

Objective 1: Enhance Facilitator Performance

Metric: Time to setup training operation (scenario)

The time required to set-up a computer-based training activity is significant. Thus, how rapidly a facilitator can set-up a training event was measured; in this case, five DVTE machines were used. In 2009, assessments were conducted with ISS V1.0, and they indicated a 25% improvement in efficiency with the ISS. More recently, assessments were conducted with V1.5 and V2.0. The latest results, with V2.0, show a 72% improvement in facilitator performance.

Objective 2: Enhance instructional quality via links between training goals and curriculum

Metric: Selection of target scenario matching a training objective

Early in the development process, Marine stakeholders reported difficulty identifying which DVTE scenarios related to which training objectives. Thus, the ability of DVTE facilitators to select specific scenarios was measured. The impact of the ISS was measured by assessing users’ ability to identify training scenarios that meet specific T&R objectives. In 2009, assessments were conducted with V1.0 of the ISS, and a 71% improvement was found. Analyses of ISS V1.5, a partial-build of the system, showed a slight decrease in this metric (due to the incremental software development approach); however, assessments conducted with V2.0 of the ISS continue to show a 71% improvement in “enhanced instructional quality” when compared against baseline results.
Instructional Effectiveness

Field Study 1: Student Outcomes

The goal of this field study was to determine if the instructional techniques found in two laboratory experiments could be instantiated into the ISS and elicit similar effects on knowledge acquisition in the field. The investigators used three cohorts of participants (N = 20): college students, novice military personnel (cadets), and senior personnel (Marine reservists). We had two hypotheses:

01. Using the ISS (with instructional strategies embedded) would improve knowledge application and performance in a simulated military environment (specifically DVTE).

02. The two strategies studied (metacognitive prompting and contrasting cases) would differentially impact the types of knowledge that participants acquired.

Both hypotheses were supported. Participants using the ISS outperformed those using the standard DVTE. Further, the contrasting cases strategy improved procedural knowledge acquisition, the metacognitive prompting strategy improved integrated knowledge application, and both strategies improved conceptual knowledge acquisition, as compared to the DVTE-only control group. More specifically, the results were:

- **Procedural knowledge acquisition** — 26% improvement with the contrasting cases cohort; the other groups’ scores remained flat between pre/post-testing.

- **Integrated knowledge acquisition** — 52% improvement with metacognitive prompting; the contrasting cases group’s scores remained flat between pre/post-testing, while the control group improved, but less so than did the metacognitive prompting group.

- **Conceptual knowledge acquisition** — 44% improvement with both strategies; the control group’s scores remained flat between pre/post-testing.
NEW-IT Presentations and Publications

PUBLISHED PROCEEDINGS


CHAIRMED SESSIONS


CONFERENCE PRESENTATIONS


Operationalizing tacit facets of scenario-based training. Paper to be presented at the 54th annual meeting of the Human Factors and Ergonomics Society (HFES), San Francisco, CA, September 27-October 1, 2010. [SBT-AID]


