Small Group Training: Web-based, Battle-staff Training

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Abstract

An essential element of a technology-based training environment is the ability to provide focused training to improve the performance of small teams, allowing the exercise of independent operations at increasingly lower echelons and developing their proficiency in the use of net-centric information[1]. Further, the training environment must be relevant to the current and future Department of Defense (DOD) training pipeline, digital natives, providing an immersive, media-rich training environment that stimulates cognitive, intuitive, innovative and adaptive thinking and hones complex decision-making skills as a group.

The Small Group Scenario Trainer (SGST) is a small group training tool using web technology that incorporates storytelling scenario introductions, real time remediation, advanced sequencing, learning content navigation and use of avatars for the purpose of stimulating critical thinking and learning while practicing within a team environment. SGST uses the latest web technology to enable distributed team training via the Joint Knowledge Online (JKO) global training platform, complementing existing collective mission rehearsal exercises and assisting battle staffs and small groups with problem solving as it facilitates the learning of contingency planning and course of action analysis. This paper describes how the technical and pedagogical challenges were identified, met and overcome to develop and deploy a web-based small group training capability. The paper provides: a description of the interactive capabilities that teach creative thinking skills to address problems encountered during virtual sessions that are developed specifically using mission-based, simulated scenarios; the framework approach allowing for reusable and flexible scenario creation, making it easily extensible for rapid mission-based, scenario simulation development; the training job aides using file sharing, video viewing and collaboration; and the challenges of developing and integrating an immersive trainer into the Joint Knowledge Online (JKO).

ABOUT THE AUTHORS

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Nancy D'Aniello Johnson is the *CTC* Program Manager for the Small Group Scenario Trainer (SGST). She brings more than 20 years of diversified experience in research, development, and management to *CTC*. She has led and managed numerous innovative network technology research and development projects for *CTC*, including the

[1] Strategic Plan for Transforming DoD Training.

Advanced Distributed Learning (ADL) Initiative, Immersive Learning Environments (ILES) Program, and the Advanced Collaborative Environment Testbed. She has a BS in Biology from the University of Pittsburgh.

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INTRODUCTION

The Training Capabilities Analysis of Alternatives (TC AoA) was conducted by the Department of Defense (DoD) from August 2003 to August 2004. The central purpose of the AoA was to identify deficiencies in Joint training and to find cost-effective ways of eliminating those deficiencies. The analysis determined that personnel assigned to joint task force (JTF) headquarters often arrive unprepared to execute the specific requirements of their jobs, and there is no mechanism in place for remedial training. As a result, the Secretary of Defense directed the United States Joint Forces Command (JFCOM) to use TC AoA funds to satisfy the goal to provide small groups with the requisite training needed to function as productive members of a JTF staff.

In response, the Joint Knowledge Development and Distribution Capability (JKDDC) sponsored the Small Group Scenario Trainer (SGST), a web-based framework to support pre-exercise training methods to fill individual, small group and complex JTF staff training gaps. Predicated on the earlier research and development efforts of the Immersive Learning Environments (ILES) (Supinski, Obeysekare, Johnson, & Wisher, 2004), SGST provides a capability to *bridge the gap between individual training and large scale collective exercises* through a highly innovative approach to online team training and mission rehearsal that aligns the individual training delivered by JKDDC with the collective training provided by the Joint National Training Capability (JNTC).

The National Military Strategy describes a future environment characterized by a wider range of adversaries and a more complex and distributed battle-space affected by technology diffusion and access. It envisions a Joint Force with significant increases in agility, decisiveness, and integration. It calls for significant changes in all aspects of military planning, organization, deployment, and fighting in order to respond to the new realities of asymmetric military threats. Planning that once was deliberate and based on a known threat, must now be adaptive to respond to highly adaptive adversaries and unconventional threats. Existing training methods are not sufficient to meet these dynamic challenges.

To develop adaptive expertise, research suggests that trainees should be active participants in the learning process and immersed in a meaningful or relevant context (Bell & Kozlowski, 2008; Cannon-Bowers & Bowers, 2010; Moreno & Mayer, 2005). Recent advances in technology have positioned simulations as a powerful tool for creating meaningful and relevant immersive learning environments, thereby helping organizations to meet these emerging training challenges (Bell & Kozlowski, 2007). Exploiting advanced web-based, net-centric technologies and processes can provide the speed and agility needed to prepare individuals and joint forces through frequent practice across a wide range of conditions, conduct what-if analysis and develop shared understanding across organizational boundaries. These technologies can expose trainees to situations that occur infrequently and allow them to experience firsthand, in a safe environment, the consequences of their decisions across a full range of threats. Repeatable and rapidly generated scenarios, as well as an adaptable, affordable and integrated training capability that can be modified based on dynamic changes, are imperative.

This paper provides a description of the interactive capabilities and problems encountered during virtual sessions that are developed specifically using mission-based, simulated scenarios, the framework approach allowing for reusable and flexible scenario creation, and the challenges of developing and integrating a web-based, immersive trainer into the Joint Knowledge Online (JKO), as well as the evaluation methodology and metrics of instructional effectiveness.

THE SOLUTION

Hosted on Joint Knowledge Online (JKO) and integrated into the Joint Content Management Architecture, SGST is a web-based exercise framework supporting multi-player, small group teams, cells and JTF battle staff training exercises. SGST supports distributed team training for improving training readiness of individuals and small staffs. Developed

specifically with internal combatant command battle staff training in mind, the SGST incorporates story telling scenario introductions, real-time remediation, advanced sequencing, learning content navigation and use of avatars for the purpose of stimulating critical thinking and learning while practicing within a team environment. A modular design supports exercise development, execution and after-action review. Trainees are quickly immersed by being provided with assignment of roles, an unfolding scenario, role specific tasks, a shared workspace, collaboration tools and performance support aids to facilitate the team training.

SGST builds upon JFCOM's Joint WarFighting Center's (JWFC's) highly agile Mission Rehearsal process. Underlying the JWFC exercise process is a unique systems architecture that enables near real-time joint training support to the mission planning, course of action analyses and mission rehearsal. It also allows for dynamic scripting, injects, observers/controllers, access to global simulation and information technologies, and real-time feedback from highly qualified experts and observer/controllers in support of Combatant Commanders and Joint Planning Groups that include coalition and interagency forces at the Operational and Strategic levels of war. The JWFC architecture (see Figure 1) was a critical systems design template that SGST adapted. SGST extends the JWFC architecture by blending distributed participants (observers and qualified experts) with digital exercise components to create a highly adaptable team training system. It provides an unprecedented opportunity to train and develop more efficient and rapid techniques to capture and distribute joint knowledge as it is generated by personnel engaged in a Combatant Command's mission analysis, planning, and rehearsal processes.

SGST was designed to provide a unique capability to leverage human expertise to rapidly analyze, plan, design, deliver, and assess training to distributed teams for the widest range of missions and scenarios. Our approach gives greater emphasis to the ability to leverage a network of human intelligence as a practical counterbalance to a dependence upon the development of sophisticated intelligent systems and knowledge fusion capabilities that will take time to develop and mature. Mission-based simulated scenarios and interactivity between trainees, the training manager, the system and the information and tools that they may need to complete their tasks drives the trainees toward accomplishing established goals and objectives.

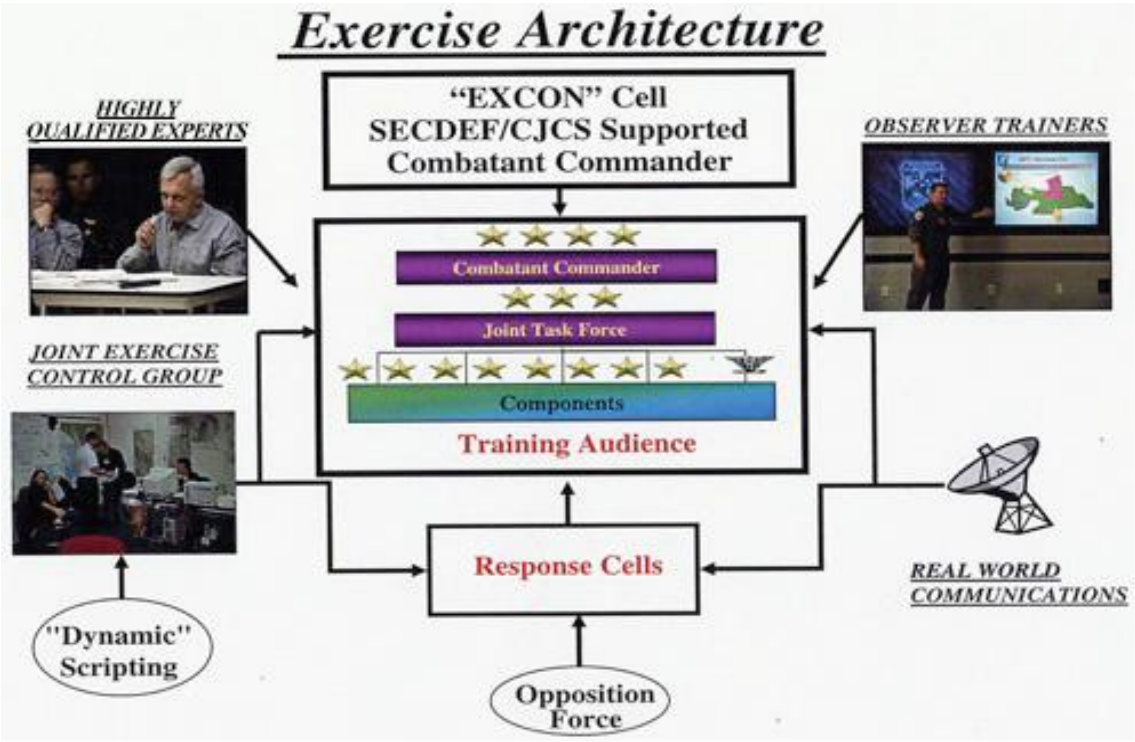

Figure 1. The JWFC Exercise Architecture is a critical systems design template for SGST

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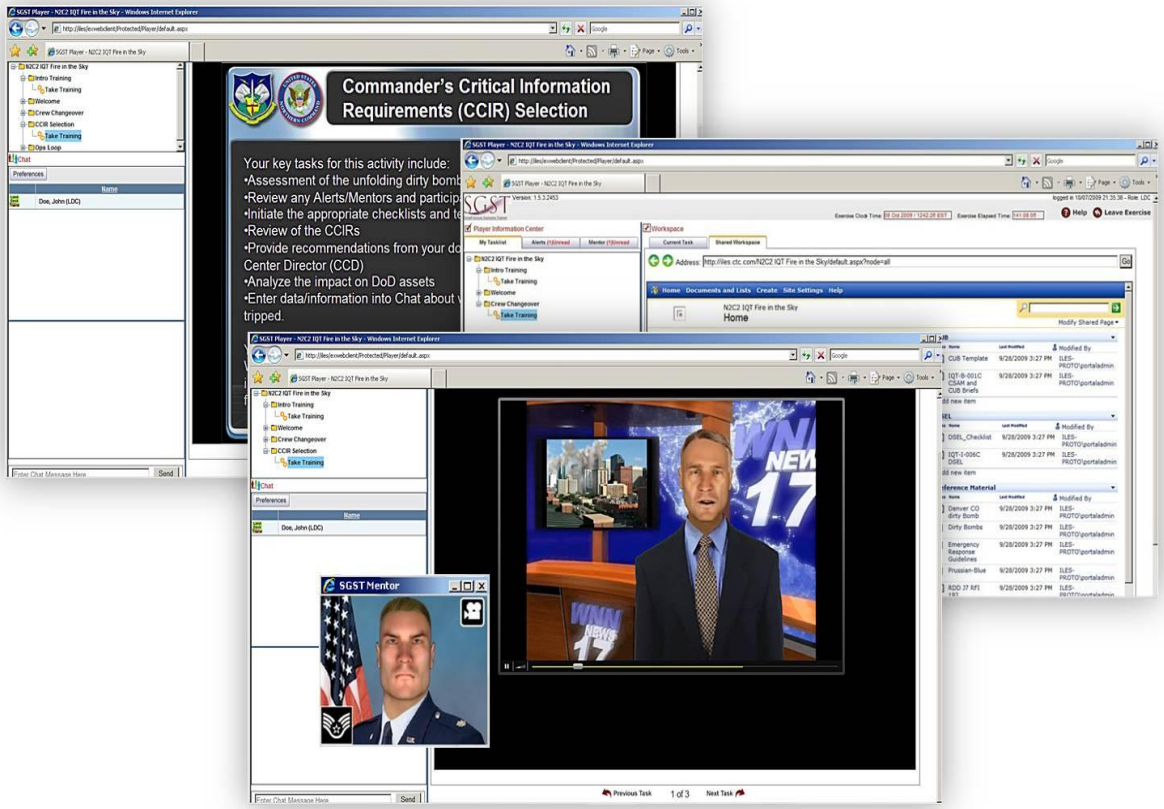

Figure 2. SGST Player Interface – delivers a range of content from text to game-based simulations

Figure 2 shows the SGST player interface. The main panel presents situational awareness in the form of multimedia scenario vignettes, task instructions and guidance to support task execution. The content can be anything from simple text to game-based simulations. The upper left hand panel of the interface shows the tasks that unfold as the trainee progresses through the exercise. Tasks are organized as a hierarchical sequence of activities or workflow designed to meet established training objectives. Two additional tabs on that panel provide alert notifications when an inject is received and when performance support elements are available. The left hand bottom pane provides a collaborative capability supporting team chat that can be used for real-time remediation and information exchange across the training participants. A shared workspace, which is a tab on the main panel, provides access to templates, standard operating procedures, reference documents, evolving work products and other resources deemed important to the training. Each trainee receives role-based content and training activities designed for their specific domain. Scenario vignettes, dynamic injects, avatar delivered performance support, coupled with facilitation support and exercise control provided by the training manager drive the training audience to collaboratively execute their tasking.

EXERCISE DESIGN AND DEVELOPMENT

SGST capabilities combined with instructional strategy provide an efficient and cost-effective approach to designing the sequence and interaction of multiplayer content and performance outcomes at many levels of complexity. Using SGST as the tool, exercises can be rapidly developed using a top-down approach that begins with strategic-level Joint Mission Essential Tasks (JMETs) and rapidly defining subordinate tasks, workflow, human/organizational interactions and related work products and activities.

This top-down approach starts with identifying the JMETs, training audience, and training objectives that need to be trained. The SGST Builder module provides forms (Figure 3) to capture this exercise information. The high level JMETs are decomposed into training objectives for each member of the team. A scenario is defined along with a timeline of events that drive the training audience to achieve their training objectives. Pre-requisite training, required templates, and other resources that are made available to the training participants begin to be defined.

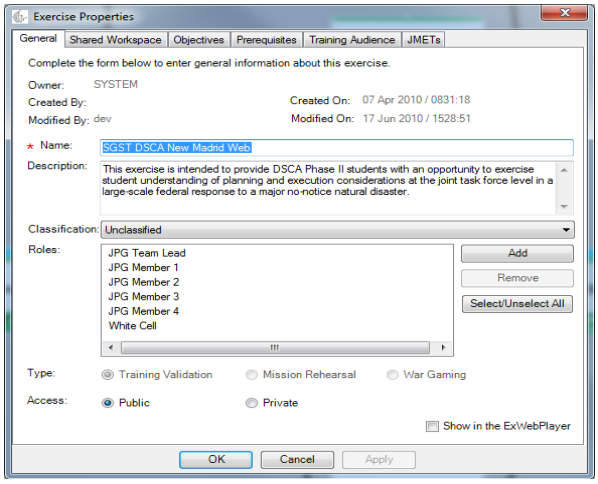

Figure 3. Establishing the exercise properties

A series of activities are defined and organized into an Event Sequence (Figure 4) that is visually displayed using a drag and drop building capability. The Event Sequence is central to the assembly of an exercise and defines the relationships between activities and the order of execution of activities, thus establishing a workflow. These relationships are created using a non-directed graph that allows the back and forth navigation through the sequence of activities once built and viewed by training participants through the Player module. The structure can represent individual, group, or enterprise level activities or combinations.

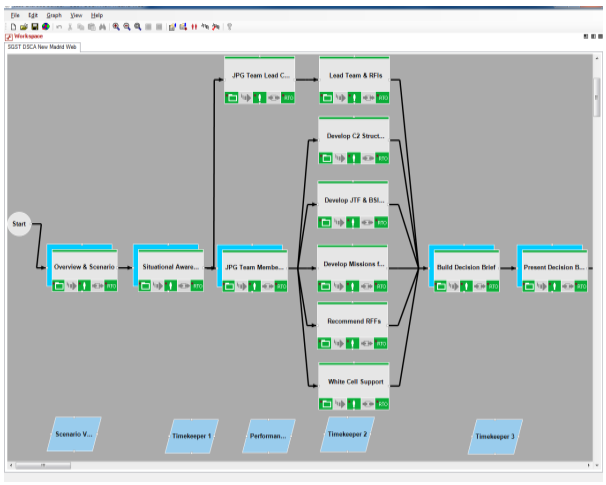

Figure 4. Authoring an Event Sequence

This visual and rapid building capability provides for efficient extraction and transfer of training requirements to exercise design, thus requiring less time of subject matter experts. Tools that support requirements extraction from subject matter experts are of great value given the demands placed on their time.

Each activity is further defined through the use of forms that identify activity level objectives, inputs and outputs that may take the form of work products to be developed, simulations, or specific actions that need to occur. Timing control is set, required content to support the individual or team activity is identified and/or developed and brought back into the building environment.

Additionally, rapid scripting of injects, such as 2-D newsroom, mentor, and multimedia (text, html, audio, etc,) injects (Figure 5), can be developed as canned or later developed on-the-fly during exercise execution. Later development can be done through the use of authoring tools available through the Builder and the Manager modules—the latter used to provide exercise management and control during exercise execution.

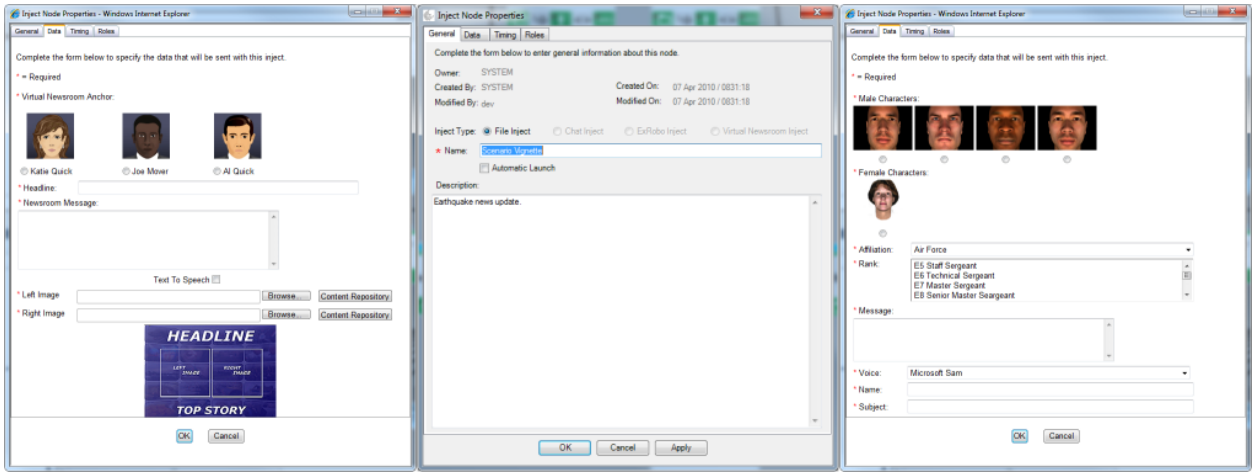

Figure 5. Authoring News, Media and Virtual Mentor Injects

Other elements of the exercise such as timing conditions for both activities and injects are defined through simple to use forms. Once the content is developed, the Builder is used to aggregate, package, and export the exercise to an underlying repository of exercises where it can be available for use.

EVALUATION, ASSESSMENT AND PERFORMANCE IMPROVEMENT

A number of approaches are used to improve performance. The most important of which is the After Action Review (AAR) that provides methods for performance and system improvement. The AAR is typically led by the training manger and structured as a reflection of what was learned or as a performance review. The AAR may include product and performance assessments and feedback for the team and individuals. The SGST Manager module records chat, user actions, timing, and events that can be visually displayed to support the AAR. The design and quality of the exercise and content elements can be evaluated to produce valuable information for refining and reiterating the exercise and closing the gap on lessons learned.

SGST uses a virtual mentor to provide individual and team performance-aiding during exercise execution. Recent studies have shown that adaptive advice and various types of support can help guide individuals through simulations and enhance learning outcomes (Bell & Kozlowski, 2002; Leutner, 1993; Moreno & Mayer, 2005; Reiber, Tzeng, & Tribble, 2004). How much and what type of support trainees need is based on their level of expertise, training goals, and job assignment. This performance support acts as scaffolding elements that can be increased or decreased depending on trainee characteristics.

Real-time remediation leveraging the human expertise involved in the exercise provides additional opportunities to improve performance. Real-time authoring of mentor injects and use of chat can provide just-in-time remediation to individuals or to the team during exercise execution.

EFFECTIVENESS

While there is an abundance of research on the effectiveness of online learning for individual performance, there is a profound lack of research on the use of online training technologies and instructional strategies to enhance *team performance*. We do know that retention and the development of intuitive skills are fostered by comprehension and practice. Sufficient practice is needed to internalize the skill to achieve requisite levels of expertise. Spaced practice leads to better retention over time. Transfer of knowledge is developed through practice across varied contexts to provide the trainee with a better chance that training will be retained and applied across relevant situations (Quinn, 2005).

Training is shifting from passive reception of information to knowledge transformation with capability to construct new knowledge through interactions and shared situational awareness. Constructivist principles include building on prior knowledge, making learning relevant and meaningful, and having trainers act as co-learners. Trainers might design activities wherein learners solve real-world problems, reflect on skills used to better manage one's own learning, experiment with

changes in technology or processes and procedures, or to flesh out plans on-the-shelf. All of these principles have been embodied in the design of the SGST framework features and in the instructional strategies that can be employed.

CHALLENGES

A number of challenges need to be overcome when deploying distributed multiplayer training applications, but security, bandwidth, robust collaboration and scalability are key challenges.

Security accreditation and limitations in secure environments impose challenges. The requirement of Secure Socket Layer (SSL) incurs extra overhead on network speed, which affects performance of content delivery. Standard web ports such as 80 and 443 are available for use; however, it is generally more difficult to implement solutions that require additional ports (due to security requirements and the need for port waivers). This also limits the integration of robust collaborative capabilities.

Exercises in SGST often have to be created with the lowest connection speed in mind, which limits content choices. Various locations often have sub broadband connections available which can cause content streaming to be choppy if file sizes are too large.

Various approaches have been taken to increase scalability. Adobe Flex or JavaScript/JQuery lighten the processing load on the web server to increase the number of concurrent users participating in an SGST exercise. Adding additional server hardware is another possibility to increase the number of concurrent users.

SUMMARY

A major benefit of the SGST over existing systems is its ability to develop libraries of content, scenarios, and exercises that can be captured, stored, adapted, and reused. This net-centric capability enables training developers to access, review, reuse content and adapt existing scenarios and exercises quickly and distribute them over the web in support of dynamic training requirements. The ability to exercise frequently and across a range of threat conditions can increase retention and transfer of knowledge. Additionally, SGST provides a means to collaboratively create and share new knowledge.

CURRENT AND FUTURE WORK

The SGST Builder module is being web-enabled and will enter acceptance testing in March 2011. Exercises that have been developed for several Combatant Commands using the thick client version of the Builder are currently available on JKO NIPRNet with deployment underway to JKO SIPRNet.

ACKNOWLEDGEMENTS

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