Positively Gaming the System: A VBS2™ Training Case Study

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ABSTRACT

The December 2008 U.S. Army Field Manual 7-0, *Training for Full Spectrum Operations*, defines the phrase "Train as you fight" as: "training under the conditions of the expected operational environment." However, an installation's ability to emulate the conditions of an expected operational environment during live training is limited due to terrain, safety, and resource constraints. Acknowledging this as a problem, the Army invested in virtual and constructive simulations. In 2008, based on requirements from the field for a semi-immersive and flexible training tool, the Army formally recognized PC-based gaming as a training enabler. This paper explores the potential of the game, Virtual Battle Space 2 (VBS2™), as an effective training and educational tool for transferring knowledge and surrogate experience, enhancing cognitive skills, and developing an adaptive mindset in Soldiers. Using Improvised Explosive Device Defeat training as a case study, we demonstrate how leveraging a common training tool and fostering collaboration within the Army and among the Joint and American, Britain, Canada, and Australia user communities provides increased opportunities for teachable moments and potentially saves lives. Enabling Soldiers to virtually operate in environments and situations characterized by an increasingly hybrid assortment of lethal and non-lethal threats and challenges, VBS2™ bridges the pedagogical gap between classroom briefs and resource-intensive live training. Because the Army has moved beyond the debate about whether gaming possesses the potential to be an effective training tool (it decided it does) and which gaming tool should be used (it selected VBS2™), we address the practical matters associated with maximizing the effectiveness of VBS2™ as a training tool. By leveraging collaboration and connecting the gaming community, the training support community, and the units conducting training, we demonstrate how VBS2™ might be successfully integrated into a commander's blended training strategy.

ABOUT THE AUTHORS

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Holly C. Baxter, Ph.D., Chief Scientist of Strategic Knowledge Solutions, has spent the past decade specializing in Instructional Design, Evaluation Metrics, Organizational Development, and Training in both military and commercial environments. Her experience includes developing effective vignette-based training for enhancing situational awareness, designing embedded training solutions for damage control personnel, developing evaluation metrics for simulation-based training, identifying cognitive training requirements using expertise in Cognitive Task Analysis (CTA), and using knowledge management tools to capture tacit knowledge in the field and turn it into effective just-in-time vignette-based training. Dr. Baxter has published many articles on cognitively-based training solutions, has been a speaker at multiple conferences and events, and has given many workshops on CTA, Vignette Development, Intuitive Decision-Making, and Leadership Development. Dr. Baxter earned a Ph.D. from Indiana University in Organizational Communication and Management with a focus on Instructional Design.

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INTRODUCTION

Army Force Generation "is a process that progressively builds unit readiness over time during predictable periods of availability to provide trained, ready, and cohesive units prepared for operational deployments" (FM 7-0). During all three phases of Army Force Generation—Reset, Train/Ready, and Available—Army units spend the majority of their training time at a home station or a mobilization station when conducting pre-deployment training. Units conduct training at hundreds of locations, including Reserve and National Guard installations, but the Army training budget is not limitless, and it cannot resource every installation with the live training facilities, equipment, and personnel required to effectively emulate the applicable operational environment. However, over the last two years, the U.S. Army, in partnership with the Joint IED Defeat Organization (JIEDDO), invested significantly in home station Live, Virtual, Gaming, and Computer- and Web-Based Training capabilities. Under the JIEDDO-funded, multi-service Home Station Training Lane initiative, the Army focused IED-D training resources on 37 installations with the largest pre-deployment training throughput. In addition to providing resources to purchase materials to develop realistic live training lanes, providing Training Aids, Devices, Simulators, and Simulations (TADSS), and some IED-D training equipment, Home Station Training Lane also accelerated two Army programs, including its PC-based, First Person Shooter Gaming program, initially titled the "Game After Ambush!", until the Army selected Bohemia Interactive's VBS2™ in December 2008. The Program Executive Office for Simulations, Training, and Instrumentation (PEO-STRI) will field VBS2™ to 36 of the Army Home Station Training Lane locations and 18 additional Army installations by the end of Fiscal Year 2009. VBS2™ fielding will consist of software licenses and a hardware suite including 53 computers and two Observer/Controller Trainers to support training. Depending on the installation, the gaming suites and personnel would be integrated into its existing Battle Command Training Center (BCTC) infrastructure or established as a separate training capability. Because the Army owns the VBS2™ enterprise license, it can also be distributed for use on any Army computer at no cost to the unit, enabling additional training capabilities for installations or units that own computers primarily intended to support training. VBS2™, characterized by a dynamic scenario editor and many military models, provides the capability and environment to support semi-immersive tactical training across the full-spectrum of operations: offensive, defensive, stability, civil support, and the hybrid mix of the aforementioned.

VBS2™ AND IED-D TRAINING INTEGRATION EFFORTS

With its adoption of VBS2™, the U.S. Army joins the United States Marine Corps (USMC), Australian Army, UK Army, and Canadian Army, among others, in the VBS2™ military training community. As a result, we now have a common gaming training tool. While VBS2™ is not yet certified to be run on Army networks to support distributed training, the ability to share scenario files and other content and best practices is a significant and cost-effective capability. Though the research community is still determining how to measure, validate, and improve the training effectiveness of gaming, the Army and USMC have seized upon it as a valid solution to a training capability gap. Not only have these Services and others applied significant resources into the development, infrastructure, and fielding of gaming (specifically VBS2™), the Army institutionalized gaming into its training doctrine by adding it to the Live-Virtual-Constructive (L-V-C) training enabler continuum, so it now reads L-V-C-G (FM 7-0). Recent research supports the use of gaming, if employed appropriately as part of a blended training strategy, as an effective training tool (Roman & Brown, 2008; Wilson et al 2009). Unless research conclusively establishes otherwise, we believe gaming is here to stay and future research should focus on how we can make it an even better training and education tool.

Though the Army has the infrastructure largely in place to support VBS2™ as an effective training tool, we believe that the Army requires a collaboratively-developed vision and process to integrate and capitalize on the full potential of this capability. TRADOC Capability Manager (TCM) Gaming, as the Army

VBS2™ combat developer, manages requirements and coordinates with PEO-STRI, the materiel developer, to ensure VBS2™ meets the needs of the training community. TCM Gaming, established in April 2008, also has responsibility for developing a VBS2™ toolkit, content repository, and community of practice. They execute these tasks aggressively, but they alone cannot make VBS2™ an effective IED-D or full-spectrum training tool without support from the larger military training community. Across the Army and USMC, the IED-D community is resourcing many VBS2™ enhancements. These efforts include both Services' developing IED-D scenarios as part of the effort to train the force in the application of IED-D and adaptive skills to counter evolving enemy tactics, including their employment of IEDs and other asymmetric weapons. Attacking an IED network, though not yet specifically defined in targeting or other doctrine, shares much in common with countering an insurgency; IEDs are the insurgent asymmetric weapon of choice in both Afghanistan and Iraq, so in most cases, attacking an IED network shares many of the same lethal and non-lethal methodologies involved in countering an insurgency. Therefore, much of what is considered IED-D-applicable VBS2™ content development and training support will also directly benefit VBS2™ training for counterinsurgency and full-spectrum operations.

In both the Afghanistan and Iraq theaters, insurgents have employed IEDs to kill and injure thousands of American and Coalition service members and attempted to use the IED, a tactical weapon, to influence policy, decisions, and public opinion at the strategic level. After the Department of Defense (DoD) recognized the strategic threat posed by the enemy's success in employing IEDs, it created JIEDDO and invested billions of dollars to combat IEDs and the enemy cells and networks that facilitate their use. Countering an insurgency and attacking an IED network both require commanders to employ an agile combination of offensive, defensive, and stability tactics and operations. Though IEDs will probably remain a lethally-significant condition of the battlefield in the foreseeable future, they will likely not be the only asymmetric weapon used by an enemy with whom we will be engaged with in the hybrid wars of the future. "Hybrid Wars incorporate a range of different modes of warfare, including conventional capabilities, irregular tactics and formations, terrorist acts including indiscriminate acts and coercion, and criminal disorder." Frank Hoffman (2007). To effectively prepare its forces to conduct full spectrum operations at the tactical level, the Army has adopted and invested in an L-V-C-G training strategy that strives to meet existing and emerging training requirements, including those in support of hybrid and irregular warfare. Gen Mattis (2009), Commander, Joint Forces Command, describes the need to "Direct a fully resourced effort to immediately develop first-class simulators for IW training." Though Gen Mattis uses the term simulator, the desired capabilities he describes include "simulating tactical and ethical decision-making in ground combat," which are cognitive and judgment skills that can be exercised and enhanced through gaming.

With the recent proliferation of simulation technologies, a constrained training budget, and the requirement for commanders to prepare their units to conduct the full-spectrum of operations, the Army must be selective in determining what TADSS it invests in. As directed by Gen Cody (2008), the former Army Vice Chief of Staff, "Commanders will not procure TADSS solutions or gaming technologies for training without prior coordination with TRADOC, who will ensure synchronization with validated Army doctrine, training strategies, and interoperability with existing and planned TADSS. Coordination is necessary to ensure standardized training environments across the Army, eliminate unnecessary duplication, and allow for logical sustainment and integration planning." This policy ensures TADSS are complementary, common, and integrated rather than niche or hastily developed and fielded without a requirement, requisite training support infrastructure, or training strategy. Gen Wallace, former TRADOC Commanding General, is often paraphrased as saying, "We don't need a field of blooming wild flowers, what we need is a well manicured rose bed!"

Because JIEDDO partnered with the Army to accelerate and enhance an Army program rather than attempt to fund and field a standalone IED-D gaming solution, IED-D capabilities will be integrated into a training tool widely-used by both the Army and USMC. Therefore, trainers can use VBS2™ to improve individual and collective skills associated with IED identification, prediction, and exploitation not only in a situation where finding or reacting to an IED is the central task, but also in the context of conducting a broader mission where IEDs are a condition of the battlefield. Indeed, with the exception of Explosive Ordnance Disposal and some Engineer units, most Army units usually seek to avoid IEDs and only encounter them in the context of executing other missions. While it is critical that Soldiers understand that IEDs are a significant threat and they must be appropriately trained to deal with them, IED-D-related tasks should be embedded into training scenarios so Soldiers learn to plan effectively against them before every patrol or mission, rather than train as if

identifying or reacting to an IED is the primary focus of their mission (Phillips et al, 2008). "Scenarios constantly expose and familiarize students with individual and collective tasks that they may have never seen before. Students are not 'wrapped around the task,' but instead are encouraged to see how the task fits into solving the larger problem. Students become familiar with the task while participating in a scenario." (Vandergriff, 2006).

Over the last three years, the military shifted the emphasis of its IED efforts from the tactical approach of defeating the device to a more proactive and holistic strategy of attacking or countering the network. Current limitations of VBS2™ constrain its employment as a tool to train most of the requisite intelligence fusion and analysis skills supporting battle staff attack the network operations unless it is federated with a constructive simulation. However, it is the service member at the tactical level who provides the valuable intelligence related to IED and insurgent networks that staffs at higher headquarters analyze and fuse to create targeting packets. Therefore, in addition to developing and reinforcing defeat the device skills—such as React to a Possible IED, Identify Visual Indictors of an IED, and React to an IED Attack—VBS2™ should be used experientially to integrate and reinforce Attack the Network skills, including "Every Soldier a Sensor" tasks related to understanding Commanders' Critical Information Requirements, recognizing change in the operational environment, and reporting appropriate information in the proper format. An example of how VBS2™ could assist in these types of skills is as simple as reporting. Currently, joint standard reporting formats for IEDs and the civilian considerations of Area, Structures, Capabilities, Organizations, People, and Events are being staffed throughout DoD for approval. When approved, these formats can be rapidly inserted into VBS2™ so that every Soldier is exposed to them in a virtual environment where observable cues can be injected to stimulate and reinforce correct reporting (see Figure 1).

VBS2™ AS A KNOWLEDGE TRANSFER TOOL

Research illustrates the effectiveness of cognitively authentic simulations and stories in transferring tacit knowledge in many environments. The incorporation of simulations into training programs has been found to produce statistically significant improvement in collaboration and decision-making skills (Baxter, Harris, & Phillips, 2004). Simulations have also been found effective in improving mental simulation and planning skills (Baxter, Ross, Phillips, Shafer, & Fowlkes, 2004), and the "Think Like a Commander" advanced study found simulations effective in improving situational awareness, understanding (ability to act), comprehension, and attitudes about learning (Prevou, 2006). The critical incidents will be applicable outside the Army and the military as well, because so many of the conflicts involve critical everyday encounters such as persuasion and conflict management (Cianciolo et al, 2007).

Figure 1: VBS2™ Screenshot (JTCOIC SIMS)

Digital storytelling, which uses machinima (a movie rendered with a gaming engine) as a learning tool, is an effective way to transfer learning in a collaborative environment. Digital stories support both distributed and traditional classroom learning forums and provide memorable and stimulating learning opportunities as well as relevant context (Cianciolo & Pearson, 2008). *Trouble at Checkpoint 4*, a proof of concept, scenario-based machinima shared and facilitated on the Army Battle Command Knowledge System's NCO Net forum, is an example of the power of digital storytelling. Within 48 hours of its posting on the forum, *Checkpoint 4* was viewed by over 4,000 NCO Net members and stimulated 152 discussion posts, including comments about tactics, leadership, and cultural awareness, and sparked multiple requests for additional machinimas (Cianciolo & Pearson, 2008). However, as popular as *Checkpoint 4* became and still is, it was a relatively expensive effort that took months to produce.

"No longer can the Army take months to respond to hostile, asymmetric approaches. Solutions must be disseminated across the force in weeks—and then adapted quickly and innovatively as the enemy adapts to counter the newfound advantages." (FM 7-0). To succeed as a learning organization and ensure training remains current across the force, the Army must possess the capability to rapidly determine and incorporate those critical and relevant tactical lessons learned from the applicable operational environment across the L-V-C-G training continuum. The Center for Army Lessons Learned, the Office of Primary Responsibility for the Army Lessons Learned Program,

posts a variety of proponent-reviewed and validated After Action Reports; Observation, Insight, and Lessons; handbooks; and other products on its website within a few months of an event or a unit's re-deployment from theater. Another means of knowledge transfer that complements the Center for Army Lessons Learned processes is the informal Virtual Right Seat Ride, which entails direct coordination between a deploying and deployed unit. While certainly useful to units preparing to deploy as well as to the schools and training centers that support institutional training events, these processes and document-based training products do not transfer knowledge experientially. Could the Army develop the capability to extract key lessons learned from these often classified significant activity reports and integrate them for practical use in an unclassified training environment within weeks without dedicating significant manpower to do so? Furthermore, could the Army replicate the success of *Checkpoint 4* and develop other scenario-based machinimas more rapidly and at less expense without significantly sacrificing quality and training effectiveness? We propose that such a capability exists now, but it is immature, not institutionalized, and requires some shaping to meet its full potential.

The TRADOC Deputy Chief of Staff, G-2 (Intelligence), in close coordination with JIEDDO, stood up a proof of concept capability in 2008, now called the Joint Training Counter-IED Center (JTCOIC) Systems Integration, and Modeling and Simulations (SIMS) Division, a tertiary entity of the JIEDDO-funded JTCOIC, whose mission is to provide training to battle staffs on attack the network skills and tools to defeat human networks associated with IEDs. Starting from scratch and primarily using VBS2™ with other tools, JTCOIC SIMS provided over 80 VBS2™ training products in support of 84 locations during a 12-month period ending in June 2009 (Covey, 2009). These training products consist of a VBS2™ IED-related or other event machinima with a playable scenario file, models, terrain boxes, or VBS2™ scripts that enhance the training experience; one or two of the above are developed every week based on a list of requirements. JTCOIC SIMS employs a rapid process that takes PowerPoint storyboards based on significant activities and exploitation of the associated event scene, declassifies them by filtering out specific information, models required objects and terrain, develops the event into an unclassified VBS2™-based machinima and scenario file suitable for training, and then notifies users that the product is available for download. The JTCOIC SIMS-produced machinima alone affords instructors a useful visualization aid for discussion in the classroom and it also provides the foundation for a digital storytelling scenario. With the pending development of cultural and language capabilities in VBS2™ and the addition of some expertise at the JTCOIC SIMS, both of which we will discuss in this paper, we believe that the Army should further explore VBS2™ machinimas as the engine that drives digital storytelling, repurposing existing and relevant content instead of investing in additional development.

If one considers that only a handful of Army installations used VBS2™ before April 2009, and fielding VBS2™ across 52 installations was less than halfway complete at that point, we can extrapolate that demand for JTCOIC SIMS products will continue to increase significantly in the Army in 2010 and beyond. The USMC also uses VBS2™ as a training tool at its BCTCs and in the Deployable Virtual Training Environment training computer suites fielded to most USMC Battalions. JTCOIC SIMS also provides VBS2™ and other simulations training content to Navy and Air Force units as well as multiple NATO countries, developing unclassified products for use by our Coalition partners, who may not have the capabilities or resources to do so themselves. The JTCOIC SIMS customer base and demand are already enormous and still growing reflected in requests for support from the field to JTCOIC SIMS (Covey, 2009).

Because the JTCOIC SIMS is still a proof of concept, the question the Army must determine is if a JTCOIC SIMS-like capability is only applicable to C-IED training and is it a required and potentially enduring capability? We believe the answers to those questions are no and yes respectively. Over the past year, the JTCOIC SIMS Division has done a tremendous job developing IED-D-related scenarios, models, and scripts, significantly contributing to the body of IED-D VBS2™ content and saving development costs and time when outsourcing. Yet, even while it remains focused on supporting IED-D training, the JTCOIC SIMS Division has also developed content and scenarios that support training for full-spectrum operations, demonstrating that though it remains focused on IED-D capabilities, it has the capacity to provide gaming training support across the spectrum of operations. The more complicated question is if the JTCOIC SIMS is a required and enduring capability. The Army has formal processes that will make that determination, but we hope this paper informs the discussion.

To provide the most authentic training operational environment possible for units using VBS2™, a few of the Army's large "hub" BCTCs maintain modeling capabilities on their staff in addition to existing BCTC support personnel and Observer Controller/Trainers.

While the units that train at BCTCs benefit from this modeling support, the Army does not have a mechanism that ensures units using gaming enablers at the smaller Army installations benefit from the capability, some of whom may have a more urgent requirement for training due to demonstrated need, such as a change of deployment date or theater. PEO-STRI does offer VBS 201 classes for advanced users, which will provide additional capabilities to the smaller BCTCs, but will not provide some of the key required capabilities resident in the JTCOIC SIMS or a Centralized Gaming Training Support Center (CGTSC). A CGTSC, with robust in-house modeling capabilities, would not only facilitate equitable training development prioritization in accordance with Army priorities, it would minimize costs and time associated with contracting for modeling work, enable the development of validated first class training products, minimize redundant efforts, and assist in managing the content repository. As VBS2™ proliferates throughout the Army and USMC, we can expect an exponential increase in the number of scenarios, terrain, and models of varying quality and accessibility. BCTCs would continue to operate in a de-centralized manner in accordance with senior mission commander priorities, but instead of submitting user gaming requirements to the combat developer, who sends them to the materiel developer, who then must contract with the vendor, who then delivers according to a fixed schedule, the CGTSC could execute much more quickly and flexibly for requirements that require immediate action and increased technical skills that do not require vendor expertise.

To enhance the training effectiveness of CGTSC products, the Army should also consider including training developers in the organization to include a modified training support package to assist commanders and Observer Controller/Trainers in preparing and executing the training, saving time—a precious commodity for commanders managing pre-deployment training requirements and a high operational tempo. These training developers could potentially draw on school and center proponents to rapidly validate TTPs, and provide a much more relevant training product. The modified training support package would potentially extend beyond VBS2™, and gaming could be repurposed so that it also supports virtual, live, constructive, computer- and web-based (including digital storytelling) training as well. For example, the Army Night Vision Electronic Sensor Directorate (NVESD) produces an IED awareness computer/web-based training product entitled Recognition of Combatants (ROC)-IED. JTCOIC SIMS is working with NVESD to provide machinimas to embed in ROC-IED, enhancing interactivity and providing a synthetic training environment that cannot be re-created with a live environment due to feasibility or cost, tailoring the scenario to the desired training objectives. The modified training support package supporting VBS2™ would also allow a tangible opportunity for institutionalizing some of the emerging Outcome Based Training and Education (OBT&E) concepts: Training to grow-problem solving abilities, increase intangibles, increase understanding and awareness, increase deliberate thought, and improve combat performance. Rather than focus on rote memorization and the step-by step process of task completion, OBT&E focuses on what outcomes are desired and does not restrict the Soldier in how he achieves those outcomes as long as it is within the commander's intent.

VBS2™ AS AN ADAPTIVE MINDSET DEVELOPMENT TOOL

As the Army adapts for the complexities of hybrid warfare today and in the future, new concepts have emerged in how it might institutionally prepare its Soldiers and leaders more effectively to anticipate, adapt, and dominate in any situation. We have discussed how commanders might use VBS2™ in the context of traditional individual and collective task training in virtual situations reflective of very recent and relevant conditions, events, and TTPs occurring in the theater or region to which their unit will deploy. Yet, VBS2™ possesses some intriguing educational potential as well. While military education refers to the process of instilling an intellectual understanding of broad principles, concepts, or mindset into service members, training is the process by which a service member practices and applies concepts in a given situation to develop skills. Learning the fundamentals of successful counterinsurgency, counter-IED, or targeting operations involves an educational process, but learning how to apply that knowledge effectively in an authentic context is a training process. In both institutional and operational training domains, trainers seek to provide relevant individual and collective training opportunities, emulative of the operational environment to which the unit may deploy. Simulation-based training can help decision makers become more adaptive thinkers. Adaptive thinking in the military is described as "the cognitive behavior of an officer who is confronted by unanticipated circumstances during the execution of a planned military operation" (Lussier, Ross, & Mayes, 2000, p1). In today's world, Soldiers are forced to be more adaptable as they face a decentralized combat environment, which has only increased the ambiguity associated with the battlefield, and especially IEDs. Junior officers are being asked to

take on roles they never imagined they would have to fill, and this has forced them to learn how to adapt and apply their mental models rapidly. Young Soldiers must learn how to deal with an unpredictable environment because the enemy is constantly adapting to their reactions. One officer captured it perfectly when he spoke about his Operation Iraqi Freedom experience by saying, "To prepare any officer for this, to prepare anyone for this, you need to just constantly test him, put him in very challenging situations, and allow them to sort of think and act under pressure and stress. That is essentially what you do here" (Wong, 2004, p.19).

Directed by the Office of the Deputy Under Secretary of Defense (Readiness) to conduct a comprehensive survey and analysis of DoD-wide adaptability training and education efforts, the Institute for Defense Analyses (IDA) reported:

"The study argued that solutions to many future military problems could not be prepackaged and trained according to the familiar task, condition, and standard methodology. Instead, a new approach to training designed to enhance adaptability performance was needed; and this approach was required for portions of training/education for individuals, teams and units at all levels. Our survey, especially the best of breed examples cited, indicates that there appears to be modest progress in this regard. However, this kind of training is still in its infancy and, despite the efforts to date, the original questions of whether it is doable and if so how to purpose-design adaptability training remain essentially open" (Burns & Freeman, 2008).

To produce good adaptive thinkers, training needs to address "a thinking performance" that can be practiced the same way as other skills (Shadrick, 2003). Using simulation-based training such as VBS2™ can be a less expensive replacement to full-scale exercises, allowing situations to unfold based on the trainees' responses in a time-pressured and realistic environment (Smith et al., 1999). For jobs that require an individual to make pressured decisions, such as dealing with IEDs, simulation training can be a great way to help Soldiers become more adaptable. However, if students are not experiencing cognitive behaviors and practicing the cognitive skills of an expert facing a similar situation, then they are not improving their battlefield decision-making skills. It is essential that when practicing, the learning process produces authentic experiences and delivers quality feedback. An important component to creating "good" vignette-based training is to make sure it is cognitively authentic (Ross, Halterman, Pierce, & Ross, 1998; Ross & Pierce, 2000). Cognitively authentic means that the training accurately captures the elements that exist in the natural environment—those challenges and indicators that activate an expert's tacit knowledge. This design allows for the critical cues and factors to be present so the appropriate problem-solving and decision-making processes are like the processes that might be experienced by an expert in the same situation. As learning progresses, "noise" should also be present to reflect the expert's ability to "tune out" information irrelevant to performance.

Don Vandergriff (2006) discusses how to develop adaptability and provides a tangible methodology so that the concept of "not teaching what to think but how to think" is not just a platitude. He proposes an Adaptability Course Model (ACM) Program of Instruction that emphasizes an experiential, scenario-driven, decision-oriented learning environment supported by four curriculum pillars: 1) Case study learning methodology; 2) Tactical Decision Games (TDG); 3) Free play force-on-force exercises; 4) Feedback through the leader evaluation system, including 360 degree after action reports and "continual observations by certified Teachers of Adaptability, with the emphasis on allowing students to discover the answers to various scenarios for themselves." Based on the capabilities of VBS2™, we believe it is an ideal tool to support the ACM methodology and four pillars. Though VBS2™ may not be the most appropriate or ideal tool to use in every situation, consider this example of how it could be used to instill an adaptive mindset in Soldiers:

1) Case Study: JTCOIC SIMS provides a machinima with a hasty training support package depicting a complex attack by 30 insurgents on an Army Infantry platoon in Afghanistan that occurred in the last month. The attack is characterized by multiple IEDs, small arms fire, and rocket propelled grenades in rugged terrain near a village. With the assistance of Close Air Support, mortars, and artillery, the insurgent attack is defeated, but several Soldiers and civilians are killed or wounded and it appears two of the houses in the village are damaged in the attack. In preparation for the training event, the Observer/ Controller Trainer and/or platoon leader has been following the news about the incident and ensuing investigation and brings updated information to facilitate the discussion about the case study the Soldiers just viewed. The case study highlights some of the types of tactical decision and dilemmas junior leaders and Soldiers may face and sets the stage for the next step: the TDG.

2) TDG: Using a CGTSC-generated VBS2™ scenario file depicting the incident, which includes geo-typical terrain, the Observer/Controller Trainer adds the granularity required to meet the Commander's training

objectives and develops the scenario into a VBS2™ TDG. The Observer/Controller Trainer provides the white cell support during the exercise and assists the platoon or company leadership in facilitating the TDG to achieve the training objectives desired. Several TDG iterations are conducted, each introducing one or more challenges or constraints, to include man-down exercises that require subordinates to assume leadership positions one or two levels up and reduced time to make decisions. The VBS2™ dynamic scenario editor allows complicating factors to be introduced on the fly so the TDG's difficulty can be increased or decreased depending on performance. The Observer/Controller Trainer facilitates reflection by all members after each TDG, encouraging them to make and defend decisions rather than focus on particular solutions. Performance on individual and collective tasks, such as IED-D tasks, in context of supporting the mission are discussed and reinforced.

3) Force-on-force: After the TDGs are complete, the VBS2™ force-on-force exercise begins, and the unit and leadership should conduct troop leading procedures, from receipt of mission to execution. A sister platoon or another unit assumes the role of the enemy and they are provided an intent to guide their tactics. VBS2™ enhances the potential training value of force-on-force exercises by enabling the trainee or unit to execute a plan against a thinking enemy rather than simply discussing and defending the plan against a hypothetical enemy. Assuming the enemy perspective and tactics also enables the unit to better understand how the enemy could exploit vulnerabilities and reflect on what their actions would be if the roles were reversed.

4) AAR: At the conclusion of the force-on-force scenario, the Observer/Controller Trainer or leader facilitates an after action report, inviting participation from multiple perspectives and focusing on why decisions were made versus whether the right decision was made. With the intuitive and multi-perspective recording capability of the VBS2™ after action report tool, the Observer/Controller Trainer can capture critical decision points to extract teachable moments. Vandergriff proposes the following criteria to evaluate trainees: "did the student make a decision? If so, did the student effectively communicate it to subordinates? Was the decision made in support of the commander's intent (long-term contract), and mission (short-term contract)? If not, was the student's solution based on changing conditions that made it a viable decision, even if it violated the original mission order, but nevertheless supported the commander's intent?" Any potential negative training caused by limitations of VBS2™ would be highlighted and discussed by the experienced NCOs in the unit. Similarly, innovative solutions to tactical problems could be refined and potential gaps in tactics or capabilities identified for further analysis.

The ACM POI described above can be applied continuously throughout L-V-C-G, providing multiple opportunities for Soldiers to develop cognitive memory skills to complement the muscle memory skills that live training provides. Dorothy Leonard and Walter Swap in *Deep Smarts* (Leonard & Swap, 2005) focus on the value of guided deliberate experience to build receptors in a person's brain that enable them to capture complex, experience-based knowledge. Without these receptors, the new messages and information cannot be incorporated into the brain's structures and remains relatively meaningless. The frameworks, overviews, and rules of thumb developed in this effort assist in providing a mental architecture to which experiences can be related. The simulated experiences and the guided deliberate practice embedded throughout the VBS2™ training concept help develop or build upon receptors necessary for the acquisition of new and more complex knowledge (Phillips, Moon, Baxter, & Cooper, 2008; Phillips, Moon, Yeager, & Baxter, 2008).

Nurturing problem-solving and other intangible skills in a stressful but safe virtual training environment is critical to preparing Soldiers and leaders for the complex challenges they will face on the battlefield. Though VBS2™ provides an ideal tool to support the training concepts outlined in the ACM and the IDA adaptability study, it will not realize its full potential without an institutionalized approach that includes training instructors differently and encouraging commanders to allow a culture where subordinates can stray from focusing on "correct" solutions and rigidly adhering to task, conditions, and standards based training.

OTHER VBS2™ CAPABILITIES

VBS2™ and its predecessors, DARWARS Ambush! and VBS1, have been used by a handful of BCTCs and units since 2004, so military use of gaming as a knowledge transfer or adaptive training tool is not entirely new. Some of the early DARWARS Ambush! and VBS2™ adopters, such as Fort Lewis, continue to refine how they employ and integrate VBS2™ to facilitate training and education, both in traditional battle drill tasks and adaptive skills. Tapping into the collective genius of the veteran VBS2™ users in the US Army, USMC, and coalition partner communities is critical to identifying and sharing best practices. As

industry and academia realize that VBS2™ is the dominant tactical training game of the Army, USMC, and other militaries, significant efforts to develop plug-in capabilities are underway and more should be expected. These efforts range from integrating training in non-lethal tasks, such as negotiation or tactical questioning where familiarity with language and culture is critical, to lethal tasks such as an improved call for fire capability. If and when VBS2™ is certified to run on military networks, both unclassified and classified, entirely new capabilities could be explored, including mission rehearsal and enhanced Virtual Right Seat Ride opportunities. Because VBS2™ possesses the potential to support training in full-spectrum operations, one could argue that the Army should consider re-labeling the genre from First-Person Shooter to something like First-Soldier Perspective, acknowledging that the Soldier is expected to be competent in a variety of lethal and non-lethal skills, while also distancing serious games intended for military training purposes from its entertainment-based cousin genre.

TCM Gaming and PEO-STRI, with input from Army Commands and the user community, will determine what capabilities will be distributed throughout the Army. However, since both the Army and USMC are VBS2™ license holders, both services will benefit from each other's investment in VBS2™, making a case for continued collaboration and leveraging of each Service's strengths. For example, the USMC's Program Manager for Training Systems (PMTRASYS) leverages the expertise of human performance staff as part of their simulations division, while the Army must depend on coordinating with research organizations within other commands, such as the Army Research Institute. Complementing an area in which the USMC does not have robust capability, the Army possesses significant modeling and simulation capabilities among organizations such as the National Simulation Center (NSC), PEO-STRI, JTCOIC SIMS, and TRADOC Intelligence Support Activity (TRISA) M&S. For example, TCM Gaming, part of the NSC, continues to support prototyping of L-V-C-G integration and other accelerated combat development efforts, which could be shared with the USMC and coalition VBS2™ training communities. Leveraging these unique service capabilities can enhance the effectiveness of training across the services, while at the same time conserving resources to apply against the most technically challenging VBS2™ improvements that require vendor involvement. Among the technical challenges is modeling and integrating some of the emerging technologies that Soldiers are using every day on the battlefield, but are absent from pre-deployment training events.

As VBS2™'s distribution, models, and other capabilities expand, an area that possesses much potential is VBS2™'s application as a tool to assist in the institutionalization of new technology training integration into pre-deployment training. A systemic problem the Army continues to experience is how to resource and integrate new equipment or technologies into pre-deployment training. The Army Rapid Equipping Force identified the issue in a broader context: "The continuing introduction of successful new technologies into combat theaters of operation is generating gaps between pre-deployment training that should be conducted on the new technologies, resources required to support that training, and time available to a commander to train. New Technology Training and equipping (e.g., training on technologies rapidly equipped/rapidly acquired), is distinct from New Equipment Training (e.g., which is associated with equipment acquired through the accepted deliberate acquisition process). New Technology Training rarely takes place during home station training or at the Combat Training Centers." (Rapid Equipping Force, 2007).

O'Bea and Beacham (2008), using route clearance training as a case study, discuss the benefits that blended virtual and gaming training capabilities provide when a unit does not have the requisite equipment with which to train. While VBS2™ should certainly not be used in lieu of a PM's formal New Equipment Training program as it cannot model highly tactile skills, in the absence of feasible live or virtual training enablers, it does offer a limited means to sustain some level of familiarity with the capabilities, limitations, and employment of some technologies. An example of how VBS2™ could be used to expose Soldiers to a capability in training in which they would have limited opportunities otherwise is with the Counter Radio-Controlled IED Electronic Warfare (CREW) capability. CREW employment is severely limited in training due to spectrum interference with civilian communications and, until recently, a lack of other live TADSS to support training in this critical task. In 2008, the CREW capability was modeled into DARWARS Ambush!, ensuring that Soldiers received awareness of its basic capabilities and had the opportunity to plan for its use during experiential training. Though VBS2™ may not be an appropriate training tool for every technology, PMs, in conjunction with TCM Gaming, should at least consider gaming and VBS2™ in addition to live and virtual enablers as a means to train on new technologies.

SUMMARY AND CONCLUSIONS

Simulation will not replace the invaluable training provided by the live training environment anytime soon, if ever. For all of its potential, VBS2™ is still just another training tool in the L-V-C-G continuum. Though it is the Army gaming training tool of today, as other gaming technologies and military information systems and policy mature, VBS2™ may be replaced by a better capability. Exploring other emerging simulation technologies is beyond the scope of this paper, but much research and development is being conducted in the areas of Massive Multi-Player Online Gaming, Real-Time Strategy, Turn-Based Strategy, and blended or federated solutions. These are all worthy investments to improve training in the future, but they do not provide any capability to the service members who are deploying into combat next month. The military training community owes deploying service members every knowledge advantage and opportunity to develop surrogate experience in ambiguous and hostile situations so they are well-prepared to anticipate, adapt to, and dominate an enemy, then return home safely and impart that knowledge and experience to the next deploying unit.

In the preceding paragraphs, we provided an overview of the concepts, potential, and ongoing efforts to enhance the effectiveness of VBS2™ as a training enabler. To develop some of these good ideas into a suitable, acceptable, feasible, and potentially enduring capability, we recommend that the Army direct the appropriate subordinate command(s) to consider the following course of action:

1. Continue to improve coordination and collaboration with USMC VBS2™ and related IED-D training efforts.
2. Conduct a Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities, and Cost analysis and Operational Assessment of the JTCOIC SIMS to determine if a "like" full-spectrum virtual training support capability is required.
3. If this capability is identified as an enduring requirement, determine governance, integration, and programmatic actions required to support this capability, to include ways to codify participation from other services and coalition partners to overcome unnecessarily bureaucratic and/or restrictive foreign disclosure policies that preclude sharing unclassified content with other services, as well as American, Britain, Canada, and Australia and NATO partners.
4. Continue to provide Overseas Contingency Operations resources or leverage JIEDDO or other available funding to maintain the JTCOIC SIMS capability until an informed decision is made to terminate or transition it to the Army as an enduring capability.
5. Consider augmenting JTCOIC SIMS with training developers who, with the assistance of the TRADOC Combined Arms Command (CAC) enterprise including CAC-Knowledge, CAC-Training, and appropriate schools and centers, will develop "hasty" training packets that address both training objectives and desired outcomes in support of machinima and interactive scenarios.
6. Using existing VBS2™ supporting documentation and the Close Combat Marine Workbook and pending USMC VBS2™ workbook for small unit trainers as models, develop an Army version of the same, emphasizing outcome-based and adaptive training principles.
7. Provide gaming Observer/Controller Trainers additional training in understanding and implementing Outcome Based Training and Education principles using VBS2™ as a tool.
8. Continue to aggressively develop and charter the Gaming Community of Practice focusing along the following three components:
   - Technology: develop an integrated solution consisting of a robust and searchable content repository, Battle Command Knowledge System forum, and the Army Training Network.
   - People: leverage the entire simulations, training, and cognitive research community's participation.
   - Process: determine methods to identify and enable discoverability of best of breed content, develop taxonomies, and ensure accessibility.
9. Leverage and apply the significant amount of ongoing cognitive research into L-V-C-G IED-D training and education. In addition to the JIEDDO-funded and USMC-sponsored Cognitive Task Analysis for IED-D Training (Phillips et al, 2008), JIEDDO also funded the Army Research Institute study on Identifying Experts on Detection of IEDs (Murphy, 2009), both of which are pending formal release in 2009 and each has the potential to enhance how we train service members for IED-D. The Joint Training Integration and Evaluation Center (JTIEC), with support from the USMC and Army, recently funded a collaborative proposal by ARI and PMTRASYS to develop cognitively-based metrics for IED-D, which will provide a template for what those metrics should look like for the cognitive aspects of asymmetric warfare performance. (Ross, 2009).

Throughout this paper, we demonstrated how VBS2™, an emerging Army and USMC tactical training tool,

could be leveraged (and in several cases is already being done so) by commanders to provide opportunities for their Soldiers and Marines to experientially train for a combination of lethal and non-lethal situations in semi-immersive, virtual operational environments. Though we primarily focused the paper on VBS2™ and the IED-D training integration efforts associated with it, we believe that the training support infrastructure and collaboration established and reinforced by this effort not only affords commanders a significant IED-D training capability in gaming environments, but also demonstrates potential to improve training in virtual and live environments. Furthermore, we believe VBS2™ offers a significant capability as a tool to assist commanders in developing adaptive mindsets in their Soldiers and an opportunity to institutionalize some of the tenets of OBT&E. Finally, we believe that these IED-D training efforts may provide the Army a framework to enhance the effectiveness, integration, and institutionalization of gaming training, agnostic both of specific game engine and operational environment to which a unit prepares to deploy.

ACKNOWLEDGEMENTS

We gratefully acknowledge the assistance of Mike Enloe and the team from the National Simulation Center and CAC-T, as well as Mark Covey and the team from the JTCOIC SIMS Division. Additionally, we thank Dr. Jennifer Murphy at ARI, Dr. Sherrie Jones at USMC PMTRASYS, and Dr. Karol Ross and Ms. Jennifer Phillips for advancing the ball in applying results of IED-D cognitive research into the training tools used by warfighters today. The concepts and recommendations described in this paper reflect the judgments of the authors and do not necessarily represent the official endorsement or positions of Bohemia Interactive, the National Simulation Center, PEO-STRI, JTCOIC SIMS, PMTRASYS, ARI, USMC, JIEDDO, Department of the Army, DoD, or the U.S. Government.

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