

Game-Based Training Effectiveness Evaluation in an Operational Setting

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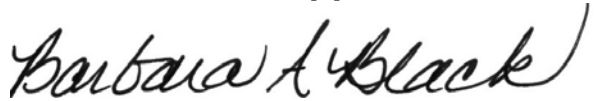
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14. ABSTRACT (Maximum 200 words) With high operational tempo and increasingly complex operational environments, , the U. S. Army is increasingly using game-based training as a lower cost and more time-effective training method for both individual and collective training of tactical skills. However, there has been little empirical evidence to demonstrate the effectiveness of game-based training and to help leaders make decisions about their use. In response to the need for more evidence regarding the effectiveness of game-based training (GBT), an evaluation of training games supported by Virtual Battle Space 2 (VBS2): U.S. Army was conducted in operational settings. This report describes the methods, measures, and results of an evaluation with 165 Soldiers participating in GBT. Pre- and post-measures were administered that focused on measuring training effectiveness through individual level (e.g., task performance) and unit level (e.g., unit effectiveness) outcomes. Results demonstrate that, in general, the training influenced both individual (e.g., task performance) and unit level (e.g., unit cohesion) outcomes. In addition, situational characteristics (the amount the unit prepared for the training and the level of leader involvement during the training) influenced both types of outcomes.					
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GAME-BASED TRAINING EFFECTIVENESS EVALUATION IN AN OPERATIONAL SETTING

EXECUTIVE SUMMARY

Research Requirement:

Army trainers are increasingly turning to emerging technologies and innovative training methods to exploit low-cost, technology-based solutions to rapidly fill critical training gaps and increase the impact and effectiveness of training for our Soldiers in a time of war. Unfortunately, the empirical research linking game-based training to training effectiveness is limited and does not extend much beyond extolling the motivational benefits of games in training. The Army lacks empirical evidence on which to base future decisions regarding the acquisition and use of game-based training. Therefore, the U.S. Army Research Institute, under the sponsorship of the U.S. Army Training and Doctrine Command (TRADOC) Capability Manager – Gaming (TCM Gaming), conducted an analysis to empirically investigate the effectiveness of game-based training in Army operational settings. In addition, this analysis also sought to understand *why* games may be useful training tools and if there are situational contexts that dictate the extent of their effectiveness. The gaming platform Virtual BattleSpace2 (VBS2): U.S. Army was used as a method for evaluating the merits of game-based training.

Procedure:

In order to develop an appropriate evaluation protocol, we observed training at Ft. Hood, TX and Ft. Lewis, WA. These observations provided information about the flow of training using VBS2: U.S. Army and also provided information about the training objectives normally targeted during training. The observations at the training sites also highlighted several constraints that had to be taken into consideration when developing the research protocol. First, we could not interfere with the training. Second, the amount of time that was made available for data collection was limited to approximately one-half hour. Third, we could not ask training facilitators to evaluate the performance of the unit. Therefore, based on these constraints and the other information gathered during the observations, we developed hypotheses and measures.

Data were collected from 165 Soldiers engaging in training using VBS2: U.S. Army at Ft. Hood and Ft. Lewis. Trainees completed pre- and post-training measures during the course of their normal training experience. Measures of learning at both the individual level (e.g., individual performance on the tasks) and the unit level (e.g., working together) were included as measures of effectiveness. In addition, due to the variance in training both within and across training locations, measures to understand the context under which training may be effective were also administered. Contextual variables considered included the difficulty of the training mission, the level of unit preparation prior to training, the level of leader involvement during the training, and time spent on the training.

Findings:

Results of the evaluation demonstrate that the training had a positive impact on individual outcomes, as well as on unit learning. Specifically, Soldiers reported being more prepared to plan tactical convoy operations following the training. In addition, higher levels of Unit Process and Unit Cohesion were reported following the training. These unit-level findings illustrate that the training impacted how well the Soldiers felt they could work together as a team, as well as their attraction to the unit, including their attraction to their tasks and other group members. In addition, contextual variables were shown to influence both individual and unit level outcomes. Both the level of unit preparation for the training and the level of unit leadership involvement during exercise management positively affected training outcomes. Together these results illustrate that game-based training (GBT) can be an effective training tool to the degree that the training has specific objectives which are focused on during the training. This focus can come from preparing for the training ahead of time and from leaders being involved during the training to provide focus and feedback.

Utilization and Dissemination of Findings:

A draft report of the results was provided to TMC Gaming 19 March 2010. Results were also presented at the Defense GameTech Conference 31 March 2010. They will be used to support future decisions regarding the acquisition and use of GBT in the U.S. Army.

GAME-BASED TRAINING EFFECTIVENESS EVALUATION IN AN OPERATIONAL SETTING

CONTENTS

	Page
INTRODUCTION	1
METHOD	4
Site Observations	4
Data Collection Protocol and Hypothesis Development	5
Data Collection	9
RESULTS	9
Individual Level Analyses	10
Unit Level Analyses.....	14
DISCUSSION AND CONCLUSIONS	18
Analysis Limitations	19
REFERENCES	21
APPENDIX A EVALUATION MEASURES.....	23
APPENDIX B SKILL PREPAREDNESS ITEMS – MEANS AND STANDARD DEVIATIONS	34

LIST OF TABLES

TABLE 1 INFORMATION ABOUT INDIVIDUAL AND UNIT LEVEL MEASURES.....	7
TABLE 2 T-TEST RESULTS COMPARING PRE – TO – POST-TRAINING OUTCOME VARIABLES	15

LIST OF FIGURES

FIGURE 1. A VBS2: U.S. ARMY SCREENSHOT	2
FIGURE 2. PREPAREDNESS LEVELS FOR PLANNING A CONVOY OPERATION	10
FIGURE 3. IMPACT OF UNIT PREPARATION ON SKILL PREPAREDNESS	11
FIGURE 4. IMPACT OF UNIT PREPARATION ON TASK PERFORMANCE	12
FIGURE 5. IMPACT OF UNIT PREPARATION ON TRAINING PERFORMANCE	13

CONTENTS (continued)

FIGURE 6. IMPACT OF LEADER INVOLVEMENT ON TASK PERFORMANCE	13
FIGURE 7. IMPACT OF LEADER INVOLVEMENT ON TRAINING MOTIVATION	14
FIGURE 8. IMPACT OF UNIT PREPARATION ON UNIT PROCESS	16
FIGURE 9. IMPACT OF UNIT PREPARATION ON UNIT COHESION	16
FIGURE 10. .IMPACT OF UNIT PREPARATION ON UNIT EFFICACY	17
FIGURE 11. IMPACT OF UNIT PREPARATION ON UNIT EFFECTIVENESS.....	17
FIGURE 12. IMPACT OF LEADER INVOLVEMENT ON UNIT PROCESS	18

GAME-BASED TRAINING EFFECTIVENESS EVALUATION IN AN OPERATIONAL SETTING

Introduction

The U.S. Army faces significant training challenges, now and in the years ahead. Some of these challenges involve persistent conflict and deployment pressures on training requirements and time. An increased diversity of operational environments, the complexity of possible domestic and global missions, and competing requirements for training resources are all key factors that have a potential impact on future training budgets (McHugh & Casey, Jr., 2010). The Army needs methods for providing Soldiers and leaders with effective training and opportunities to practice tasks effectively and efficiently. Consequently, Army trainers are increasingly turning to emerging technologies and innovative training methods to exploit low-cost, technology-based solutions to rapidly fill critical training gaps and increase the impact and effectiveness of training for our Soldiers in a time of war.

One technological approach to training that has received increased interest over the last decade is the use of game-based training (GBT). Training researchers hypothesize that games are instructive because they engage the player/learner, leading to skill acquisition and retention (Colquitt, LePine, & Noe, 2000; Mathieu, Tannenbaum, & Salas, 1992; Prensky, 2001; Tannenbaum & Yukl, 1992). In fact, empirical research has provided evidence that attributes of games (e.g., challenge, realism, and interactivity) influence trainee motivation and the length of time that trainees are willing to invest in mastering the skills taught during game play (e.g., Corbeil, 1999; Engel, et al., 2009; Garris, Ahlers, & Driskell, 2002).

Many Army agencies and organizations, including the U.S. Army Training and Doctrine Command (TRADOC), have recognized that games have the potential to augment and improve military training for both individuals and collectives. Examples of active GBT applications include Army DARWARS Ambush! and Tactical Iraqi. These games are being used to train Soldiers on a variety of skills including convoy operations, language, cultural awareness, and other tactical drills and tasks.

The most recent GBT effort is the acquisition and fielding of Virtual BattleSpace2 (VBS2): U.S. Army. VBS2: U.S. Army is based on the commercial gaming engine Real Virtuality 2 created by Bohemia Interactive. It is an interactive, three-dimensional training system to provide a synthetic environment on networked PCs suitable for a wide range of military training and experimentation purposes. Trainees typically interact with the simulation using a keyboard and mouse, although simulated vehicle control interfaces (steering wheel and pedals) can be used. It offers large, realistic terrain areas (up to 100km x 100km in size). VBS2: U.S. Army includes after-action review capability, High Level Architecture/Distributed Interactive Simulation (HLA/DIS) compliance, and a mission editor that allows scenarios to be created and also modified in real time. VBS2: U.S. Army places military trainees in realistic urban or rural settings, and provides them with the opportunity to practice protocols relating to convoy and ambush operations. Trainees can drive Army vehicles, pilot aircraft, and fire weapons across a number of game scenarios. The use of VBS2: U.S. Army is designed to be a stepping stone in Soldier training. Ideally, units will use the game to practice tactics, techniques

and procedures prior to going into the field. By engaging in GBT, Soldiers can improve their skills prior to participating in a live training exercise.

A VBS2: U.S. Army screenshot is shown in Figure 1. Further information about VBS2: U.S. Army can be found at the Army MILGaming Portal (<https://milgaming.army.mil>).



Figure 1. A VBS2: U.S. Army screenshot.

While the Army has established a game technology program of record, there are still many unanswered questions regarding game technology training effectiveness. Much of the common wisdom concerning the effects of GBT is anecdotal, lacking an empirical foundation (Hays, 2005). The majority of articles and reports written and published on instructional games are based on the writers' opinions of the promise of instructional games (Rieber, Smith, & Noah, 1998). Few articles have empirically studied the effectiveness of instructional games for either individual or team training (Hays, 2005). The research that does exist has been focused on enhancing our understanding of how to design training games to keep trainees interested, with less emphasis placed on how games influence the acquisition of specific knowledge and skills. Just because a game is motivating to play does not mean that it will be instructional. In fact, what is motivating about a game may hinder learning. Research has shown that if the content is not correctly embedded into the game, learners are more likely to walk away with increased knowledge of how to play the game rather than the transferable, operational knowledge or skill (Belanich, Sibley, & Orvis, 2004).

The existing body of research does not provide insight as to how well GBT works relative to other methods, nor why or when (under what conditions) to use it. Decisions to use games to train have been based on a "leap of faith," and there have been few efforts to test that faith through rigorous evaluation of the hypothesized benefits of games over other training

methods (Hays, 2005). Training designers need to understand how to incorporate game-based approaches to provide training that is pedagogically sound, as well as motivating and engaging. The credibility and impact of GBT programs could rise dramatically if solid empirical research was conducted on the effectiveness of such training approaches.

During FY 2009, the Army distributed copies of VBS2: U.S. Army to many training locations all over the world. With such an aggressive application of GBT, there is a need to evaluate the effectiveness of the platform in both operational and institutional settings. In response to this need, the U.S Army Research Institute for Behavioral and Social Sciences (ARI), under the sponsorship of TRADOC Capability Manager Gaming (TCM Gaming), conducted a two-part effort to assess the effectiveness of the use of computer games for Army training. Both efforts use VBS2: U.S. Army as the evaluation platform. The work described in this report focuses on evaluating the use of VBS2: U.S. Army in the operational (unit) setting, while the other effort focuses on the use of GBT in the institutional setting.

The research literature indicates that training effectiveness is influenced by three primary determinants: a) the training program itself (including the game), b) the trainee (in terms of personal characteristics and attitudes), and c) the situational context in which the training takes place (Campbell & Kuncel, 2001; Colquitt, et al., 2000; Mathieu, et al., 1992; Salas & Cannon-Bowers, 2001). In addition to studying the overall effectiveness of VBS2: U.S. Army, the purpose of this analysis was to investigate the impact of situational variables on training outcomes. Such a multi-pronged approach not only evaluates the overall effectiveness of the GBT but also explains “why” the game-based approach may or may not be effective, and therefore, provides suggestions for improving future effectiveness of GBT.

This report first describes the method associated with developing the evaluation protocol. This method consisted of making site visits to Army posts using VBS2: U.S. Army on a regular basis. Next, the evaluation protocol is described, along with the associated measures and hypotheses. Finally, this report presents the evaluation results and also makes recommendations for the use of GBT in an operational setting.

Method

Site Observations

Prior to developing the method by which evaluation data would be collected, we conducted site visits to locations using VBS2:U.S. Army. The purpose of those visits was to learn how training was conducted at each site in order to develop an appropriate evaluation plan that matched the training method used.

On 11-13 August 2009 and 18-19 August 2009, site visits were conducted at Ft. Hood, TX and Ft. Lewis, WA, respectively. These sites were chosen because both were using VBS2: U.S. Army for training on a regular basis. Throughout the five days of observation, a number of units came into the training centers to train using VBS2: U.S. Army. Although the primary training objective across the two sites was convoy training, VBS2: U.S. Army also supported additional training objectives including crew coordination and teamwork; communications; and reinforcing rules of engagement (ROEs) or standard operating procedures (SOPs). Although there were some differences across the two sites in terms of the training logistics, the overall flow of the training was the same. The next section of this report describes that training.

Training using VBS2: U.S. Army. At both Ft. Lewis and Ft. Hood, each training facility contained computers for each individual Soldier to use during the training session. After the training unit entered the training facility, each Soldier was assigned a different role or position for the convoy scenario – driver, gunner, truck commander, or observer. One Soldier was also assigned the position of convoy commander. In addition, the role of higher headquarters is filled by either a training facilitator or someone in a leadership position (e.g., company commander) within the unit. By having all of these roles filled during the training, the Soldiers are able to get a sense of what each role does, learn how to utilize each position, and also learn to convey the appropriate information to the appropriate person at the appropriate time.

At each training site, there was the potential for wide variability in the computer skills and experience with games across all of the Soldiers. Therefore, before beginning actual missions, Soldiers were all given initial training on how to use the game in order to get all trainees comfortable with the controls. Following this initial training period, the training unit was given its mission, and planning for the mission commenced. All Soldiers were then briefed on the mission (typically by the convoy commander) and given time to ask questions. Following the mission brief, Soldiers then went through the mission. Throughout the mission scenario, training facilitators played the role of the opposing forces (OPFOR) and embedded attacks in the form of insurgents, snipers, and improvised explosive devices (IEDs) into the scenario. The unit had to achieve their mission objectives while contending with attacks from the OPFOR. During the observed training, it was not uncommon for a Soldier's avatar to experience a casualty during the scenario. All of these elements added a sense of stress to the training mission, encouraging the Soldiers to take the training seriously.

Finally, after the mission was complete, a thorough after-action review (AAR) was conducted. After completion of the AAR, units could conduct a second mission, following the same procedure as described above. Depending upon the unit commander's plan, the second

mission could be identical to the first one conducted or could be different and possibly more difficult.

Across the observed missions, there was a lot of variance in who led and conducted the AAR. For some units, the AAR was led by a higher-level leader who had not actually participated in the training. For other units, it was led by the individual given the position of convoy commander during the training, and hence, was deemed “the leader” of the exercise. In other instances, the AAR was conducted by a Soldier who had been selected to conduct the AAR at the completion of the exercise. Finally, for some units, the AAR was led by one of the training facilitators and not by a Soldier or higher-level leader in the training unit. This variance contributed to some AARs being conducted more thoroughly than others.

One of the unique features of VBS2: U.S. Army is that it has the capability to play back the entire mission, including from a birds-eye view, for use during the AAR. This capability allows Soldiers to see things like where the insurgents were shooting from, what their truck formation looked like, and how each individual Soldier was reacting and behaving. Getting this overall view of the mission can provide Soldiers with a better and more objective understanding of their behaviors and the results of those behaviors. Although the playback capability is available, there were differences in how well the recording was integrated into the AAR. At times, the video playback capability was not utilized, or only partially used.

These observations provided insight into the types of measures that should be used in the evaluation. These visits also highlighted the challenges associated with conducting the evaluation. One of the things that stood out was the fact that there were differences not only between Ft. Hood and Ft. Lewis, but also within each site in terms of how the training was conducted. For example, some units spent a much longer time planning their missions than others. Some units had the involvement of very senior officers, such as lieutenant colonels, whereas other units had no leadership present other than those participating in the training scenarios, and others had some level of leadership present only observing, not participating. Another source of variability observed was the training scenarios used. Because each unit came to the training with its own unique training needs and objectives, it was nearly impossible to develop objective measures of performance prior to conducting the evaluation. It became clear that the only way to control for all of those factors was to measure them to the greatest extent possible while keeping in mind that the actual data collection time was limited. In short, the evaluation plan had to be designed to try and overcome some of these challenges associated with the training.

Data Collection Protocol and Hypothesis Development

Following training observations at Ft. Lewis and Ft. Hood, the data collection protocol was developed. Although time to administer measures was limited, we were given permission from each training facility to administer a short set of measures both prior to and after training was complete. Therefore, measures to administer both pre- and post-training were developed.

The hypotheses and measures generated as part of the protocol focused on measuring the skills that VBS2: U.S. Army targeted during training. Training seemed to focus on the development of two areas: skills associated with individual level learning and skills related to

learning at the unit level. Therefore, the measures generated for this evaluation also focused on measuring these two different types of outcomes. In addition, the data collection protocol included measures of the varying contextual differences observed across the training sessions. The majority of measures were administered both pre- and post-training. The difference between the two administrations was in the question stems. The post-training items asked the trainees to respond to the items *now that they have engaged in training using VBS2: U.S. Army*.

Individual level measures. Given the variation in the technical training objectives across training scenarios, it was difficult to develop measures to assess individual level learning. However, based on our observations and conversations with the training facilitators, we developed measures associated with specific behaviors and tasks that are typically performed while engaging in training using VBS2: U.S. Army. For example, specific behaviors and tasks associated with conducting convoy operations (e.g., scanning sectors of fire, communicating with unit members, locating sources of enemy fire, and identifying civilians) were identified and used in measures associated with performing these skills during training.

The individual level measures administered consisted of a demographics measure (8 items; Appendix A, pg. 23), skill preparedness measure (13 items; Appendix A, pg. 24), training motivation (10 items; Appendix A, pg. 25) and task performance (15 items; Appendix A, pg. 26). For the majority of these measures, trainees responded on a 5-point scale (1 = Strongly Disagree; 5 = Strongly Agree). When necessary, items were re-coded so that higher numbers represented a more positive score. Table 1 lists when each measure was administered (e.g., pre- or post-training), a description of the measure, and an example item for each measure.

Unit level measures. Several measures were used to assess unit level outcomes. Examining these measures over time provides evidence of the training impact on unit outcomes. These unit level variables included the following: unit process measure (13 items; Appendix A, pg. 27), unit cohesion measure (task and interpersonal cohesion for a total of 11 items; Appendix A, pg. 28), unit efficacy measure (7 items; Appendix A, pg. 29), and overall unit effectiveness measure (3 items; Appendix A, pg. 29). All of these measures were administered both pre- and post-training. More information about each of these measures is in Table 1.

Contextual variables. In order to understand the context under which GBT may be more or less effective, we also generated several measures to assess variables that may impact the effectiveness of the training. These measures were completed by outside observers to the training. All measures assessing contextual variables are in Appendix A.

Table 1. Information about Individual and Unit Level Measures

Measure	Measure Description	When Administered	Example Item(s)
Skill Preparedness	Assess Soldier belief in level of preparation to perform certain general tactical tasks often a part of VBS2 training missions	Pre- and Post Training	<i>How prepared do you feel to...</i> “Assess the tactical situation?” “Plan a tactical convoy operation?”
Training Motivation	Assess Soldier motivation level to participate in VBS2 training	Post-Training	“I tried very hard during this exercise.”
Task Performance	Assess Soldier belief about performance on specific tasks performed during training	Post-Training	<i>Please rate your ability to perform each of the following tasks in the simulator...</i> “Scan for threats.” “Identify insurgents.”
Unit Process	Assess Soldier belief about how well the unit worked together during the training in terms of different teamwork skills (e.g., communication, monitoring progress towards goals). Research has hypothesized that engagement in effective unit processes are directly linked to increased unit performance (e.g., Marks, Mathieu, & Zaccaro, 2001).	Pre- and Post Training	“My training unit members and I understand how one another prefer to communicate information to other members.” “My training unit members and I understand how members are going to work together to achieve our goals.”
Unit Cohesion	Assess Soldier attraction to the unit, including their tasks (task cohesion) and other group members (interpersonal cohesion). Research has shown that unit cohesion influences unit performance (e.g. Gully, Devine, & Whitney, 1995).	Pre- and Post Training	<i>Task Cohesion:</i> “When one person is struggling with a task, another member of the training unit will step in to help.” <i>Interpersonal Cohesion:</i> “The members of my training unit get along with one another.”
Unit Efficacy	Assess Soldier confidence level in ability of the unit to work together and perform well during the training. Research has shown a positive relationship between unit efficacy and performance (e.g. Stajkovic, Lee, & Nyberg, 2009).	Pre- and Post Training	“I am confident that the members of my training unit and I can effectively set contingency plans.”
Unit Effectiveness	Assess Soldier belief about how effective the unit was during the training mission	Pre- and Post Training	“This training unit is effective.”

Training facilitator measures. The training facilitators completed measures regarding the level of unit preparation of the unit prior to training (Appendix A, pg. 30). Facilitators completed these ratings at the end of each mission completed by one training unit. This measure was designed to account for differences in how much effort the unit put into preparing for the VBS2: U.S. Army training prior to coming to the training facility. Differences may exist in terms of how much the unit communicates with the training facilitators ahead of time in regard to mission objectives, training scenarios, etc. For this measure, facilitators rated each unit on a 5-point scale (1 = Completely Unprepared; 5 = Completely Prepared). These ratings were averaged across facilitators if more than one facilitator rated the level of preparation. In order to classify the units into more meaningful groups, a dichotomous variable that classified those units who received an average rating of 3 or less as “Less Prepared” and those units who received an average rating of over 3 as “More Prepared.” This dichotomy was used throughout all analyses involving this variable. Given that this measure was meant to tap into the unit’s initial level of preparation, only the rating given by facilitators regarding the first mission completed at the training center was used.

Observer measures. Training observers from ARI, Aptima, and TCM Gaming completed several measures as they observed each mission. Namely, observers completed Time Spent on Training and Leader Involvement measures (Appendix A, pgs. 31). For the Time Spent on Training measure, observers simply recorded the number of minutes each training unit spent on 1) initial VBS2: U.S. Army training (e.g., buttonology), 2) the mission brief, and 3) the actual training mission. The time spent on the initial training was only taken into account once, whereas the time spent on the mission brief and the actual training mission was taken into account each time the unit began a new mission.

The Leader Involvement measure consisted of six questions targeted at recording the level of involvement from unit leadership (not actually involved as a participant in the training) during each training mission. The qualitative information from each of these measures was transformed to a quantitative three-point scale to measure the level of involvement. A rating of 1 meant that unit leadership was not present at the training exercise; a rating of 2 meant that unit leadership participated in either the mission brief or the AAR portion of training; and a rating of 3 meant that unit leadership was present and participating in both of those important aspects of the training.

Hypotheses. Based on all these measures, we generated several hypotheses about how training would impact individual and unit level learning, as well as how the contextual variables would influence training effectiveness.

1. VBS2: U.S. Army training positively impacts the training outcome of Skill Preparedness.
2. The level of *Unit Preparation* for the training positively impacts the training outcomes of a) Skill Preparedness, b) Task Performance, and c) Training Motivation.
3. *Leader Involvement* in training positively impacts the training outcomes of a) Skill Preparedness, b) Task Performance, and c) Training Motivation.

4. VBS2: U.S. Army training positively impacts the training outcomes of a) Unit Process, b) Unit Cohesion, c) Unit Efficacy, and d) Unit Effectiveness.
5. The level of *Unit Preparation* for the training positively impacts the training outcomes of a) Unit Process, b) Unit Cohesion, d) Unit Efficacy, and d) Unit Effectiveness.
6. *Leader Involvement* in training positively impacts the training outcomes of a) Unit Process, b) Unit Cohesion, d) Unit Efficacy, and d) Unit Effectiveness.

Data Collection

Participants. One-hundred and sixty five Soldiers participated in the evaluation study 76 at Ft. Hood and 89 at Ft. Lewis. These 165 Soldiers represented 9 different platoons. 95% of these Soldiers were enlisted; 4% were officers; and less than 1% were warrant officers. The mean age of the trainees was 25.20 (SD = 5.68). In addition, 33% of the trainees reported having engaged in training using VBS2: U.S. Army in the past.

Procedure. Soldiers were given a brief overview of the project upon entering the training facility. They were informed that their participation was voluntary and that all of their responses were anonymous and would not be linked back to any single individual. Soldiers read and signed the informed consent form, and then were given the pre-training questionnaire packet to complete. This set of measures took approximately 15 to 20 minutes for each Soldier in the unit to complete. Following completion of these measures, the unit engaged in training as usual using VBS2: U.S. Army. As described above, this training consisted of a practice mission, to be followed by the actual training mission, and an AAR. Soldiers completed a second set of measures after the final AAR of the day.

In addition to the Soldiers completing measures, after each mission, training facilitators provided an overall rating of how prepared the unit was for the training. Aptima and ARI personnel present during the data collection also recorded the time each unit spent on training and conducting the mission. All of these measures served to control for some of the variability present across the training events.

Results

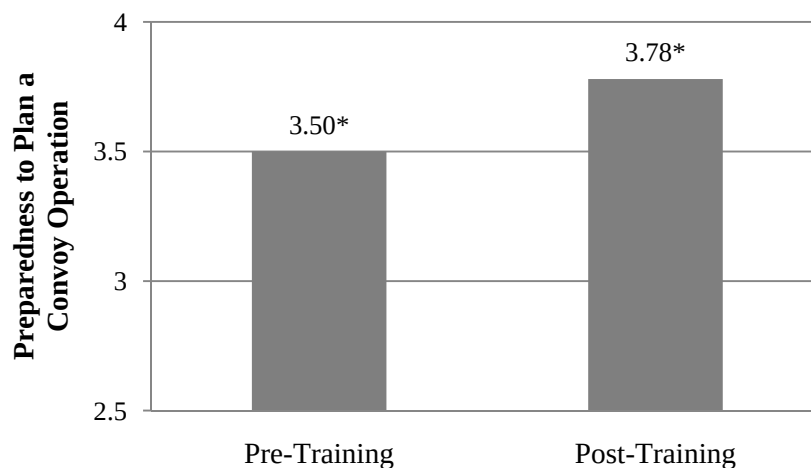
Before conducting any analyses, the measures themselves were examined to ensure that they were reliable. Statistically, all of the items in each of the measures fit well together, as demonstrated by a measure of internal consistency (alpha levels ranging from .76 to .96). This statistic indicates that the items within one measure all tap into the same construct.

Trainees spent an average of 86 minutes (SD = 39.65) on the initial VBS2: U.S. Army training; this time was spent teaching trainees how to use the simulation prior to conducting their training mission. The average time spent conducting the mission brief and planning for the mission was 17.88 minutes (SD = 8.96), and the average training mission lasted 83.64 minutes (SD = 61.18).

Overall, the results demonstrated that training with VBS2: U.S. Army had some impact on both individual-level and unit-level outcomes. The context in which this training occurred also impacted both sets of variables. This results section first discusses the analyses associated with the individual level variables, followed by a discussion of the results with the unit level variables.

Individual Level Analyses

Hypotheses 1 through 3 focused on the influence of the training and the training context on the individual level variables (Skill Preparedness, Task Performance, and Training Motivation). First, in order to generally understand how trainee scores changed from pre- to post-training measures (and test hypothesis 1), a paired sample *t*-test was conducted on the Skill Preparedness measure (since pre-measures were not administered for Task Performance or Training Motivation, no analyses could be conducted on these measures). Although the trainees reported feeling slightly more prepared to conduct the skills after training ($M = 3.97, SD = .76$) compared to pre-training ($M = 3.93, SD = .67$), this difference was not statistically significant, $t(141) = -.61, n. s.$ However given that the skills each unit performed during the training mission were aligned with the diverse training objectives of each unit, we looked more deeply at the individual items in this measure. Upon examination, we found that trainees reported feeling more prepared to “plan a tactical convoy operation” after the training ($M = 3.78, SD = 1.06$) than prior to the training ($M = 3.50, SD = 1.15$), $t(141) = -2.61, p = .01$. Figure 2 depicts this relationship. These results demonstrated that although trainees did not report feeling more prepared to perform a variety of skills following the training, they did report that the training made them feel more prepared to engage in one of the more general objectives of VBS2: U.S. Army – planning for a convoy mission. The results of the analyses for each individual Skill Preparedness item are in Appendix B.



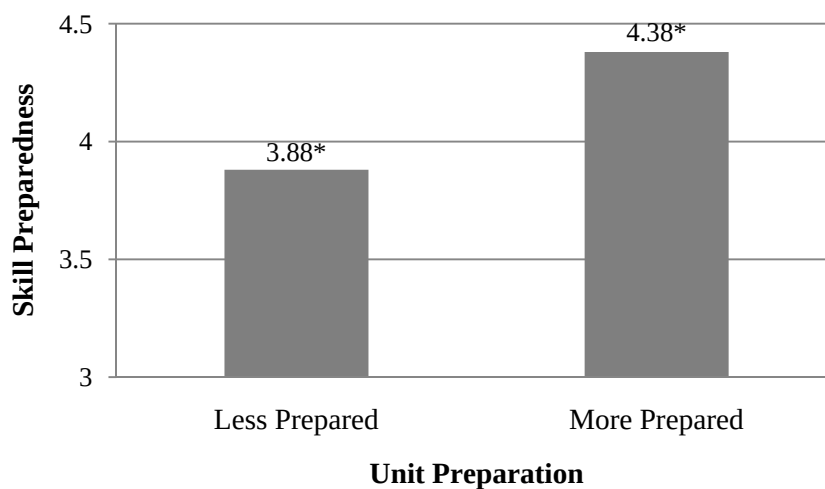
* $p = .01$

Figure 2. Preparedness levels for planning a convoy operation.

Hypotheses 2 and 3 focused on the impact of situational factors on training effectiveness. To examine the influence of Unit Preparation and Leader Involvement on the individual level

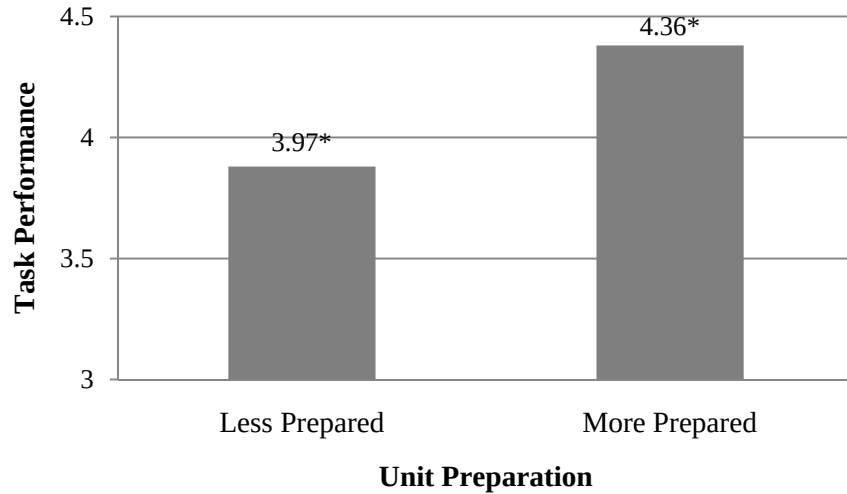
outcomes, Analysis of Covariance (ANCOVA) was conducted. This statistical analysis technique was utilized multiple times while analyzing the data. ANCOVA statistically controls for variables that may mask the direct relationship between two other variables. In all instances where ANCOVA was used, the impact of the platoon that the trainees were in, as well as pre-training levels of the variables where relevant, were controlled for. For example, hypothesis 2a looks at the impact of Unit Preparation on Skill Preparedness. In order to understand the more direct relationship between these two variables, we accounted for random variance associated with the training unit to which the trainees belonged and their initial preparedness levels. This type of analysis allows for a cleaner examination of the situational variables on the training outcome. Therefore, the results reported here for Hypotheses 2 and 3, as well as for other applicable hypotheses, are based on accounting for those extraneous variables.

For Hypotheses 2, ANCOVA results showed that Unit Preparation significantly impacted a) Skill Preparedness, b) Task Performance, and c) Training Motivation. Figures 3, 4, and 5 depict the nature of these relationships. As shown in these figures, trainees in units which had prepared more for the training reported being more prepared to conduct certain skills and perform various tasks throughout the training; they also reported higher motivation for the training.



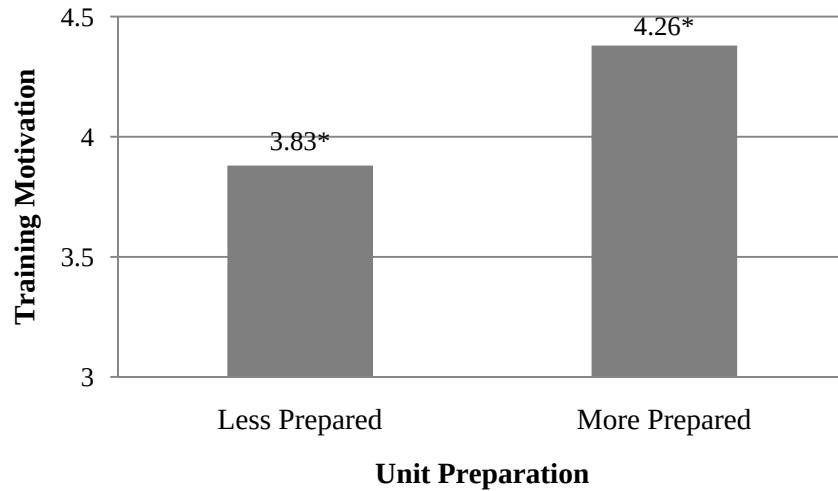
* Adjusted means significantly different from one another, $F(1, 126) = 5.48$, $\eta^2 = .04$, $p < .05$

Figure 3. Impact of unit preparation on skill preparedness.



* Adjusted means significantly different from one another, $F(1, 124) = 7.88$, $\eta^2 = .06$, $p < .01$

Figure 4. Impact of unit preparation on task performance.

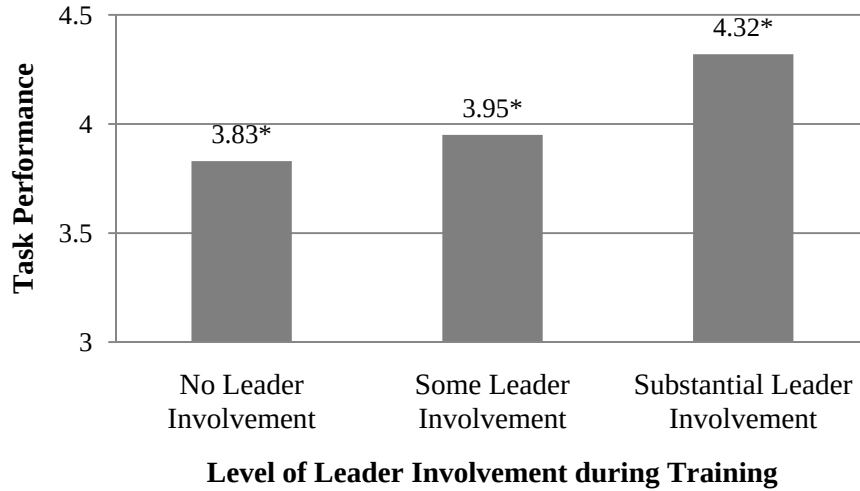


* Adjusted means significantly different from one another, $F(1, 126) = 5.73$, $\eta^2 = .04$, $p < .05$

Figure 5. Impact of unit preparation on training motivation.

Hypothesis 3 was similar to Hypothesis 2 and predicted that the level of Leader Involvement in the training positively influences a) Skill Preparedness, b) Task Performance, and c) Training Motivation. Parts *b* and *c* of this hypothesis were supported; an ANCOVA indicated that there was no statistically significant relationship between the level of Leader Involvement in the training and Skill Preparedness. Figure 6 illustrates the significant relationship between the level of Leader Involvement during training and Task Performance. According to LSD post-hoc tests, Soldiers in units with substantial levels of Leader Involvement ($M_{adj} = 4.32$, $SE = .11$) were

more likely to report higher task performance compared to Soldiers in those units with only some level of Leader Involvement ($M_{adj} = 3.95$, $SE = .06$, $p = .01$) and units with no Leader Involvement ($M_{adj} = 3.83$, $SE = .13$, $p = .01$). The difference in reported levels of Task Performance is not statistically significant for those Soldiers in units with some level of Leader Involvement compared to those Soldiers in units with no Leader Involvement during training.

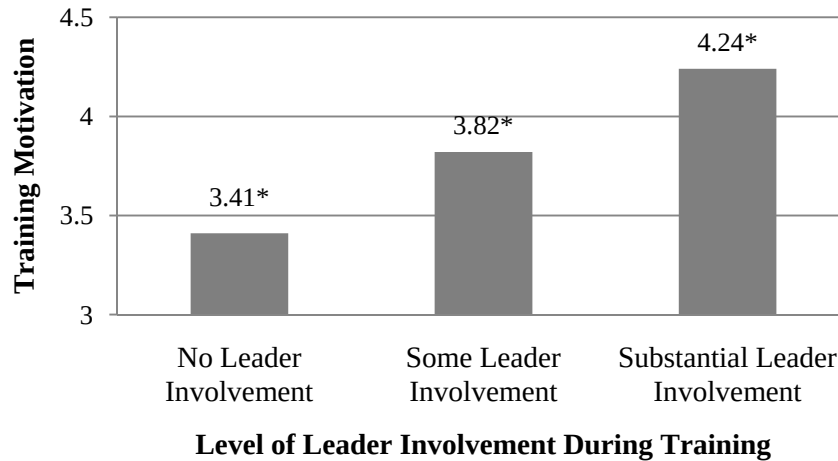


* Adjusted means significantly different from one another, $F(2, 136) = 3.67$, $\eta^2 = .05$, $p < .05$

Figure 6. Impact of leader involvement on task performance.

Figure 6 depicts the relationship between the level of Leader Involvement during training and Training Motivation. As can be seen in this figure, the highest Training Motivation levels were reported by those trainees with substantial levels of Leader Involvement ($M_{adj} = 4.24$, $SE = .14$). LSD post-hoc tests demonstrated that both trainees with some ($M_{adj} = 3.82$, $SE = .08$, $p < .05$) and no ($M_{adj} = 3.41$, $SE = .17$, $p < .01$) Leader Involvement reported significantly lower levels of motivation. The difference in motivation levels for Soldiers in units with no Leader Involvement and some Leader Involvement is also statistically significant ($p < .05$).

In general, these results demonstrate that GBT can have the power to impact individual-level learning, especially in an appropriate context. Being prepared for the training seems to be one key element for individuals to learn from GBT. Also, having unit leadership involved during the training seems to provide support for individuals to be more motivated and perform better during the training. The next section examines similar relationships with unit-level variables.



* Adjusted means significantly different from one another, $F(2, 138) = 5.41$, $\eta^2 = .07$, $p < .01$

Figure 7. Impact of leader involvement on training motivation.

Unit Level Analyses

Hypotheses 4 through 6 focused on the influence of the training and the training context on unit level variables (Unit Process, Unit Cohesion, Unit Efficacy, and Unit Effectiveness). The first analysis with the unit level variables was to examine the general impact of the training. Paired sample t-tests were conducted to examine whether trainees perceived higher levels of these unit level variables following the training as opposed to prior to the training. Although all of the post-test scores were higher than the pre-test scores, the only significant differences existed with Unit Process and Unit Cohesion. Table 2 showcases the results of this analysis for all four unit level outcomes. These results indicate that Soldiers reported feeling better about how their unit engages in various team processes (e.g., communication, backing each other up) and the level of cohesion present among unit members after having participated in training with VBS2: U.S. Army.

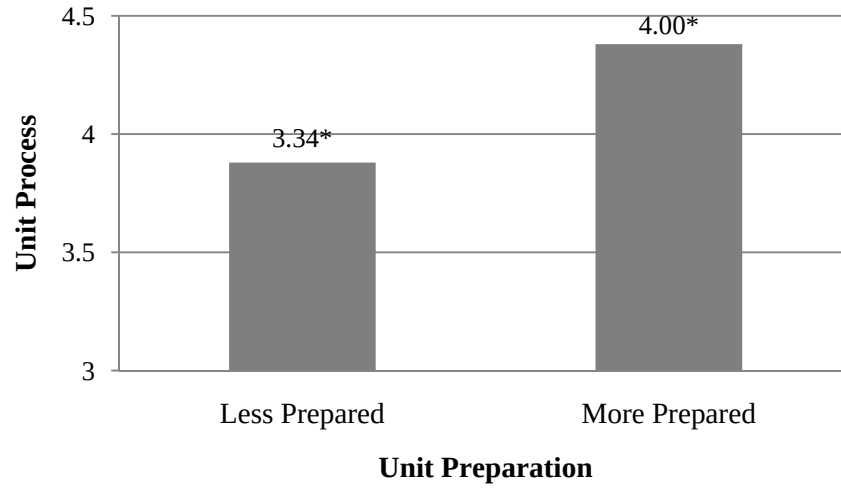
Table 2

T-Test Results Comparing Pre- to Post-Training Outcome Variables

Comparison	<i>M</i>	<i>SD</i>	<i>t</i>
Unit Process			
Pre Training	3.30	.70	-2.71*
Post Training	3.46	.78	
Unit Cohesion			
Pre Training	3.41	.68	-1.93*
Post Training	3.54	.89	
Unit Efficacy			
Pre Training	3.46	.78	-1.33
Post Training	3.55	.82	
Unit Effectiveness			
Pre Training	3.07	.78	-1.40
Post Training	3.16	.83	

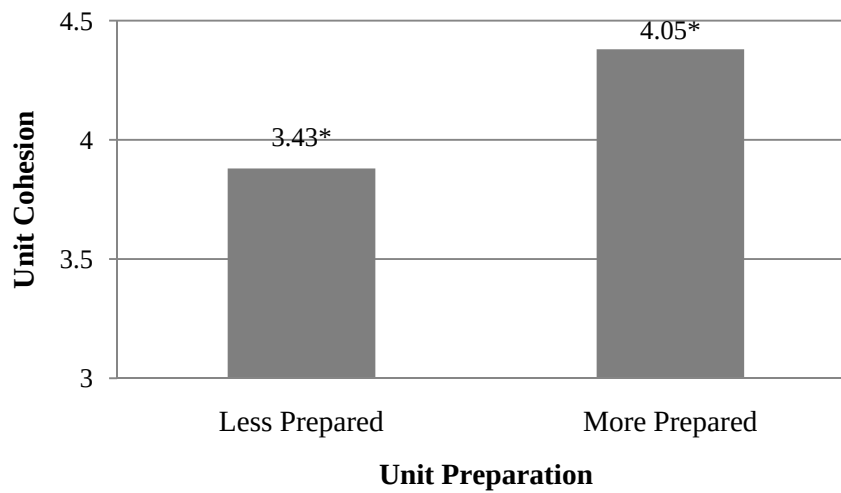
* $p \leq .05$

Hypotheses 5 and 6 focused on the impact of situational factors on training effectiveness at the unit level. As with the individual level variables, the effect of Unit Preparation and Leader Involvement on the unit level outcomes was examined through ANCOVA, controlling for the impact of the platoon that the trainees were in as well as pre-training levels of the variables. Results showed that the level of Unit Preparation significantly impacted a) Unit Process, b) Unit Cohesion, d) Unit Efficacy, and d) Unit Effectiveness. Figures 7 through 10 depict the nature of these relationships. As seen in the four graphs, higher levels of unit level variables were reported by Soldiers in units that had prepared more for the training exercises. These analyses indicate that the VBS2: U.S. Army training was particularly effective at increasing how unit members work together and feel about working together when units have adequately prepared for that training.



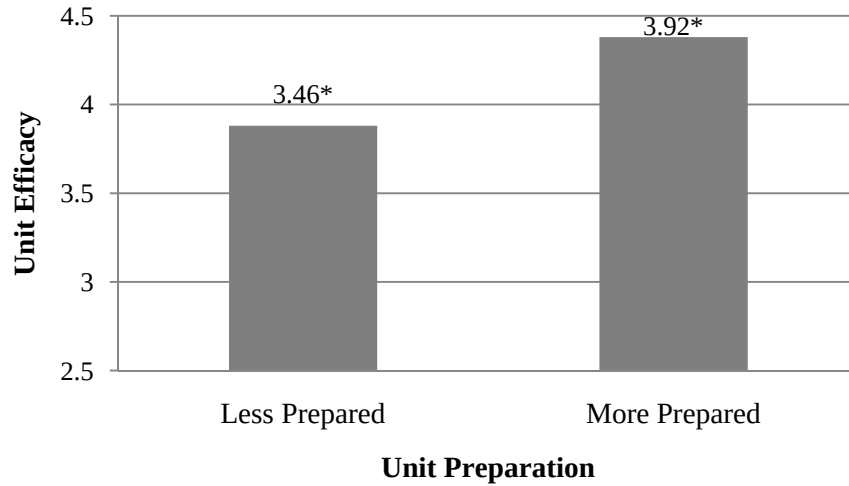
* Adjusted means significantly different from one another, $F(1, 126) = 10.23$, $\eta^2 = .08$, $p < .01$

Figure 8. Impact of unit preparation on unit process.



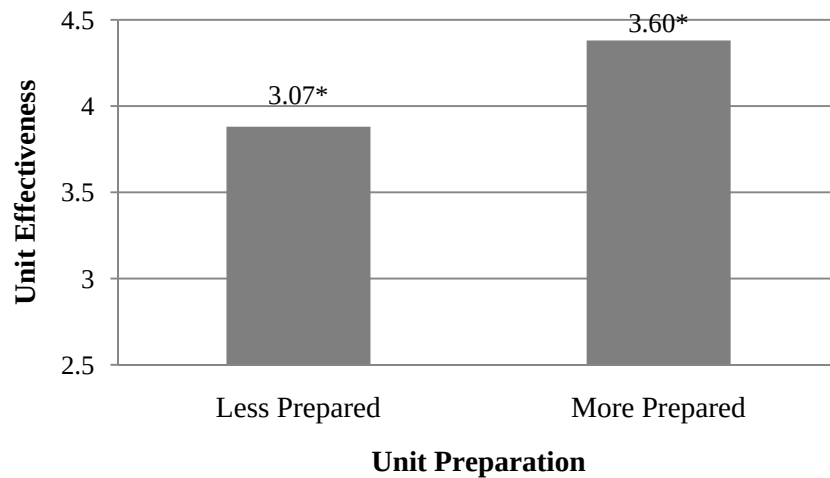
* Adjusted means significantly different from one another, $F(1, 126) = 6.72$, $\eta^2 = .05$, $p < .05$

Figure 9. Impact of unit preparation on unit cohesion.



* Adjusted means significantly different from one another, $F(1, 125) = 3.95$, $\eta^2 = .03$, $p < .05$

Figure 10. Impact of unit preparation on unit efficacy.

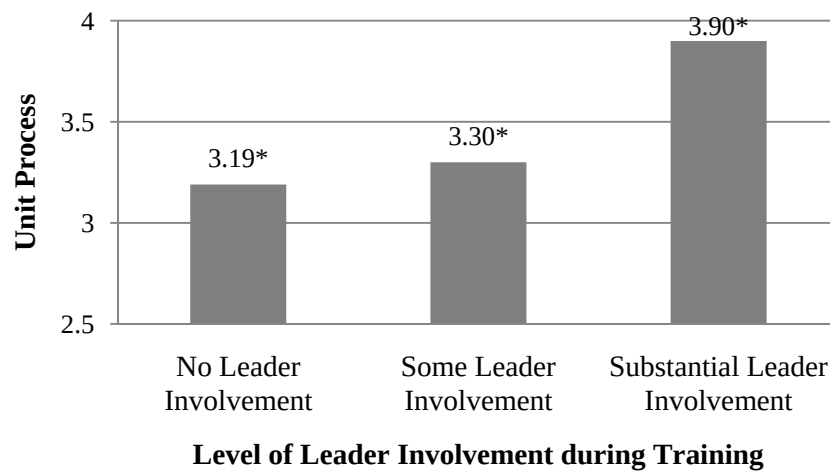


* Adjusted means significantly different from one another, $F(1, 125) = 5.00$, $\eta^2 = .04$, $p < .05$

Figure 11. Impact of unit preparation on unit effectiveness.

Finally, Hypothesis 6 predicted that Leader Involvement would positively impact the four unit level variables. Support was found for only one part of that hypothesis; specifically, the level of Leader Involvement was significantly related to Unit Process. This relationship is illustrated in Figure 11. As can be seen in this graph, Soldiers in units with substantial levels of leader involvement perceived the highest levels of Unit Process ($M_{adj} = 3.90$, $SE = .17$). Post-hoc LSD tests demonstrate that this reported level of Unit Process is statistically different compared to Soldiers in units with some Leader Involvement ($M_{adj} = 3.30$, $SE = .09$, $p < .05$) and no Leader Involvement ($M_{adj} = 3.19$, $SE = .20$, $p < .01$). The difference in Unit Process levels perceived by

Soldiers in units with no Leader Involvement and some Leader Involvement was not statistically significant.



* Adjusted means significantly different from one another, $F(2, 137) = 4.02$, $\eta^2 = .06$, $p < .05$

Figure 12. Impact of leader involvement on unit process.

Discussion and Conclusions

This report provides some evidence that training using VBS2: U.S. Army is effective in improving both individual-level and unit-learning learning. In terms of individual-level learning, the training did not directly impact how prepared Soldiers felt to perform certain skills; however, this non-significant finding seems to be more of a function of measurement than the actual training. The lack of consistency across the training scenarios, and consequentially the training objectives, makes it difficult to measure the appropriate skills. That is, our list of skills, prepared in advance of the training and without knowledge of the unit's training objectives, may simply not have matched well with the skill(s) the unit wished to train. However, after engaging in the training, Soldiers reported feeling more prepared to plan a convoy operation than prior to training. Even though specific training objectives differed from unit to unit, one commonality across all of the training sessions was that each mission focused on planning for and conducting convoy operations. Therefore, it makes sense that Soldiers would report feeling more prepared to do this type of planning after actually having done it through training using VBS2: U.S. Army. This finding has implications for evaluating GBT, as well as presents evidence for the validity of GBT. First, it points to the importance of targeting and measuring clear learning objectives when using GBT. Second, this finding illustrates that when clear learning objectives are present in games, games can effectively prepare trainees to some extent and make them feel more confident in their ability to perform skills targeted during the training.

Results associated with understanding the impact of GBT on individual level learning also point to the importance of the context surrounding the training. Particularly, the extent to which units prepared for the training and how involved unit leadership was during the training influence training effectiveness. Although both of these contextual variables positively impacted

the individual level variables, unanswered questions still remain about their impact. Future research needs to further examine the nature of Leader Involvement in GBT to understand exactly how it contributes to effectiveness. For example, is it enough for leaders to just be present during training, or do they need to provide a certain type of feedback to be influential? Additional research should focus on uncovering this relationship in more depth.

Results of this analysis suggest that the GBT investigated here is particularly useful for increasing unit-level outcomes. In general, the training influenced how the unit felt they worked together (Unit Process), unit motivational states (Unit Cohesion and Unit Efficacy), and the perceived effectiveness and performance of the unit. Trainees reported more effective unit processes and increased levels of unit cohesion from pre- to post-training. In addition, Soldiers in units that were more prepared for the training reported higher levels of Unit Process, Unit Cohesion, Unit Efficacy, and Unit Effectiveness compared to Soldiers in units with lower levels of preparation. It is likely that units who spent time preparing for the training exercises emphasized and focused on getting the unit to work together. Anecdotal evidence from our training observations and data collections indicates that unit leaders were using the training as a chance to focus on unit level behaviors. They continually emphasized the importance of communicating with each other during the training and understanding the role and position of each unit member. The results with the unit level variables mirror this emphasis by the units prior to and during the training.

In contrast to the influence of Unit Preparation on all four unit-level variables, the level of Leader Involvement in the training only influenced the level of Unit Process reported by the trainees. As pointed out with the individual-level variables, understanding the nature of this involvement may help to explain why process was the only variable influenced. When unit leadership was involved during the training, their involvement likely came in the form of feedback about how the unit was working together (i.e., their team processes) and was not centered on motivational states or overall performance feedback.

Analysis Limitations

There are several limitations associated with this analysis, many of them associated with the challenges in collecting data. As indicated earlier in this report, there was a very limited amount of time available to collect data. Therefore, the measures administered had to be limited and mainly self-report in nature. Second, there was no opportunity for a control group. Although we were able to gather both pre- and post-training data, the results of this analysis would have been stronger if we had been able to compare the GBT to a group that did not receive GBT. In addition, collecting data from the same training units following a field training exercise would provide a useful analysis of transfer of training. The performance of units which engaged in GBT could be compared to the performance of units which did not engage in GBT to more deeply understand how effective the training was. Finally, it was difficult to measure objective training performance given the differences in training objectives across the units. Each of these limitations made it more difficult for us to identify significant changes or improvements as a result of training with VBS2: U.S. Army. Despite these limitations, several interesting findings emerged to lend credence to the use of games for training purposes. Under the correct conditions, GBT can be an engaging, useful training mechanism.

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Appendix A-1
Evaluation Measures

PARTICIPANT INFORMED CONSENT FORM

Date: 1 October 09

Title: Game-Based Training Effectiveness (Unit)

Purpose: This research is being conducted by the Army Research Institute (ARI). The purpose is to obtain information about the effectiveness of computer simulations for Army training. This information will be used to help determine the future use of similar simulations in the Army.

What you will be asked to do in this study: In addition to normal training activities, you will be asked to complete a short background questionnaire, several paper and pencil tests, and several questionnaires about your training.

Time required: It is estimated that all questionnaires will take no longer than 30 minutes to complete in total.

Cost/Risk: There are no associated risks with participating in this research. Providing information is voluntary, and you have the right to withdraw from the research at any time without consequences. Failure to respond to any particular question will not result in any penalty. All of your responses will be kept confidential and will not be shared with other individuals participating in this research. Any identifying information collected will be used only by persons engaged in, and for the purposes of, the research.

Benefits: The benefits that you may expect from your participation in this research are minimal. Your participation will aid efforts to improve the effectiveness of Army training.

Voluntary consent: Your signature below means that you have read this consent form and agree to voluntarily participate in this study. Your signed consent form will be kept separate from the rest of the research materials. Thus, your name will not be associated with your responses, and the data that you provide will be anonymous. You must be 18-years of age or older to participate.

- I have read the procedure described above.
- I have been informed of the reasons for this research.
- I have had the research explained to me.
- I have had all of my questions answered.
- I give consent voluntarily to participate in this research.
- By signing this consent form, I have not given up any of my legal rights.

Signature of Participant

Date

Printed Name

Signature of Person Conducting Informed Consent Discussion

Date

Privacy Act Statement

Title: Game-Based Training Effectiveness (Unit)

Date: 1 October 09

AUTHORITY: The Department of the Army may collect the information requested in this session under the authority of 10 United States Code, Section 2358, "Research and Development Projects." In accordance with the Privacy Act of 1974 (Public Law 93-579), this notice informs you of the purpose, use, and confidentiality of this session.

PURPOSE: The purpose is to collect obtain information about the effectiveness of computer simulations for Army training.

ROUTINE USES: This information will be used to help determine the future use of similar simulations in the Army.

DISCLOSURE: Participating in this session is voluntary and you may choose at any time not to participate. There is no penalty for choosing not to participate.

CONFIDENTIALITY: We will not identify you, or attribute responses to any particular participant made during this session, and we will NOT include your name or other personally identifiable information in our interview notes or report. Likewise, we ask that you respect the confidential nature of this session, by not identifying individual participants with comments made or heard during this session.

We cannot provide "confidentiality" or "non-attribution," to a participant regarding comments involving criminal activity/behavior, or statements that pose a threat to yourself or others. Do NOT discuss or comment on classified or operationally sensitive information during this session.

CONTACT: For further information about this project or your rights as a participant, send e-mail to: ARI_RES@conus.army.mil (type "GBT Unit" in the subject line).

RETAIN FOR YOUR RECORDS

Demographics

1. Age

2. Civilian Education (check highest level attained):

☐ GED ☐ High School ☐ Some College ☐ B.S. /B.A. ☐ Post-college

3. Time in
Service:

Yrs _____

Mos. _____

4. Grade/
Rank:

5. MOS/
Branch

6. Deployment Experience (Provide information for all that apply)

	Position(s)	Time (months)
OIF		
OEF		
Bosnia		

7. Have you participated in VBS2 training before today? ☐ Yes ☐ No

If yes, how many times prior to today have you participated in VBS2 training? _____

8. Using the scale below, indicate how familiar are you with the other Soldiers that you are training with today; please think about familiarity in terms of training together, deployed together, and even just knowing each other in a more social aspect: _____

1 – Completely unfamiliar (e.g., I have not met most of them prior to today). 2 – Slightly unfamiliar. 3 – Neutral. 4 – Slightly familiar. 5 – Very familiar (e.g., I know most of them very well)

Skill Preparedness

Prior to training with VBS2/Now that you have trained with VBS2, please respond to the following items about how prepared you feel to conduct the following tasks; please use the following scale in your assessment of each task:

1 – Unprepared, 2 – Slightly Unprepared, 3 – Neither Unprepared nor Prepared, 4 – Slightly Prepared, 5 – Prepared

- _____ 1. React to Attack (Near or Far).
- _____ 2. Assess the tactical situation.
- _____ 3. Consolidate and Reorganize.
- _____ 4. Locate known or suspected enemy positions.
- _____ 5. Scan my sector appropriately.
- _____ 6. Comply with rules of engagement.
- _____ 7. Control convoy movement while NOT in contact with the enemy.
- _____ 8. Plan a tactical convoy operation.
- _____ 9. Break contact.
- _____ 10. Coordinate activities with your chain of command.
- _____ 11. Communicate with members of your unit.
- _____ 12. Conduct CASEVAC/Recovery Operations.
- _____ 13. React to IED

Training Motivation

Use the following scale for the following items:

1 - Strongly disagree, 2- Disagree, 3 – Neither Agree nor Disagree, 4 - Agree, and 5 - Strongly Agree

1. I enjoyed this training exercise very much.
2. I put a lot of effort into this training exercise.
3. It was important to me to do well in this training exercise.
4. I tried very hard during this exercise.
5. This training exercise was fun.
6. I would describe this training exercise as very interesting.
7. I am satisfied with my performance in this training exercise.
8. I did not try very hard during this exercise.
9. During this training exercise, I was thinking about how much I enjoyed it.
10. This training exercise did not hold my attention.

Task Performance

Please rate your ability to perform each of the following tasks in the simulator at the end of today's training. Please respond using the following scale:

1 – Did Not Attempt, 2 – Very Poor, 3 – Poor, 4 – Good, 5 – Very Good

	Did Not Attempt	Very Poor	Poor	Good	Very Good
1. Move tactically while dismounted.	①	②	③	④	⑤
2. Engage a target with my individual weapon.	①	②	③	④	⑤
3. Enter a building.	①	②	③	④	⑤
4. Drive a vehicle.	①	②	③	④	⑤
5. Change my posture (prone-kneeling-standing)	①	②	③	④	⑤
6. Detect an IED.	①	②	③	④	⑤
7. Scan for threats.	①	②	③	④	⑤
8. Identify civilians.	①	②	③	④	⑤
9. Communicate with others.	①	②	③	④	⑤
10. Locate the source of enemy fire.	①	②	③	④	⑤
11. Mount a vehicle.	①	②	③	④	⑤
12. Distinguish between friendly and enemy fire.	①	②	③	④	⑤
13. Engage a target with a vehicle-mounted weapon.	①	②	③	④	⑤
14. Identify insurgents.	①	②	③	④	⑤
15. Dismount a vehicle.	①	②	③	④	⑤

Unit Process

Use the following scale for the following items:

1 - Strongly disagree, 2- Disagree, 3 – Neither Agree nor Disagree, 4 - Agree, and 5 - Strongly Agree

1. My training unit members and I understand how one another prefer to communicate information to other members.
2. My training unit members and I understand when we need to consult each other.
3. My training unit members and I have a good understanding of the roles played by each member.
4. My training unit members and I sometimes feel confused about how members should work together.
5. My training unit members and I understand how members of the unit should help each other out.
6. My training unit members and I understand how members are going to work together to achieve our goals.
7. My training unit members and I are clear about what tasks each member is responsible for.
8. My training unit members and I are able to prevent conflict from occurring between members.
9. My training unit members and I are able to manage the emotions of the team (e.g. frustration, excitement).
10. My training unit members and I are able to keep confidence high within the unit.
11. My training unit members and I are able to keep motivation high within the unit.
12. When something about the situation is uncertain, more knowledgeable members of the training unit will help the other members make sense of the situation.
13. When one person is struggling with a task, another member of the training unit will step in to help.
14. My training unit is engaged in or “into” our mission.

Unit Cohesion

Use the following scale for the following items:

1 - Strongly disagree, 2- Disagree, 3 – Neither Agree nor Disagree, 4 - Agree, and 5 - Strongly Agree

1. My training unit is engaged in or “into” our mission.
2. My training unit members enjoy working on the mission/tasks we must collaborate on.
3. It is important for my training unit to produce high quality goals.
4. It is important for my training unit members to perform well when given a mission and/or task.
5. The members of my training unit consider the mission/tasks we must work on together as meaningful and important.
6. My training unit expects to benefit from successful mission/task performance.
7. The members of my training unit like each other.
8. The members of my training unit get along with one another.
9. The members of my training unit feel similar to one another.
10. It is important that the members of my training unit socialize while working together.
11. The members of my training unit like being a part of this unit.

Unit Efficacy

Use the following scale for the following items:

1 - Strongly disagree, 2- Disagree, 3 – Neither Agree nor Disagree, 4 - Agree, and 5 - Strongly Agree

1. I am confident that the members of my training unit and I can effectively set contingency plans.
2. I am confident that the members of my training unit and I can develop good strategies.
3. I am confident that the members of my training unit and I can understand the tasks at hand.
4. I am confident that the members of my training unit and I can coordinate effectively with all members.
5. I am confident that the members of my training unit and I can determine our progress towards goals.
6. I am confident that the members of my training unit and I can help each other out if necessary.
7. I am confident that the members of my training unit and I can manage conflict and frustration.

Unit Effectiveness

1. My training unit performs well at most missions/tasks.
2. This training unit is effective.
3. Relative to other training units performing similar functions, this training unit performs:
 - a) Better
 - b) The Same
 - c) Worse

Unit Preparation for Training

Please rate the preparedness of the training unit using a 5-point scale (1 = Very easy; 2 = Easy; 3 = Average; 4 = Difficulty; 5 = Very difficult). Please circle your answer.

You will see anchors below to help you make your assessment. Each rating has several factors for you to consider in your assessment. Please note that not every factor has to be true in order for you to make your rating. In addition, it is likely that some additional factors may influence your assessment of Unit Preparedness. Please do not consider the factors below as the definitive criteria, but instead, use them as a guide to help you make your rating.

Unit Preparedness Rating	Factors to Consider in Rating
1 (Completely Unprepared)	• Arrived at the training center with no prior communication with the training facilitators about training objectives • No definitive training objectives • Spent no time planning for the mission once in the training center
2 (Slightly Unprepared)	• Arrived at the training center with no prior communication with the training facilitators • Had some slightly defined training objectives • Spent no more than 10 minutes planning for the mission once in the training center
3 (Neither Prepared nor Unprepared)	• Talked with training facilitators once to convey training objectives • Spent no more than 1 hour in the training center on mission planning
4 (Slightly Prepared)	• Talked with training facilitators more than once to convey training objectives • Discussed ideas with the training facilitators about how training missions may be modified to meet objectives • Spent at least a half day planning for the mission in the training center prior to conducting mission
5 (Completely Prepared)	• Met with training facilitators multiple times prior to the training exercise • Provided real-world missions for the training facilitators to incorporate into the training • Worked with, and provided suggestions to, the training facilitators on how best to accomplish training objectives • Spent one whole day in the training center conducting mission planning prior to conducting the actual mission

Time Spent on Training

1. Time spent on VBS2 training: _____ minutes
2. Time spent on mission briefing: _____ minutes
3. Time spent on actual mission: _____ minutes

Exercise Management – Leader Involvement

Please answer each of the below questions according to your observations during the unit training.

1. What was the highest level of unit leadership present during the training exercise?

2. Who conducted the mission briefing (e.g., the platoon sergeant, the company commander, a training facilitator)? _____
Aside from the person named in the line above, who else helped with the briefing?

3. If feedback was provided to the trainees during the exercise, who provided it?

4. If someone from the unit participated in the training exercise by serving as headquarters, who was it? _____
5. If someone from the unit communicated with the training facilitators *during* the exercise to contribute to the events that occurred during the mission, who was it? _____
6. Who conducted the AAR? _____

Aside from the person named in the line above, who else helped with the AAR?

Appendix B-1

Skill Preparedness Items – Means and Standard Deviations

Comparison	<i>M</i>	<i>SD</i>	<i>t</i>
React to an attack			
Pre Training	3.96	.91	1.09
Post Training	3.85	1.04	
Assess the tactical situation			
Pre Training	3.89	.90	-.47
Post Training	3.94	.94	
Consolidate and reorganize			
Pre Training	3.84	.94	.14
Post Training	3.83	.99	
Locate known or suspected enemy positions			
Pre Training	3.89	.90	.83
Post Training	3.82	.99	
Scan my sector appropriately			
Pre Training	4.39	.83	.51
Post Training	4.35	.92	
Comply with rules of engagement			
Pre Training	4.12	1.06	-1.69
Post Training	4.29	.91	
Control convoy movement while NOT in contact with the enemy			
Pre Training	4.08	.93	-.64
Post Training	4.14	.96	
Plan a tactical convoy operation			
Pre Training	3.50	1.15	-2.61*
Post Training	3.78	1.06	
Break contact			
Pre Training	3.77	1.05	-.54
Post Training	3.82	.99	
Coordinate activities with your chain of command			
Pre Training	3.84	.96	-.64
Post Training	3.90	.98	
Communicate with members of your unit			
Pre Training	4.20	.82	.68
Post Training	4.13	.92	
Conduct CASEVAC/Recovery operations			
Pre Training	3.68	1.05	-.66
Post Training	3.75	1.02	
React to IED			
Pre Training	3.94	1.02	-.98
Post Training	4.04	.99	

* $p < .01$