Virtual Supplementation of Tactical Decision Making Training

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ABSTRACT

A fundamental aspect of training U.S. Army infantry Platoon Leaders (PLs) includes providing junior officers with opportunities to make leadership decisions during realistic scenarios and giving them constructive feedback about the timeliness and effectiveness of their actions. Traditionally, this has been accomplished during live exercises in the Infantry Basic Officer Leader Course (IBOLC). However, live exercises take extensive time and resources to conduct. Given resource constraints and the typical student throughput IBOLC must maintain, any given student may only have one or two opportunities to practice in the role of PL during a live exercise. The current research attempts to increase the number of opportunities for PL decision making practice by examining the effectiveness of virtual tactical decision making exercises (VTDEs) as supplements to live exercises during IBOLC.

Six VTDEs were piloted with IBOLC graduates. Each VTDE provided a brief overview of a scenario in which participants played the role of a PL. Each overview detailed an initial plan of action being conducted by the PL's unit. Following the overview, participants were provided ongoing updates to the unfolding situation via audio and textual "injects." The participants were asked to monitor the situation and when/if necessary to press an "override" button, indicating they would significantly deviate from the current plan. After overriding, participants would be asked to provide their rationale for overriding as well as to indicate what changes they would make to the plan. Infantry subject matter experts identified a window of time within each VTDE (typically consisting of 3 to 4 consecutive injects) wherein participants should ideally override the plan. After responding to each of the VTDEs, participants were provided with feedback on the timeliness and effectiveness of their actions. Results indicated participants benefitted from the use of the VTDEs and the method holds promise for supplementing live exercises.

ABOUT THE AUTHORS

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Ray Morath, PhD, a Fellow with ICF International, has more than 25 years of experience managing and contributing to applied research projects in the areas of performance assessment, leader development, job analysis and competency modeling, test development and validation, and training development and evaluation on behalf of U.S. Army and other DoD clients. He holds a Ph.D. in Industrial/Organizational Psychology from George Mason University.

Joanne D. Barnieu, Senior Technical Specialist at ICF, has twenty-six years of experience in education and instructional design with extensive work on Defense-related projects. For eleven years, she has served as the lead instructional designer for emerging training technology projects and supported the design and execution of training effectiveness studies for military personnel for the Army Research Institute, Army Research Laboratory, and PMTRASYS. Ms. Barnieu ensures sound instructional design principles related to high-end technology-based training systems design, including serious games development, simulations, and haptic devices and has designed several prototypes used in military training research. She holds a Bachelor of Arts degree in French Education from Franklin and Marshall College and is pursuing a Master of Science degree in Organizational Development and Psychology at St. Joseph's University.

Jonathan Bryson is a Manager at ICF with over 10 years of applied research experience. He formerly served as an officer in the United States Army National Guard and Reserves where he led platoons, conducted training programs, mentored subordinates, and advised senior level personnel. He also deployed for a year during Operation Iraqi Freedom. In addition, he has a Master of Arts degree in Industrial / Organizational Psychology from George Mason University.

John Grantz is a retired Lieutenant Colonel with 21 years of military experience. He has previously served as the Infantry Basic Officer Leader Course Battalion Commander (IBOLC) and as a Senior Platoon Trainer at IBOLC. Additionally he served as an instructor and course director at the Maneuver Captains Career Course and the Chief of Military Training at the United States Military Academy at West Point. While serving as the IBOLC commander, Lieutenant Colonel Grantz led the staff and faculty to implement changes to the course resulting in new methods of training, including implementation of the Army's Adaptive Soldier & Leader Training and Education (ASLTE) program, resulting in outcomes versus process-based training.

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INTRODUCTION

The Army's Infantry Basic Officer Leader Course (IBOLC) has the primary goals of educating, training, and inspiring agile, adaptive, and ready leaders. One of the primary means of achieving these goals has involved providing IBOLC students with live training exercises—to supplement the classroom training that is part of the IBOLC curriculum. Such exercises are conducted in field settings in which students take on various roles (e.g., team or squad member, Team Leader, Squad Leader, Platoon Sergeant, or Platoon Leader). Students are rotated among the various roles when conducting the live field training exercises (FTX), such that each student is provided opportunities to develop awareness and knowledge of each of the various roles/positions of a platoon. Additionally, FTXs must provide specific opportunities to develop skills required of the platoon leader (PL). Unfortunately, there are typically few opportunities within the 17 weeks of IBOLC for a student to take on the role of PL. Simply put, with approximately 40 Soldiers in an infantry platoon, a student can only take on the role of PL once every 40 live training exercises. Additionally, if a student performs to standard during his/her training opportunity (i.e., "look," the term used for observation and evaluation of student) in the role of PL and does not require additional remediation opportunities/looks, he/she may only obtain one or two such looks during IBOLC. IBOLC instructors' decisions to focus attention to other students does not mean initially successful students have nothing left to learn, however. PL skills are complex and the opportunities in which students can be provided constructive feedback regarding the timeliness and effectiveness of their actions and decision making processes are limited by the number of looks they receive. Thus, students would benefit from additional training exercises in which they are in the PL role, are able to face realistic problems/scenarios, make decisions, provide direction and leadership to their platoon, and then receive feedback regarding their performance. IBOLC leadership has sought methods to expand those opportunities.

The current research focuses on the development and pilot testing of Virtual Tactical Decision Making Exercises (VTDEs) that would serve to increase the number of decision making opportunities students would receive in IBOLC as well as the type and breadth of the various scenarios in which these decisions are required in the role of PL—across a wide range of performance environments (e.g., Platoon Attack; Urban Operations; Platoon Live Fire; Counter-Improvised Explosive Device (IED); and Combined Competitive Maneuver Exercise). A current limitation of IBOLC is that students can only experience live training (in the role of PL) in one or two of the above domains. The use of VTDEs would enable students to practice and receive feedback on their decision-making performance across each of these domains.

Benefits of Virtual Scenario-Based Training

Virtual or simulated training has become an important means of training in both military and civilian settings and has a number of advantages when compared to live training because it offers the ability to do the following:

- Train a large number of students within a controlled environment
- Increase the number of practice opportunities, increasing the number of opportunities to receive feedback
- Provide more varied scenarios (live practice is limited by environment and actors—which is very costly)

- Make mistakes in a safe environment (reduces the risk to personnel and equipment involved in live training)
- Create high stress situations (psychological fidelity of timing, explosions, casualties) that may also be very difficult and costly to replicate in live settings)

As virtual reality and serious games have emerged in educational settings over the last two decades, there has been skepticism over whether these methods could be as effective as live training with an instructor. However, research comparing the effectiveness of traditional training to virtual reality simulation training in a technical training task found that both methods were equally effective (William, Vidal, & John, 2016). Furthermore, there is an abundance of research to support virtual learning and serious games in terms of their ability to increase trainee motivation and engagement, increasing the desire to learn, the desire to practice, and training related outcomes (Mautone, Spiker, Karp, & Conkey, 2010; Topolski, Leibrecht, Cooley, Rossi, Lampton, & Knerr, 2010). Particularly in the military, young service men and women who have grown up in the computer gaming era enthusiastically receive this type of instructional approach (Ricci et al, 1996). Repetition and practice (e.g., 10,000 hour rule) are required to achieve expert level mastery (Ericsson, Krampe, & Tesch-Romer, 1993; Gladwell, 2008), and virtual reality environments provide learners the self-directed ability to practice skills in variety of scenarios with increased complexity.

Research shows that embedding and delivering assessments within these environments is critical for learning (Bedwell & Salas, 2010; Johnson & Mayer, 2009), and advances in intelligent tutoring as well as micro-sequencing (e.g., providing guidance or hints) and other scaffolding techniques provide learners immediate feedback without the need for instructor intervention. In addition, graphic design and animation capabilities within virtual environments induce a sense of presence (e.g., "being there") and immersion through multiple sensory inputs (e.g., visual, auditory) related to the virtual environment (Rebelo, et al., 2012) and social emotional engagement (Gorini et al., 2011; Diemer et al. 2015), and also allow for real-time assessment of participants' responses closely resembling their real-world functional abilities (Parsey & Schmitter-Edgecombe, 2013). Graphic design and animation capabilities within virtual environments creates stress-producing experiences (e.g., a comrade in distress), in which the learner can actually see or hear what it is like to be in that situation. For example, in their book chapter on individual and team decision making under stress, Cannon-Bowers and Salas (1998) stated that "Demands on the human decision maker in military tactical environments are becoming more complicated... Modern combat scenarios are often characterized by rapidly evolving and changing conditions, severe time compression, and high degrees of ambiguity and uncertainty." (p. 18). The authors identified a variety of environmental stressors that influence decision making (e.g., multiple information sources, rapidly changing scenarios, requirements for team coordination, performance pressure, time pressure, high information load, auditory workload, and threat) that, when incorporated into training (live or virtual), improve the psychological fidelity and quality of the training experience. Virtual reality can provide learners an interior view of explicit details that cannot be produced in a live environment (e.g., the inside of a severed leg). Although live environments can produce stress, provide practice, and be engaging, access to repeated practice is limited, feedback can be delayed, stress production is limited to live actor capabilities (e.g., play dead), and coordination of the events is costly. In summary, advances in virtual environment technology can be leveraged in assessments to present dynamic, consistent, and precise stimuli, creating an immersive experience for learners, and capture responses similar to those in real life (Parsons, 2015). Thus, the use of virtual reality enables assessment platforms that create a balance between the need to exert research control over key variables and naturalistic observation, thus enhancing ecological validity (i.e., the extent to which research findings from laboratory settings can be generalized to real-life processes normally occurring in people's daily lives) (Campbell et al., 2009; Matheis et al., 2007; Jovanovski et al., 2012a, b).

NEEDS ANALYSIS

A needs analysis was conducted to inform the development of the VTDEs. Interviews were conducted with IBOLC cadre (11 officers and NCOs) and students (five lieutenants) at Fort Benning to identify areas in which IBOLC students tend to struggle or fail to meet expectations and to provide examples (i.e., critical incidents) highlighting these areas of struggle or performance deficiencies. The cadre members were asked to identify those areas in which lieutenants tend to exhibit performance deficiencies during their first assignment as a platoon leader, and to provide descriptions of these critical incidents as well.

The needs analysis revealed that decisiveness and adaptability were the most frequently cited areas of need. For example, half of all participants (including three lieutenants) described decisiveness as a key area where lieutenants struggle. The reasons given for why decisiveness was a problem area revolved around a lack of opportunities to practice decision making during IBOLC, a fear of making mistakes that could impact their IBOLC grade, and lieutenants always wanting more information before a decision could be made. In addition to problems regarding lieutenants delaying their decision making (i.e., taking too long to make a decision) in order to gather more information, participants also described (though less frequently) the problem of individuals making rash or too hasty decisions. The second most frequently cited area of struggle involved adaptability—or more specifically, a lack thereof in lieutenants. Almost 40% of those interviewed identified the lieutenants' inability to adapt to the changing environment as a key area of struggle. Several participants described examples in which lieutenants would make a plan and then go about executing the plan regardless of new information and situational changes that warranted the lieutenants modifying or adapting their plans.

DESCRIPTION OF THE IBOLC TACTICAL DECISION MAKING TRAINING TOOL

Based on the outcomes of the needs analysis, scenario storyboards were constructed by Army Subject Matter Experts (SMEs)—with extensive tactical combat infantry experience in deployed operational settings—who often used actual scenarios/incidents from deployed operational settings as the basis for the VTDE storyboards developed for the tool. The storyboards emphasized stress-inducing features such as rapidly evolving conditions, time pressure, multiple information sources, realistic audio in terms of battlefield sounds, and threat/danger. From these, six VTDEs were developed to align with one of the three modules or phases (i.e., Red, White, and Blue) of IBOLC to emphasize various aspects of the PL role. In addition, a platform for providing feedback in the form of After Action Reviews (AARs) was developed that included doctrinal references and other materials appropriate for Lieutenants' self-development.

Phases of IBOLC

Red: Foundational Infantry Skills Training (e.g., Marksmanship, Land Navigation)
White: Intermediate Infantry Skills Training (e.g., Troop Leading Procedures, Operation Orders)
Blue: Advanced Infantry Skills Training (e.g., Urban Operations, Platoon Live Fire Exercises)

The VTDE tool provided students/participants with scenarios by which they could be assessed, opportunities for PL-specific practice, and individualized feedback regarding their decision-making and adaptability skills. The tool supplemented the IBOLC live leadership assessments by providing students with additional means of practicing and enhancing these leadership skills and capabilities in 'low-stakes' and 'low-cost' settings. The tool consisted of a tutorial or instruction section; a VTDE selection screen that allowed participants to choose VTDEs from either the Red, White, or Blue phases; six VTDEs (3 Red, 1 White, 2 Blue); and AARs after each phase to provide feedback regarding participant performance on the selected VTDEs.

After logging into the tool, the participant was taken to the VTDE Selection screen where they could choose to review the tool tutorial for information regarding the purpose of the tool and instructions for how to complete the VTDEs. After completing the tutorial, the participant selected the first VTDE to complete (e.g., R1 for Red Phase (Figure 1)). After completing the Red Phase, the participant proceeded to the White and Blue Phases.

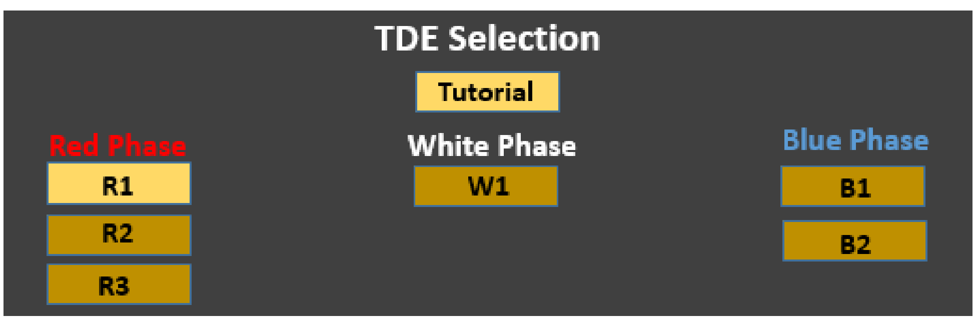

Figure 1. VTDE Assessment and Training Tool: Selection Screen

The participant—playing the PL role—was presented with background information regarding the particular scenario of the VTDE (see Figure 2). This background information typically included guidance from the PL's commander, a detailed plan of action, or an objective for the PL's unit.

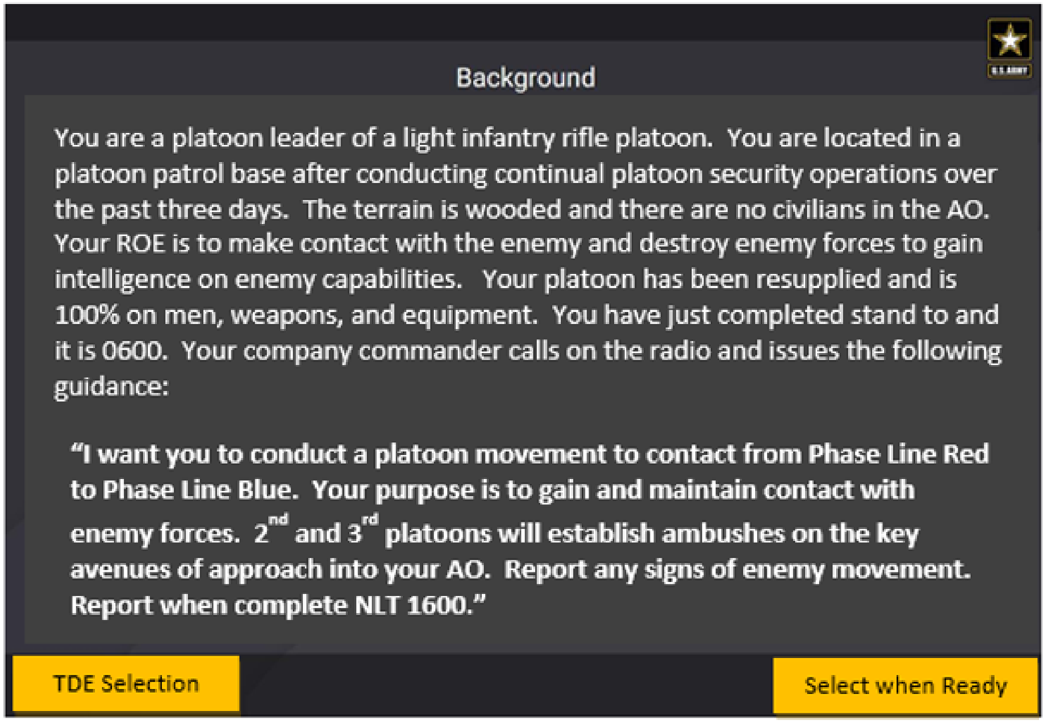

Figure 2. VTDE Assessment and Training Tool: Background Information Screen

Following the review of the background information the participant was provided with a series of 8 to 12 injects (or updates) to the evolving/unfolding scenario, with each inject screen and its accompanying information and stimuli presented to the participant for approximately 15 to 30 seconds (see Figure 3 for an example).

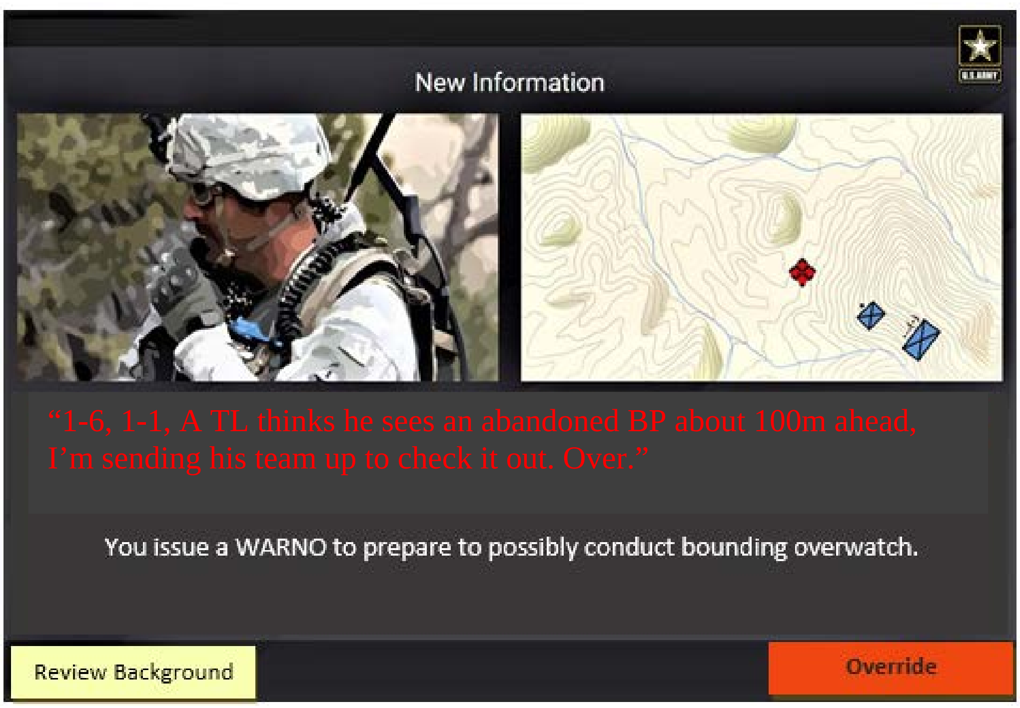

Figure 3.VTDE Assessment and Training Tool: Inject Screen

Each inject screen consisted of: 1) a stylized image in the upper left-hand portion of the screen representing events taking place at that time in the scenario; 2) a topographic map or satellite imagery in the upper right portion of the screen that provided the platoon's current location (including location of each squad of the platoon at that particular point in the scenario (this map/imagery also included other relative features, such as enemy units, villages, or buildings); and 3) text in the lower half of the inject screen that provided information (to include radio communications) occurring at that point during the VTDE. In addition to the stylized image, map, and text, injects also provided audio of the communications, radio transmissions, and environmental/ambient sounds (e.g., vehicle engines, doors closing, incoming artillery impacts) to produce a virtual experience that was stress inducing and high in psychological fidelity. As noted by Goldstein (1993) in his seminal training text, "…the purpose of the simulation is to produce *psychological fidelity*—that is, to reproduce in the training tasks those behavioral processes that are necessary to perform the job." (p. 260).

Participants were instructed to monitor the series of unfolding injects and when/if necessary to press an "override" button, indicating that a fundamental change in the situation had taken place requiring the PL to intervene in the unfolding series of events. After overriding, participants were prompted to provide their rational for intervening as well as to indicate what action they would take upon intervening (see Figure 4).

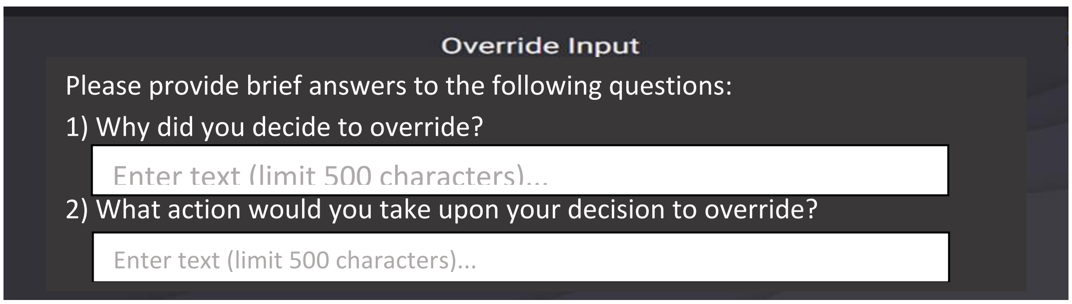

Figure 4. VTDE Assessment and Training Tool: Override Input Screen

After providing their open-ended responses to these prompts, another screen prompted them to rate the criticality of a number of separate elements/cues (on a 5-point scale ranging from not critical to very critical) in terms of how critical that cue was to their override decision (see Figure 5). They were then asked to explain what about that critical element/cue influenced their decision to override.

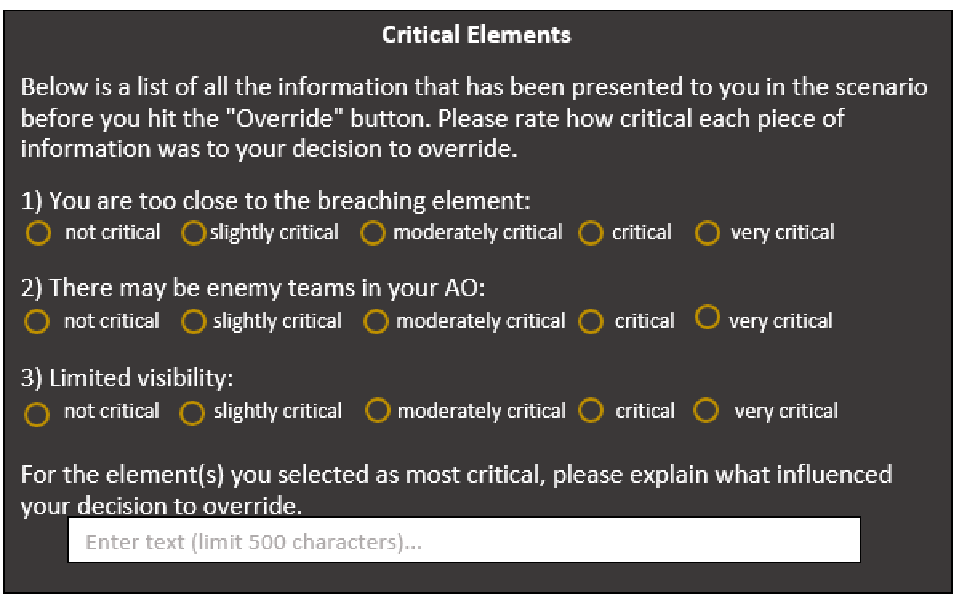

Figure 5. VTDE Assessment and Training Tool: Critical Elements Screen

Next, the participant was presented with a multiple choice question in which they selected the most appropriate course of action from among a series of viable courses of action at the point in which they intervened (i.e., clicked the 'override' button) (see Figure 6).

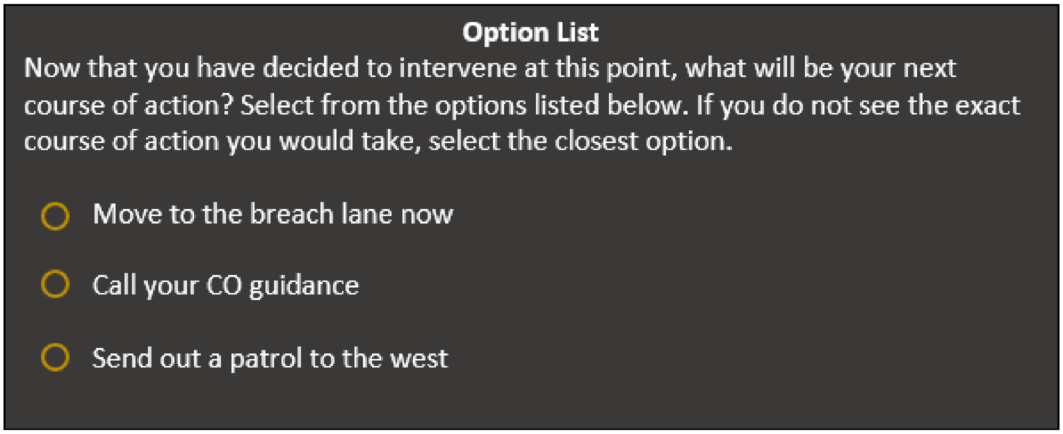

Figure 6. VTDE Assessment and Training Tool: Option List Screen

There was an optimal window of time (typically 2 to 4 injects) within each VTDE in which to intervene. In order to correctly complete the VTDE, the participant had to click the "override" button during this optimal inject window and select the most appropriate action from among the alternatives. After responding to each of the VTDEs of the phase, participants were provided with feedback (in the form of AARs) on the timeliness and effectiveness of their actions regarding each of the VTDEs of that phase (see Figure 7). Participants were also given the option of retaking each of the VTDEs in a 'practice' mode as many times as they chose.

Figure 7. VTDE Assessment and Training Tool: After Action Review Screen

PILOT TEST AND RESULTS

The tool was pilot tested with 63 students who had recently graduated from IBOLC. The data from the pilot test were analyzed and scores were computed for each participant regarding:

- **Timing of Override Decision – within or outside the "Zone of Adaptability:"** For each VTDE, the timing of the participant's decision to override either fell within the acceptable zone of adaptability (i.e., decision made during the appropriate window of time in the scenario) or outside (i.e., either under (to early) or over (too late) the zone of adaptability). Participants who chose to override within the acceptable zone of adaptability received a point for the timing score and those who overrode outside the acceptable zone received no points.
- **Decision Quality:** After participants chose to override in a VTDE, they completed a multiple-choice question to select the best course of action at that point. Only decisions made within the zone of adaptability were scored (i.e., participant decisions were not scored for those who overrode too early or too late). Each correct answer received a point and an incorrect answer received no points.

Once in operational use, participants who complete a series of VTDEs will receive timing and decision quality scores/feedback for each VTDE they complete. They will also receive an assessment timing score (i.e., percent of

VTDEs within the zone of adaptability) and an assessment decision score (i.e., percent of TDEs within the zone of adaptability where a correct course of action was selected), summarizing their performance across the VTDEs they complete.

Table 1 below summarizes the item descriptive statistics for both the timing and decision quality scores by VTDE and the item-total correlations. Items R1, W1, and B2 were somewhat easier than R2, R3, and B1, with the percentage of participants selecting the correct answer for the timing score at or above 40 percent and those for the decision score at or above 50 percent. Only a small percentage of participants chose to override within the zone of adaptability for R2, R3, and B1 and few participants answered the multiple-choice question correctly. On average, participants responded within the zone of adaptability about a quarter of the time. Of the subgroup responding within the zone of adaptability, participants chose the correct course of action about 60% of the time.

Table 1. Item Descriptive Statistics

VTDE	Timing Score				Decision Score			
	Number of Participants	Mean	Standard Deviation	Item-total *r*	Number of Participants	Mean	Standard Deviation	Item-total *r*
R1	63	.40	.49	.62**	25	.88	.33	.60**
R2	63	.14	.35	.47**	9	.22	.44	.65
R3	63	.14	.35	.53**	9	.00	.00	-
W1	63	.40	.49	.53**	25	.48	.51	.69**
B1	63	.03	.18	.22	2	1.00	.00	-
B2	63	.44	.50	.48**	28	.61	.50	.57**
Total	63	.26	.20	-	48	.59	.39	-

**** p < .01; Item-total *r* = correlation of the item score with the total assessment score;**

The item-total correlations for the timing score are at or above .50 for all VTDEs except for B1 due to the low percent of responses within the zone of adaptability. For the decision quality score, the three VTDEs that functioned best (i.e., R1, W1, B2) had item-total correlations at or above .50. The other three VTDEs either had low variability in the decision score or had an N size that was too small.

VTDE R1: Platoon Assault

VTDE R1 was one of the items that performed particularly well in terms of participant response pattern (see Figure 8 below). A quarter of participants chose to override at inject point R1g, which is the first inject over the zone of adaptability. This is consistent with the VTDE design intent for the inject to serve as a "wake-up call" (i.e., 1st Squad Leader reports a second casualty within his squad and the enemy rate of fire is increasing) and pose a serious consequence for failing to take action. Of the 25% of participants who chose to override at inject point R1g (one inject too late), nearly all reported that their override reason involved the squad/unit taking on too many casualties, the squad/unit getting outgunned, and/or the fire superiority of the enemy.

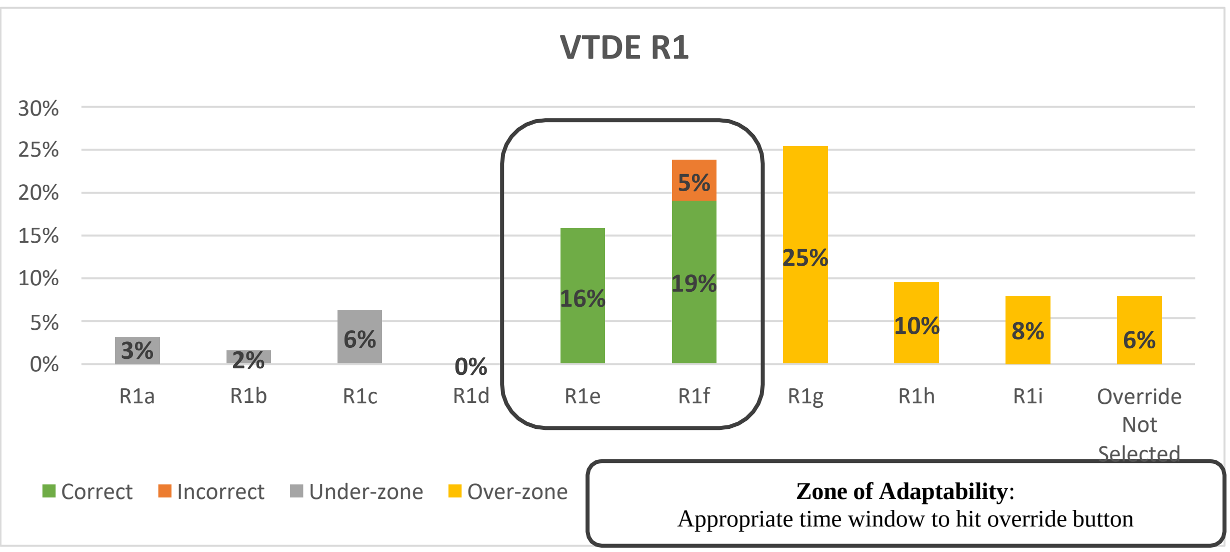

Figure 8. VTDE R1 (Platoon Assault) Results

This item was able to identify a group of participants who failed to take timely action—which would be valuable information, whether it be for IBOLC instructors attempting to identify students who require additional training, or for the student attempting to identify weaknesses for subsequent self-development. Figure 8 shows that the vast majority of participants who chose to override at the appropriate time (i.e., within the zone of adaptability at injects e or f) selected the correct course of action (identified in green) versus those that selected an incorrect course of action (identified in red).

Participant Reaction Survey Results

Table 2 presents a summary of participant responses (N = 59) to the tool reaction survey that was administered immediately following completion of the VTDE scenarios. Overall, perceptions of the assessment were very positive. On average, over 80% of participants viewed the assessment favorably across all survey items. More than 90% of participants held positive perceptions toward the realism and job relevance of the VTDEs. Items related to the format and content clarity of the VTDEs were rated less positively: Only 64% of respondents reported having no trouble understanding or responding to the VTDE format, and over 15% of respondents did not feel the contents were clear. The authors speculate that these findings may be due to some percentage of participants not fully reading/reviewing the instructions and expecting to merely 'get-it' upon starting the tool. While only 63% of participants agreed (and over 20% disagreed) that they would like to complete the same VTDEs again. Notably, approximately 85% of participants indicated interest in completing additional VTDEs with new scenarios.

Table 2. Tool Reaction Survey Results

Tool Reaction Survey Item	% Agree	% Neutral	% Disagree
Q1- Completing the Tactical Decision Exercise (TDE) Assessment and Training Tool was a worthwhile use of my time.	83 %	15%	2%
Q2- The Scenarios presented in the TDEs are realistic.	91	7%	2%
Q3- The Scenarios presented are relevant to my job.	98	2%	0%
Q4- I had no trouble understanding or responding to the format of the TDEs.	64	22%	12%
Q5- The contents of the TDEs was clear to me.	73	12%	15%
Q6- The media (i.e., graphics, audio clips) included in the TDEs was appropriate.	85	12%	3%
Q7- I found the TDEs challenging.	73	22%	5%
Q8- I found the TDEs engaging.	90	8%	2%
Q9- I would like to complete the same TDEs again to gain additional practice / repetitions in enhancing my tactical decision making.	63 %	15%	22%
Q10- I would like to complete additional TDEs with new scenarios to enhance my tactical decision making skills.	85 %	13%	2%
Q11- I believe learning from the TDEs can be directly applied to my job.	88	10%	2%

Participants also responded to an open-ended question regarding what they liked most about the tool. Example responses cited: 1) realism and job relevance of the scenarios, 2) stressors/pressures associated with the scenarios, and 3) the desire to be able to complete more VTDEs/scenarios. Additional features that they liked are provided below:

Realism and Job Relevance:

--*The situations were realistic and easy to relate to what I imagine our jobs will be as future Platoon Leaders.*

--*Very realistic scenarios that allow us to practice making fast decisions without having to go through the actions of a full mission which are very time and resource consuming. Great training.*

--*What I like most about the assessment tool is the realism about each scenario. It really provides an eye-opener on how missions will feel like and also gives an insight on what I should focus on.*

Stressors/Pressures

--*It really provides an eye-opener on how missions will feel like and also gives an insight on what I should focus on.*

--*The time and pacing of the scenarios demanded critical thinking and quick response time...*

--*It was challenging and engaging while forcing the PL to make decisions rapidly.*

--*Good to practice stress based decisions*

--*The timed aspect. I had to make a decision quickly. I often found myself intrigued with what would happen next and struggled on whether I should act now or see what happens.*

--*Multiple platforms of stimuli, timed decision making processes.*

Desire for more VTDEs:
--More scenarios…
--I'd like more… so I could do this as part of my self-development.
--More TDEs and more scenarios please.

Examples of various features that participants liked about the tool:
--I liked the whole concept of having to decide when, if at all, to intervene into a combat situation. It simulated a STX (i.e., Situational Training Exercise) lane well enough that I was engaged and treated it like an actual scenario.
--It was challenging and engaging while forcing the PL to make decisions rapidly.
--I think that this is a good way to engage the minds of our future infantry leaders…

Summary of Pilot Results

The six VTDEs of the prototype tool ranged in difficulty with three of the items (R1, W1, B2) found to have timing accuracy at or above .40 (i.e., 40% or more of participants correctly chose to override within the zone of adaptability) and decision accuracy at .48 or higher (i.e., approximately 48% or more selected the best course of action upon overriding). The other three items (R2, R3, B1) were judged to be more difficult in that smaller percentages of participants overrode within the zone of adaptability (resulting in lower timing accuracy scores). Of this group, a small percentage chose the correct course of action (resulting in lower decision accuracy scores).

IBOLC Leadership was extremely pleased with pilot test results illustrating that the tool included items/scenarios that were of moderate difficulty as well as high difficulty. The research team—through a review of the override percentages at each inject and the participant's stated reasons for overriding at these injects—identified methods for altering the injects of the more difficult items (i.e., via subtle changes to the inject information cues/information both within and outside the zone of adaptability) to make them somewhat less difficult. However, the IBOLC Leadership suggested that no changes be made to these more difficult items as they provide the cadre—and students—with the opportunity to identify key areas of future developmental focus—however challenging they might be. Simply put, just because these scenarios are highly difficult does not mean that IBOLC should not employ them. Similarly, these more difficult items also allow for a means of identifying the smaller subset of high performing (i.e., high potential) students from the larger body of students. These results, along with the results of the tool reaction survey, suggest that the prototype tool holds promise for supplementing live exercises as a means of assessing, developing, and providing performance feedback on leader adaptability and decision making.

DISCUSSION AND IMPLICATIONS

The effort to design, develop, and test the tool identified various potential strengths of the tool:

<u>Participants as well as IBOLC leadership and trainers view the tool as highly effective in developing decision making skills</u>: Participants as well as IBOLC Leadership and IBOLC trainers had very favorable reactions to the tool in terms of the realism and job relevance of the scenarios. In meetings with IBOLC leadership and trainers to review the tool capabilities as well as the pilot test results, the IBOLC leadership and trainers viewed the tool as a highly useful resource regarding the assessment and development of tactical decision making skills in IBOLC students. The vast majority of participants (i.e., over 80%) also agreed that learning from use of the tool applied to their job and that they would like to complete additional scenarios to enhance their decision making skills. Participant responses regarding perceived realism also suggest that the VTDE is a more cost-effective level III Interactive Multimedia Instruction (IMI) form of virtual training that holds great promise due to sequenced injects of stylized still images with supporting text and audio that transition from one to the other in a rapidly evolving nature similar to that experienced on the battlefield). These responses indicate that the VDTE might be able to provide required psychological fidelity needed for effective training outcomes at a fraction of the cost to produce physical high-fidelity level IV IMI trainings.

<u>Participant decision making process</u>: The tool prompts participants to explain their override decision as well as articulate the action that they would take upon overriding—allowing for cadre members to better understand 'why' a student acted in particular manner (whether they made the correct decisions or not). The insights and understanding regarding the participant's thought processes can be used by cadre to better tailor subsequent instruction/training. Asking participants to immediately reflect upon and explain their actions and decision processes, combined with the

immediate performance feedback that students receive regarding their performance on each scenario/VTDE, serve to both increase participant self-awareness and learning/development.

<u>Time-bounded decision making</u>: The tool requires participants to process incoming information from a variety of streams (e.g., text description of events, radio transmissions, position of platoon and enemy elements on maps, battlefield sounds (e.g., recognition of enemy machine gun (PKM) indicates size and strength of enemy element; recognition of Bangalore torpedo explosion indicates need for platoon movement) across the evolving scenario and to react appropriately. The participant cannot slow or halt the oncoming stream of information and stimuli—which realistically simulates the flow and evolution of information and stimuli that must be perceived and processed by PLs dealing with such tactical scenarios in deployed settings. A key strength of this tool is the requirement that the participant accurately perceive and process this oncoming flow of information and make a decision within the appropriate window of time.

<u>Individual and class-level skills gap diagnostics: </u>The qualitative data (e.g., reasons behind override decision, cues influencing override, and course of action) as well as quantitative data regarding timing and decision quality, can be used by cadre members to identify gaps and guide subsequent training for individual students. Similarly, cadre members and course managers can also use these data points to track the performance of entire cohorts across the various phases and modules of IBOLC. These data may guide reinforcement of particular concepts or skills within a class. Additionally, if enough converging data is collected across cohorts, these findings may guide possible modifications or refinements to IBOLC curricula.

<u>Features of the tool that align with and/or reinforce adult learning principles</u>:

- Immediate performance feedback to enhance self-awareness: The tool provides immediate performance feedback to participants in the form of AARs for each scenario. The feedback—which can be viewed by the participant as well as the trainer—is highly detailed, student centered, and doctrinally sound.
- Psychological fidelity: Scenarios were designed to require 'real-time' decision making in highly realistic and stress-inducing environments The participant feedback (via survey ratings and comments) regarding the perceived realism of the VTDEs suggests that the tool was successful in providing a virtual environment that is high in psychological fidelity—an important component of a successful training simulation.
- Opportunity to practice to enhance self-development: The tool provides participants with the opportunity to practice decision-making (with the type of situations/scenarios that they will face in their job as PL) in a safe, controlled, and low-cost setting. The tool also allows students to 'retake' or 'replay' scenarios.
- Just-in-time training that can be accessed via table or smart phone: Participants can access the tool via laptop, tablet, or smartphone. They can also access the tool to perform self-development or remediation training to address an identified deficiency, and they can also access the tool immediately prior to conducting live training.

The results of the pilot study appear to validate findings from the needs assessment regarding IBOLC student deficiencies regarding their ability to adapt to changing conditions and make timely and effective decisions. The VDTE showed the average percentage of participants overriding within the zone of adaptability was only 26%, while 25% overrode too early. Those overriding too late came to 49%. Thus, in most cases when participants do not override within the zone of adaptability, they are waiting too long or are missing the cues that should lead them to intervene before situations degrade to an unsalvageable degree.

One of the limitations of the tool is that the research team was unable to collect/access student IBOLC performance data with which to conduct criterion-related validation of the tool (i.e., does performance on the tool correlate with other dimensions of IBOLC performance). Subsequent efforts will seek to obtain this performance data. Another limitation of the tool was the small number of VTDE scenarios developed to date. This small number of items also limited the research team's ability to assess the reliability and validity of the tool.

In conclusion, the prototype tool demonstrates great promise as a highly cost effective and efficient means of assessing and developing tactical decision-making skills in IBOLC students. It provides a valuable supplement to the extremely limited number of live training exercises that students are currently provided within IBOLC in which they are in the decision-making role of PL and increases the number of assessment and practice opportunities. Additionally, the VTDE produced very high levels of perceived realism, job relevance, user engagement, and stress (i.e., high psychological fidelity) at a fraction of the production cost of Level IV IMI Simulations.

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