U.S. Army Research Institute
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Research Report 1868

Accelerating the Development of Adaptive Performance: Validating the Think Like a Commander Training

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14. ABSTRACT *(Maximum 200 words)*:

The contemporary operational environment and the Global War on Terrorism require junior leaders in the U.S. Army to exhibit high levels of adaptive performance. This research examined whether or not the tactical environment of Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) contributes to the development of more adaptive leaders. In addition, the level of adaptive thinking for lieutenants, captains, majors, and lieutenant colonels was investigated. The results revealed that leaders with OIF or OEF experience performed better on a test of adaptive thinking, and that performance increases with rank. The results support the validity of the adaptive thinking measurement instrument and the relevance of the Think Like a Commander training program. In addition, the results suggest that deliberate training methods may be more effective and efficient than live, virtual, or constructive experiential learning environments.

15. SUBJECT TERMS
Adaptive Thinking, Adaptive Performance, Think Like a Commander, TLAC, Battle Command skills

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Personnel Performance
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ACCELERATING THE DEVELOPMENT OF ADAPTIVE PERFORMANCE: VALIDATING THE THINK LIKE A COMMANDER TRAINING

EXECUTIVE SUMMARY

Research Requirement:

Complex missions, urban environments, civilian populations, coalitions, asymmetrical enemies, and the requirement to perform the full spectrum of military operations are contributing to the demands placed on our junior leaders. The ambiguous, changing nature of the contemporary operational environment and the Global War on Terrorism require the development of agile, adaptive leaders. Recent reports suggest that events in Iraq (i.e., Operation Iraqi Freedom [OIF]) and Afghanistan (Operation Enduring Freedom [OEF]) are contributing to an increase in adaptive thinking skills in leaders. The present research explores differences in adaptive thinking between officers of various ranks who have been deployed to Iraq and Afghanistan compared to officers who have not, in an attempt to validate the Think Like a Commander (TLAC) adaptive thinking training and performance measurement method. The TLAC approach uses deliberate practice concepts to train a key component of adaptive thinking – how to quickly evaluate a rapidly changing tactical situation using the expert behaviors. The training uses cognitive battle drills to apply deliberate practice training concepts to battlefield thinking skills and allows officers to model their battlefield understandings, plans, visualizations and decisions after expert tacticians' thinking patterns.

Procedure:

One-hundred and forty-three officers (lieutenant through lieutenant colonel) completed three challenging and dynamic tactical problems drawn from the TLAC training program. The tactical situations were used to assess each participant's level of adaptive thinking. Performance evaluations were completed by two separate raters. Participants were classified by rank and whether they were previously deployed to Iraq or Afghanistan. A 2x4 (deployment by rank) Analysis of Variance was completed to test the significance of differences between the groups. In addition, the results were compared with previously obtained TLAC training data.

Findings:

Officers with Iraq or Afghanistan deployment experience performed significantly better on the adaptive thinking task. For the officers without OIF or OEF experience, performance showed a consistent increase with rank. For the officers with OIF or OEF experience, the performance of captains and majors converged with that of the lieutenant colonels. The analysis revealed no difference in performance between lieutenants with or without OIF/OEF experience.

Utilization and Dissemination of Findings:

The research supports the use of situational judgment test methods to measure complex battle command skills such as adaptive thinking in tactical situations. The data also support the conclusion that the TLAC program trains a skill that is relevant to OIF and OEF performance.

Comparing the results of the current research to data obtained using the adaptive thinking training as a part of the TLAC formal training program suggests that deliberately training complex cognitive skills may be substantially more effective and efficient than the experiential learning methods that take place in live and virtual environments. These findings can be used by trainers to develop methods for measuring and deliberately training other cognitive battle command skills. The results were briefed to the Commander of the U.S. Army Training and Doctrine Command in January 2006, to representatives of the U.S. Army Armor School and 16th Cavalry Regiment in February 2006, and the to Commanding General and Deputy Commanding General, Fort Knox, and the Deputy Commanding General, Fort Benning in September 2006.

ACCELERATING THE DEVELOPMENT OF ADAPTIVE PERFORMANCE: VALIDATING THE THINK LIKE A COMMANDER TRAINING

CONTENTS

List of Tables

List of Figures

ACCELERATING THE DEVELOPMENT OF ADAPTIVE PERFORMANCE: VALIDATING THE THINK LIKE A COMMANDER TRAINING

Introduction

A major focus of the U.S. Army and its transformation effort has been the development of adaptive, agile, and innovative leaders. Recent reports have suggested that the complex and unpredictable environment of postwar Iraq have greatly contributed to that effort (Brownlee & Schoomaker, 2004; Wong, 2004; Gehler, 2005; Barnes, 2005). Indeed, after completing numerous interviews with junior officers deployed to Iraq, Wong suggested that the "crucible" experience of Operation Iraqi Freedom (OIF) is producing lieutenants and captains that are "becoming more creative, innovative, and confident as they learn to deal with the complexities, unpredictability, and uncertainties of counterinsurgency and nation-building in postwar Iraq" (p. 2-3). While the crucible experience may be producing a cohort of adaptive leaders, the rapidly evolving operational environment is placing increasingly more difficult demands on junior leaders. Wong (2004) also highlights a growing number of junior officers in OIF that are "frustrated by the constant change" while other junior officers feel "unease in dealing with ambiguity" (p. 20). In addition, decisions must often be made in a limited amount of time under the influence of a variety of physiological, psychological, behavioral, and social stressors. Obviously, the modern operational environment is a complex one that places extraordinary demands on military decision-makers. The transformation effort, coupled with the demands of the contemporary operational environment is leading to significant training challenges. Army leaders will need to be skilled at making rapid battlefield decisions under the most difficult of conditions (Johnston, Leibrecht, Holder, Coffey, & Quinkert, 2002).

Rather than the "trial-by-fire" of crucible experiences described by Wong (2004), it is more appropriate to provide our junior leaders with the *adaptive* skills they require prior to deployment. Unfortunately, previous research into decision-making has not produced results that are easily applicable to improving performance in emerging operational environments (Cannon-Bowers, Salas, & Grossman, 1991) and very little has been done to develop and maximize adaptive skills (Thompson, Wilson, & Sanders, 2002). However, one training program that has been used to train adaptive thinking, a specific component of adaptability, the Think Like a Commander (TLAC) training program (Shadrick & Lussier, 2002; Lussier, Shadrick, & Prevou, 2003; Shadrick & Lussier, 2004) has shown considerable promise. This report will present data to support the use of TLAC training for the development of adaptability skills. It will also present data to support the construct validity of the training program and of the measures associated with it. It will demonstrate that TLAC training does train a behavior that is relevant to the adaptive performance required by tactical leaders in current conflicts.

Defining Adaptive Thinking

In military terms, adaptive thinking on the battlefield refers to "the cognitive behavior of an officer who is confronted by unanticipated circumstances during the execution of a planned military operation," (Lussier, Ross, & Mayes, 2000). The conditions in which the thinking task must take place are an essential and defining ingredient. The thinking that underlies battlefield decisions does not occur in isolation or in a calm reflective environment; it occurs in a very challenging environment. Commanders must think while performing: assessing the situation, scanning for new information, dealing with individuals under stress, monitoring progress of multiple activities of a complex plan. Multitudes of events compete for their attention. In that environment, adaptive thinking refers to the thinking the leader must do to adapt operations to the requirements of unfolding events and is thus a key component of competency in battle command.

The skillful commander will, when performing adaptively, make adjustments within the context of the plan either to exploit the advantage or minimize the harm of the unanticipated event, in short, to adapt to conditions for a more successful outcome. This description of the adaptive thinking task defines the behavior in terms of the problem to be solved: to monitor the unfolding tactical situation for unanticipated events and to determine the proper actions in response to them. Commanders who do not allocate many cognitive resources to adaptive thinking will still likely feel themselves very busy. Commanders who do allocate resources to adaptive thinking will need to find ways to free those resources.

Knowledge of the domain area is clearly an important requisite for performing the task well, but it is not sufficient. Typically U.S Army officers, after years of study both in the classroom and on their own, develop a good conceptual understanding of the elements of tactical decision-making. However, that knowledge alone, no matter how extensive, does not guarantee good adaptive thinking. Thinking is an active process; it is a behavior one does with his or her knowledge. As an example, if officers are told that the enemy has performed various actions on the battlefield and they are asked to infer the enemy's intent, they can generally do this fairly well depending on their understanding of the tactical domain. They have both the knowledge and the reasoning ability to solve the problem. Despite that, the same officers when placed in a demanding environment and required to perform as commanders will not necessarily display the behavior, i.e., develop a model of a thinking enemy and update that model based on continuing assessment of enemy actions. Expert adaptive thinking under stressful performance conditions requires considerable training and extensive practice in realistic tactical situations until thinking processes become largely automatic.

Deliberate Practice and Themes of Battlefield Thinking

The cornerstone of developing expertise is the use of deliberate practice. A main tenet of the deliberate practice framework is that expert performance reflects extended periods of intense training and preparation (Ericsson, Krampe, & Tesch-Roemer, 1993). Describing the structure of deliberate practice activities, Ericsson et al. wrote

> ...subjects ideally should be given explicit instructions about the best method and be supervised by a teacher to allow individualized diagnosis of errors, informative feedback, and remedial training.... Deliberate practice is a highly structured aim; the specific goal of which is to improve performance. Specific tasks are invented to overcome weaknesses, and performance is carefully monitored to provide cues for ways to improve it further. (pp. 367-8)

Repetitive performance causes behavior to become automatic. It is important that the behaviors that become ingrained conform to those of an expert – that they are the right behaviors. It is a well-known phenomenon that novices, through practice alone, will improve rapidly for a short time but then may continue performing for decades without further improvement. Practice alone does not make perfect; it must be structured to ensure that performance, in this case thinking, is done in a correct manner. In order to accomplish training using a deliberate practice method the student must perform selected task elements and strive to conform his or her performance to some model of "correct form" or "expert form." If those desired elements of form have not been clearly identified, then the training will resemble the discovery learning of "train as you fight" more than it does deliberate practice. A critical component in the construction of the Think Like a Commander training for tactical adaptive thinking - an explicit set of expert tactical thinking behaviors - was formulated based on interviews by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) and on research with acknowledged tactical experts (Deckert, Entin, Entin, MacMillan, & Serfaty, 1994; Lussier, 1998; Ross & Lussier, 2000). These eight behaviors are termed "themes" of the training and are referred to as the Themes of Battlefield Thinking. Below is a list of the themes and a brief description of each:

Keep a Focus on the Mission and Higher's Intent -- Commanders must never lose sight of the purpose and results they are directed to achieve -- even when unusual and critical events may draw them in a different direction.

Model a Thinking Enemy -- Commanders must not forget that the adversaries are reasoning human beings intent on defeating them. It's tempting to simplify the battlefield by treating the enemy as static or simply reactive.

Consider Effects of Terrain -- Commanders must not lose sight of the operational effects of the terrain on which they must fight. Every combination of terrain and weather has a significant effect on what can and should be done to accomplish the mission.

Use All Assets Available -- Commanders must not lose sight of the synergistic effects of fighting their command as a combined arms team. They consider not only assets under their command, but also those which higher headquarters might bring to bear to assist them.

Consider Timing -- Commanders must not lose sight of the time they have available to get things done. Experts have a good sense of how much time it takes to accomplish various battlefield tasks. The proper use of that sense is a vital combat multiplier.

See the Big Picture -- Commanders must remain aware of what is happening around them, how it might affect their operations, and how they can affect others' operations. A narrow focus on your own fight can get you or your higher headquarters blind-sided.

Visualize the Battlefield -- Commanders must be able to visualize a fluid and dynamic battlefield with some accuracy and use the visualization to their advantage. A commander who develops this difficult skill can reason proactively like no other. "Seeing the battlefield" allows the commander to anticipate and adapt quickly to changing situations.

Consider Contingencies and Remain Flexible -- Commanders must never lose sight of the old maxim that "no plan survives the first shot." Flexible plans and well thought out contingencies result in rapid, effective responses under fire.

The Think Like a Commander Training Approach

The TLAC[1] approach uses deliberate practice concepts to train a key component of adaptive thinking – how to quickly evaluate a rapidly changing tactical situation using the expert themes described above. The TLAC approach uses cognitive battle drills to apply deliberate practice training concepts to battlefield thinking skills and allows officers to model their battlefield understandings, plans, visualizations and decisions after expert tacticians' thinking patterns. The cognitive battle drills are represented in a set of vignettes based on tactical situations drawn from a single overarching scenario. Each vignette is a short, complex situation—typically two to four minutes in duration—that is presented in an audio-video file (see Figure 1).

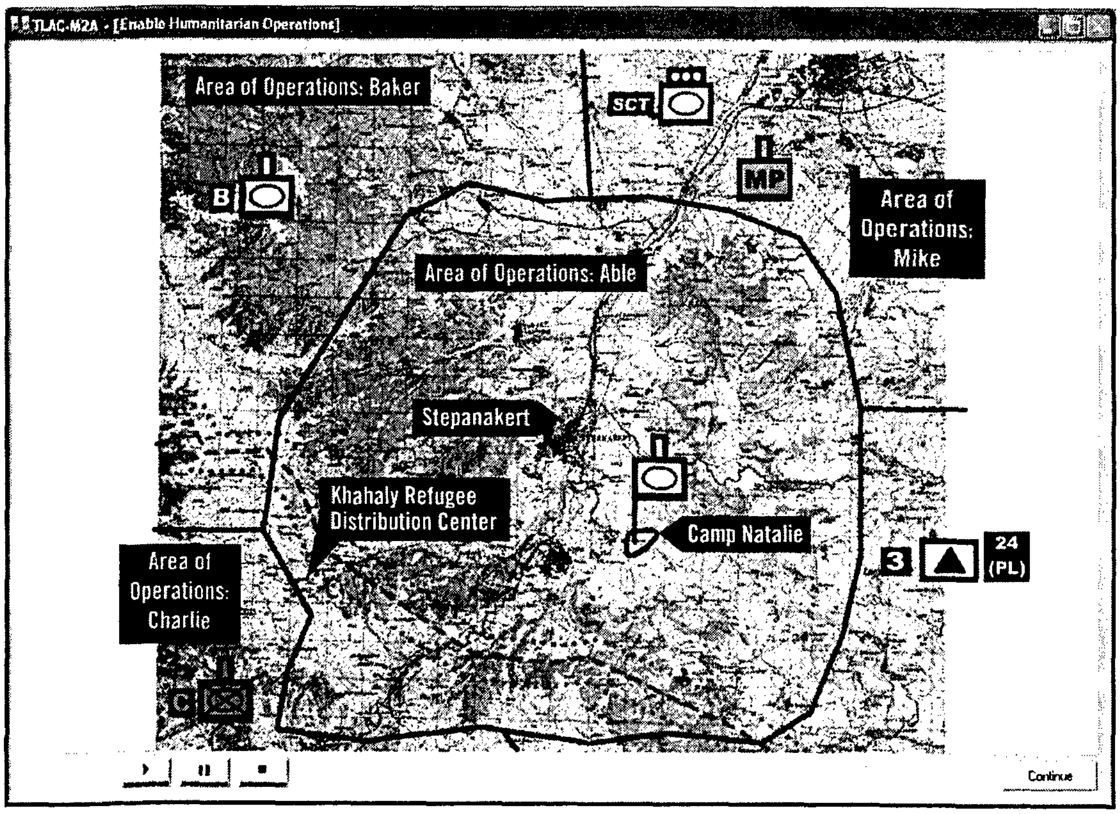

Figure 1. Depiction of a Think Like a Commander vignette.

Each vignette has a set of unique "indicators" that represent important considerations of expert battlefield commanders. These are the elements of the situation—the key features—that should play a role in the decision-maker's thinking. For each vignette, about 24 such indicators

[1] A more extensive description of the training is available in *Think Like a Commander prototype: Instructor's guide to adaptive thinking* by Lussier, Shadrick, & Prevou, (2003).

were determined by expert tactical thinkers. While the themes are consistent across all vignettes, each vignette has unique indicators that represent what an expert commander should consider in that specific vignette situation if he or she were to engage in the thinking behavior represented by a particular theme.

Once the presentation is completed, the student is asked to think about the situation presented and to list items that should be considered before making a decision. Over the course of the training, the amount of time students are allowed to respond to vignettes is decreased, forcing students to adapt to increased time pressure. After each student completes his or her list, an instructor leads a class discussion. Class members discuss the second- and third-order effects related to actions students suggest. Students are encouraged or required to discuss and/or defend considerations relevant to the vignette. Such coaching by a subject-matter expert (SME) is a key part of the learning process to enable the student to develop expert habits.

In the final phase of each vignette, the students see the list of considerations that experts believed were important, along with the list they initially made, and mark the indicators they have in common with the experts. Students are also asked to make the same evaluation on the class as a whole. The purpose in this step is to allow the students to get a true representation of their individual performance. For example, a student may only get 50% of the important considerations for a given vignette. During the class discussion, however, 90% to 100% of the key considerations may be discussed. Students may inappropriately believe that their performance was directly linked to the performance of the class as a whole. Once the students rate their performances, they are given feedback linked to the general themes, (e.g., 25% for the 'Model a Thinking Enemy' theme). This individual feedback supplements and complements the feedback given by the instructor during the class discussion phase of the training. The students are then able to focus their future thinking on subsequent vignettes and place additional attention on themes for which they scored low.

Implementation and Evaluation of the Think Like a Commander Training Program

The TLAC training program has been used during classroom (face-to-face) training in the Armor Captains Career Course (ACCC) at Fort Knox. The training has also been provided via synchronous distance learning to officers in the Armor Captains Career Course – Reserve Component (ACCC-RC) at Fort Knox with students deployed to Bosnia, Afghanistan, and Iraq – as well as other locations. In addition, the training has been used or demonstrated at Fort Benning, Fort Bragg, Fort Carson, Fort Drum, Fort Eustis, Fort Huachuca, Fort Leavenworth, Fort Lee, Fort Leonard Wood, Fort Sill, and the Joint Forces Headquarters of the Indiana National Guard. The training has been used for schoolhouse, unit, and pre-deployment training. An instructorless version of the training has also been developed.

Shadrick and Lussier (2004) showed that use of the *Think Like a Commander* training program produced several dramatic findings. An examination of student self-scores revealed significant performance gains in a key component of adaptive thinking: the rapid analysis of battlefield situations to identify key considerations for decision-making. Student scores were verified by an independent rater to insure scores were not systematically inflated. Performance gains were found even though time constraints were made increasingly more stringent. Figure 2 shows the mean amount of critical information identified for each of seven vignettes used in the training. The figure indicates a significant improvement in performance as students progressed through the training. Initially, students were provided 15 minutes to respond to the situations. As students progressed through the training the amount of time was reduced to three minutes. Remarkably, student performance continued to rise even though increasingly more difficult time constraints were imposed on their performance.

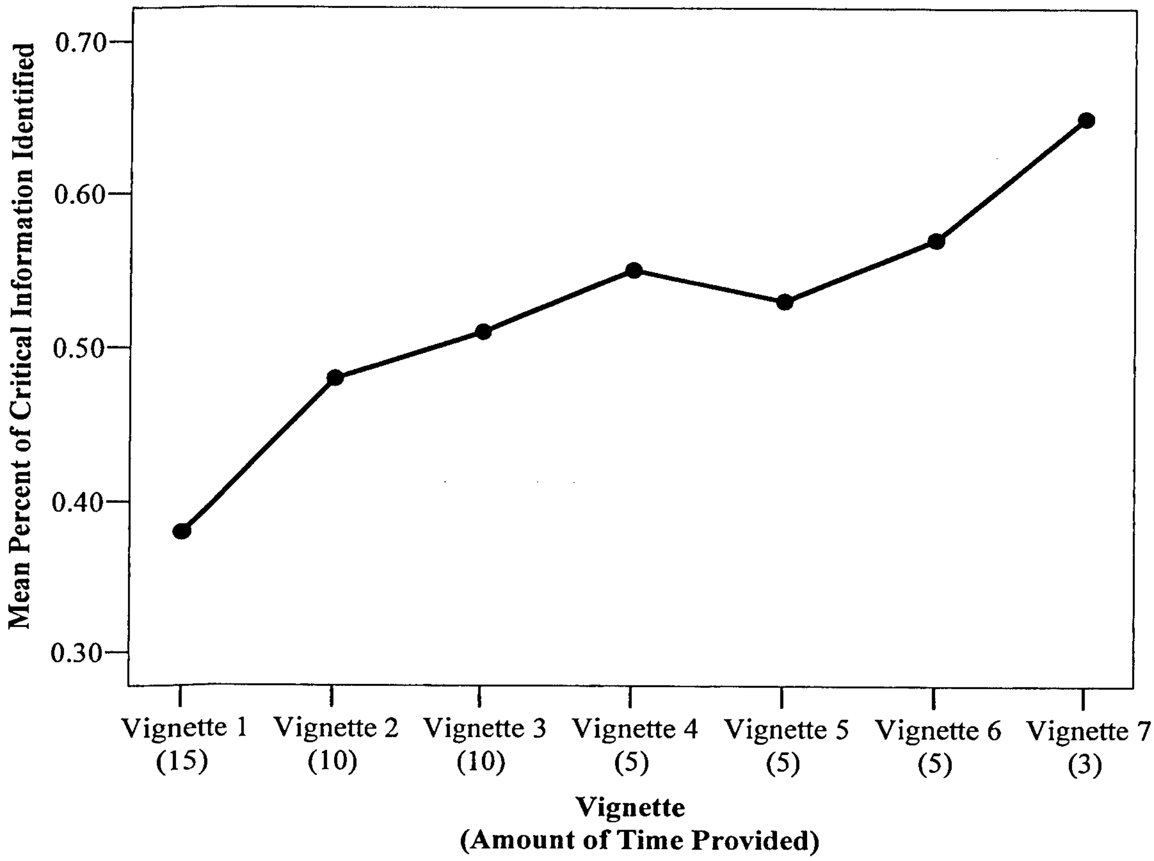

Figure 2. Results from an assessment of the Think Like a Commander training program.

After the success of the TLAC training in the ACCC, the training was provided via a synchronous collaborative tool to captains in the U.S. Army Reserve and National Guard, many of whom were deployed to Iraq or Afghanistan. Both students and instructors perceived the training as being valuable (Gossman, Heiden, Flynn, Smith, & Shadrick, in preparation). Specific feedback from deployed leaders collected as a part of the ACCC-RC at Fort Knox indicated that the TLAC training is a useful and important training and learning tool. Many student-officers wished they would have had access to the training prior to their deployments to Iraq or Bosnia. Others indicated that it prepared them for events they face on a daily basis. The significant performance gains and the feedback obtained from deployed leaders led us to investigate whether leaders deployed to Iraq and Afghanistan would perform better on TLAC exercises than those individuals without such deployment experience. If the contemporary operational environments of Iraq and Afghanistan are producing adaptive leaders and if TLAC is training adaptive thinking then we would expect performance differences between those officers with deployments and those without. In addition, we wanted to better understand the impact of the TLAC training by gaining a better understanding the performance levels of officers of various ranks. That is, we wanted to see if the significant performance gains identified by Shadrick and Lussier (2004) accelerated the adaptive thinking in U.S. Army captains to a level consistent with those leaders deployed to OIF/OEF or of more senior ranks. In effect, such research might serve as validation for the TLAC measurement and training methods.

Method

Participants

Data was collected from 143 officers of the ranks lieutenants, captains, majors, and lieutenant colonels at Fort Benning, GA, Fort Bliss, TX, Fort Campbell, KY, Fort Carson, CO, Fort Drum, NY, Fort Huachuca, AZ, Fort Knox, KY, Fort Lee, VA, and Fort Leonard Wood, MO. A short demographic questionnaire was used in order to gather specific demographic data on the participants. The data gathered consisted of the participants' current rank, branch affiliation, years in service, and major deployments. Figure 3 shows the number of participants at each rank. The lieutenants that participated in the research had an average of 4.3 years of military services; captains had 8.9 years; majors 15.8 years; and lieutenant colonels had 20.9 years. The average amount of military service for the complete sample was 13 years, 4 months.

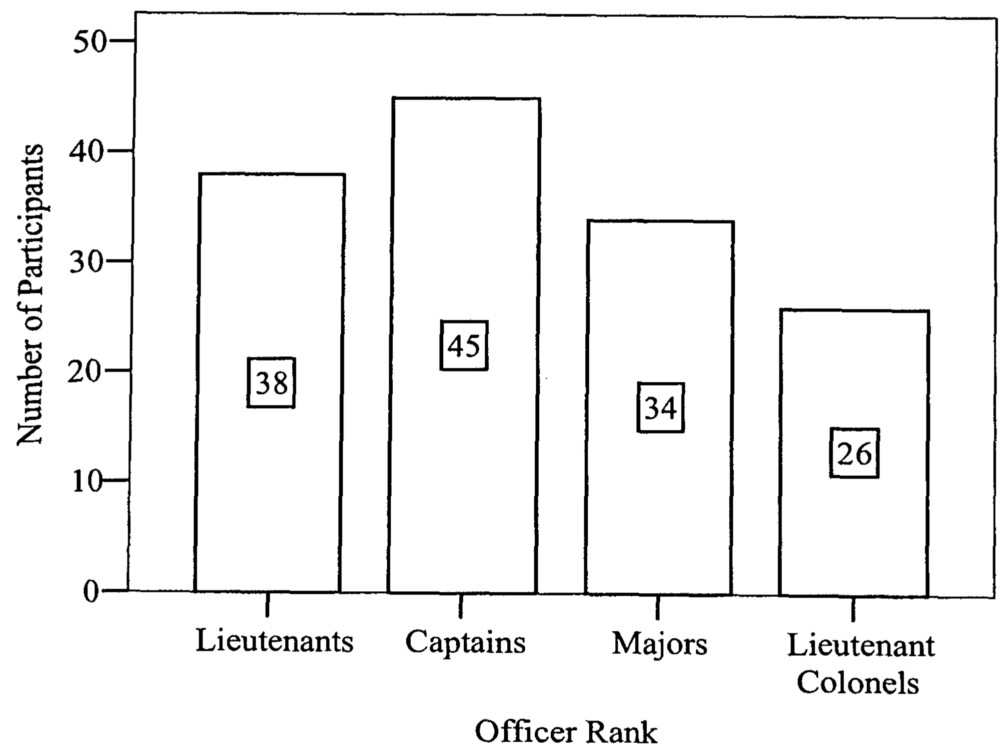

Figure 3. Number of participants for each rank.

Participants were also classified based on branch classification. In some cases it was difficult to classify a participant to a specific branch based on the information provided. As a result, all available information was used to classify participants based on major branch functions (i.e., Combat Arms, Combat Support, and Combat Service Support). Figure 4 shows the number of participants for each major branch function.

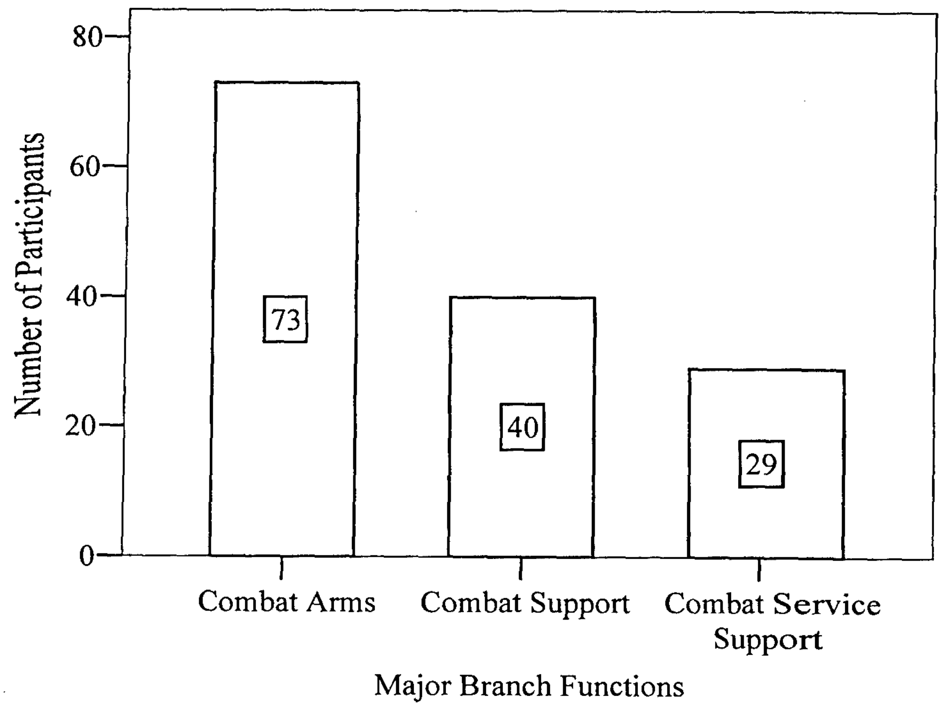

Figure 4. Number of participants for each major branch function.

Finally, participants were grouped based on whether the officer was previously deployed to OIF or OEF. Figure 5 shows the number of participants for each grouping. Of the 73 participants without a deployment to OIF/OEF, over half had deployments to Bosnia, Kosovo, or other locations.

Procedures and Data Collection

Three tactical vignettes from the TLAC training program were administered to groups of four to eight participants during a two hour session. Each vignette consisted of a short, two to five minutes in duration, audio-video file that presented a challenging and dynamic tactical problem. After the vignette was presented, participants were asked to identify critical features that should be considered before a decision is made. Ten minutes were provided for participants to respond to each vignette. Students responded by writing their comments on a blank sheet of paper. Response forms were collected at the end of each vignette.

During the data collection there was no discussion of adaptive thinking or the Themes of Battlefield Thinking. Participants received no training on how to respond to the vignettes other than being asked to identify and record the critical features of the situation. Confidentiality was emphasized to the participants, and the purpose of the research was explained as an attempt to understand how experts respond to tactical situations.

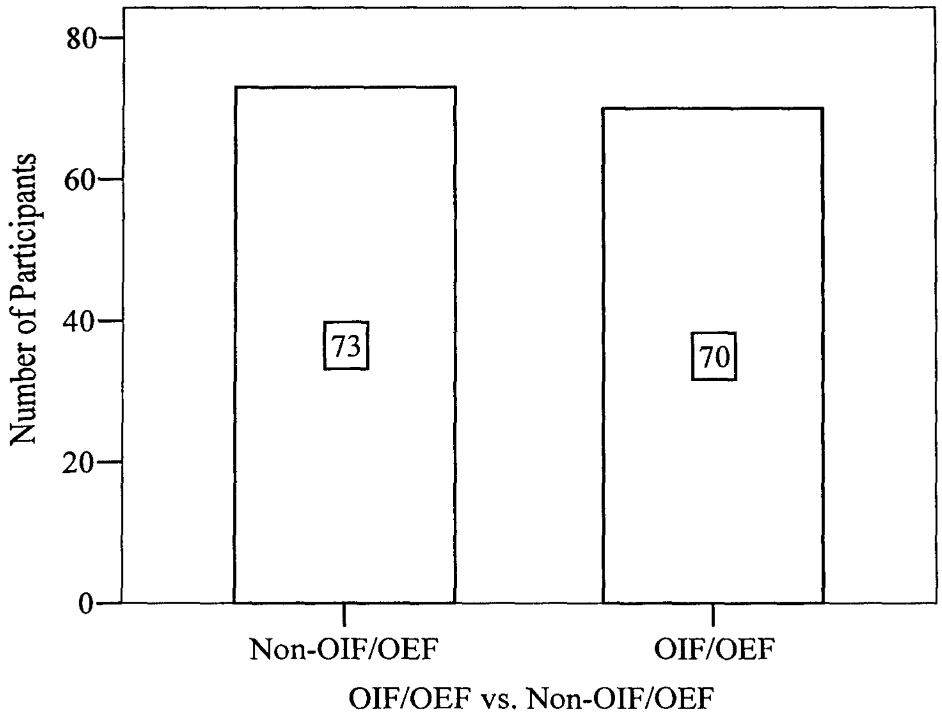

Figure 5. OIF/OEF Deployments.

Measures

Each vignette has a unique set of about 24 indicators or elements of the situation that were previously developed by a panel of tactical experts. With the assistance of senior military experts, the set of indicators was reduced to 16 for each vignette. The indicators represent the key features that an expert commander should consider in the specific situation before making a decision. Identifying the indicators requires the participant to apply his or her tactical knowledge to think adaptively. The performance assessment was completed by comparing the participant's response to the unique set of indicators for each vignette. The participant's score was calculated by taking the mean score on all three vignettes.

Performance assessments were completed by two separate raters. The raters were unaware of personal information for participants as well as which condition, Non-OIF/OEF and OIF/OEF, in which they were designated. The reliability of ratings for each individual indicator (i.e., did combinations of raters agree that participant identify a particular indicator) was .81 indicating a strong agreement between the raters. When assessing the interrater reliability of total scores, the reliability increased to .87. The reliability estimates are consistent with previous reliability estimates (i.e., .901) obtained when verifying student self scoring on TLAC vignettes used for training (Shadrick & Lussier, 2004).

Results

A total of 143 participants participated in the research. One participant left the data collection session early and did not complete the third vignette. Statistics for the amount of critical information identified by participants on each of the three vignettes are presented in

Table 1. Reviewing the means for each vignette suggest, for the most part, that the scores are relatively stable across the three vignettes. There is a slight increase in the amount of critical information identified from vignette 1 to vignette 2. This may reflect a better understanding by the participants as to what was expected of them allowing them to focus more attention during subsequent vignettes. The standard deviations for each vignette are relatively consistent across all of the vignettes. The standard deviations obtained are slightly larger than those established in previous research where the vignettes were used in a training application with a cohort of U.S. Army captains (Shadrick & Lussier, 2004). The larger standard deviations may reflect the differences between officers of different ranks, differences due to deployment, a reduction of variability due to training, or a combination of the three.

Table 1

Mean (M) and Standard Deviation (SD) for Percent of Critical Information Identified for each Vignette

	Statistic	Vignette 1	Vignette 2	Vignette 3	Mean
Non-OIF/OEF	*M*	.29	.35	.36	.33
	SD	.12	.14	.13	.10
	N	72	72	71	71
OIF/OEF	*M*	.34	.44	.44	.40
	SD	.13	.19	.15	.11
	N	70	70	70	70
Total	*M*	.31	.39	.39	.37
	SD	.13	.18	.15	.11
	N	142	142	141	141

Note: Scores represent the mean percent of information identified.

A 2X4 (deployment by rank) analysis of variance (ANOVA) was used to test the significance of the difference in performance between officers with deployments to OIF/OEF compared to those without such deployments for the various levels of rank. The analysis revealed a statistically significant main effect for deployment on the mean percent of critical information identified, $F(1,134) = 17.102, p < .05$. Officers with deployments to OIF/OEF, (M = .40, SD = .10) identified significantly more information then officers without OIF/OEF deployments (M = .33, SD = .10). The results of the analysis are presented in Table 2. The results also indicated a significant main effect for rank, $F(3,134) = 5.2, p < .05$. Performance improved as a function of Rank.

Table 2

Analysis of Variance on Performance Differences by Deployment

Source	df	F	*p*
Deployment (D)	1	17.102	.000
Rank (R)	3	5.200	.002
R X D	3	1.374	.253
Error	134		
Total	141		

Note: The dependent measure represents the mean percentage of information identified across all three vignettes.

Post-hoc comparisons were conducted to examine the performance differences between each level of rank. The results of the analysis are presented in Table 3. Based on the analysis, captains (M = .39, SD = .11), majors (M = .38, SD = .13), and lieutenant colonels (M = .39, SD = .11) performed significantly better than lieutenants (M = .31, SD = .07) with a mean difference of .079, .081, and .094 respectively. However, there were no significant differences between captains, majors, and lieutenant colonels.

As expected, the analysis did not reveal a significant deployment by rank interaction, $F(3,134) = 1.374, p. > .05$. However, it is important to understand the differences between those participants deployed to OIF/OEF compared to those not deployed to OIF/OEF for each level of rank. Thus, an analysis of the interaction comparisons (i.e., interaction contrast) was conducted. The results are presented in Table 4 and are illustrated in Figure 6. As the figure illustrates, there were no significant differences in performance between lieutenants with deployments to OIF/OEF compared to those without an OIF/OEF deployment, $F(1, 134) = .534, p. > .05$. Both captains, $F(1, 134) = 11.896, p. < .05$, and majors, $F(1, 134) = 7.619, p. < .05$, showed a significant difference. While lieutenant colonels deployed to OIF/OEF did not perform significantly better than those without such deployments, $F(1, 134) = 2.215, p. > .05$, their performance was noticeably better than their non-OIF/OEF counterparts.

Table 3

Post-hoc Comparisons of Performance by Rank Differences (Bonferroni)

Rank (I)	Rank (J)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
LT	CPT	-.0749(*)	.02129	.004	-.1319	-.0179
	MAJ	-.0689(*)	.02269	.017	-.1297	-.0081
	LTC	-.0813(*)	.02447	.007	-.1468	-.0157
CPT	LT	.0749(*)	.02129	.004	.0179	.1319
	MAJ	.0060	.02195	1.000	-.0528	.0648
	LTC	-.0064	.02378	1.000	-.0701	.0573
MAJ	LT	.0689(*)	.02269	.017	.0081	.1297
	CPT	-.0060	.02195	1.000	-.0648	.0528
	LTC	-.0124	.02504	1.000	-.0794	.0547
LTC	LT	.0813(*)	.02447	.007	.0157	.1468
	CPT	.0064	.02378	1.000	-.0573	.0701
	MAJ	.0124	.02504	1.000	-.0547	.0794

* The mean difference is significant at the .05 level.

Table 4

Interaction Contrast Comparisons for Deployment at Each Level of Rank

Rank		df	F	*p*
LT	Contrast	1	.532	.467
	Error	134		
CPT	Contrast	1	11.896	.001
	Error	134		
MAJ	Contrast	1	7.619	.007
	Error	134		
LTC	Contrast	1	2.215	.139
	Error	134		

Figure 7 also illustrates the difference for each group for those officers with and without deployments to OIF/OEF. As can be seen by the figure, for non-OIF/OEF officers, performance differences were clearly observed by order of rank. That is, captains, performed better than lieutenants, majors better than captains, and lieutenant colonels better than majors. For deployed officers, the results are not as clearly observed. Lieutenants with OIF/OEF deployments performed no better than lieutenants with non-OIF/OEF deployments. However, captains, majors, and lieutenant colonels with OIF/OEF deployments performed better than those without. In addition, the performance of the three groups converges.

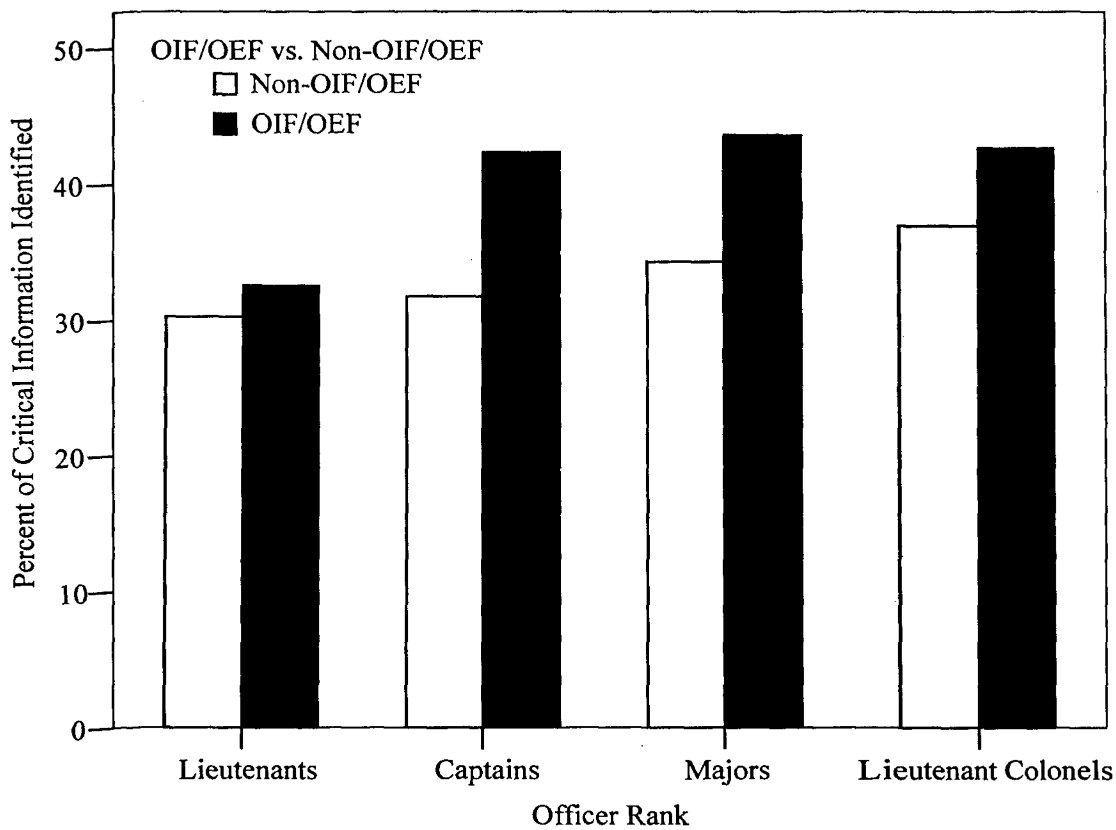

Figure 6. Mean percent of critical information identified for each rank by deployment.

Figure 7 illustrates the performance differences on each vignette for each level of rank for those officers with and without deployments to OIF/OEF. As the figure indicates, those officers with OIF/OEF deployments performed better than their Non-OIF/OEF counterparts on each vignette.

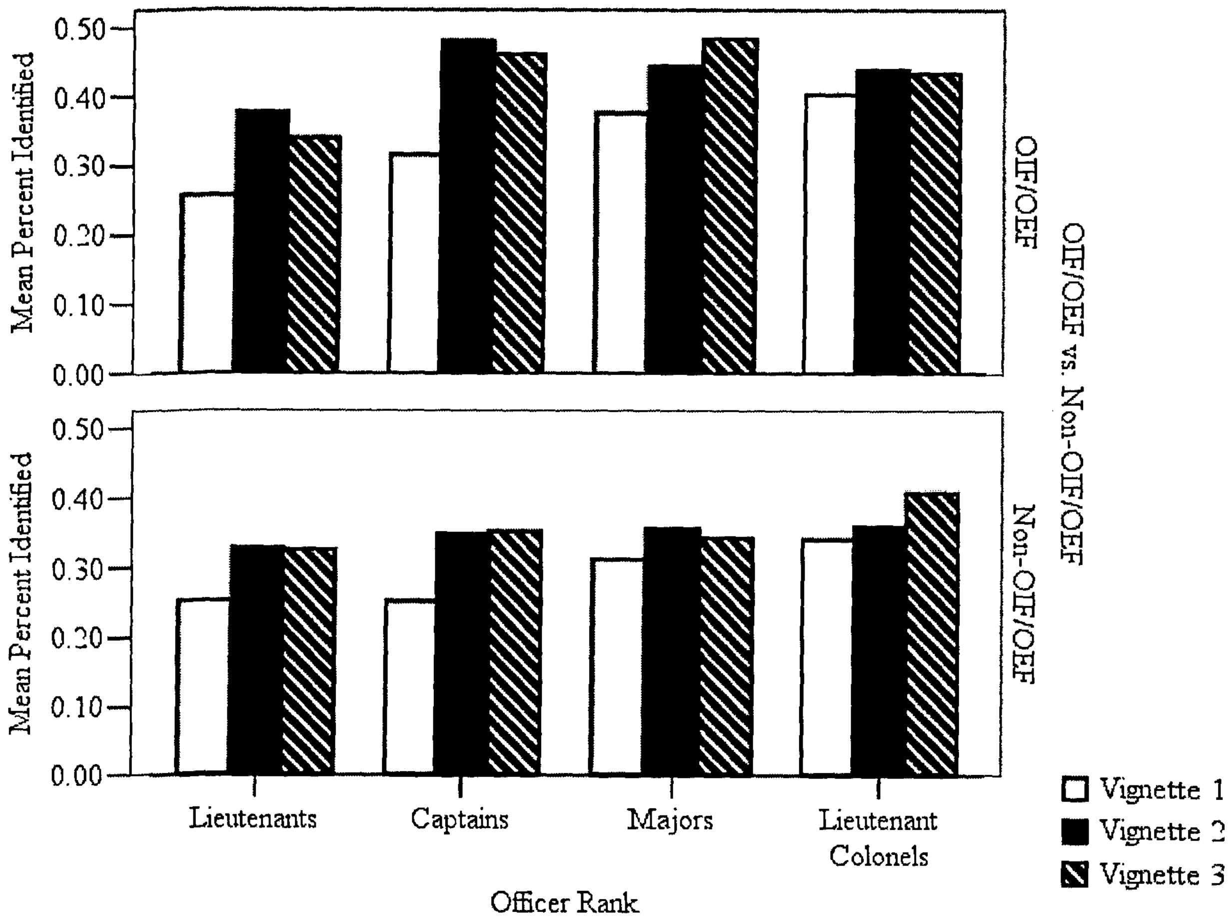

Figure 7. Percent of critical information identified on each vignette by rank and deployment.

Discussion

The need to develop adaptive leaders has been well documented and remains an area of focus to the U.S. Army senior leadership (Harvey & Schoomaker, 2006). The operational environment the U.S. Army is currently faced within Iraq and Afghanistan, as well as anticipated future environments, are viewed as requiring high levels of adaptive performance from junior officers. The TLAC training program was developed to address that critical need. Previous research has demonstrated that the TLAC training can increase a captain's ability to rapidly evaluate a tactical situation within the confines of the training environment. The current research examined the performance of leaders at various levels of experience to help establish the construct validity for the training program. Individuals with greater experience, expertise, and skill will generally score higher than individuals with limited experience, expertise, or skill on tasks designed to measure the construct of interest. The difference in performance between the various groups is an indication that "treatment manipulation is related to direct measures of the process designed to be affected by the treatment" (Cook & Campbell, 1979, p. 60). Thus, if measures of the construct converge and diverge in a predicable manner then the construct validity of the measures will be apparent (Cook & Campbell, 1979; Horan, 1987; McNamara & Horan, 1986).

For Non-OIF/OEF officers, the results clearly demonstrated a direct relationship between the level of experience and the amount of critical information identified. Scores for non-OIF/OEF officers increase as the level of rank (or experience) increases. Those results clearly indicate that there is a relationship between rank and performance levels when measured with TLAC vignettes.

On the other hand, results for those officers with OIF/OEF deployments were not as clear. For those officers, there was a convergence of scores for captains, majors, and lieutenant colonels. The result is consistent with the assertion that captains in Iraq and Afghanistan are being forced to become more adaptive (e.g., Wong, 2004). The fact that a deployment to OIF/OEF, and the experience gained during that deployment, did change performance adds additional support for the validity of the training and the performance measures. Thus, the results clearly support the notion that the TLAC training does train adaptive thinking skills.

One exception is the results obtained for lieutenants. Lieutenants with deployments to Iraq and Afghanistan performed no better than their non-deployed counterparts. There are several potential reasons for this finding. First, our assumption about tactical adaptive thinking is that it is a trainable behavior rather than knowledge-based skill alone. Officers, through training, practice, and experience develop an ability to skillfully apply the tactical knowledge they possess. Thus, one potential explanation is that the lieutenants participating in the research did not have the appropriate level of knowledge to analyze that tactical situation presented or were not capable of applying that knowledge to effectively develop a mental model sufficient to successfully analyze the dynamic and complex situations presented. In other words, the level of tactical knowledge required by the vignettes was too high.

A second potential explanation is that lieutenants deployed actually performed better than their non-deployed counterparts. However, those differences were not universal and when the aggregated data were analyzed, these performance differences were not detected. We have evidence that a group of lieutenants from one specific location, with predominantly OIF/OEF participants, performed much poorer than those from other locations. That one group could have attenuated the results for the lieutenants as a whole – considering the relatively limited number of lieutenants included in the overall analysis. This is clearly an area where more data are required to understand the differences obtained.

The results obtained during this research clearly demonstrated measurable performance differences between officers deployed to Iraq and Afghanistan compared to those officers without such deployments. The gains in performance for those deployed officers reflect experiential learning that took place during the deployment. The learning that took place is valuable and contributes to the development of expertise and adaptive performance. However, what effect would deliberately training adaptive thinking skills have compared to the "trial-and-error" approach of experiential learning? Previous research has already demonstrated significant performance gains in adaptive thinking when the TLAC approach is used to deliberately train tactical adaptive thinking. How do the performance gains demonstrated in training compare to those of experiential learning?

To make that comparison, we extracted the data for captains obtained during this research and compared it to data previously obtained from captains using TLAC as a part of a formal training event (see Figure 9). It is important to note that there are several issues in comparing these two separate sources of data. First, the data for the group of captains using the training was obtained using a different set of TLAC vignettes. While the vignettes used in the training were different, we suspect that they are very similar to the vignettes used in the current research. Second, the participants in the training group had initial training on adaptive thinking and the Themes of Battlefield Thinking. That is, there was an explicit presentation of the themes. In addition, the training group had access to the themes during the training and could review them whenever needed. The participants in the current research were not provided with the themes, nor were they provided any specific training on adaptive thinking or performance. Third, the training group received 15 minutes to complete the first vignette. The time was reduced to 10 minutes for vignettes 2, 3, and 4; 5 minutes for vignettes 5 and 6; and 3 minutes for vignette 7. Participants in the current research received 10 minutes to complete each individual vignette. Finally, the training group received coaching and feedback after completing each vignette; however that was not provided in the current research.

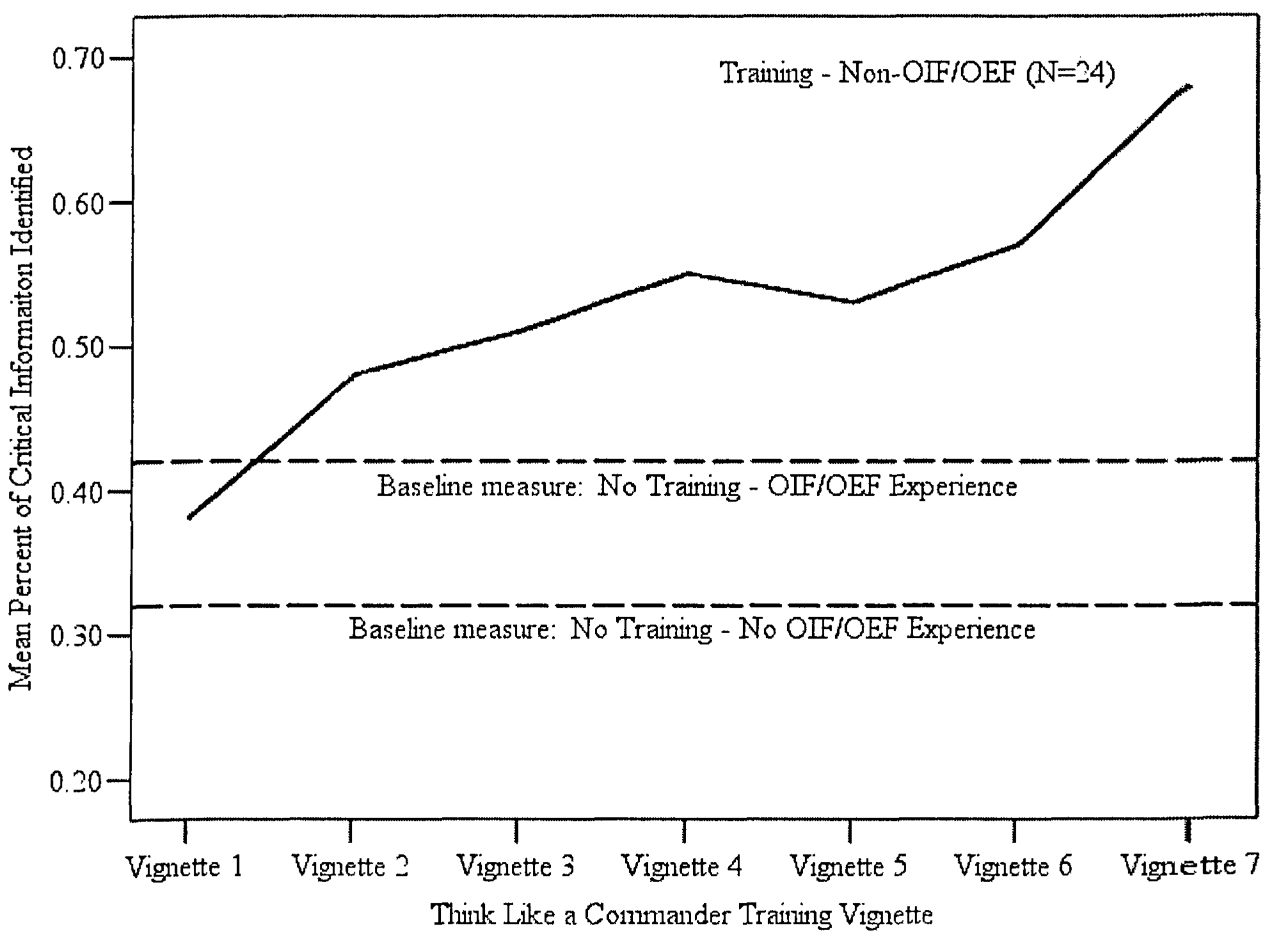

Figure 8. Illustration of the value of adaptive thinking training for captains.

As Figure 9 illustrates, the captains with an OIF/OEF deployment that participated in the current research performed better than the non-deployed captains (as illustrated by baseline measures of performance). However, the captains that received TLAC training, none of which had been previously deployed to Iraq or Afghanistan, performed better than captains with up to a one year deployment. In addition, the performance for the training group continued to rise far beyond the performance of the "experiential learning" deployed group. In fact, at the end of the training, the training groups' performance was superior to that of the lieutenant colonels obtained during this research. We do not mean to imply that captains can perform battle command tasks at the level of lieutenant colonels. Only that, with training, captains can be taught to quickly identify key tactical features of a rapidly changing situation and perform that task at levels above officers who gained their skill through long experience, even the 'crucible' experience of current conflicts.

In spite of the caveats we place on the comparisons described above, we feel that the measured differences in performance reflect the improvement that can be obtained when deliberately training complex cognitive tasks. Unfortunately, many cognitive tasks are not explicitly trained in the U.S. Army. Traditionally the training of tactical thinking in the U.S. Army has not employed deliberate practice concepts. Instead, many battle command tasks are trained by placing participants in realistic, unstructured, whole-task environments using some form of costly, high-fidelity live, virtual, or constructive simulation.

The maxim "train as you fight" has risen to such a level of familiarity in the U.S. Army that the value of the notion goes almost unquestioned; that is, that the best training method is to 'just do it' in a realistic environment. Yet studies of the development of expertise clearly indicate that "as you fight" meaning performing in fully realistic simulated battles is neither the most effective nor efficient method of developing expertise. Such "performances" can help a novice become acquainted with applying military knowledge and can reinforce existing knowledge in an experienced person, but will not in and of themselves lead to the development of expertise. In many fields where expertise has been systematically studied, including chess, music, and sports, development beyond intermediate level requires large amounts of deliberate practice (Ericsson, et al., 1993) and good coaching (Ericsson, 1996; Charness, Krampe, & Mayr, 1996).

We do not mean to imply that the U.S. Army should not utilize high-fidelity simulations for training. However, we make a distinction between the terms training and practice. These terms are frequently confused because both usually involve task performance under real or simulated conditions and because both are significant components in gaining proficiency. Training activities are specifically intended to accomplish some significant change in the way a person performs a task – a change in the actual behaviors performed – to make the performance more effective or more in conformance with an expert's way of doing the task. Whether a cognitive or motor task, with good training the learners come to understand the steps of task performance and the manner, order, reason, purpose, etc. of the process of task performance. Once the learner has training to a sufficient level they can be allowed to participate in less structured, simulation environments (Beaubien & Baker, 2004).

With practice activities, however, the task is performed in the manner already known by the learners – they perform it in their usual way – but through repetition intend to ingrain the task, to make performance smoother and more automatic, to perform it under a variety of conditions, and to develop an ability to perform the task with little or no conscious attention. Coaching and instruction are less significant during practice activities, and performance measurement focuses on task outcome (speed, error rate, tactical success) rather than form or process. Practice without training (probably not very different from what has been termed experiential or discovery learning) is not a very efficacious method, neither efficient nor ultimately effective.

A war environment furnishes an excellent and effective (though unforgiving) practice ground but by its design is a rather poor place to train. Simulation technology – especially that intended for training – has made tremendous advances, offering unprecedented levels of realism, immersion, and fidelity. Unfortunately, the ability to use simulations for training in addition to practice has not kept pace. To insure quality training, the simulator must incorporate "specific key components based upon sound instructional principles," (Black, 1996). Training research in military aviation, an area that relies more heavily on simulation than any other, has independently reached the same conclusion (see Salas, Bowers, & Rhodenizer, 1998; Stewart, Dohme, & Nullmeyer, 2002). When new simulators are acquired, they are often treated as replications of the aircraft, and it is assumed that simply shifting flight hours to the simulator will result in effective training. The higher the fidelity of the simulation, the more it is assumed that exposure to such a virtual environment will result in more effective training. Hence, the simulation technology continues to evolve, whereas the training technology remains the same as it has been for decades. Military aviation primary flight training still tends to be lockstep and hourly-based, instead of adaptive and proficiency-based. In brief, the syllabus is designed so that the slowest learner will finish on time and graduate with his or her class.

To insure quality training, the simulator must incorporate "specific key components based upon sound instructional principles" (Black, 1996, p 1). The significant components are: a) identification of tasks, b) presentation of enabling knowledge, c) demonstration of how the task should be performed, d) the opportunity for the trainee to perform the task, e) provision for feedback to the trainee concerning task performance, and f) the opportunity to practice task to mastery under increasingly difficult, but realistic conditions (Black & Quinkert, 1994; Black, 1996; Holding, 1965, as cited in Black, 1996). Other components of effective training that we would add to the list are an explicit description of elements that constitute correct performance of the task, performance measurement to assess whether the task is performed correctly, active and effective coaching, the opportunity for immediate repetition of poorly performed tasks, and a focus on tasks which are difficult, critical, or constitute areas of individual or collective weakness.

For many tasks the Army has had great success in developing simulation-based training approaches, two of many possible examples being aviation and tank gunnery. In part, the reason for the success of such simulators as the Unit Conduct of Fire Trainer (UCOFT) is the adherence to the instructional principles listed above. Command and staff tactical training and the training of battle command skills have also made use of tactical engagement simulations in live (e.g., Combat Training Centers), virtual (e.g., Close Combat Tactical Trainer), and constructive (e.g., institutional JANUS exercises) modes but with less clear results. The difficulty no longer lies in the capability of the simulation to present a realistic performance environment; rather the problem is insuring that the components of sound instruction identified above are present. Of the components of effective training listed in the preceding paragraph, tactical engagement simulations by themselves only truly enable the opportunity to perform and the opportunity to practice. Much additional exercise design work must be done to add the other components. Furthermore, the pace and complexity of exercises driven by tactical engagement simulations may often interfere with many key training components such as demonstration, measurement, feedback, immediate repetition, isolation of complex tasks, and focus on key tasks that occur infrequently.

Conclusions

The validation of the training method, along with feedback from deployed officers participating in TLAC training, supports the continued use of the TLAC training program. Further, the results of this research illustrate the benefit of deliberate training methods compared to "experiential learning" for complex battle command tasks. Ongoing ARI research is exploring how the deliberate training methods discussed here can be applied to train other complex, cognitive task such as battlefield visualization. Other research is developing new ways to provide coaching and feedback to train participants using low cost, three-dimensional animations and developing improved methods for measuring the performance of cognitive tasks.

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