Simulations in Education: Creating an Experiential Learning Environment

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ABSTRACT

Past use of simulations in educational environments has focused primarily on tactile and psychomotor skills rather than cognitive development. Our research explores the hypothesis that imbedded simulations in the military's institutional learning environment improves the quality and outcome of thinking and decision-making skills and leads to a more self-aware and adaptive leader. Current literature indicates that changes in learning theory and instructional pedagogy have undergone radical changes in the past two decades. Furthermore, technological capabilities now offered by simulations and simulators, automation, digital command and control systems and e-learning have created unlimited opportunities in education and training.

Two studies that were conducted within the School for Command Preparation (SCP) at FT. Leavenworth, Kansas demonstrate significant improvement in a leader's perception of his or her decision-making skills as well as an increase in content retention rate. The second study demonstrated that the use of interactive multimedia simulation in an online learning environment significantly improved retention over a text-based learning format across learning styles. This paper offers a modern approach to instructional methodology that integrates advances in learning theory with technology and creates opportunities for deliberate practice that increases student experience and knowledge retention. It offers a methodology for applying simulations to classroom instruction and a framework for a spectrum of simulations.

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Teach me and I will forget,
Show me and I will remember,
Engage me and I will understand.
-- Confucius

CREATING AN EXPERIENTIAL LEARNING ENVIRONMENT

Although these words were written 2500 years ago, they exemplify the experiential, engaging learning environment we are constantly trying to achieve in not only military education, but also in our civilian schools. The current focus in professional military education on processes verses decision-making-during-execution and knowledge transfer verses experiential learning has created a generation of military leaders who are prisoners of an education system that taught them *what to think* and failed to develop adequate experience required in the contemporary operational environment. The result is leaders who look for "the answers" rather than adaptable leaders who know *how to think* their way through a problem and analyze a situation quickly, during periods of uncertainty, rapidly consider options and make decisions to achieve their units' objectives.

Educational initiatives underway in Ft. Leavenworth's School for Command Preparation (SCP) and Command and General Staff Officers Course (CGSOC), FT Knox's Armor School, and the Initial Brigade Combat Team's (IBCT) Leader Development Course (LDC), demonstrate a more effective use of students time in the schoolhouse. These revolutionary programs teach leaders *how to think* rather than what to think and build experience in a batting cage type of environment where deliberate practice, and improvement replaces the one shot, performance oriented, task-centric training of the past. But to achieve this type of collaborative-execution-centric learning environment requires a whole new way of thinking about educational technology and the use of simulations in Army schools.

The focus of this paper addresses an educational philosophy, instructional strategy and method for the use of technology in the classroom and provides today's educational leaders a model to create a foundation of experience on which to build experiential learning as well as critical and creative decision-making skills.

The Contemporary Operating Environment

The Army is in the midst of the largest transformation since World War II. The institutional Army must transition as well if it is remain relevant. Col. Douglas MacGregor reminds us in his book *Breaking the Phalanx*, that in 1939 General Marshall felt so strongly that the Army's educational institution were dominated by concepts and thinking that were outmoded that he simply closed the General Staff and War Colleges and relied instead on officers like McNair, Patton, Arnold, Wood and Herman whose views on warfare had been formed outside the mainstream by independent, professional study. Military readiness is irrevocably connected with growth and renewal through education and experience. Failure to adapt and change will make professional military education irrelevant and we will be forced to look to other means, as Gen. George Marshall did, to educate our leaders.

> *"Our [professional military] educational should be the foundations of flexible as we develop leaders who can perform throughout the spectrum of warfare. Currently our institutions develop set piece thinkers. If we expect the objective force small unit leader to exhibit self-aware and adaptive skills then we must change our educational institutions into models of free thought and creative problem solving as leaders are taught how they individually think, (as well as others), perform predictably, express emotions, receive and develop and provide information and most importantly command in various warfighting environments. Only through experimentation can we breakout of linear thinking."*
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> LTG (R), US Army

This paper explores the hypothesis that embedded simulations in the military's institutional learning environment improves the quality and outcome of

individual leaders and leads to increased leader proficiency and eventually unit readiness. Evidence in a number of recent studies demonstrates the value of simulations and experiential learning. Yet our curriculum models and instructional strategies still lack clarity and definition, and our faculty development programs are largely devoid of instructional strategies and methods for using technology to achieve learning objectives.

Teaching through the use of simulations is also a proven form of instructional methodology in K-12 education. In K-12 education, simulations do not necessarily utilize technology. Role-playing and the re-creation of unique situations are all types of simulations that have been used in the traditional face-to-face classroom. Technology has allowed teachers to use more complex simulation environments in the classroom in which students can create their own city in *SimCity* or simulate the emigration and journey of the West through the *Oregon Trail*.

Current literature indicates that changes in learning theory and instructional pedagogy have undergone radical changes in the past two decades but the institutional Army, for the most part remains mired in the pedagogy of the past. Furthermore, technological capabilities now offered by simulations and simulators, automation, digital command and control systems and eLearning have created unlimited opportunities in education and training. Among the many questions we are attempting to answer in ongoing studies is whether specific educational technology tools (elearning, simulations, electronic tactical decision games and virtual reality systems) produce significant improvements in leader development to justify the enormous expense. Additionally, as a result of five years of classroom experience with simulations, we have developed and refined a strategy for integrating technology into resident curriculum resulting in a collaborative-execution-centric learning environment that focuses classroom instruction on higher cognitive learning skills (Bloom, 1970). In the future we plan to look at ways of integrating simulations into online instruction.

Full spectrum operations demand Army leaders who are masters of both the art and science of military operations. Success in this environment comes from imaginative, flexible, and daring leaders. The combination of these quality soldiers, competent leaders and cohesive units creates a versatile, powerful force. The Army Operations manual (FM 3-0, 2001) identifies leadership, one of the five elements of combat power, as the most dynamic element of combat power. Confident, audacious and competent leadership focuses the other elements of combat power and serves as the catalyst that creates conditions for success. Leaders provide purpose, direction and motivation in all operations. The duty of every leader is to be competent in the profession of arms. Competence requires proficiency in four sets of skills; interpersonal, conceptual, technical, and tactical. Army leaders develop these skill sets through institutional training and education; operation assignments and experience in units, and self-directed self-development.

Adaptive, self aware leaders

Today's leaders must do more than lead and manage; they must focus on meta-competencies of self-awareness and adaptability. In this context, self-awareness is the ability to understand how to assess abilities, know strengths and weaknesses in the operational environment, and learn how to correct those weaknesses. Adaptability is the ability to recognize changes to the environment, assess against that environment to determine what to learn to be effective; and the learning process that follows . . . all to standard and with feedback. Self-awareness and adaptability are symbiotic; one is useless without the other (Prevou & Wikoff, 2001). These meta-competencies can only be developed and honed through the balanced acquisition of knowledge and experience. According to a recent Army wide study, our current Army education system fails to meet the expectations of officers and fails to adequately prepare them "to lead and protect their units in full spectrum operations" (ATLDP, 2001).

The Army recognizes the need to change its training approach to address the changing battlefield environment and leadership demands and commissioned a series of Army Experiments (AE) that concluded, "In order to effectively and efficiently train adaptive and multi-dimensional leaders and soldiers, new training methodologies must be developed to teach leaders 'how to think' when faced with difficult challenges." (Hoeper, 1999). Initial results suggest that the Army could benefit from institutionalizing battle-focused, collaborative-execution-centric training and education to compliment the small group instruction methodology for learning. The implications from the Army experiments are clear: institutional education provides the foundation for leader development and must precede organizational change. The Army school system must balance training (what to do/know) and education (how to do/think) and improve the opportunity to acquire and develop the skills, knowledge and attributes to perform the requirements of future duty positions.

A NEW EDUCATIONAL ENVIRONMENT

In the wake of the technology boom, computer assisted training and education has begun to emerge as the medium of choice for busy professionals seeking to fulfill their educational requirements. With the rush to produce computer-learning modules, many institutions have failed to integrate these modules to develop an interesting and engaging learning environment. Many studies have explored the usefulness of computers in instruction and how people with different learning styles interact with computers. A study by Smith and Woody (2000) tried to determine whether multimedia presentations of material were easier for students to learn than from a traditional lecture setting, because they wanted to know if instructors should alter their teaching style to better instruct the students. They found that most students did gain more benefit from a multimedia presentation (a form of simulation in our educational context), but that students who were highly verbal learners could have difficulty learning from purely multimedia presentations. They suggested that instructors should use combinations of these two teaching styles so that students could gain the most benefit from their classes.

For the military educational experience to be relevant to contemporary and future warfare we create a coherent educational leader development strategy from pre-commissioning through senior Service College. This strategy must be soundly based on an educational philosophy or ideology that moves institutional instruction away from the process-centric instruction currently used to a collaborative-execution-centric curriculum that how to make decisions during execution – not just during planning. To achieve this change requires change in three areas; educational philosophy, curriculum and instruction, and the use of educational technology. (Prevou & Costanza, 2002)
To enhance thinking and problem solving skill, our educational institutions will need to develop lessons that encourage students to make clear choices, to work in small, dynamic groups, to exchange ideas and viewpoints with staff, faculty and peers. The current classroom setting is hostile toward this pedagogy. To align the classroom setting to an experiential, collaborative-execution-centered curriculum, reformers will have to attack organizational arrangements that largely are governed by parochial branch and functional area requirements that determine the use of time and space in our classrooms and shape how and by whom instructional decisions are made.

Changing our educational Philosophy

Creating change in the institutional instruction base of the Army will require a significant effort. Our first challenge will be to determine the type of leader we want to produce and an educational philosophy that will help us achieve these ends. If an adaptable, self-aware leader capable of handling complex situations in a constantly changing environment is truly our goal then our ideology must be centered on building battlefield wisdom through a proper balance of knowledge and experience (Antal, 2001). The focus of the institutional education system at the junior leader level should be to inculcate new leaders with a common set of values and traditions and to train them with the combined arms tactical and technical skills and knowledge necessary to make the initial transition to their first assignment. At the intermediate level the focus shifts to providing an educational environment and curriculum that provides for a common core of army operational instruction combined with a tailored training and education to better prepare them for career fields and functional area.

Next we must address the curriculum, or the types of subjects and tasks we require leaders to "Be, Know, Understand" and organize them in a manner that builds competence and confidence throughout a leaders career. As we reform our curriculum, we must look at how we instruct and link the instruction to the new curriculum, within the context of our educational philosophy. How we teach is as much an issue as what we teach, and poor instructional methodology can lead to non-educative or mis-educative experiences that stifle learning (Dewey, 1938). Finally we must leverage innovative educational technology to improve our classroom methodology. Integrating simulations and tactical decision games into each classroom, linking the classroom with combat training centers and knowledge management networks, shifting much of the curriculum into distributed format and providing a collaborative planning system that can be accessed from outside the classroom, will allow military educators and instructors to focus classroom time on higher cognitive learning through the creation of experience.

Before we narrowly focus on the specifics needed to develop 21st Century leaders we should review why and how adults learn best. Malcolm Knowles (1970), the father of adult education, gives us insight into the principles we must keep in mind as we consider any reform of our learning institutions.

- Adults learn best when they take responsibility for determining what they learn.
- Adults learn best that which is personally beneficial to them.
- Adult learn best when they discover for themselves

- Adults learn more from experience and feedback than experience alone.

Creating an experiential environment through deliberate practice

To achieve higher learning in an experiential, collaborative-execution-centric curriculum the School for Command Preparation of the Army Command & General Staff College is piloting a new curriculum and instructional (C&I) model for majors through colonels. This model creates an experiential learning environment, which embodies these adult learning principles, is performance oriented in an execution centric (verses planning centric) situation, and includes embedded simulation and digital training tools in each classroom. Initial results in the Tactical Commanders Development Program using these C&I reforms are very positive. As a result of increasing the use of constructive and decision oriented simulations, student performance has increased by 30-50% in most cases, as has student satisfaction with their educational experience. (Prevou & Costanza, 2002) These improvements have inspired further study where we looked at the use of multimedia decision oriented simulations across multiple education levels and learning styles to determine if there was a significant improvement in learning over more traditional methods (Prevou & Crowther, 2002).

The challenge was to develop an education model and technology tools that allows students to spend classroom time primarily de-conflicting issues, identifying options, solving complex problems and understanding why things occur as they did. In this execution-centric classroom students are placed "in the fight" and given an opportunity to explore ways to succeed in a rapidly changing, dynamic environment and then receive feedback from subject matter experts – "coaches", mentors–senior retired officers, as well as peers and instructors. This model allows instructors to focus on knowledge and experience to build wisdom not information and process.

Collaborative-execution-centric instruction forces students to produce results in accordance with the higher commanders' or instructors' desired endstate (Commander's Intent) both individually and as part of a team. Like the baseball player that spends hours in the batting cage, he combines his knowledge and experience to become a home run hitter for his team. Yet even the skilled hitter contributes to the team and when each player plays to his potential, the sum of their achievements is greater than the parts. To our military leaders, an experiential learning philosophy, coupled with a collaborative-execution-centric curriculum builds knowledge and experience in not only decision-making but improves a students' critical and creative thinking skills and sharpens his pattern recognition ability (Klien, 1998) which is key to developing adaptive, self-aware leaders. The key however, in creating this learning environment is the use of educational technology.

A strategy for the use educational technology

This new framework of a collaborative-execution-centric learning environment goes beyond the construct of the current pedagogy by incorporating decision-making, coaches/mentors, deliberate practice, and embedded simulations in an organized strategy to produce experience and achieve learning objectives at the top end of the taxonomy. While these "experiences" in the classroom cannot replace the first hand experience of actually performing the mission in the field, under operational conditions, they can provide an opportunity for practice and thought that we otherwise would be without. Like our baseball player, nothing can substitute for playing in the majors but no player or coach would attempt to enter the game without deliberately practicing their hitting skills in the batting cage.

Through the creative use of simulations and tactical problem solving strategies, SCP has institutionalized the concept at an intermediate level of development called deliberate practice. This level of development requires basic military knowledge but is difficult to attain in the challenging environment of field exercises due to the cost and the numbers of personnel required. Because of miniaturization, reduced costs of computers and advances in simulations, we are now able to 'create' opportunities for deliberate practice in the classroom. Deliberate practice is a common concept in the development of perceptual and motor skills (e.g., gunnery and aviation), but it is not very common in development of thinking skills. Through deliberate practice, (think of a batting cage approach) a well learned behavior or thinking process could be learned so thoroughly that performance is almost automatic and does not require as much cognitive effort. Automatic habits continue to operate in times of stress, fatigue and competing demand. After 48 months of instructing with this methodology in SCP the results are remarkable. While the SCP is still collecting data, initial feedback shows improvement in all tasks performed with as much as a 50% improvement in many of the skills. These results lead us to believe that given the proper use of technology coupled with advanced C&I and a progressive attitude, changes could have a profound effect on all levels of military education as well as significantly increase the proficiency of leader competencies and improve unit readiness.

Planning these operations while important – is moved out of the classroom for the most part allowing more time for developing adaptive thinking strategies revolving around making decisions and solving complex problems in a battlefield environment. However moving planning out of the classroom does not mean eliminating the peer collaborative environment that most often challenges students' thinking. Arrangements should be made outside of the classroom where plans can be developed as teams. The team's plan is then executed in the classroom. To accomplish this we must think of educational technology as an enabler to our classrooms. We must resource the classrooms with the tools that give us the ability to collaborate via the Internet, stimulate a constructive environment, replicate digital Army Battle Command Systems (ABCS) and offer distributed learning while in residence.

Focus on the Learning Objective

Another problem we noted and corrected was how simulations were being used in military education. For the most part they are still used to create a tactical environment where students acting as a US Force are pitted against a professional, thinking OPFOR. These exercises usually start at the assembly area or the line of departure and continue until culmination or annihilation occurs on one side. They are great models for attrition warfare. These exercises cover 10 hours to 10 days and produce so many outcomes or lessons learned that there is no way to cover them in a single AAR or hope students can internalize the issue and make correction.

Rather than one fight for 10 hours we believe 10 fights of one hour each is more effective. The exercise would start just short of a decision point and place the student into the situation with either a verbal brief or a simple, short handout. Each exercise would be constructed to achieve one to three learning objectives, a manageable amount. One defensive fight that would normally occur over six to eight hours would be run at 2:1 speed, be broken into three or four separate activities, each focused only on the actions centered around decision-making. This method has produced improved results. This vignette-based methodology is known as "Fight-Huddle-Fight" (Prevou & Wikoff, 2001). The Fight-Huddle-Fight approach allows the students and instructors to zero in on the critical learning objectives, review specifically the hindrances to accomplishing those objectives, make correction and see the results of their action.

Once an effective learning environment is in place, there should be opportunities for students to deliberately practice the tasks and receive feedback on their performance. Individuals who rise to world-class standards customarily engage in large amounts of deliberate practice over a period of years. There is rarely that much time to prepare Army leaders for contingency operations in the full spectrum of conflict. An effective approach is needed that allows students to practice scenarios in an ever-increasing scope of mission complexity.

> *"The maximal level of performance in a domain is not attained automatically as a function of extended experience, but the level of performance can be increased even by highly experienced individuals as a result of deliberate efforts to improve." (Ericsson, K.A., Krampe, R., & Tesch-Romer, C., 1993, p. 366)*

A MODEL FOR SIMULATIONS IN THE CLASSROOM

Before we can start planning the use of simulations we need to address where in the process of curriculum design and development we determine what type of activity or intervention is required to help achieve the learning objective and if a simulation is needed, what type of simulation is sufficient based on resources available.

In traditional K-12 education settings, curriculum design models are used to design instructional environments. Using a model, such as the Dick and Carey Instructional Systems Design Model (1990), requires the designer to first identify the instructional goals of the lesson. Once the goals are identified, the designer moves on to complete the following design stages: write performance objectives, develop criterion reference tests, develop an instructional strategy, and develop and select instructional materials. Once the instruction has been completed the instructor should conduct an evaluation of the instruction.

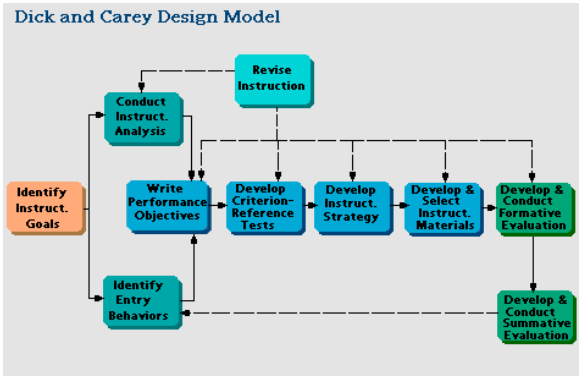

Figure 1

In the instructional strategy stage of this model we should determine three things: 1) whether of not to use simulations, 2) the type of simulation from a spectrum

of simulations, that will be used, and 3) the delivery medium, such as text based, multimedia, CBT/WBT or other. The common mistake, in our experience, is that instructional designers fail to identify the instruction strategy early enough in the process or they confuse strategy with the identification of the instructional material. Too often the use of simulations is an afterthought and the course materials and objectives do not match the type of simulation selected. Furthermore the simulation selected may be far too costly or manpower intensive for the desired objectives.

A "spectrum of simulations" ranging from; role playing to multimedia problem oriented vignettes, to tactical decision games and constructive simulations, to virtual simulations and full scale maneuvers offers the instructional designer a myriad of tools to use to achieve specific learning objectives.

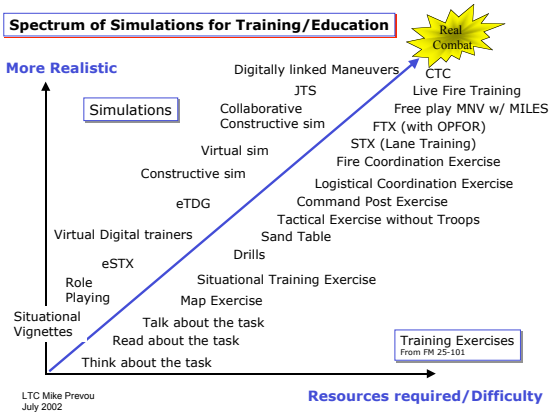

Figure 2

Simulation Media and Environments

There are several environments through which simulations can be experienced. A simulation could take place within a traditional face-to-face classroom, where students role-play or use drama to re-create a situation. With the help of computer technology simulations can be delivered through various media, such as any combination of text, video, audio, and graphics. In addition, these media can be made available through an onsite simulation classroom with computers or through online resources. The instructor must decide which medium would best meet the instructional goals and objectives for the intended audience.

In a previous study (Prevou & Crowther, 2002), learning material delivered in the form of text was compared to the same learning material delivered through an interactive audio-visual format. The results showed that a multimedia presentation of material can be more effective in instructing than a text presentation. The study also looked at participants' learning style in relation to the instructional medium. An interaction between learning style and mode of presentation was not found. This means that either there will be no difference in performance for different modes of presentation for these styles of learning or this test was not suited to test such an interaction. External research, however, indicates multimedia may address different learning styles.

Based on the demonstrations conducted at the Command and General Staff College in March of 2001 and the results of Army Experiment 8 in spring of 2001, a robust execution (constructive simulation) model (Prevou & Wikoff, 2001) demonstrated promise toward a technology solution to objective. The goal is to provide a cost-effective package in each classroom that allows students to complete planning outside of class in a collaborative environment, while providing dynamic execution of small vignettes up to larger exercises in the classroom. While many simulations and tactical games are available to enable this objective the most serious technical hurdles still appear to be security and bandwidth. Once we overcome the resource shortfalls we need a method for using embedded simulations in each classroom that produces deliberate practice and increases experience.

A New Methodology

With embedded simulations in the classroom and linked through the internet to a collective network, the instructor can use simulations in a series of five instructional levels to produce deeper and broader understanding of both the content of subject mater and the process or context in which it applies. For illustrative purposes, let's consider how we might instruct and educate officers to conduct a tactical envelopment of an enemy position.

In the typical military classroom we begin with having the students read the details of the operation in a field manual then the instructor lectures them on specific characteristics and principles. The students are then given a mission and told to plan the operation, usually on a map with acetate or in sketch form on a white board, write all or part of an operations order and then brief the operation in a set format as prescribed in another manual. Success is determined in this practical exercise by the students' ability to recall the characteristics and principles and place them in the order outlined in the manual. While this process-oriented methodology currently passes as a performance–oriented practical exercise (TRADOC Reg 350-70) there is often little learning occurring and most certainly no experience being developed.

With embedded simulations in the classroom we could take a student through five instructional levels or stages that would not only better develop their understanding of the operation but produce opportunities for them to demonstrate proficiency both individually and as part of a team, in multiple-repetitions of the same operation. This method increases experience and broadens their ability to recognize patterns and make decisions. The five stages of instruction are:

1. **Visualize the operation**
2. **Synchronize the operation**
3. **Collaborative Operations**
4. **Competition**
5. **Distributed Exercise**

Stage 1

Now let us consider how the instruction would occur employing the five stages with embedded simulations in each classroom. At this initial stage of instruction, we want students to understand what an envelopment looks like; to "visualize" the mechanics, and understand how combat multipliers like artillery, engineers, smoke, aviation would be synchronized to assist in the successful execution of the mission. During this stage of instruction students are engaged as observers and provide feedback as to what they observe happening, why, and the observed outcomes. This level of instruction is crucial to understanding what right looks like and forces the student to assess the cause and effect relationship between variables (combat multipliers) and understanding the role each plays in successfully accomplishing the mission.

Stage 2

In stage 2, students, now with a vision of what right looks like, attempt to individually synchronize the battlefield operating systems to develop an understanding of the complicated nature of battle and the dynamic nature of decision making during execution. These simulations, set up as tactical vignettes, would last no more than thirty or sixty minutes and have time for feedback from the coach/instructor built in. Planning is done from home, stored in the classroom server for execution at the next meeting. Each student acts independently to synchronize all the battlefield operating systems and completes his planning as homework by "dialing in" to the collaborative server in his classroom to synchronize his/her plan. Upon returning to the classroom, the instructor selects a number of student fights and reviews them as a group, usually at increased run speed. Feedback from the group focuses on cause and effect again and leads to adjustments in the BOS and a better understanding of the required synchronization of tasks. Multiple iterations of the same fight reinforce these skills and provide alternative ways to accomplish the same mission while review and discussion of variations of the fight increases critical and creative thinking skills. After reviewing the operation students would fight again and again using the fight-huddle-fight methodology.

Both stage 1 and 2 lend themselves to the use of either constructive simulations or tactical decision games depending on the size of the unit being observed. Tactical decision games like TACOPS and BC2010 have shown promise in the Command and General Staff Officers Course and the Armor Officers Advanced Course. Simulations like, Decisive Action, JANUS, BBS, DBST and Eagle ModSAF have been used in CGSOC and TCDC for visualization and synchronization practice with varying degrees of success. Another benefit of these visualization and synchronization exercises is how they help us recognize our bias. We form an expectation of what the enemy (or any other entity) will do, then by human nature we try to remain consistent to those expectations, often ignoring indications that signal change. If this happens too late it can be catastrophic. Through deliberate practice in these two stages we can recognize our bias trends and work (with the feedback from the coach/mentor) toward overcoming them.

Stage 3

Once each student has demonstrated an ability to visualize the operation and understands the synchronization required we move to a third level in which students' work as a team to synchronize designated operating systems. In their role as a battle staff officer they develop their tactical and technical branch skills as well as their collaborative skills as part of a leader team. Using the simulation in the classroom students now plan their teams' operation (still using the envelopment scenario) using the collaborative capability via the Internet or Intranet. Each student from his/her home computer plans and synchronizes via a dial-up PC/laptop into the schools host server. Students, now in the role of battle staff officers for one the brigade's conducting the envelopment, plan, wargame, synchronize and execute in the collaborative on-line environment. Upon return to the classroom the plan is executed on the constructive simulation systems in the same fight-huddle-fight methodology described earlier.

After students master the analog skills of applying their battlefield functional area we move instruction into the digital command and control systems being fielded to many of the Army's Force XXI units. The collaborative workstations can be setup to emulate the Army Battle Command System (ABCS) workstation typically used by the student for his/her battlefield functional area. The military intelligence officer acting as the Brigade

S2 would have his system configured as an ASAS station, the artillery officer as the Brigade Fire Support Officer (FSO) configures his as AFATD, the combat arms student S3/XO station may emulate MCS and so on. Using a constructive simulation to stimulate the digital environment, the instructor starts the collaborative-execution-centric vignette in progress and places the students near a critical decision point where they are required to re-synchronize their Battlefield Functional Areas (BFA) during execution, in response to a dynamic battlefield. Multiple iterations of deliberate practice hone the student's tactical and cognitive skills and produce a more adaptive leader.

Once students have mastered their BFA staff role they move from the isolated Brigade operation to part of a larger force and collaborate and coordinate with other classrooms conducting the same operation. By conducting multiple repetitions under the watchful eye of the coach/mentor, students build experience through deliberate practice. In this level Opposing Force (OPFOR) could be automated or played by support personnel.

Stage 4

The fourth level of instruction capable in the collaborative-execution-centric model system is a competitive phase. Students from one classroom plan, prepare, and execute against another classroom, building a sense of competition. Classroom A plays the enveloping Brigade while Classroom B assumes the OPFOR role. At the next meeting the roles are reversed. Critical and creative thinking flourishes here as one classroom attempts to best the other, then discusses the plan and execution in a combined After Action Review (AAR). This is not initially, a free play event. Learning objectives outlined by the coach/instructor drive the scenario. After students demonstrate competency in the learning objectives, free play can be used as a tool for creativity and discovery learning. Expert feedback from the coach/instructor should always follow in the form of an AAR. Students playing the OPFOR role learn to consider a thinking enemy in more detail than would occur today. Because of the dial-up connectivity of the collaborative system, students need not sit in classrooms and coordinate over paper maps and acetate to plan this operation. Planning can be done from any portal allowing students to spend classroom time executing the fight and reviewing the outcomes (feedback).

Stage 5

The fifth level involves multi-echelon multi-unit exercises that we typically think of as capstone events. But due to the simplicity of collaborating from classroom to classroom and home to classroom, these crucible "events" could be conducted much more frequently at far less overhead and involve many more echelons of leaders. These external exercises could employ different classrooms as different echelons, different services, coalition units, or as governmental and non-governmental organizations.

In one set of classrooms students could replicate a Brigade Combat Team (BCT) while across the hall, International Offices role-play a coalition Division. One classroom could serve as an interim brigade and next door their battalions might be played by students actually programmed for assignment to one of these new units. Because of the collaborative nature of these systems, military intelligence officers at the Command and General Staff College can "reach-back" to Fort Huachuca where captains at the career course provide strategic and operational intelligence. RSTA troops and battle staffs could be played by Armor Officers at school at Fort Knox and Infantry companies and Infantry staff by Infantry Officers at Fort Benning or the officers attending the Combines Arms Service and Staff School (CAS3) at FT. Leavenworth. Pre-command course students could fill command positions in these crucible events. The list for participants could go on and on. With today's educational technology we could literally link every TRADOC School for multiple repetitions of these tactical exercises and build increased battlefield wisdom by honing experience and knowledge through deliberate practice and shared, multi-echelon events.

To highlight the cost of our current exercise mentality, lets look at a typical TRADOC school capstone exercise. A single Prairie Warrior Exercise previously conducted each year at the end of the Command and General Staff Officers Course (CGSOC) at FT Leavenworth, costs approximately $2.5 million. This seven day capstone wargame takes nine months to plan, requires a full time staff of 5 military and civilians and dozens of students in a part time capacity, involves over 225 contractors and around 40 instructors (Hansen, 2002). All of this to create one experiential learning event for the 1100 students, of which many instructors believe, less than 25% receive the direct benefit of being in a decision making roles. That equates to almost $10,000 for each student benefiting from the exercise. By comparison, if this money were used to create the collaborative-execution-centric environment discussed above, one PW exercise could pay for a suite of high-end computers for every classroom in CGSOC and the tactical games and constructive simulations needed along with a team of educational specialists and technical support personnel. The saving from each subsequent year would ensure maintenance of curriculum, equipment and simulations and provide enough funding to transition nearly 50

hours of classroom instruction into a distributed format. Furthermore, the new methodology would ensure that every student is engaged in activities that foster learning according to their preferred learning method. How many other schools and centers are spending similar amounts to train only a few leaders in a single event? This past year, CGSC moved from the one large PW exercise to four smaller, more experiential exercises. Analyses of the results of those exercises are ongoing.

Implications for Distributed Learning

These techniques are only two examples of how we can leverage technology to improve our leader development education and training. Outside the brick and mortar walls of our institutional training and education campuses there is great potential to use this technology for non-resident instruction in virtual campuses. These virtual campuses would be a tremendous asset to the National Guard and Reserve leaders who can often not afford the time away from civilian employment to get the same experimental learning opportunities as active soldiers. The virtual campus could fill the educational gap between professional military education courses – the 1LT selected to be the battalion S1/S4 could take a web-based course with embedded simulations, to help them understand the new position and their role and responsibilities. For units preparing for an operational or training mission, constructive simulations could provide a mission rehearsal tool that can be used to better prepare leaders for the dynamic nature of future operations.

Civilian and industry education has much to gain from this methodology. Most, if not all the constructs and principles apply directly to higher achievement in schools, in universities and industry settings. I believe an opportunity would exist for follow-on studies that demonstrate the application of these principles in other than military education.

Recommendations for Future Research

Although many types of simulations are used in K-12 classrooms, there is no standard methodology employed for the use of simulations in the instructional process. Research on simulation effectiveness is also insufficient to justify the types of expenditures experienced in the 90's technology boom. Collaboration between civilian and military academic institutions could lead to improvements in both strategy and instructional design.

Effectiveness of educational technology. Evaluating whether the high cost of educational technology significantly affects the outcomes of a military learning environment or whether a particular curriculum and instructional (C&I) methodology can produce a similar outcome. Additionally we should compare both C&I methods and the technology construct factors against the military education levels to evaluate whether education level significantly affects either factor. Can instructional changes create improved outcomes equal to or greater than that possible with new technologies? Research is required to ensure we change in the right direction and show a return on our investment.

Education vs. Training. Should we reduce the amount of time a leader spends in institutional education in favor of increased time in a unit? Does the experience gained in a unit outweigh the conceptual knowledge and experience gained through effective, collaborative-execution-centric-instruction?

Distributed Learning. Will the potential of distance learning, e-learning and computer-assisted instruction (CAI) prove to be as effective as institutional learning? Will students accept DL as a routine source of education or will they expect experiential learning through resident instruction? Very little research is available to demonstrate the effectiveness of DL on the military learner or to determine which competencies can best be learned through DL. Furthermore, no data is available to give us insights into how much DL a student can conduct at any given time. Can we really expect military students to engage in 40-80-120 hours of DL/CAI in the short time frames being considered?

The traditional learning model used in PME courses today must change to remain relevant to prepare 21st century leaders for the leaps in battlefield technology and the explosive environments characterized by weak political infrastructure, complex urban situations, and quickly changing mission roles. The Army must research the effectiveness of educational technology before it invests heavily in simulations and network technology which, if used incorrectly, may have little significant effect on learning outcomes.

CONCLUSION

Our institutions provide more than education and training, they provide an opportunity for deliberate practice of essential skills where each coach has the means to hone a students tactical and leadership skills through multiple iterations of problems under changing conditions. We must move away from the standard classroom approach of just "telling" students. The means are there to engage every student in every course in every military school. To tailor the instruction so it is relevant to that student and to

provide feedback against a known and published standard.

Army education must remain relevant. During Transformation the institutional and intellectual change must lead the physical change as the Army adapts. It is incredible to think about how effective our institutional schools could be if we made a few fundamental philosophical changes and focused our curriculum and instructional methodology on a collaborative-execution-centric format enabled by technology. The approaches discussed here offer only a few potential solutions toward creating an integrated learning environment where all the functions of education from learning basic doctrine and organization, to the highest levels of creative and critical thinking, can be challenged. As former Army Chief of Staff Eric Shinseki reminded us in a briefing last year, "if we think change is hard then we won't like being irrelevant"

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