Beyond Game Effectiveness Part I: an Empirical Study of Multi-role Experiential Learning

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ABSTRACT

This paper discusses issues concerning a frequently asked question by the operational community using non-kinetic game-based training to support Stability, Security, Transition, and Reconstruction (SSTR) operations —"What can be learned from games used in training?" The present paper summarizes findings from an empirical study that investigated experiential learning in a multi-player, PC-based game module transitioned to PEO-STRI, DARWARS Ambush! NK (non-kinetic). DARWARS Ambush! will be supported by the Army until 2010 and is used to train thousands of soldiers around the world. This empirical study seeks to understand what and how users of non-kinetic game-based missions learn when engaging in multiple roles. The results are applicable to First-Person game-based cognitive trainers designed to enhance trainee non-lethal, or non-kinetic engagement skills such as interpersonal and intercultural communication. We discuss results obtained from data collected from 85 research participants of diverse backgrounds who trained by engaging in tasks directly, as well as observing and evaluating peer performance in real-time. We discuss how Experiential Learning Theory (Kolb) and metacognition served as inspirations for our investigation of multiple roles in game-based training. We describe the roles and non-kinetic mission used in our experiments. Specifically, this paper addresses questions such as, "Are there significant differences when a task involves observation and evaluation or performance?" and "What do the lessons learned from this empirical study mean for the future use and design of game technology for training?" The paper concludes that contrary to current trends in military game development, experiential learning is also supported by approaches designed to facilitate trainee mastery of reflective observation and abstract conceptualization as much as performance-based skills.

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Elaine M. Raybourn, Ph.D. in intercultural communication with an emphasis on human-computer interaction brings an expertise in understanding culture and communication to the design of serious games & experiential simulations, adaptive training systems, and validation & verification of Human, Social, Cultural, and Behavioral (HSCB) models for training and analysis. Her research and design concern topics such as intercultural competency, real-time in-game assessment, novel after action review (AAR) systems, creative collaboration, and designing learning applications that stimulate intercultural communication, and cognitive & metacognitive agility (adaptive thinking). Elaine has led the development of game-based training systems for the U.S. Army Special Forces and DARPA that have been transitioned to the John F. Kennedy Special Warfare Center and School and PEO-STRI, respectively. Currently Elaine leads research programs in adaptive training systems & Human, Social, Cultural, and Behavioral (HSCB) Model Validation & Verification. Elaine was an ERCIM (European Consortium for Research in Informatics and Mathematics) 2002-04 Fellow. She is an I/ITSEC 2009 ECIT subcommittee member, reviewer for the I/ITSEC Serious Games Challenge, and on the 2010 Defense Science Board for Joint Professional Military Education. She is a principal member of Sandia National Laboratories and a National Laboratory Professor at the University of New Mexico's Department of Communication & Journalism.

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INTRODUCTION

Over the course of the past several years the training and education community has begun to see more studies identifying the characteristics that constitute game effectiveness (Belanich, et. al., 2004; Orvis, et. al., 2006; Beal, 2006; Rowan & Brown, 2008). These contributions address the question, "What can be learned about the use of games in training?" For example, Rowan & Brown (2008) indicate that serious games, when executed properly, can provide an effective and efficient means of blended training. The cognitive and affective learning possible in a game-based experiential environment is valuable for both individual and collective training. Beal (2006) learned that games are most effective in training when focused on specific training objectives and when facilitated by experienced instructors as opposed to used as a stand-alone tool. Rowan & Brown (2008) also found that serious games are an effective means to address tactical training requirements. Belanich and others (2004) learned that certain design and interface features of games enhance trainee motivation. In follow-on work examining the use of a first-person shooter, Orvis and others (2006) learned that characteristics such as prior videogame experience, goal orientation, and self-efficacy can also impact motivation. The findings from these studies address primarily kinetic game-based training missions.

The past several years have also seen the growth of non-lethal (a.k.a. non-kinetic) cross-cultural engagement training. While the United States military is adept at performing kinetic operations, gaps have been identified in home station training in the area of cross-cultural, non-kinetic engagements (Wong, 2004). Stability, Security, Transition, and Reconstruction operations (STTR) require non-lethal, or non-kinetic[1] competencies to succeed such as languages, regional and technical expertise, intercultural communication, interpersonal skills, and adaptive thinking.

Notable efforts are made throughout the training and education development community to prepare troops with the non-kinetic skills needed upon deployment. Command training centers and schoolhouses may provide live-action, constructive or virtual simulation, and/or game-based training exercises for rehearsing kinetic/non-kinetic missions in a more blended approach. There are also a number of game-based training applications aimed at learning languages, leadership, decision-making, negotiation, team-building, communication, and cultural awareness ranging from web-based advanced distributed learning to interactive video vignettes to single-player and multi-player commercial or government game-based training solutions. These serious games and related applications, although not discussed here, contribute to the resources available for home station STTR training.

Problem Statement and Rationale

While the body of research regarding the study of tactical training game effectiveness is growing as described in the above section , empirical study of non-lethal, or non-kinetic, game effectiveness is lacking. Eventually pushing past tactical, kinetic, game effectiveness studies our community will better understand best practices for how we can make learning itself more effective with games.

The present paper is the first in a series that seeks to go *beyond game effectiveness* per se to understand how we can make *game-based learning more effective*, especially learning focused on training non-lethal, or non-kinetic engagement skills. Making learning more effective is an opportunity for out-of-the-box thinking (Raybourn, 2007a). For example, in most cases our community designs and develops game-based training solutions that leverage the dominant paradigm of how users conventionally engage in entertainment games. In particular we design practice environments or trainers that assume that in order to engage trainees

[1] The US Army changed the term "non-kinetic" to "non-lethal" in 2007. In the present paper, non-kinetic is used to refer to civilian engagement techniques that do not involve the use of force.

cognitively, experientially, and affectively we need to keep them busy in the game by "doing." However, what would happen if we also kept them "busy" by merely observing and thinking in a game?

In two cases, such as the DARWARS Ambush! NK and Adaptive Thinking & Leadership, multi-player game-based training systems have been deployed which provide trainees with opportunities to play multiple training roles designed to exercise intercultural communication, adaptive thinking, and metacognitive skills (Raybourn 2006, 2007a,c; 2009). Real-time feedback supported the use multiple roles in negotiation and cultural awareness non-kinetic training for Special Forces (Raybourn et. al., 2005) however more research is needed.

Research Objectives

The purpose of this research is to investigate the utility of the inclusion of multiple roles focused on both "doing" and "metacognitive thinking" in multiplayer game-based training. In particular, multi-player, first person perspective games are fast paced, and often task-oriented. While it might seem counter-intuitive at first to create multi-player training roles for real-time metacognitive skill development in which players observe and evaluate the performance of others, we believe this approach may offer out-of-the-box solutions for training metacognitive agility and adaptive thinking. Therefore in the spirit of desiring to make game-based learning more effective, we studied the inclusion of multiple roles in a non-kinetic game-based training mission. The following research questions were of interest:

Do participants, regardless of role (either player observation/evaluation role), report change with respect to their learning?

Are there significant differences among groups participating in different roles in non-kinetic engagement training, especially when one role requires more active participation that the other?
What do the lessons learned from this empirical study mean for the future use and design of game technology for training?

The present paper presents our first analyses of an empirical study investigating multi-role experiential learning in the multi-player game-based training modules transitioned in 2007 to PEO-STRI, DARWARS Ambush! NK.

WHY MULTIPLE ROLES?

Experiential Learning Theory

The incorporation of multiple roles in our game-based training approach was inspired by Experiential Learning Theory, metacognition, and our previous work with the US Army John F. Kennedy Special Warfare Center and School (USAJFKSWCS). During an ethnographic investigation at the Special Warfare Center and School, The author learned that role-playing, observing others model behavior, reflecting to analyze best practices, and providing constructive peer feedback were key elements to the way Special Forces trained across their education curriculum (Raybourn, 2009). In addition she noted that each of these elements could be part of the same game-based training system, but should be trained differently—which required *thinking differently* about the design of conventional first-person, game-based training (Raybourn, 2007a).

Experiential Learning Theory defines learning as "the process whereby knowledge is created through the transformation of experience" (Kolb, 1984; p. 41). According to Kolb knowledge results from the combination of both grasping and transforming experience. The constructs for creating knowledge include concrete experience and reflective observation for grasping experience, and abstract conceptualization, and active experimentation for transforming experience (Kolb et. al., 2000). Learning is characterized as a cycle of creative tension among these four learning modes. The cycle is expressed as such: concrete experiences form the basis for reflective observations. These observations form abstract concepts that provide a framework for new implications of actions that can be taken. These implications are then tested in active experimentation to guide the formation of new actions. Multiple roles were introduced into two multi-player game-based systems in order to provide trainees with different cognitive experiences at the same time and regarding the same training content so that they could better learn from each other during debriefings and after action reviews [AAR] (Raybourn, 2006, 2007a,c).

Metacognition

Metacognition has been defined a number of ways over the years. A good working definition of metacognition is higher order thinking that involves active control of one's learning process to include knowledge of persons, task, and strategy (Flavell, 1979; White et. al., 1999). Thus *metacognitive agility* is defined in the

present paper and has been defined by the author previously (Raybourn, 2007c) as possessing the ability to analyze the way one or others think, discern different tasks or problems requiring different types of cognitive strategies, and employ those strategies to enhance learning and performance. Knowledge is considered to be metacognitive in nature if it results in *strategic* use toward the accomplishment of a goal. For example, knowing one's strengths and weaknesses with respect to a given task and using this information strategically (through task analysis, planning, monitoring, evaluating, and reflecting) to meet a goal or improve performance is exercising executive or metacognitive skills (Veenman et. al., 2005).

Incorporating a role that exercises more strategic thinking, reflection, and self-regulation can provide trainees with a unique view of different sides of the same coin. According to Livingston (1996) "simply providing knowledge without experience or vice versa does not seem to be sufficient for the development of metacognitive control." Menaker et. al. (2006) take this notion further by arguing that experience alone is not enough to make an activity "cognitive." Therefore in developing training to exercise cognitive or metacognitive agility, designers should make the diverse cognitive processes explicit to trainees so they can utilize these skills again or in diverse settings. Multiple roles can help trainees better experience and identify their executive skills (metacognition).

Experiential Learning Theory and metacognition contributed to the design of multiple training roles which provide opportunities for 1) addressing the four experiential learning theory modes in multiplayer first-person game platforms 2) honing one's meta-level thinking about the strategies employed by performers in game-based training while providing constructive performance evaluation feedback to others. Honing metacognitive agility is also integral to becoming a competent intercultural communicator (Bennett, 1984; Raybourn 2009) which is a key capability of successful STTR operations and the basis for the Simulation Experience Design Method (Raybourn, 2006, 2007a) used by the author to design multiple training roles.

EXPERIMENTAL ENVIRONMENT

DARWARS Ambush! NK [non-kinetic] (Raybourn et. al., 2008) was developed to provide DARWARS Ambush! (Roberts et. al., 2006) with non-kinetic mission modules. The modules were transitioned to PEO-STRI in 2007. DARWARS Ambush! NK consists of immersive multiplayer scenarios in a fictitious environment and builds on commercial computer game technology (Operation Flashpoint, developed by Bohemia Interactive Studios). The DARWARS Ambush! NK platform includes roles for an instructor, soldiers, local nationals, observer/evaluators, and non-player-characters (NPC). Role-play is centered on exercising non-kinetic stability operations competencies within two different scenarios. Much like the Adaptive Thinking & Leadership training game (Raybourn et. al., 2005) role-players use headsets with microphones to communicate and interact with others during the game-based training. Reflective Observer/Evaluators provide real-time performance evaluations.

Real-time injects that influence the actions taken by role players in the scenario help the instructor create opportunities for adaptive thinking and demonstration of leadership skills as the situation dynamically changes (Raybourn et. al., 2005, 2008). The training design also includes a proprietary method of collecting real-time in-game assessment and feedback from observer controllers, subject matter experts, or peer learners in the role of observer/evaluators (Raybourn, 2006, 2007c). Adapting this approach to a multiplayer environment, one with multiple observers and multiple trainees, necessitated some changes to the DARWARS Ambush! environment.

DARWARS Ambush NK! missions include a socio-cultural human terrain overlay for the DARWARS Ambush! geographical map. A workshop was conducted at Ft. Lewis, WA with training developers in February 2007. The lessons learned and invaluable contributions of Ft. Lewis subject matter experts helped generate the DARWARS Ambush NK! training materials (Raybourn et. al., 2007b) designed to aid home station training developers in creating non-kinetic engagement missions for convoy and dismounted STTR operations training.

MULTIPLE ROLES USED IN STUDY

The Cordon and Knock mission module (Raybourn et. al., 2007b; Raybourn et. al., 2008) was used as the context for our empirical study. Portions of the multiple roles discussed below are excerpts from DARWARS Ambush! NK mission documentation and an unpublished manuscript that accompanied a poster presentation at the December 2008 Army Science Conference.

Player Role

A Cordon and Knock mission was designed to hone player's listening, communication, and problem

Figure 1. Player interface.

solving in an intercultural setting (see Raybourn, 2006, 2007a for mission design model). A concluding task was comprised of one kinetic, novel situation dilemma that allowed the player to demonstrate leadership and creativity (Raybourn et. al., 2005). The player receives an Operations Order to bring a local national (LN) from the village back to the FOB for questioning. As a trainee the goal of this mission is to successfully conduct tactical questioning in the intercultural setting. If successful, the trainee learns that the local national's cousin is an Imam who is cooperating with US Government. The questioning allows the trainee to practice aspects of intercultural communication such as cultural awareness, language, listening, cultural norms, and some nonverbal communication. The trainees' objective is to negotiate with the local national to return to the Forward Operating Base (FOB) for questioning willfully and voluntarily. Other tasks executed by the trainee include investigating a nearby marketplace where questionable equipment is for sale (e.g., weapons, night vision goggles) and communicating with merchants (non-player character text dialogue) who can provide additional information as to the whereabouts of the local national to be interviewed. A player view (3rd person perspective) is shown in Figure 1. Players interact with the interface similar to many commercial first-person perspective games including Operation Flashpoint and more currently VBS-1 and 2.

Reflective Observer/Evaluator Role

An approach to training metacogntive agility and adaptive thinking is to give trainees concrete practice, reflective observation, abstract conceptualization and active experimentation with evaluating their own actions and those of others. Non-kinetic engagement training such as rapport building, negotiation, questioning, interviewing, etc. is aimed at improving communication and cultural awareness skills. A goal of the Reflective Observer/Evaluator Role is to provide trainees the opportunity to reflect on communication events, speech acts, and verbal strategies that are enacted in player roles (Raybourn 2009).

The creation of a new trainee role, the role of the peer Reflective Observer/Evaluator, allows both trainees and experts such as observer controllers to provide real-time, in-game performance & feedback evaluation (Raybourn, 2007c). Up to 20 trainees may perform the Reflective Observer/Evaluator role in a given DARWARS Ambush! NK training session. This role enables more trainees to actively reflect on and evaluate the effects of one's actions and the ways they might have responded or acted if they were in the player's shoes. This approach places evaluators in the training event, and gives them the ability to assess the player's performance and comment on events as they unfold.

The Reflective Observer/Evaluator interface shown in the following screenshot allows users to track the activities of any character in the mission from that character's point of view with the expressed purpose of evaluating performance in real-time. Evaluations are initiated by the instructor who selects the performance criteria from a competency drop-down list. The instructor sends requests for evaluation to all the Observer/Evaluators. Presently there are 10 general non-kinetic engagement competencies from which to choose including several items related to cultural awareness, leadership, communication, and adaptability.

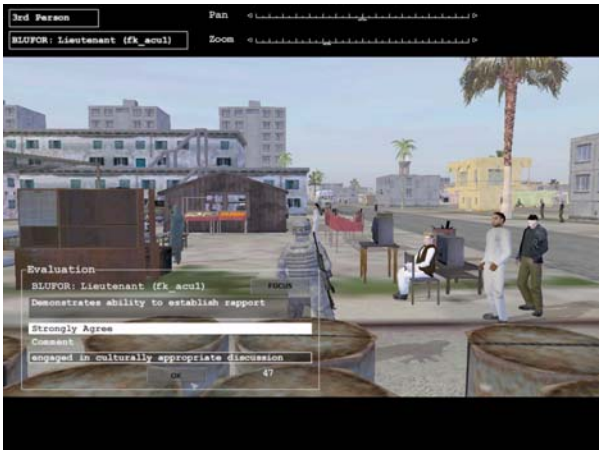

Figure 2. Reflective Observer/Evaluator interface.

The interface above shows the character centered in the scene from a third-person perspective. As that character navigates through the virtual world, the display will update automatically. Two controls at the top of the screen adjust the relative viewpoint: the **Pan** slider slews the view to the left or right of the character's own body's orientation; the **Zoom** slider moves the viewpoint closer or farther from the character (Raybourn et. al., 2007b, 2008).

Observer/Evaluators attach themselves to any character or team in the mission using the drop-down list at the upper left of the screen. They can also switch between third- or first-person perspectives using the adjacent drop-down list button.

METHOD

Recall that the purpose of this research is to investigate the utility of the inclusion of multiple roles focused on both "doing" (enacting) and "metacognitive thinking" (observing and evaluating) in multiplayer game-based training. The previous sections describe roles that comprise an approach to training designed to exercise the skills needed for adaptive thinking, communication (Raybourn et. al., 2005), intercultural competence, self-awareness, reflection (Raybourn, 2007a), and related non-kinetic skills. A quasi-experimental design was used to measure the effects of participation in a multi-player, multi-role game-based training mission. All attempts were made to replicate training as it might occur at a schoolhouse. The following research questions were addressed:

RQ1: Do participants, regardless of role (whether in player or observation/evaluation roles), report change with respect to their learning?

RQ2: Are there significant differences among groups participating in different roles in non-kinetic engagement training, especially when one role requires more active participation that the other?

Procedure

Participants arrived in groups of two and completed demographic questionnaires and a pre-test questionnaire designed to baseline their learning expectations. Following the completion of questionnaires both participants received training on the interface commands and maneuvering characters in the game. They were allowed time to familiarize themselves with the game controls and interface. Next, participants were trained on how to operate the Reflective Observer/Evaluator interface and taught how to evaluate the player's performance (e.g. what to look for, definitions of terms and corresponding behaviors, etc). Participants then watched a video of a 10 minute power point briefing administered by a member of the U.S. Army (in uniform) on the mission and the player's mission objectives. For example, the briefing consisted of the local geographical area, culture and society, the key items to be on the lookout for, and the operations order to bring a local host national from a fictitious city back to the FOB for questioning. Participants were also told that the US Army unit had been working on relationship building with a key individual of the area. After the video briefing, participants self-selected the role of player or Reflective Observer/Evaluator. The training mission lasted approximately 25 minutes. During the mission players were in the role of a commander or the Observer/Evaluator. Commanders had one squad member (played by a confederate of the experiment) assigned to them. Observer/Evaluators listened to the communications and observed/evaluated the gameplay. They provided real-time evaluations on the player's performance in key moments. This feedback was logged and not made visible to the player so to not alter events. After the training mission had concluded both participants completed posttests and switched roles.

All attempts were made to replicate real-world training events as the author has witnessed/conducted at military battle command simulation centers and schoolhouses. The present study investigates the first half of the entire study, that is, participation in one role during the first 25 minutes of the training exercise. Expanded findings for the effects of full participation will be available in a future report of the repeated measures, cross-wise study.

Participants

Eighty-five members of Sandia National Laboratories volunteered for the present study. Most of the 85 participants were novices with little to no military experience, only 13% reported ever being or currently a member of the US Armed Forces. They ranged from ages 18 – 64. Only 12 females participated in the study. Sixty-two percent reported being European American. Thirty-three percent had master's degrees and 11% had doctoral degrees. Ninety-nine percent reported having no computer game-based training, although 64% had played single-player games, and 26% reported playing multi-player games.

RESULTS

The author tested two hypotheses described below. The first hypothesis tested self-reported change in learning for trainees in one of the two roles (either player or observer/evaluator) and was measured as the difference between pre- and posttest scores as calculated by a paired sample t-test. The decision rule for paired sample t-test was five percent significance. The second hypothesis was tested by mean differences of independent sample t-tests calculated on the difference scores of pre- and posttest questionnaires completed by participants in each of the two conditions: Group 1 Player and Group 2 Observer/Evaluator. The decision rule for independent sample t-test was five percent significance.

The first null hypothesis stated that *participants, regardless of role (whether player or Observer/Evaluator), would report no change regarding their learning after participation in the non-kinetic training mission*. Paired sample t-tests on the pre- and posttest means indicate that the posttest mean statistically significantly increased after participation in the non-kinetic training mission as compared to the time of the pretest. The null hypothesis was rejected. Results suggested that players reported learning about their communication by interacting in the training mission (t= 2.8, [df = 36], p<.009), that the training was a good use of their time (t= 3.4, [df = 36], p<.002), that they learned something about cultural awareness by interacting with the mission (t= 4.0, [df = 36], p<.000), that the training mission was an engaging way to practice communication skills (t= 6.2, [df = 35], p<.000), that that the skills learned during the training mission are helpful in solving problems and making decisions(t= 3.5, [df = 36], p<.001), and that the training mission was difficult (t= 2.7, [df = 34], p<.012).

Reflective Observer/Evaluators reported believing the training mission was an engaging way to practice communication skills (t= 2.6, [df = 41], p<.014), that they learned something about cultural awareness by interacting with the mission (t= 2.4, [df = 41], p<.023), and that that the skills learned during the training mission are helpful in solving problems and making decisions (t= 2.4, [df = 41], p<.02).

The second null hypothesis stated that *there would be no significant differences among the two groups participating in different roles of non-kinetic engagement training*. The second hypothesis was tested by mean differences of independent sample t-tests calculated on the difference scores of pre- and posttest questionnaires completed by participants in each of the two conditions: Group 1 Player and Group 2 Observer/Evaluator. The null hypothesis was rejected. Participants in Group 1 Player reported learning about their communication by interacting in the training mission (t= 2.9, [df = 83], p<.005), that the training was a good use of their time (t= 2.3, [df = 83], p<.022), that the training mission was difficult (t= 2.2, [df = 83], p<.03), and that they learned more about their strengths and weaknesses by participating than they would have if they did not participate (t= 1.2, [df = 83], p<.05, equal variances not assumed). In other words, players reported learning tasks that were specifically designed to address communication and self-awareness.

However, on other tasks that were specifically designed with Observer/Evaluators in mind there were no significant differences among the two groups even though both groups reported learning. That is, when taken independently both groups reported statistically significant learning, but when the means of the two groups were compared, they were not statistically significantly different. For example, there was no statistical difference on previously salient items such as believing the training mission was an engaging way to practice communication skills (t= .82, [df = 83], p>.4), learning something about cultural awareness from interacting with the training mission (t= .81, [df = 83], p.>.4), and that the skills they learned from interacting with the mission would be helpful in solving problems and making decisions (t= .12, [df = 83], p>.9).

CONCLUSIONS

The results indicate that contrary to popular expectations participants in both roles (Player and Reflective Observer/Evaluator) reported statistically significant learning. That is to say, trainees don't have to "do" or perform in order to learn in game-based non-kinetic training. One may also observe, "think," and evaluate another's performance in game-based non-kinetic training and still report engagement and learning. The Observer/Evaluator role was designed to provide an opportunity for real-time reflection and meta-cognitive learning.

Both Group 1 Player and Group 2 Observer/Evaluator exhibited significant change in learning after participation in the training mission from the time the pre-test was taken. Those participating in Group 2 Observer/Evaluator reported believing that the mission was an engaging way to practice communication, that they had learned about cultural awareness, and that the skills they learned from the mission were useful for

problem solving and decision making. . While Group 1 Players reported significant difference on certain items closely associated with performing a communication task (which was the purpose of the mission for the player), it is important to note that there were a number of commonalities between the reported learning experiences for Group 1 Player and Group 2 Observer/Evaluators. Both groups learned, and in the end, there were only a few items that players reported learning more than Observer/Evaluators.

The Reflective Observer/Evaluator role focuses trainees on providing performance evaluations in real-time for behaviors such as cultural awareness, communication, leadership, and adaptability. It is possible that observation/evaluation is more complex activity than originally thought—therefore requiring concrete experience with the training topic. Recall a principle from Experiential Learning Theory: concrete experiences form the basis for reflective observations (Kolb et. al., 2000). It may be possible that trainees need to have a direct concrete experience with the training topic before they can identify salient behaviors in themselves and others for evaluating performance. Evaluation can be a rather abstract task that may require "graduate level" understanding of the training objectives. After all, in order to evaluate others fairly one must understand the phenomenon very well and be able to articulate the rationale for evaluations. Players' tasks may have been more straightforward, and the reward perhaps more immediate. Follow-on research is needed to better address these issues.

What do the lessons learned from this empirical study mean for the future use and design of game technology for training? First, the role for Reflective Observer/Evaluators was much more engaging than most would imagine. In a non-kinetic engagement mission where small groups or key individuals (commanders) practice the act of intercultural communication or negotiation, introducing a role for Reflective Observer/Evaluators can be a force multiplier in developing a shared understanding of collective skills practiced in game-based training. By drawing every trainee into the same mission they learn from each other (Raybourn, 2007a). Ultimately it is learning from each other that we hope to engender with this training.

Second, the results of this study help us see that we have not yet fully explored what it means to learn and train with multiple roles in games. Does one always have to "do," to learn in games? Should the tasks always be concrete and procedural? The results would suggest that one can also learn in roles that may be more abstract and conceptual honing different ways of "thinking" and metacognition (Kolb et. al., 2000) Games can potentially provide different roles which can also be played more than once or in a different order to potentially enhance experiential learning in new ways. Further research is warranted.

FUTURE RESEARCH

The present study is the first in a series that seeks to investigate the use of multiple roles in non-kinetic game-based training. The present analysis was conducted on participation in one role during the first 25 minutes of a longer training exercise in which participants self-selected roles and then after the first session was complete, switched roles. As the participants were not randomized into group assignment there is some chance that the results may be biased however there is no indication from examining the results to suggest this concern. Participants were not randomized into groups in order to closely follow the quasi-experimental protocol that attempts to replicate a true training event. A future repeated measures analysis will further investigate multi-role experiential learning. Future research will address the order in which one plays both roles and whether there are any notable differences among multi-role learning experiences. Research is also currently underway by the author to identify salient factors in communication performance, recall of information, social behavior modeling, and the development of new strategies in multi-role game-based training.

The present paper sought to go *beyond game effectiveness* to understand how *game-based learning can more effectively* focus on training adaptable non-kinetic engagement skills by introducing multiple learning roles that exercise different cognitive skills. This approach is different in spirit and design from more conventional means of interaction and engagement used in training and entertainment games. The training and game design approaches used by the author were empirically tested and the results presented in the present paper. Finally, contrary to current trends in military game development, the present study illustrates (albeit not entirely) that experiential learning can be supported by approaches designed to facilitate trainee mastery of reflective observation and abstract conceptualization as much as performance-based skills. By providing trainees with the opportunity to switch roles, and play from different perspectives we can engender the adaptive behaviors needed to excel in non-kinetic engagements and STTR operations.

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