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A METHODOLOGY FOR DETERMINING IF VIRTUALIZATION IS APPROPRIATE FOR MILITARY TRAINING APPLICATIONS

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ABSTRACT

Military training through virtualization has become the norm. The military is focused on becoming more expeditious in its goals by transitioning real world training into the virtual world. It is important for organizations to objectively identify if virtualizing a process is suited for the training. The fundamental issue with virtualized training is whether or not it can transfer the necessary knowledge to the trainee. The Virtualization Process Theory (VPT) is an IT theory that was designed to determine if a process should be virtualized. It analyzes a set of constructs in a process and the ability of those constructs to be transferred into a virtual environment. This paper sets up a suggested methodology for future research to utilize to analyze if the Virtualization Process Theory can be used to determine which military processes can be virtualized successfully through a knowledge management frame. This is just an informational approach to perform an insightful study for creating effective Virtual training for the military.

Keywords: Information Technology (IT), Knowledge Management (KM), Virtualization Process Theory (VPT)

INTRODUCTION

In today's military, training through virtualized modules has become the standard operating procedure. Information Technology (IT) has increased its ability to simulate real world processes; the military has begun to simulate training for warfighting contingencies. These warfighting simulations are typically seen as ineffective for transferring knowledge [2]. The Department of Defense continues to pay billions of dollars annually to virtualize military training [4]. The Virtualization Process Theory provides a potential tool for the military to use for determining what processes to virtualize. A literature review shows that the military is focusing on the challenges of transforming its training into a virtual environment [1, 2, 4, 6, 8, 9, 10]. Also, the literature discusses the military's continued desire to improve and understand what level of knowledge is transferred through virtual training and simulation. [6, 8]. The military could utilize the VPT as a general approach for continuing its research into this matter.

RESEACH QUESTIONS

These are suggested research questions to focus a study with this methodology. These questions focus on how the Visual Process Theory can be used to explore the necessary constructs of a process for it to be considered for virtualizing. These macro-level questions set a foundation and boundary for building specific questions about this subject that a researcher can utilize to investigate this matter.

RQ1: Can the Virtual Process Theory be applied to Military training processes?
SQ: Do the Virtual Process Theory constructs correlate to the basic constructs in military training?

RQ2: Does the Virtual Process Theory consistently predict if the virtualized process transfers knowledge comparably to real world training in the military?

RESEARCH METHODOLOGY

The proposed research method will be a qualitative evaluative approach. The evaluative approach offers a strategy to investigate whether or not an initiative is worth implementing in an organization. O'Leary contends that this research strategy will be appropriate to determine if utilizing the VPT for military virtualization is practical. The data collection method will be a focus group. The projected focus group should be a Command level group of military leaders who specialize in the management of training. A qualitative questionnaire derived from the research questions would be utilized in this study. A question such as: "Does the process that is attempting to be virtualized

contain sensory requirements that are capable of being simulated? Or "Do all of the constructs in the Visualization Process Theory apply to the military training attempting to be simulated?" The data from the interviews should assist in developing in-depth and insightful perspectives from the experts to provide answers to the research questions [11].

KNOWLEDGE MANAGEMENT BACKGROUND

In order to analyze how the virtualization process affects the knowledge transfer for training, it is critical to understand knowledge itself. Davenport and Prusak's "Working Knowledge" defined and discussed the managing of knowledge. It starts by breaking down related concepts. The three different concepts are data, information, and knowledge. Each concept builds upon the last. Data itself is only a fact, but when data "shapes" the person who receives it, it is then information. Knowledge is when information is framed and provides context to that information. It is more in-depth and incorporates experience into the information. This allows for people to use the knowledge for decision making and performing specific tasks. Effective knowledge management should be the goal of organizations. Knowledge comes from the mind and is contained in people, built through experience. It ties into experience and action. It is flexible and adaptive. It develops and changes over time. Knowledge may not always be clear; it combines experience with complex facts and is able to make sense of them. Two key factors of Knowledge Management are the knowledge transfer and decision making processes [1].

Knowledge Transfer

Knowledge transfer is knowledge sent from one individual to another in some form of communication. Knowledge transfer "can be described as a process of coding, transmitting and decoding knowledge" [15]. This is based on the Shannon and Weaver (1949) communication model. The only difference is that Shannon and Weaver's communication was based on information transferred by coding and decoding [14]. The coding process is a critical step in knowledge transfer; it is important for knowledge to be coded with context to be transferred appropriately for the recipient to gain knowledge. Knowledge must be transferred to the receiver so that the knowledge will be used for organizational decision making [15].

MILITARY TRAINING

The military has operational training tasks that employees perform daily and warfighting tasks that are specific to the mission or situation. Training includes "knowledge in action" where the training is performed by the trainee and supervised by the trainer. The knowledge transfer process that takes place is effective, as trainers and trainees can go through the actual process and share the experience. The subtleties that go along with the process are absorbed by the trainees. This type of training is usually combined with written task objectives to compliment the hands-on training. The operational training is tracked by statistics, as they are quicker and easier to review for managers who do not have the time to try to obtain detailed knowledge about all aspects of this large organization. These informational reports are shown and discussed among low level and middle level managers; this discussion does lead to contextualized information. There it is possible to build knowledge through the experience of low level managers providing insight into the "ground truth." The ground truth is the truth at the worker level, where they know the minute details that go into making the process actually work.

There is a knowledge transfer from the lower level managers to middle level managers. In the military, this knowledge is transferred from workers through the enlisted supervisors to the entry level officers. This knowledge transfer is possible because a majority of these lower and middle managers have grown from workers into their positions; they have similar experiences to those on the ground, and it gives them a perspective to be better able to receive the knowledge from the workers. These reports and statistics continue to get passed up the command chain; however, it starts to downgrade from knowledge to information. Squadron, group, and the base commanders have larger areas of responsibility; they would be overloaded with all the details that comprise the knowledge from each section. They are only briefed the reports and statistics from sections, and these briefings lack the context and experience needed for this to be knowledge. The reports that are passed to higher level managers show the statistics and goals of the organization, but this does not contain the knowledge needed for each decision. Davenport discusses that the lack of time given to transfer the knowledge is a "friction" that slows down the knowledge transfer process and in this case, creates ineffective decisions from lack of knowledge. It is understood that managers must

make decisions based on time and other restraints, but ensuring organizations balance time management with effective knowledge management is important. Knowledge management is essential to organizational success [3].

The problem then becomes that the decisions made at the higher base levels and Air Force levels are only looking at data. They are not always consciously taking into consideration the detailed knowledge or context that goes into accomplishing these tasks. This knowledge is important to understand so that decisions that are made produce the desired results. Complex entities have multiple variables. Not taking into account how each variable could react to a change from a decision could lead to unwanted consequences. "The training policy was developed for the operational community through an intuitive trial-and-error process rather than through periodic, thorough investigations and analyses of training effectiveness" [p. 181]. However, effectiveness is now becoming a priority as more critical tasks become virtualized. A key example of this is virtual pilots who control drones. Also, there is a push for pilots and aircrews to train through simulated warfighting scenarios. These virtualization processes contain interactive sensory controls and visualizations. The simulations are meant to represent the overall environment for the combat experience. There is skepticism regarding how well these simulators can represent the physical experience. "One of the most important challenges for the CAF DMO program was not how to integrate high-fidelity simulators into combat training policy, but to develop a new operational training strategy that blended live and simulator training into a combat-focused approach" [1, p. 183].

Literature from Polanyi augments the knowledge management (KM) frame utilized to investigate knowledge processes in the military. He provides a knowledge management perspective of how entities work, which should be considered when virtualizing a process. Polanyi states that there are two comprehensive imperceptible principles that go into the knowledge of an entity. These are the particular details of the entity and the overview or function of the entity. He illustrates his point discussing that machines have two distinct principles that need to be identified and realized for the machine to work effectively. There is the operation principle that dictates how the machine operates. This includes what functions it is supposed to do and its purpose. Then there are the particulars. He discusses the physics and chemistry that go into the machine's ability to physically move and the physical laws that play a role in allowing this to transpire. These two principles must build upon one another for the machine to work. Decision makers need to understand this concept applies to all the different entities in this organization. The knowledge of the variables of each entity, and how it works, should influence the decisions that are made, in this case, specifically the decision for a process to be virtualized. Therefore, they must analyze these training processes' principles. The military needs to identify the operations of training and the physical elements that go into the actions of training. This is to ensure these factors are considered when virtualizing the process [13].

VIRTUALIZATION

Virtual Training Trend

The shifting of warfare tactics and increases in technology has affected how wars are being fought. The United States' military must develop new training and keep ahead of these changes. Limited resources and the unpredictable nature of today's warfare paradigms have pushed the military towards simulated training. Other countries, such as Germany, Turkey, and Canada have begun looking at utilizing these types of simulations in their militaries. Simulations can engage trainees in behaviors and provide a virtual environment replicating survivability, combat actions, and the physical properties of the environment. The environment is a "decisive factor" in whether or not a mission can be successful. The complexity of the weapons and warfare that are used in today's battles make training more important, but difficult to simulate. Ham, Kwon, and Park set up research for a framework to build a possible Information System that could offer the necessary functions to create lifelike simulated training. Their research framework suggests using a continuous detection system and event based combat simulation combination program that creates a more realistic simulated environment. The Virtual Process Theory provides another layer of measuring how these types of simulation systems will provide meaningful training to the military [6].

Virtual training is an important factor in the military's focus for preparing troops. It is viewed as a much more cost effective method of training. It allows multiple scenarios to be practiced without any traveling to exercise locations. Virtual Training is such a vital part of the Defense industry. Virtual military training is over a $6 billion annual business. The United States is spending approximately $4.6 billion and even with budget cuts, it is projected to continue to invest over $4 billion annually through 2022. Though with Department of Defense (DoD) budget

decreases, the DoD understands that training must still continue for the military. Any failures in training and readiness can lead to lost lives and failed missions on the battlefield. The training and simulation creators sell the virtual training modules as a cost effective alternative to deploying troops and equipment for practice [4]. The government cannot accurately identify how much money is saved by implementing virtual training instead of costly physical exercises. In addition to cost savings, proving the increased training rates from the virtual training are difficult to measure. The Government Accountability office has invested in finding methods to analyze the cost benefits of training, along with various methods to measure virtual task proficiency and if it is reflected in combat. Military Commanders have a high emphasis on readiness standards and are emphasizing the need to validate virtual training effectiveness. There are no consistent methods being used for research on what factors of the training typically lead to success for Virtual training [8].

The Navy is utilizing simulations to train its members as well. The Navy has contracted training that independent from the ship to cut costs and maintain readiness. Stefan discusses the need for Navy Seaman to take on multiple responsibilities and obtain more "complex knowledge" from training. These training simulators provide training on various scenarios, tasks, and combat systems related to operating the warships. Sailors need to obtain the knowledge and skills required to navigate the ship in "worldwide multi threat scenarios." This saves thousands of gallons of fuel that practicing on a real ship would consume. The Navy has invested into simulations that are used for advanced training. They have stat e of the art multipurpose software using High Level Architecture (HLA) technology. "It represents by far the most recent and promising step on the way to simulation re-usability and interoperability. The HLA technology opens a wide area of applications, in which the most distinct simulation modules can interact with each other almost universally [10, p. 75]'.

Codification in Contingent Knowledge Sharing for Virtualization

Virtual settings call for a more specific coding process [15]. The military is a unique organization due to its different skill sets. It has daily activities and contingent skills, and both are very distinct and require different forms of knowledge management. The distinctive nature of the military's contingency mission makes knowledge management difficult. The current training method is through computer based modules, or CBTs. While current training for the military attempts to make military members knowledgeable about real life combat situations, it falls short of obtaining and codifying the experience. There are emergency and battle computer based training programs that are used to prepare military members for contingency situations.

The knowledge codification for computer based training (CBT) should be evaluated. The creators of the computer based trainings are not lower level managers who have access to all of the users. Therefore the CBTs do not possess the knowledge from those who have experienced what is being trained in the modules. This is because the programmers do not have the all of the experience and context that is related to the information nor data in the CBT. Without that knowledge, they cannot provide the insight and experience of the real life situations to the users.

This is supported by a study that was done on military members training for medical disasters [7]. The study showed that military members were not satisfied with the knowledge transfer from computer based trainings. They may not have been aware of the concepts of knowledge management, but they were aware that the information and data obtained from the trainings were lacking the hands-on experience needed to be effective. "There was a low perception of disaster exercises conducted in the manner of a real-world event. This was attributed to unrealistic participation and training methods. Computer-based training was identified as an ineffective method of training; hands-on instruction clearly identified as the preferred method" [p. 13]. The trainees for these computer based trainings did not perceive the training as being comparable to real world training. They were not getting transfer knowledge needed to successfully prepare for the simulated events. Real world instructors and situations can provide knowledge that is not obtainable from a computer. The information from the training can be put into context, combined with physical actions, and communicated for better reception to the trainees [7].

The major limitation in virtual training is its inability to recreate the environment represented by the training. It has been proven that it is difficult to replicate the necessary "sensory cues" from the real world into the virtual world. These virtual environments have to be coded and built by designers with the knowledge from those who have had the real life experiences [2]. The Army is setting their focus on increasing the quality of virtual training for soldiers. The Army wants to create more comprehensive scenarios where soldiers have simulated interactions with villagers.

Army leaders wanted realistic interactive environments where soldiers gain experience in operating in different cultures. Soldiers need to train to be able to get information and work with locals. The Army wants developers to create engaging programs that can be easily adapted to different scenarios by the military, without a complete system overhaul [9].

The virtualization of military processes and knowledge transfer should be explored. As the focus is set on all these tasks becoming virtualized, it should be researched to determine if these training modules can be coded with the experience and context elements to pass along the knowledge to the receiver. The Virtualization Process Theory (VPT) should be evaluated as a tool to identify what processes can maintain an effective knowledge transfer by way of these CBTs. The theory proposed by Overby in 2008 breaks down a process into the constructs of sensory requirements, relationship requirements, synchronism requirements, and identification and control requirements. These apply to all virtualization processes. This figure below represents the model and factors that can be used to analyze processes to determine how well they can be virtualized [12].

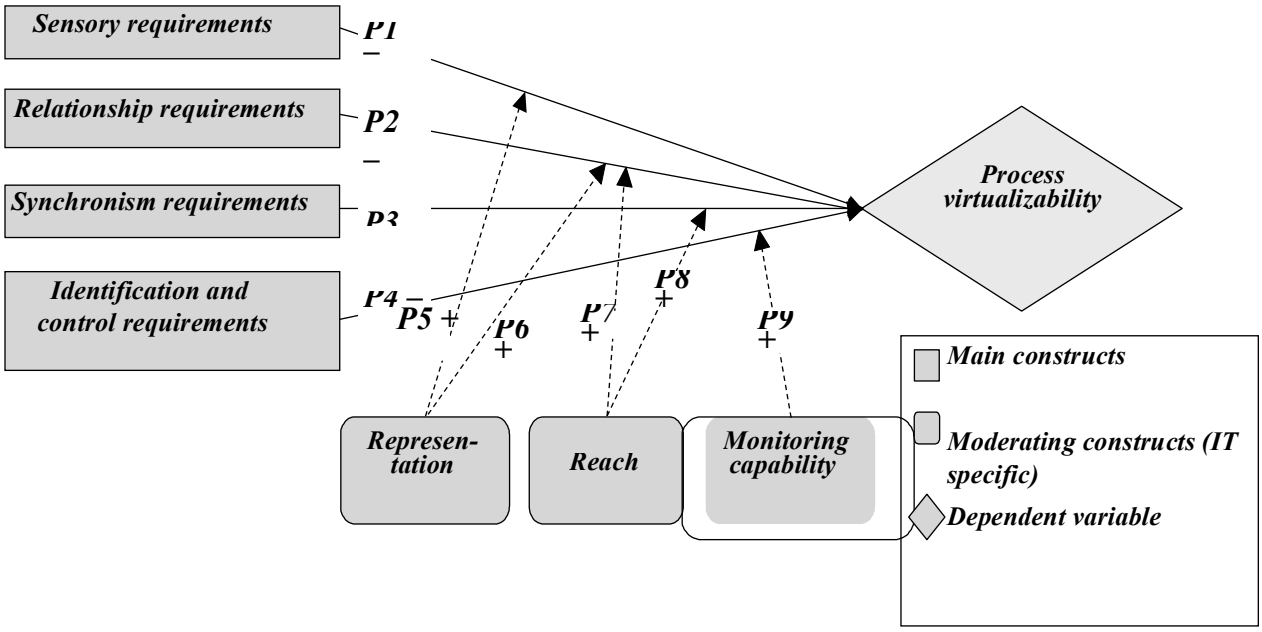

Figure 1. Virtualization Theory Process

Each of the main constructs has to be able to transmit the proper context through the virtual environment. The moderating constructs assess if the main constructs can transfer the knowledge virtually in a comparable manner to real world transfer. This theory may be able to assess the military's ability to determine which processes can be virtualized and still transfer the necessary knowledge [11].

CONCLUSIONS

Knowledge Management is vital for organizational success. Knowledge must be transferred by message from the sender to the receiver. This transfer requires proper coding to ensure that the knowledge is passed to the receiver. The message must contain the necessary experience and insight for the training to reflect the real world scenario being trained. Managers need to understand how knowledge management works for decision making, specifically for the virtualization of training. The articles about virtualizing training focus on better KM practices for military training [1, 2, 4]. Critical training and simulations are being virtualized for the military [8, 10]. These trainings and simulations can represent intense warfighting scenarios and must prepare trainees to succeed in these harsh environments. It is vital for these virtual trainings to transfer the required knowledge to allow these trainees to succeed. The military is focusing on how to improve these scenarios and virtualize more processes. The United States government, along with countries around the world, invests billions of dollars into this technology and

researching how to improve simulation training. Researchers are investigating methods to measure how cost effective simulation technology can be for the military. Military leaders attempt to measure task efficient training that simulations offer for their troops [4, 8]. With all of the money and research that is being invested into simulation technology, the researcher suggests that the Virtualization Process Theory should be explored to determine if this theory can be applied to the processes that the military wants to virtualize, as this theory asserts that it can evaluate if a process should be performed through a virtual environment. The findings from a study based on this proposed methodology could assist in decision making for selecting processes to be virtualized. This proposed methodology research could examine if the VPT accurately predicts if military processes can be virtualized and transfer the essential knowledge to trainees.

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