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ORIGINAL ARTICLE

Effectiveness of Simulation Based Training - An Overview

R. Devanathan[1] and V. Sethuramalingam[2]

[1]Ph.D Research Scholar, [2]Associate Professor
[1,2]Department of Social Work, Bharathidasan University,
Khajamalai Campus, Tiruchirappalli – 620 023.

Abstract:

A crucial aspect of simulations based training is notion of fidelity and fidelity achieved through simulations. Fidelity is broadly defined as the degree of similarity between the training situation and operational situation that is simulated, has been approached from a number of perspectives. There is no in-depth research work undertaken in the area of ascertaining effectiveness of simulations based training in terms of fidelity, immersion, and interactivity and communication richness. Further, it is found from available research work that implicit knowledge measurements are much neglected area of measuring it as training outcome.

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INTRODUCTION

The competencies requirements of Industrial workforce keep changing at faster rates in line with advancements of science and technology. The competencies are of nature that is more specialized but needs enough flexibility to keep in line with changing circumstances of business demands. Research suggest that trainees should be active participants in the learning process in order to improve levels of competency and learning sharing should occur in meaningful or relevant context (Moreno & Mayer 2005). Recent advances in technology have positioned simulations as a powerful tool for creating more realistic, experimental learning environments and theory keeping organizations to meet these emerging training challenges (Bell and Kozlowski, 2007). The results noticed from the usage of simulation-based training methods both in business management Institutions and Industry are very much encouraging. Faria (1998) found that 97.5 per cent of business school used simulations in curricula and 75 per cent of US based business organizations with more than 1000 employees used simulation training extensively.

Simulation based training creates a kind of micro world or synthetic wherein the trainees undergo realistic work experience and expose themselves for real work life environment. Usage of simulation training brings in greater challenges such as cost of creating simulations training programs in the form of fixed costs and utilization of simulations to deliver the training programs. Bell and Kozlowski (2007) viewed a more important challenges is that research on the effectiveness of simulation based training has produced mixed results with several studies failing to reveal an advantages for simulations. Another challenges understood for empirical research that instructional designer's inability to understand method of

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developing effective system.

The purpose of this research article is to explore pressing needs for prosecuting research studies in the area of simulation based training .In pursuit of attaining objective of the working paper, it becomes necessary to examine benefits and challenges associated with simulations based training using various eminent scholars views and their study findings.

Concept of Simulation Based Training

Simulations are generally defined as artificial environments that are carefully created and managed individuals experience in reality. There are various constructs such as simulations games might fall with in the scope of broder construct simulations based training. .For the purpose of this working paper, simulations based training maybe referred broadly to all types of simulations techniques, including computer-based simulations, which are used to create synthetic learning environments.

Benefits of Simulation Based Training

Instructional features of simulations based training and potentional benefits there from were extensively studied in the recent past (Mayer, 2001; Summers, 2004; Flore, Johnson and Mc Daneiel, 2007). In all these studies information richness was evaluated using two end of continuum low and high. These scholarly studies examined distributed learning system features viz.,content, immersion, interactivity and communication and specific benefits arising from instructional contents were examined .The focus on technology is evident in the simulation based training literature as may studies have focused on the describing the technological features of simulations or on describing specific training systemd and applications (Summer, 2004)

Kozlowski and Bell (2007) suggest looking past the technologies perse and instead of focusing on the instructional embedded with in the technologies.Their approach links instructional goals of varying complexity to the instructional characteristics necessary to engage trainess learning process to achive those set goals of simulations based training. Therefore, although simulation research has typically focused first on technology, Kozlowski and Bell (2007) treats technology choice as the end of training design process. .They advanced arguments that desired instructional experience could be achived though well distributed learning technologies such as videogame, quality graphics and supplementary training materials On Line or in CD ROM. Further it is experienced that instructional designers should have deeper understanding of instructional capabilities of different technologies. Such understanding of instructional design shall enhance possibility of achiving effectiveness of training systems to meet out set training objectives. Mayer (2001) echoes this view in its work. .Accordingly, training simulation typically utilize an arrange of multimedia features to convey information though different secondary model (Eg; images sound and to creat realistic and relevant context). Fiore and Johnson &McDaniel (2007) observed that stories and narratives are increasingly being used to spark learning interest, foster greater effort and help guide the learned though stimulated experience.

Trainers learning experience is very closely related to the contents influence or sense of realism created by the contents of training though usage of appropriate technologies. High fidelity features such as three-dimensional representations of content and motion/action, offer physical fieldability, which immerses trainess in realistic experience, exposes them to important environmental characteristics. In essence, psychologigal fidelity provides contextual solutions for learning and physical fieldibility offers contextual richness that embeds in different cues and contigencies in to instructional experience (Kozlowski and Bell 2007).

The second category discussed by Kozlowski and Bell (2007) focuses on features that influence immersions or sense of realisation. At the low end, features are used to construct a synthetic representation of the task environment that offers psychological fiedility of constructs, processes and preference. Further, it is observed by Kozlowski and Deshon (2004) that the goal immension is not to replicate the actual performance environment but rather to prompt the essential underlying psychological processes relevant to performance characteristics in the real work world.

Inter activity is third category which captures characterstics that can influence the potential, captures characteristics that can infulance the potential degree, and type of interaction between users of the system ,between trainers and trainees or collaborative learning group (Kozlowski and Bell, 2007). Increasingly simulation are enhancing the level of interacivity through the use of characters and virtual agents that stimulated competitors,colleague or customers.As an example of the use of characterstics in simulation based training a customer service stimulation may present the trainee with several customers who questions about stores merchandisers (Summers, 2004).

The interaction between the agent and the learners is free in form and evolves as they respond to one another. Although virtual agents are more sophisticated than characters, there is no acadamic research

that compares the effectiveness of agents based stimulations and decision tree simulations nor is there research that compares the effectiveness of these new technologies to more behaviour simulations (Summers, 2004). Thus the utility of using these features to increase the level of interactivity and enhance learning out comes (training outcome) is currently unknown.

Finally, it is important to consider features that influence communication richness or bandwidth, which determines the extent to which users can communicate via verbal and non-verbal means. Advanced training simulations use two-way synchronious commuunication to allow individuals and teams to inter act real time (Kozlowski and Bell, 2007)

Challenges in Simulation Training

Summers (2004) explained that computer based simulations was often delivered via seminars or in class rooms settings, which meant that organisational incurred a number of indirect training costs associated with facilitators, classroom facilities, employee travels,absentation from work. Leveraging the learners control is another additional feature of simulations training. As training simulations are delivered on demand, trainees are being asked to engage in learning without direct involvement of an instructor or teacher. Learner control can induce active learning and allow learners to generate relationships among new concepts and their existing knowledge.

Brown (2001) argued that there has been a growing recognition of powerful influence that individual difference in ability, prior experience and disposition (personality) can have how trainees approach, interpreat and respond to training. Bell and Kozlowski (2007) viewed that most simulation products currently do not address the diversity in learning style. Instructional designers need to be careful to avoid "one size fits all" approach to simulations design and research is needed to better understand that individual differences that are important in simulation based training and methods to accommodate these needs different trainees.

Evidence in the Current Research

A growing body of literature suggests that simulations can serve as effective training tools. Washbush and Goshen (2001), for example, identified eleven well-designed experimental studies of business simulations and concluded that the use of simulations improved learning by an average of ten per cent on pre and post training knowledge assessments.

Wolfe (1997) included quasi-experimental studies in his review, but reached a similar conclusion that simulation gaming produced better learning than the use of business case studies. In their recent review of synthetic learning environments, Cannon-Bowers and Bowers note that simulations have been shown to be effective in a variety of contexts, including the training of pilots, clinicians, military personnel, firefighter, and survey interviewers. A number of studies have also shown that in addition to enhancing learning outcomes, individuals generally report positive reactions (e.g., satisfaction) to the use of simulations in training and education (e.g., Mitchell, 2004; Romme, 2004).

However, it is important to recognize that the evidence for the effectiveness of simulations is far from conclusive. First, some observers have suggested that the extant research is not extensive enough to firmly conclude simulations are effective, due to a shortage of rigorously conducted studies (Tonks & Armitage, 1997). Keys and Wofe stated, "… many of the claims and counterclaims for the teaching power of business games rest on anecdotal material or inadequate or poorly implemented research designs. "Unfortunately, a recent review by Goshen and Washbush (2004), conducted over a decade later, reached a similar conclusion. Second, although there exists significant support for simulation Simulation-based training, a number of studies have failed to find an advantage for simulations (Cameron & Dwyer, 2005; Ellis, Marcus, & Taylor, 2005; Thomas & Hooper, 1991).

A closer examination of prior research in this area highlights several specific issues that limit the extent to which we can draw valid conclusions regarding the effectiveness of simulation-based training. First, a large number of the studies on simulation effectiveness have been conducted in K-12 or college settings (Moreno & Mayer, 2004; Vogel, Greenwood- Erickson, Cannon-Bowers, & Bowers, 2006). While these studies provide important information regarding the effectiveness of simulations for educating children and young adults, one needs to exercise caution in using these findings to endorse the use of simulations for training employees in business settings. Additional research is needed to examine the effectiveness of simulations for training adults on topics relevant to business contexts (e.g., customer service, management, change management).

A second limitation of prior research concerns the outcomes used to measure the effectiveness of simulations. Due to the prevalence of studies conducted in school settings, prior research has focused largely on the effects of simulations on self-reported learning or tests of knowledge (Wideman, Owston, Brown, Kushniruk, Ho, & Pitts, 2007). However, several researchers have suggested that because

simulations promote experiential, discovery learning, they may create knowledge that is more implicit than explicit and, therefore, difficult to measure using traditional knowledge tests. Swaak and de Jong (2001), for example, used a series of five effectiveness. Thus, future research is needed to examine the effects of simulation-based training on a broader range of outcomes, including transfer, adaptability, and other more implicit or tacit measures of knowledge (Swaak & de Jong, 2001). A final limitation of prior research concerns the fact that very few studies have examined the learning processes through which simulations affect important learning outcomes. Scherpereel (2005), for instance, notes that although business simulations are designed to help participants think differently, there has been little empirical research examining the effects of simulations on trainees' mental models. Wideman et al. (2007) similarly note that research on educational gaming has done very little to illuminate the cognitive practices and learning strategies that students employ when playing a game. A focus on learning processes is critical for determining the underlying mechanisms or causes of the outcomes of simulation-based training (Cannon-Bowers & Bowers). As Wideman et.al., state:

"An understanding of game play and its relationships to the cognitive processes it evokes in users is essential for answering the question of how games succeed or fail, and it plays a critical part in untangling the complex relationships between various game attributes, the learning process, and learning outcomes."

Future Research Directions

As discussed experiments to compare the effects of simulations on several measures of implicit knowledge and more traditional declarative knowledge, their results revealed a positive effect of simulation-based training on the implicit knowledge measures, but no effect on the more traditional knowledge measures. Similarly, Thomas and Hooper (1991) have argued that the implicit knowledge developed by simulations may be better revealed through tests of transfer and application, which unfortunately are rarely included in studies of simulation-based training.

The theoretical framework presented by Kozlowski and Bell (2007) represents a preliminary attempt to link the instructional features of various distributed learning technologies to the types of instructional experiences they support. As noted earlier, this framework moves beyond a focus on technological systems and focuses instead on the instructional capabilities of the underlying technological features. One contribution of this approach is that it provides greater insight into the technological components that influence learning in distributed environments. Further, this approach can aid instructional designers and trainers in developing or selecting a training system that integrates the technology components essential to achieve desired learning outcomes. In this article, we have used this theoretical framework to examine the distributed learning system features of simulations and their associated instructional benefits. As we have noted, however, research on the instructional capabilities of simulations is limited and, therefore, future application-oriented work is needed to examine the ability of simulations to offer specific levels of richness on the various distributed learning features. This work can also serve as the foundation for research aimed at better understanding how the features of simulations can and should be used to accomplish different types of training objectives Similarly, research needs to provide guidance regarding the level of immersion necessary for achieving different types of training goals (Leung, 2003). As Moreno and Mayer (2004) state, "… there is no need to waste costly resources on developing high-immersion virtual reality learning environments if high immersion does not directly serve the educational objective of the lesson."

Cannon-Bowers and Bowers also highlight the need for future research on the instructional capabilities of simulations. In particular, they focus attention on the six categories of instructional events discussed by Sugrue and Clark (2000), such as providing appropriate practice environments, and identify research issues in each of these areas that need to be addressed to optimize the design of synthetic learning environments. For example, they suggest that examples, narratives, and stories may represent effective means of providing information and enhancing learners' engagement and feelings of presence, but research is needed to determine how best to incorporate these strategies into the simulation environment (Fiore et al., 2007). In addition, they argue that research is needed to understand what degree of authenticity (i.e., cognitive and emotional fidelity) is required to support learning and to determine what factors contribute to an authentic experience. In summary, the research agenda specified by Cannon-Bowers and Bowers further highlights the need to better understand how the instructional capabilities of simulations can be used to shape trainee is learning experience.

CONCLUSIONS

Simulations have great potential as a medium to creat highly relavant training contexts where trainees are active participant in the learning process. The framework discussed in this working paper that instructional features of simulations and linked them to specific instructional capabilities. The

variables like physical fidelity, immersions, interactivity, and communication richness are some of the most uncovered areas of research investigations as on now in the scholarly research and further assessment of learning out come of simulation based training is limited to declarative knowledge gains. It is necessary to validate implicit knowledge gain while evaluating the effectiveness of simulations based training. In short, simulations based training has demonstratably reached the point where question of its fundamental effectiveness should be no larger play a part in evolving its potential use for any given training programs but other aspects pointed out in this working paper merits consideration for research investigation.

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