Medical Simulation as a Tool to Enhance Human Performance Technology in Healthcare

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INTRODUCTION

Technological innovations are changing the way education is delivered in healthcare. With instructional media evolving at an exponential pace, instructional designers and educators have a variety of options when deciding what tools are best for delivering their instruction. Immersive simulation is the recreation or imitation of an environment that the learner is expected to perform in during training. This type of learning involves recreating an environment, including equipment and resources that the learner would typically have if they were performing in the actual environment, and providing the instructor with the opportunity to observe the learner interacting with and managing challenges that may arise. Simulation is a form of instruction that has been used in a variety of different industries including clinical training for physicians and nurses, aviation, department of defense, weather, and customer service.

Human performance technology (HPT) is a systematic approach for improving performance through a methodic approach that takes into account organizational, environmental, and causal analyses in order to make data-driven decisions regarding intervention design, implementation, and evaluation (ISPI, 2013). Simulation in its most primitive form has been used for decades in order to improve performance among a variety of disciplines and learning audiences. Depending on its intended use, the medical profession has utilized simulation in recent years to address individual training needs, team training needs, and medical decisions impacting healthcare organizations.

Medical simulation has grown to be accepted as a viable instructional tool for training individuals new to health care, teaching new concepts to experienced healthcare professionals, and as a means for professional development and continuing education. With a growing number of health care institutions and professional disciplines incorporating simulation within their training guidelines and curriculum, principles of HPT can be utilized to identify areas for improvement as well as tools and strategies to measure the effectiveness of simulated interventions and activities. This article will address how the evolution of medical simulation has changed healthcare in terms of education, professional training, knowledge management, and patient safety, while aligning with the principles and standards of human performance technology.

BACKGROUND

Simulation in its most primitive form is a replication of something that is real. A simulation could be classified as simply as an imitation of a particular body part that is being operated on or the replication of a patient room, operating room or emergency department. Morton (1995) has defined medical simulation as a strategy used "to replicate some or nearly all of the essential aspects of a clinical situation so that the situation may be more readily understood and managed when it occurs for real in clinical practice" (p. 76). The history of simulation dates back to the early 1900s when anatomical models were first being used to train physicians (Rosen, 2008). Now, with the help of technological advances in communication, science, and education, health care professions are now able to simulate very detailed procedures in order to train novice health care professionals in a safe and effective manner.

Simulations are classified in terms of fidelity based on the degree to which they approach reality (Hovancsek, 2007). Simulators used in medical education are often classified under three levels of

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fidelity: low, moderate, and high (Seropian, Brown, Gavilanes, & Driggers, 2004). Low-fidelity simulations are comprised of case studies and role playing activities where health care professionals may practice acting out specific procedures and receive feedback from an instructor. Task trainers may also be classified as a lower-fidelity simulation depending on the level of detail. Task trainers can range in levels of fidelity from something as simple as an anatomical model for viewing purposes to a higher-fidelity simulator that allow a health care professional the ability to practice administering shots, taking blood, inserting a central venous line, or performing a colonoscopy. Task trainers are often smaller in size compared to other simulators, and are typically a replication of one particular body part or region that is being addressed during a lesson plan.

Higher fidelity simulations provide a greater degree of reality, and to be classified as such, the real-life situation must be replicated as closely as possible (Medley & Horne, 2005; Jeffries & Rogers, 2007). These simulators are often designed with haptics that help the health care professional feel as those they are performing a procedure on a real human being. Human patient simulators are responsive to the treatments that are being provided to them. For example, a simulation technician can communicate to health care professionals and answer questions the way that a patient would or provide bodily reactions such as the dilation of pupils, reactions to medications, or seizures. Simulated learning environments that are designed to recreate an entire operating room or patient examine room are often classified as a high fidelity simulated environment because they provide the trainee with an opportunity to practice using the exact same equipment that they would see in the real clinical environment.

A driving proponent for medical simulation has been the goal of working towards improved patient safety. During investigations of sentinel events, it has been reported that often times, the root cause of analysis of patient harm has been due to breakdowns in the communication process between members of the healthcare team (Leonard, Graham, & Bonacum, 2004). A common challenge for health care professionals is the lack of role clarity among team members when working in high stress situations, poorly defined procedures, and unfamiliarity with rare patient presentations.

MAIN FOCUS OF THE ARTICLE

Issues, Controversies, Problems

"Human performance technology is the study and ethical practice of improving productivity in organizations by designing and developing effective interventions that are results-oriented, comprehensive, and systemic" (Pershing, 2006, p. 6). Performance improvement technologists explore opportunities within organizations to solve problems, improve quality, and identify new opportunities for growth and expansion. Understanding the cause of problem will better equip organizational leadership with the ability to drive a solution (Wilmoth, Prigmore, & Bray, 2010).Many, if not all, performance improvement frameworks (VanTiem, Moseley, & Dessigner, 2012; Mager & Pipe, 1984; Ripley, 1997; West, 1997; Gilbert, 2007) take an environmentally systemic and systematic approach to understanding how a proposed intervention is to be integrated within an organization's regular routine.

Performance improvement models are systemic, taking into consideration all facets and moving parts of an organization. Performance analysis is conducted to identify all stakeholders associated with a project along with the organizational goals and strategies. Performance analyses place focus on three areas: the desired performance state, the actual performance state, and the gap between the desired and actual performance states (Van Tiem et al., 2012). Figure 1 demonstrates how data from a performance analysis may be used to identify a performance improvement strategy using medical simulation.

Environmental analyses (Rothwell, 2005) are conducted to dissect organizations through multiple lenses such as the worker, work, workplace and world. The worker lens looks at the individuals responsible for carrying out particular tasks. Table 1 shows how a four dimensional environmental analysis can be translated to align with medical simulation initiatives within an organization.

Great efforts have been made to utilize medical simulations to assess health care professionals' levels of competency regarding their performance of clinical tasks. In addition to assessing one's level of competency, simulated environments provide educators with an op-