ABSTRACT

Designing feedback that trainees receive in a training simulator while practicing non-technical skills in complex cognitive domains is demanding but, though potentially productive, has received inadequate attention. This paper describes research which aims to understand the impact of fidelity on feedback provided during training for crisis management. More specifically, the goal was to learn whether there were differences between learning feedback types in three different environments, a real-life training exercise, a table-top exercise and a design of an experiential training simulator. The basis for the comparison was a framework of essential feedback types that emerged from the literature and three types of fidelities, physical, functional and psychological. The study showed that there were few occurrences of psychological fidelities of feedback. It also showed that high fidelity can be achieved in the absence of feedback forms categorized as psychological, and that loose organization of an exercise may lead to significant variation in learning outcomes in different learning environments. In addition, the research demonstrated how the fidelity analysis of feedback types can be useful for designing feedback for learners in a training simulator.

Keywords: Crisis Management Training, Feedback, Fidelity, Human Computer Interaction, Interaction Design, Training Simulator, Virtual Environment

1. INTRODUCTION

Training for crisis management is costly, needs to be performed regularly, and involves recruitment of personnel from various authorities. Training for managing airline crisis incidents requires that each trainee have prior knowledge of his/her tasks and roles (King, 2002). Trainee roles include medical staff, rescue teams, police force and airline personnel (Stolk, Alexandrian, Gros, & Paggio, 2001). Effective performance of these roles means mastering the appropriate knowledge: for example, medical trainees have to know how to perform medical triage and first
aid procedures on victims of the plane crash, whereas rescue workers need to know how to assess situations, and coordinate and make decisions (Stolk et al., 2001). All authorities have to communicate and organize their work collaboratively. The purpose of training for crisis management is to gain practical knowledge and improve skills (Kozlowski & DeShon, 2004). Traditional crisis management training may include practicing technical or non-technical skills (Crichton, Flin, & Rattray, 2000). Technical skills are the physical motor skills of knowing how to perform a task and are acquired through training, e.g. performing a surgical operation (Kneebone, Nestel, Vincent, & Darzi, 2007) or extinguishing a fire. Non-technical skills may be cognitive or behavioral, e.g. making a decision as a group (Linehan, Lawson, Doughty, & Kirman, 2009). Most research in the field of crisis management is done with the aim of improving trainees’ cognitive skills (Comfort, 2007; King, 2002; Lukosch, van Ruijven, & Verbraeck, 2012).

Due to the costs and complexity surrounding real-life training, other forms of exercising crisis management are being practiced as alternatives, namely table-top exercising or training in a simulated virtual environment. The table-top exercise is similar in organization to playing a board game with pieces on the table (Toups, Kerne, & Hamilton, 2011), while a virtual simulation is a computer-based imitation of a real-world environment and its situations (Nakanishi, 2001). When designing these alternative exercises, the aim is to stimulate transfer of practical knowledge and aims to motivate trainees through full engagement in the simulated working environment. The difference between these learning platforms is sometimes expressed in describing their fidelities (Hays & Singer, 1989), i.e. how well the simulation imitates the real environment.

One way of motivating trainees to learn is to give them feedback on their performance (Alvarez, Salas, & Garofano, 2004). This feedback may be provided in different forms. In a virtual simulation, it can be issued by the system or by a person, while in a real-life environment it is always provided by a person. In spite of the significance of incorporating feedback in the learning environment of an exercise, which forms of feedback need to be included and how they should be delivered have not been analyzed systematically (Renaud & Cooper, 2000). The design of an exercise in a training environment requires a comparison of its practical knowledge components, such as feedback, with the original training exercise. This comparison can be carried out by analyzing the fidelities of one training environment against another (Kozlowski & DeShon, 2004).

Fidelity is the degree of reality in a learning environment, such as a training simulation (Hays & Singer, 1989). It is an important drive of knowledge transfer in training (Alexander et al., 2005). Evaluating the fidelity of a training simulation may be done in terms of verification or validation. While verification refers to evaluating how closely the finished product represents the initial design, validation refers to how closely the results achieved imitate the initial goal (Feinstein & Cannon, 2001). Feinstein and Cannon (2001) identified criteria for evaluating different aspects of physical, functional and psychological fidelities for a training simulation with respect to validity, such as accuracy, believability, content, predictability, and educational values. The present study only focuses on the educational values of different fidelities.

In a learning environment, when a student observes an event, s/he should ideally detect and recognize it, and associate it with a potential occurrence in a real-life training environment. Thus, if the simulation introduces patterns and events that contradict what is found in a real-life environment setting, the learning outcome may be a failure (Feinstein & Cannon, 2001). Several studies and debates acknowledge the different impacts of varying levels of fidelities on the outcome of trainee learning (Dahlstrom, Dekker, Van Winsen, & Nyce, 2009; Toups et al., 2011; Waldenström, 2012). Hence, it is important to evaluate the levels of fidelities in a training simulation to predict the possible learning outcome as a result of using...
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