

Design and Build a Wizard of Oz (WOZ) Telemedicine Simulator Platform

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INTRODUCTION

This chapter covers the building blocks for designing, building and evaluating a telemedicine, Simulation Based Training (SBT) platform that leverages a Wizard of OZ (WOZ) concept. The idea behind a WOZ concept is to keep a human trainer in the loop, during computerized training, to support and assist in enhanced learning. SBT provides learners a risk-free environment to make mistakes and learn, especially in fields like medicine and aviation, where mistakes can be very expensive. Combining SBT with the WOZ concept and integrating them into a telemedicine platform results in benefits to patients and doctors in remote and less developed countries.

The two most important pieces of a WOZ Telemedicine Simulator are the platform used to enable interaction between learners, trainers and the medical context that should be properly built, and targeting effective learning. A Telemedicine WOZ platform should support remote training, be low cost, widely accessible on most devices (windows, macs, android...) and has the flexibility to support different types of medical fields and different types of training modes, such as automated e-learning compared to instructor-led training. Medical context should be based on real cases (to prevent medical inaccuracies), and include a predefined story (presented as case questions), support a variety of media objects and include best practice answers as a reference point for trainers.

The final piece before implementing a Telemedicine WOZ platform is evaluating its contribution to enhanced learning. Evaluation can easily be achieved using simple statistical methods for hypothesis testing, comparing two or more different training methods or evaluating the knowledge gains before and after training. In some cases, actual verification can be accomplished by comparing actual data before and after training, for example, measuring the amount of yearly exposures to ionizing radiation before and after training in a radiation protection course based on the trainer.

The objectives of this chapter are:

1. Discussing the benefits of a Telemedicine WOZ Simulator program.
2. Discussing key principles for designing and building a Telemedicine WOZ Simulator.
3. Discussing key points for evaluating a Telemedicine WOZ Simulator.

BACKGROUND

Telemedicine uses telecommunications technologies to improve medical outcomes in remote and less accessible environments (Bangert, Doktor, & Johanson, 2001). Telemedicine encapsulates known concepts

DOI: 10.4018/978-1-4666-9978-6.ch011

to achieve its goals, for example remote diagnosis, operations and treatments using dedicated hardware, remote consultations, remote training and remote knowledge sharing.

The main goal of a telemedicine program is to accomplish actual learning and knowledge transfer. Klein (2006) describes the traditional approach for learning by its objectives as the gap between the knowledge a person has and the knowledge he needs to perform a certain task. Klein (2006) also argues that the conventional concept of cognitive skill improvement via practice, feedback and accumulation of knowledge rarely applies to cognitive skills, contrary to behavioral skills.

The cognitive learning process relates to our ability to change our beliefs, the way we see and understand events and not just the addition of information to our knowledge base. The traditional learning approach assumes that knowledge gaps can be filled by a course provided with feedback (Hoheisel, 2000). This approach, also called the storehouse metaphor, may be relevant to simple procedures but may fall short when dealing with complex cognitive learning (Klein and Baxter, 2006). The drawbacks in traditional learning called for more advanced techniques of training, such as discovery learning, team learning, problem-based learning and simulation-based learning.

Using simulators for medical training was covered by Katz (2015), focusing on a new type of a low-cost, telemedicine simulator integrating the WOZ (Wizard of OZ) concept. The WOZ concept returns the trainer to the simulator for process flow controlling and for supplying online feedback to trainees. The WOZ concept was derived from computers inability to automate human intuition into complex and abstract questions. Katz described simulation's advantages in general and to the medical field in particular. Some of the covered advantages were supplying a more engaging learning environment (game like), simulation being risk free to patients and doctors and simulation granting trainees with an opportunity to experience and not just perceive. Amplifying simulation with human interaction and online feedback (the WOZ effect) can produce better learning outcomes.

A rising approach for improving medical education quality is the flipped classroom concept. The challenge of transferring an expanding medical knowledgebase in a limited time frame can be met using the flipped classroom model. The flipped classroom model is a new form of active learning that strives to make lessons more memorable, "stickier". The model is flipped due to lectures given through digital media as homework and class time that is spent on applying transferred knowledge. Application is achieved by solving case-based and team-based problems that capture students' curiosity and provoke students emotionally (Prober and Heath, 2012).

Simulation-based training is widely adopted in many fields, yet most research done in the field tends to be weak, non-empirical and even biased (Issenberg, 2005). Issenberg (2005) in his systematic review argues that only 20% of research publications in the field of medical simulators reported on outcomes that were clear and probably true. Issenberg's review concluded that 47% of covered publications reported that feedback is the key contributor to learning, 39% of the publications reported on repetitive practice as a major contributor to learning and 25% reported that medical simulators integrated with a curriculum have a strong impact on learning outcomes. Also, Thompson (2006) reported on the benefits of medical simulators to learning outcomes, in the short-term and long-term when integrating them with a learning curriculum. Other studies reported positive learning outcomes in regards to online and immediate feedback, a history inquiry mechanism and a structured debriefing procedure for teams (Davidovitch, Parush, & Shtub, 2010).

Prommer (2006) described WOZ as a system whose functionality is simulated to a certain extent by a hidden human wizard, whereas test subjects are left in the belief of interacting with a computer system. An actual example of the WOZ concept was observed in our first pilot run. During a training session the learner remarked "I noticed short delays until receiving feedback to my answers". The learner was

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