Chapter 10
Designing for Learning in Computer-Assisted Health Care Simulations

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ABSTRACT

This chapter is about designing for learning in educational computer-assisted simulations (ECAS) in health care education (HCE). This is an area in need of an informed educational framework for analysis and design, on a research level as well as on a practice level. Drawing upon the works of Luckin (2008, 2010), an Ecology of Resources framework is proposed, which, informed by experiences from the research field (Gaba, 2004; Issenberg et al., 2005), can support researchers as well as practitioners in analyzing and designing health care simulations. Using this framework, we will discuss original empirical data from two studies from the Learning Radiology in Simulated Environments project, and more specifically how changes in design, or adjustments to the Ecology of Resources, impact the simulation process. Data include video-recorded observations of collaborative simulation training, a student questionnaire directly after training and later follow-up interviews. We will illustrate the usefulness of the framework and point out some challenges and suggestions for future development and research.

INTRODUCTION

This chapter will address a challenge central to the research field of learning in educational computer-assisted simulations (ECAS) in higher education: the need for an informed educational framework for analysis and design. In order to further enhance teaching and learning with ECAS in health care education (HCE), such a framework is needed as a complement to the often empirically strong but theoretically limited research which currently seems to be dominating health care research on this topic.

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We will propose Luckin's *Ecology of Resources* model of learner context (Luckin, 2008, 2010) as one possible framework, but we note that when applying this model to the field of health care ECAS, there are relevant experiences from this field that can be used to inform it. We will primarily draw upon the empirical research review work of Issenberg *et al.* (2005) as well as Gaba's (2004) conceptualization of health care simulation applications. This will lead us to focus on the resources, decided by features as well as uses of simulator technology, that are available to learners in a given ECAS training and on the interactions between resources and simulation process and outcomes.

In addition to sketching out this informed framework for analysis and design of health care ECAS, we will apply it to two studies performed within the Learning Radiology in Simulated Environments project and present a modest contribution of original empirical data. Using the framework, we will illustrate how changes in design, or in the Ecology of Resources, impact aspects of the simulation process, and how adjustments can be made to the ecology to enhance teaching and learning.

We begin by introducing, through the background section, the topic of ECAS in health care education and the limitations of current research, followed by an introduction to the research and development project within which the chapter's empirical data were produced. The next section, informing analysis and design of health care simulation, introduces Luckin's Ecology of Resources model, tunes it to the health care ECAS field through Gaba (2004) and Issenberg *et al.* (2005), and applies the tuned model to our own studies. The methodical issues related to the empirical data are dealt with in the methodical concerns section and the empirical results are presented in Learning radiology—Empirical findings. We finish off by discussing the usefulness of the framework and future research directions.

BACKGROUND

Health care education seems to be in transition and to be facing new challenges in terms of design for learning. It has been stated that medical education, or parts of it, should and is undergoing a paradigm shift from an educational model focused on learning through clinical practice to a model focusing more on documented expertise before clinical practice (Aggarwal & Darzi, 2006; Debas *et al.,* 2005; Luengo *et al.*, 2009). A central cause is decreased opportunities for clinical training on patients, a tendency which is also true for nurse education (Tanner, 2004). Reasons include, but are not limited to, changes in practitioner mobility, altered patient expectations, the Bologna Accord and new forms of governance of training (Luengo *et al.,* 2009, s.105). With decreasing opportunities for students to gain clinical experience from training on actual patients, educational computer-assisted simulation alternatives are spreading (Issenberg *et al.*, 2005; Nehring, 2009). These tools are designed to allow students to develop, and educators to evaluate, competence, proficiency or expertise on tasks (such as radiological diagnosis or intravenous catheter placement) prior to performance on actual patients (Aggarwal & Darzi, 2006). This type of training is characterized by model-based imitation of clinical practice.

Simulations are, generally speaking "the technique of imitating the behaviour of some situation and process...by means of a suitably analogous situation or apparatus" (Simulation, n.d.). Simulations will have some framework in the shape of a spatial and temporal context, starting positions, aims, means, agents and time where the agents have more or less influence over the process. Educational simulations have the overarching aim of developing participants' competence in relation to what is imitated. Computer-assisted simulations will require more or less direct interaction with computer software. Within the field