

Preface

This is a book about “Simulation and Learning”. It is written for educators, teachers, and instructional scientists, but also for instructional designers, and anyone else involved in designing or using simulation-based learning environments. I argue herein that, to comprehend the instructional potential of simulation and to design effective simulation-based learning environments, what occurs inside the computer and inside the students’ minds *must receive equal consideration*.

The framework I adopt to do so is *Model-Centered Learning*, in which simulation is viewed as being particularly effective when learning requires a restructuring of students’ individual mental models, as ideally occurs when they learn scientific concepts. I focus on mental simulation as a fundamental capacity of the human brain, which allows us the flexibility of shifting from static to dynamic mental models, in function of a given situation.

I also formulate the hypothesis that simulation models can extend our own biological capacity for carrying out simulative reasoning. I therefore examine recent approaches in cognitive science such as Embodied Cognition and the Extended Mind Hypothesis. Lastly, I propose a conceptual model, the “Epistemic Cycle”, as a blueprint for understanding the cognitive activities that are involved in simulation-based learning and for designing and planning instructionally effective simulation-based instructional activities.

This book is intended to promote the increased use of simulation in educational institutions, and the examples presented herein range from those that are appropriate for middle school to higher education levels. Most of the examples are drawn from the natural and applied sciences, but the accompanying considerations and guidelines are equally valid for other branches of science. The book is also intended to provide teachers with insights into making simulation-based activities more meaningful for students.

My choice of basing the book on the cognitive approach to simulation does not, of course, intend to minimize the importance of other approaches to this topic, such as the social, cultural, and historical, which I consider equally valuable, as they are beyond the scope of my own field of investigation.

As illustrated throughout the book, given the appropriate instructional planning and conditions, a circular, student-simulation interaction can arise, in which mind

and program modify each other in real time. My own aim in writing this book was to engage the reader in a similar interaction.

I would therefore be very grateful to receive the Reader's comments, suggestions, and/or critiques on the ideas presented herein, so as to adapt my conceptual models to better reflect the complex nature of the simulation-learning relation.

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