Preface

This volume began with a request to consider a follow-up to the *Innovations in Science and Mathematics Education: Advanced Designs for Technologies of Learning* book co-edited by Michael Jacobson with Robert Kozma nearly a decade ago. All of the chapters in that volume represented the work of US-based researchers, many of whom had been funded by the US National Science Foundation in the middle to late 1990s. In the intervening years, however, increasingly we see research into the design and use of technology-based learning innovations conducted by international teams of researchers, many of whom are now identified with the emerging field of the *learning sciences*.1 Consequently, in planning for this new book, it was decided to request chapters from selected contributors to the earlier Jacobson and Kozma volume to illustrate more recent developments and research findings of relatively mature programs of research into innovative technology-enhanced learning environments, as well as to solicit chapters reflecting newer research activities in the field that also include international researchers.

It is important to realize, however, that the societal context in which research such as this is conducted has changed dramatically over the last decade. Whereas in the late 1990s, relatively few schools in countries such as the United States or in Europe (where computer scientists and engineers had developed the Internet and technologies associated with the World Wide Web) even had access to this globally distributed network infrastructure, let alone with significant numbers of computers with high resolution displays and processing capabilities. Today, countries such as South Korea have high speed Internet connectivity to all schools in the nation and nearly all developed countries have national plans for educational advancement that prominently feature discussions of using ICT (“information and communication technologies” that are essentially Internet connect multimedia computers) to help stimulate educational innovations. Further, there is increasing access in businesses, government, and homes to a variety of network-based information resources and Web-based tools, as well as sophisticated digital media such as networked 3D computer games and virtual worlds used daily by millions around the world.

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1For an excellent collection of papers dealing with theory and research in the learning sciences with background information about the field, the *Cambridge Handbook of the Learning Sciences* edited by Keith Sawyer is highly recommended.
Approaching the second decade of the twenty-first century, it may be safely said that many of the “advanced technologies for learning” of the 1990s are now accessible in various forms by relatively large groups of teachers and students. It is less clear that many of the learner-centered pedagogical innovations such technologies may enable are as widely implemented as unfortunately didactic teaching approaches are still predominately used in the major educational systems around the world. A challenge we now face is not just developing interesting technologies for learning but also more systemically developing the pedagogical and situated contexts in which these learning experiences may occur, hence the major theme of this volume: designing learning environments of the future.

We recognize, of course, that one of the few certainties in life in the present century is rapid technological change. Still, we have solicited chapters to provide a representative (but not comprehensive) survey of a wide range of types of learning technologies that are currently being explored by leading research groups around the world, such as virtual worlds and environments, 2D and 3D modeling systems, intelligent pedagogical agents, and collaboration tools for synchronous and asynchronous learner interactions. More important, we believe, are that these various research projects explore important learning challenges, consider theoretical framings for their designs and learning research, and (in most chapters) discuss iterations on their respective designs for innovative learning environments. We hope these considerations of how research findings in these various projects may inform thinking about new designs for learning might serve as models for other researchers, learning designers, teachers, and policy makers who certainly will have to grapple with dynamic changes in the contexts of learning over the next few decades.

The chapter authors are all internationally recognized for their research into innovative approaches for designing and using technologies that support learner-centered pedagogies. This collection will be of interest to researchers and graduate students in the learning and cognitive sciences, educators in the physical and social sciences, as well as to learning technologists and educational software developers, educational policymakers, and curriculum designers. In addition, this volume will be of value to parents and the general public who are interested in the education of their children and of a citizenry in the twenty-first century by providing a glimpse into how learning environments of the present and future might be designed to enhance and motivate learning in a variety of important areas of science and mathematics.
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