

LEARNING IN VIRTUAL WORLDS

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LEARNING IN VIRTUAL WORLDS

RESEARCH AND APPLICATIONS

Edited by

Sue Gregory, Mark J.W. Lee, Barney Dalgarno,
and Belinda Tynan



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Sue Gregory, Mark J. W. Lee, Barney Dalgarno, and Belinda Tynan

FOREWORD

This important book provides both a synthesis of current research on virtual worlds as media for engagement and learning as well as an implicit research agenda for the future. As the authors note, at this point in the evolution of immersive interfaces, those making claims about their value should support them with both theoretical and evidence-based justifications. We know that learning technologies are not innovations that intrinsically generate learning; rather they are catalysts that, when used well, can enable high engagement, active learning, authentic assessment, and links between schooling and life (Dawley & Dede, 2014). Virtual worlds have many affordances that provide potential for these dimensions of effective learning, and this book describes to what extent these capabilities are currently realized and where improvements in design, implementation, and research are needed.

As the authors discuss, part of the difficulty lies in designing an interface that scaffolds the motivational and learning goals of a specific virtual world. Simplistic authoring shells have the virtue of easy usage, but this comes at the cost of having features beyond basic chat and graphics. To develop richly detailed simulated real-world situations with challenges that can be resolved through applying academic knowledge and skills, more sophisticated features are necessary, such as simulating data collection or enabling shared representations among team members (Kafai & Dede, 2014). Our work with immersive digital ecosystems demonstrates that such authenticity sometimes requires custom programming beyond what even a high-end gaming shell like Unity provides (Metcalf, Kamarainen, Tutwiler, Grotzer, & Dede, 2011). These advanced affordances also enable individual learners to customize (Dede, 2012a; Warschauer & Matuchniak, 2010). This anthology notes how important this personalization is in providing access to the broadest possible range of learners.

Virtual worlds have many capabilities (e.g., navigation, communication, embodiment) that not only aid motivation and learning when used well but also provide rich data for diagnostic, formative assessment. The unobtrusive, real-time assessments used to provide formative feedback include (Dede, 2012b, pp. 3–4):

- *Capturing exploratory paths.* The paths that a student takes in exploring a virtual world to determine the contextual situation, identify anomalies, and collect data related to a hypothesis are an important predictor of the student’s understandings about scientific inquiry.
- *Analyzing usage of guidance systems.* Gathering data on when students first choose to use an interwoven individualized guidance system, which messages they viewed, where they were in the immersive simulation when they viewed them, and what actions they took subsequent to viewing a given guidance message provides diagnostic insights that can aid instruction.
- *Interacting with animated pedagogical agents (APAs).* APAs are “lifelike autonomous characters [that] co-habit learning environments with students to create rich, face-to-face learning interactions” (Johnson, Rickel, & Lester, 2000, p. 47). The trajectory over time of questions students ask of an APA is diagnostic—typically learners will ask for information they do not know but see as valuable. This can help us comprehend a student’s thought processes and methods of knowledge acquisition. Also, APAs scattered through an immersive authentic simulation can collect diagnostic information in various ways, such as the APA requesting a student to summarize what he or she has found so far.
- *Documenting progress and transfer in similar settings.* Shifting a student to a similar, but not identical environment in which he or she must identify a problem (earlier in the curriculum) or resolve a problem (later in the curriculum) can provide insights into a student’s progress and aid transfer. Further, centring these assessments on learners’ common misconceptions and then immediately conveying the results to them can prompt “aha” moments that help synthesize new levels of understanding.
- *Attaining “powers” through accomplishments.* Like levelling up in games, students can attain new powers by reaching a threshold of experiences and accomplishments. These new capabilities document team achievements, promote engagement, facilitate learning, and offer additional opportunities for interwoven assessment.

Several chapters describe the potentially valuable contributions APAS can make to engagement, learning, and assessment in virtual worlds.

The material in this book about implementation of virtual worlds for learning and assessment of their strengths and limitations adds an important real-life dimension to this emphasis on effective design. Research and development on immersive interfaces must necessarily take into account the many challenges of real-world contexts, including professional development, cross-cultural understanding, and legal issues. Overall, this book is a very important, timely contribution to the ongoing dialogue about reaching the full potential of educational virtual worlds.

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INTRODUCTION

*Mark J. W. Lee, Barney Dalgarno, Sue Gregory,
and Belinda Tynan*

Three-dimensional (3D) immersive virtual worlds have been touted as being capable of facilitating highly interactive, engaging, multimodal learning experiences; as a result, they have enjoyed considerable interest and uptake in education over the past several years. Educators and institutions worldwide have invested heavily in virtual worlds, with some making use of commercially hosted platforms like Second Life and ActiveWorlds, and others extending and adapting open-source products such as OpenSimulator (OpenSim), Open Wonderland, and Open Cobalt to create worlds hosted on internal servers and networks. Still others have built their own bespoke platforms and systems using a variety of programming languages and game engines to accommodate specific needs and goals.

Many of these efforts have been fuelled and driven by beliefs that virtual worlds, with their powerful affordances and rich, immersive properties can be used to achieve higher levels of student engagement and make enhanced educational outcomes more attainable. In the field of online and distance education in particular, there has been much optimism about the promise of virtual worlds to solve traditional problems such as learner isolation, bridging the gap between on- and off-campus cohorts by engendering collaboration and participation, and enabling a greater sense of immediacy, co-presence, and feeling of belonging to a community. Yet much of what has been published in the area has tended to be descriptive, centring almost exclusively around students' and teachers' impressions of the technology and offering only limited research-based evidence attesting to the real educational benefits. Now that the initial novelty of virtual worlds has worn off and the hype surrounding them has

begun to subside, educators are faced with an imperative to look beyond the rhetoric for proof about what actually works and what does not. As the technology gradually approaches maturity (see LeHong & Fenn, 2012; Gartner, 2012), virtual world proponents are being forced to confront the reality of rising hosting and maintenance costs, and must build stronger, more defensible business cases grounded in research to justify continued investment within their institutions and organizations.

This book has been created with the mission of advancing scholarly inquiry and developing and sharing best practices in the use of virtual worlds for learning in formal, non-formal, and informal education settings. Its objectives are threefold. First, the chapters supply readers new to the field with an introduction to the current knowledge base in the domain of virtual worlds for learning. Second, they present leading-edge research that will be of interest to experts and novices alike. Third, the editors hope that the coverage of emerging trends and developments will identify areas in need of further investigation, including opportunities for future theoretical and empirical research.

Overall, the editors and contributors seek to provide a forum for research-informed, evidence-based perspectives on the educational uses of virtual worlds. It is intended to serve as a one-stop resource that is relevant and useful to a wide audience including teachers, students, and researchers, as well as administrators and policy-makers.

How the Book is Organized

This book consists of three sections, each comprising a number of chapters that consider current research topics and challenges relating to learning in virtual worlds. Each one of the thirteen chapters deal with an aspect of the interactions between the learner and the virtual world, technological innovations that hold particular promise for the enhancement of the virtual world learner experience, or the design and implementation of virtual world-based learning interventions. What follows is a brief descriptive overview of the sections and chapters. At the end of the book is an Epilogue where we review the key findings from the chapters, identifying and discussing prominent issues and themes that emerge. We also contemplate possible future research directions.

Section 1: Human–Computer Interaction

The first section of this book is devoted to examination of some of the human factors pertaining to learning in virtual worlds. In the opening chapter, “Navigation and Wayfinding in Learning Spaces in 3D Virtual Worlds,” Shailey

Minocha and Christopher Hardy report on research carried out at The Open University in the UK aimed at achieving a better understanding of how users navigate and find their way around learning spaces in Second Life, and what can be done to improve the usability of spaces. This research is important because navigation and wayfinding can have a profound influence on the effectiveness and efficiency of learning activities undertaken in avatar-based 3D virtual environments. Through student-user observation, interviews, and heuristic evaluations conducted using predefined criteria, the authors were able to derive a set of evidence-based guidelines for the design of virtual world-based learning spaces and tasks. Minocha and Hardy proffer those guidelines to help designers and educators minimize learners' frustration and confusion and discourage time-wasting activities that distract them from core tasks and objectives.

The second chapter, "Communication Modality, Learning, and Second Life" by Stephany Wilkes explores a key issue for educators considering the use of virtual worlds for learning and teaching: that of communication modality. Specifically, Wilkes is concerned with the question of whether text communication, voice communication, or a combination of both should be used. Wilkes employed a quantitative study that looked at the impact of communication modality on cognitive load, short-term retention, and perception of presence in an inworld course on building in Second Life completed by 60 students. She found that the choice of communication modality had an effect on cognitive load and retention levels, but not on the perceived sense of presence. Wilkes discusses the implications and recommendations for practitioners in light of the findings, and cautions readers against making assumptions about the appropriateness or superiority of one communication modality over another in the absence of information about learners' backgrounds and prior experience, or without taking into account the context and nature of the learning tasks.

Chapter 3 by Laura Fedeli, "Virtual Body: Implications for Identity, Interaction, and Didactics," is about embodiment in a virtual world—in particular, how the ability to assume an avatar and carry out actions and interactions with it can give rise to active, social, and experiential learning not possible through the use of other technologies and media forms. While it is known that virtual worlds have a number of unique distinguishing characteristics that lend themselves to learning and teaching applications, including the facilitation of embodied actions and verbal and non-verbal communication, empirical evidence connecting these characteristics to the learner's construction of an inworld identity and his or her experience of a sense of presence and co-presence within the virtual world is sparse (see also Mikropoulos & Bellou, 2006; Mikropoulos & Natsis,

2011). Similarly, while a number of virtual world learning affordances have been identified by various authors (see, for example, Dalgarno & Lee, 2010; Hollins & Robbins, 2008; Warburton, 2009), there is a paucity of knowledge about the precise relationships that exist between the aforementioned characteristics of a virtual world and the pedagogical benefits arising from the performance of learning tasks that the technology affords. Fedeli's chapter addresses these gaps in the literature by reporting on a study that involved 21 educators as research participants and focused on their use of Second Life in their teaching practice. The researchers analyzed open-ended questionnaire responses and transcripts of inworld interviews and focus group sessions to obtain deep insight into the participants' experiences.

The next two chapters have a strong social justice theme in that they are concerned with promoting equity for particular groups of learners—namely, learners with disabilities or elderly learners—and ensuring these groups are able to successfully partake in virtual world-based learning activities. The first of these, Chapter 4, “(In)Accessible Learning in Virtual Worlds” by Robert Todd, Jessica Pater, and Paul Baker, tackles the problem of accessibility as it applies to educational applications of virtual worlds. It highlights critical issues that act as barriers keeping disabled learners from participating and makes recommendations for mitigating those issues that include both technical solutions (i.e., involving the use of assistive technologies) as well as those that relate to the way in which the environment, resources, and learning tasks are designed and implemented. The authors concentrate on Second Life and OpenSim, with a detailed treatment of the accessibility-related challenges and affordances of the former.

In Chapter 5, “Benefits of Second Life in the Ageing Population,” Ann Smith describes pilot studies examining the use of virtual worlds for learning by older people. This work points to the numerous potential benefits that stand to accrue from senior citizens' participation in virtual worlds, which include a range of social, psychological/emotional, and developmental benefits. At the same time, however, Smith also calls attention to the need for careful consideration of various aspects of interface and task design as well as the need to provide dedicated training and support for these learners. Smith examines usability and other problems that may be encountered by elderly users in a virtual world, as observed in the pilot studies, and she offers some suggestions for practice, further research, and development.

The first section concludes with a position piece by Helen Farley: Chapter 6, “The Reality of Authentic Learning in Virtual Worlds,” which questions common assumptions held and claims made with regard to the capacity of virtual worlds

for enabling so-called authentic learning. Farley contends that although virtual worlds may seem, at face value, to be the ideal environment to have students engage in learning that prepares them for the tasks, problems, and challenges they will face in the real world—arguably a primary goal of all formal education in the twenty-first century—certain subject areas and knowledge domains do not lend themselves to simulated learning in virtual worlds, at least in their current form. Farley examines some of the factors influencing the success of attempts to facilitate authentic learning in virtual worlds and some of the limitations of technology currently available in the mainstream.

Section 2: Advanced Technology

Many of the basic, underlying technologies seen in virtual worlds are not new but have existed for some time, and have been used in education in some form for well over two decades (Mikropoulos & Natsis, 2011). That said, at the turn of the millennium there was a sort of renaissance, a renewal of interest and activity in the area of desktop and networked virtual reality environments. A new generation of massively multi-user virtual world platforms was born with the mainstreaming of high-speed, broadband Internet connectivity, which is now commonly available in homes and workplaces in addition to schools, colleges, and universities. These platforms are highly extensible, lending themselves to tailoring and modification even by novice users who have no knowledge of programming. More technically savvy users can create powerful scripts that allow the virtual environment and objects within it to exhibit sophisticated custom behaviours, relying on simple rule-based systems or complex artificial intelligence techniques.

The second section of the book comprises two chapters focusing on advanced technologies that can be embedded into virtual worlds to support and augment the learner experience, with an emphasis on the possibilities offered by software-based agents in the form of “bots,” or non-player characters (NPCs). The section begins with Chapter 7, “Conversational Agents in Second Life: Freudbot” by Robert Heller, Mike Procter, and Corbin Rose, which looks at the potential of conversational agents, in particular those representing historical figures, used inworld in an online and distance education context. The case study they report on focuses on the use of Freudbot, an agent based, as its name suggests, on the nineteenth-century psychologist Sigmund Freud. The study analyzed transcripts from 39 conversations between learners and the Freudbot agent within Second Life along with transcripts from 25 conversations between learners and a similar text-based agent outside of a virtual world in order to

compare the levels of social presence and learner engagement evident in each. There were no significant differences in measures of social presence and engagement, although variations were discovered in the characteristics of the conversations. The authors make some preliminary observations regarding conversational agents in virtual worlds that may help guide and inform subsequent work in the area.

Chapter 8, “Virtual Bots, Their Influence on Virtual Worlds, and How They Can Increase Interactivity and Immersion through VirtualPREX” by Torsten Reiners, Sue Gregory, and Vicki Knox, provides a different perspective on bots, describing their use as part of a project called VirtualPREX (Virtual PProfessional EXperience), aimed at enabling pre-service teachers to practise their lesson delivery and classroom management skills in a virtual world environment to prepare for their school-based professional experience placements (more information about the VirtualPREX project can be found in Masters, Gregory, Dalgarno, Reiners, & Knox, 2015). They focus on how these bots can be used in place of human-controlled avatars to increase interactivity and immersion for learners in a virtual world, the rationale being that it is often not feasible to have real actors role-playing characters, especially in scenarios involving large numbers of “people.” The authors introduce four platforms and script libraries that can be used to develop bots in Second Life—Pikkubots, Pandorabots, Logic System, and LIBOPENMV—before explaining how bots were designed and scripted to act as virtual children (primary school students) in the VirtualPREX simulated classroom environment.

Section 3: Learning Design and Implementation

In the third and final section of the book, the authors turn their attention to topics that have to do with the design of virtual world-based learning tasks and interventions, and with the implementation of those designs in various educational settings. In Chapter 9, “Analyzing Teaching Practices in Second Life: A Design Taxonomy for the Implementation of Workshops in Virtual Worlds,” Steven Warburton and Margarita Pérez García propose a taxonomy suitable for the design of hands-on workshops to be conducted in a virtual world, drawing on studies of 177 such workshops. Warburton and Pérez García examined the workshops using an “analysis grid” that yielded a set of 27 descriptors, grouped under the four headings of “planning and preparation of the instruction,” “delivery of the instruction,” “follow up and evaluation,” and “activities for recalling and transferring learning.” The grid was then repurposed as a design scaffold and they evaluated its use in this way in a further 52 inworld workshops.

Next, in Chapter 10, “NetConnect Virtual Worlds: Results of a Learning Experience,” Francesca Bertacchini and Assunta Tavernise report on the design and use of three virtual world environments devoted to cultural heritage learning. Students between the ages of 15 and 18 were able to “visit” and explore virtual archaeological sites in the form of inworld reconstructions of historical settlements in Poland, Germany, and Italy that have been ruined or no longer exist. This case study demonstrates a clear need for groups to come together when using pedagogical approaches that draw upon student contributions, and for development and research that goes beyond simulation and the mere provision of information. The co-construction of knowledge among the groups is an important outcome, and opens the door for moving toward deep learning for individuals in collaboration with their peers.

Chris Campbell and Leanne Cameron wrote Chapter 11, titled “Scaffolding Learning Through the Use of Virtual Worlds,” which relays the findings of two projects: the first involving fourth-year undergraduate student teachers learning with and about Second Life, and the second involving secondary school students using OpenSim for what they described as “construction activities.” Support provided to students consisted of familiarization exercises they took prior to commencing the main part of the activity, just-in-time support delivered within the face-to-face classroom during the course of the activity, and technology-mediated support, also during the activity, through various Web 2.0 tools as well as supplementary image and video resources. Campbell and Cameron evaluated the activities, and in particular the scaffolding methods and approaches employed through questionnaires, focus group interviews, and student reflective journals.

Chapter 12 by Paul Resta and Miri Shonfeld, “Challenges and Strategies in Designing Cross-national Learning: Team Projects in Virtual Worlds,” is an account of a series of studies in which graduate education students from Israel and the United States worked in teams consisting of a mix of students from each country. The teams were tasked with developing virtual world-based learning activities such as Virtual WorldQuests (similar to WebQuests, but undertaken inworld), field trips, and role plays using a combination of asynchronous and synchronous communication mechanisms to discuss their ideas and produce and share project deliverables that were subjected to both instructor and peer assessment. The researchers conducted surveys and interviews with student participants to identify the perceived strengths and weaknesses of the approach, particularly in terms of social presence, group cohesion, engagement, and satisfaction, and to develop advice for other educators wishing to organize similar

cross-national, cross-cultural project-based learning experiences for their students that capitalize on the collaborative capabilities of virtual worlds.

Lastly, the closing chapter in the book, Chapter 13, “Introduction to Laws Relevant to Virtual Worlds in Higher Education,” is a contribution by Layla Tabatabaie, who provides an analysis of the key legal considerations in the use of virtual worlds in higher education. She surveys the legal and public policy landscape of this area and makes comparisons between countries that are representative of each of the three major legal systems of the world: the American system (represented by the US), the English system (represented by England), and the Far East system (represented by China). University and college teachers, students, and administrators from across the globe will find this international comparative analysis invaluable as it provides practical insight and guidance for navigating the pitfalls within their relevant jurisdictions.

This anthology provides the reader with an overview of how virtual worlds can and are being used for online, face-to-face, and blended learning, focusing on three sections: technology, usability, and design. An international lineup of authors provide chapters outlining research that readers can consider when using virtual worlds in their own teaching and scholarship.

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Francesca Bertacchini has substantial experience as a designer of educational virtual environments, working on videogame prototypes to be used on personal computers and mobile devices. Moreover, she has worked in the field of science communication, developing videos, exhibitions, and installations of virtual reality. She has also implemented advanced interactive systems for the study of the theory of complexity and chaos at school, writing a book on Chua's circuit as a paradigm of contemporary science. She is a member of the Evolutionary Systems Group at Università della Calabria, Italy.

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Her research focus is investigating how ICT can effectively be integrated into learning activities. Prior to her arrival at ACU, Leanne worked with Macquarie University's E-Learning Centre Of Excellence (MELCOE), where she managed a number of research projects that developed online scaffolds to assist teachers with creating their own effective learning designs. Leanne also spent a number of years working as a teacher in both primary and secondary schools, and as a technology trainer for the New South Wales Department of Education's Training and Development Directorate.

Chris Campbell currently lectures in digital technologies at The University of Queensland, Australia. As an early-career researcher, Chris was previously involved in an Australian Research Council (ARC) Linkage Grant investigating students' capacity for self-regulation, and has been successful in obtaining numerous other grants in areas such as robotics implementation in primary schools, iPods in secondary schools, and online reflective journals in higher education. Her skills in implementing and trialling new technologies are documented in various publications, where she reports on the use of online tools including LAMS, Second Life, and Assistive eXtra Learning Environments within a range of educational settings. Chris uses various scaffolding techniques when teaching ICT skills to pre-service teachers.

Barney Dalgarno is professor and co-director of ulmage, a Digital Learning Innovation Laboratory at Charles Sturt University, Australia. His research interests are captured by the overarching question, "How can learning be improved through the use of technology?" Specific topics of interest include uniting on-campus and distance university students through media-rich real-time collaboration tools, the use of virtual worlds to provide simulated professional experience for pre-service teachers, the characteristics of the "Net Generation" and implications for university learning and teaching, the relationship between interactivity and cognition in multimedia and 3D virtual environments, and pre-service teachers' preparedness to use ICTs in their teaching. As well as being awarded a number of research and teaching grants, he has received national recognition for innovative teaching and learning design using leading-edge technologies. He is a co-lead editor of the *Australasian Journal of Educational Technology*.

Helen S. Farley is an associate professor in the Australian Digital Futures Institute at the University of Southern Queensland. For a number of years, her research focus has been the use of virtual worlds in higher education. She has

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Laura Fedeli has a Master of Science degree in instructional technology and distance education (US) and a Ph.D. in e-learning, knowledge management, and psychology of communication (Italy). She has been involved in a number of European projects dealing with e-learning, quality procedures, and policies, and with the use of social media and virtual worlds in education. She is currently a lecturer at the University of Macerata, where she teaches three graduate courses in the Faculty of Education Sciences: Streaming Media and Virtual Worlds for E-Learning Courses, Teaching and Learning Technologies, and Methodology and Technique of Game/Play and Animation.

Sue Gregory is associate professor, chair of research and a member of the ICT education team in the School of Education at the University of New England, Australia, responsible for leading and driving research within the school and training pre-service and postgraduate education students on how to incorporate technology into their teaching. She is a long-term adult educator and since 2008 has been teaching in Second Life, where she has created and manages several inworld spaces, including classrooms and a playground for students. Sue's research focuses on adult learning, authenticity, engagement, immersion, impact, and the efficacy of virtual worlds for education; in particular, she has been examining student perceptions of their learning in a virtual world. She is chair of the Australia and New Zealand Virtual Worlds Working Group (VWWG) and leader of the Australian Government Office for Learning and Teaching (OLT)-funded project "VirtualPREX: Innovative Assessment Using a 3D Virtual World with Pre-Service Teachers."

Christopher Hardy is a technical analyst with ENER-G Holdings Plc, a UK-based company providing global energy solutions. He achieved his Master of Science in Computing with The Open University in 2011 under the supervision of Professor Shailey Minocha. The research reported in his dissertation demonstrated through empirical investigations in Second Life that, while navigating and wayfinding in 3D virtual learning spaces, avatars use a combination of real-world navigational mechanisms and those available in 2D and 3D virtual environments. Interviews with designers and educators showed that the design aspects from 2D and 3D virtual environments such as the Web and computer games can be successfully applied to the design of 3D virtual learning spaces.

Robert (Bob) Heller obtained his Ph.D. in experimental psychology in 1992 at the University of Alberta and held a post-doctoral research fellowship from 1992 to 1994 in the Centre of Excellence on Ageing Research Network, where he conducted research on driving, dementia, and ageing. He joined the Centre for Psychology at Athabasca University in 2001 as an associate professor and became interested in conversational agents and their role in distance education. This research has evolved into an investigation of animated historical figures as pedagogical agents and their place in immersive worlds.

Vicki Knox is based at the University of New England (UNE), where she was a project officer for the VirtualPREX project. She has worked for many years as a research assistant in linguistics, predominantly in the areas of natural semantic metalanguage, pidgin and creole languages, and second dialect acquisition. She is currently also working on the Australian Research Council (ARC) Discovery Projects “Bilingualism in the Bush” and “The Languages of Southern New Guinea: An Unexplored Linguistic Hotspot.”

Mark J. W. Lee is an adjunct senior lecturer with the School of Education at Charles Sturt University and an honorary senior research fellow with the School of Engineering and Information Technology at Federation University Australia. He has published widely in the areas of educational technology, online learning and teaching, and innovative pedagogy in higher education, with over 70 refereed journal articles, conference papers, and book chapters to his name. In addition to educational applications of virtual worlds, his areas of interest include mobile and pervasive computing tools for learning, instructional games and simulations, pedagogical uses of Web 2.0-based social software, and academic staff development in the use of ICTs. Mark was the editor-in-chief of the *MERLOT Journal of Online Learning and Teaching* from 2012 to 2014, and continues his service as the editor-in-charge of special issues for the *Journal of Computer Assisted Learning*, as an associate editor of the *IEEE Transactions on Education*, and as an editorial board member for several other leading international journals.

Shailey Minocha is professor of learning technologies and social computing in the Centre for Research in Computing at The Open University, UK. Her research in learning technologies has focused on how emerging tools can support digital scholarship, including topics such as blogging and reflective practice, wikis and virtual team collaboration, 3D virtual worlds and training

and skills development, and the role of social media in research dialogues and research skills training and development.

Jessica Pater is a research associate in the Information Technology and Telecommunications Laboratory at Georgia Tech Research Institute (GTRI), the non-profit applied research arm of the Georgia Institute of Technology. She received her Bachelor of Science in International Affairs from Georgia Tech. Her research at GTRI focuses on the use of serious gaming and virtual worlds in education, how social media platforms contribute to self and group identity, and the development of cybersafety/digital citizenship educational modules for the K–12 domain. She also works on developing metrics for discourse and identity of individuals within virtual worlds.

Margarita Pérez García is an educational research consultant, having previously worked as a lecturer in e-learning in the Media, Arts and Design Faculty at the Catholic University College Limburg and the Provincial University College Limburg. She has worked in the field of education for 15 years, in all levels from primary through to higher education. She has coordinated several projects on digital identity and reputation, social technologies in education, and e-portfolios. She was responsible for coordinating MUVEnation, a European initiative for training teachers in the use of virtual worlds for education. Her current research interests are in second language acquisition and understanding teaching experiences in virtual worlds through narrative inquiry.

Mike Procter obtained his Bachelor of Science in Electrical Engineering in 1982 and is a registered professional engineer in Alberta, Canada. He has over 25 years of experience in the information technology industry, with a background in real-time systems development, system and network management, project management, and enterprise application deployment. He is currently employed as an IT consultant working for Athabasca University developing software for research in animated conversational agents.

Torsten Reiners is a senior lecturer in logistics at the Curtin University of Technology in Perth, Western Australia. His expertise lies in the areas of clustering and mining large data sets, operations research (especially online algorithms and incorporation of bio-analogous meta-heuristics in simulation models for container terminals), fleet logistics, information systems, e-learning, and software development. He conducts research in semantic networks to improve cross-border communication, e-learning, and machine translation. Torsten's

current interests include virtual worlds for interconnectivity/exchange without barriers; development of adaptive systems; automatic processing, analysis, evaluation of documents; and innovative platforms in combination with emerging technologies like mobile devices. He is the co-founder of the Second Life Island University of Hamburg and Students@work, an initiative to promote education in Web3D as well as the value of students' work.

Paul Resta holds the Ruth Knight Millikan Centennial Professorship in Learning Technology and is the director of the Learning Technology Center at the University of Texas at Austin. His current work focuses on ICTs in teacher education and on online collaborative learning environments such as virtual worlds. He currently serves as president of the international jury for the United Nations Education, Scientific and Cultural Organization (UNESCO) Prize for ICT in Education. He also serves as chair of the Association of Teacher Educators National Commission on Technology and the Future of Teacher Education. Paul is the founding president of the International Society for Technology in Education and a past president of the International Council for Computers in Education. He founded the Educational Native American Network, which has been responsible for equipping hundreds of Aboriginal schools across the United States with access to the Internet. He has received numerous awards, including the Society for Information Technology in Teacher Education Lifetime Achievement Award.

Corbin Rose obtained his Bachelor of Arts in Psychology at the University of Alberta in 2011. He was responsible for coding the chat logs for the Freudbot study reported in Chapter 7.

Miri Shonfeld has played an influential and instrumental role in bringing about key changes in teacher education in Israel. She worked to integrate technology as head of the forum for ICT coordinators in teacher education by writing the teacher education section in the country's new national technology program as well as numerous position papers. She has been invited by universities all over the world to present her philosophy and pedagogy on using ICT in education. Her research deals with online learning environments, collaborative work, and intercultural links. She is currently the head of the Technology, Education, and Cultural Diversity Centre at Mofet Institute, and the director of the graduate program in technology in education at Kibbutzim College of Education in Tel-Aviv.

Ann Smith is a bioinformatician at Cardiff University, but her work on ageing was conducted at Newport University. She obtained a Ph.D. in Computer Science (Swansea, UK), specializing in information visualization, modelling, and 3D web-based virtual environments. She previously worked at Cardiff University implementing a 3D interactive virtual model to simulate an eco-village to analyze the latest low-carbon technologies. She has worked with a marine biologist to visualize nine years of bathymetric data. Her work on ageing involved investigating methods using virtual worlds to tackle the problems of social isolation and improve well-being in communities in Wales.

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Steven Warburton is a professor of technology-enhanced learning at the University of Surrey and a fellow of the Centre for Distance Education at the University of London International Programmes. His research interests include learning design, MOOCs, learning and teaching in virtual worlds, the meaning and management of digital identity, and the use of design pattern approaches to sharing expert practice. He has been involved in a range of high-impact national and European projects that have included: MUVEnation, LLL3D, and OpenHabitat in area of virtual worlds; the Rhizome project, which focused on the development of design patterns for digital identity; and the JISC Emerge project, whose goal was to support a UK-wide community of practice in user innovation and development in the area of Web 2.0 and emerging technologies.

Stephany F. Wilkes completed her Ph.D. at the Illinois Institute of Technology in 2009 and owns West by Midwest, a product strategy and design company in San Francisco, CA.