Preface

The 11th International Conference on Cognition and Exploratory Learning in Digital Age (CELDA 2014) was held in Porto, Portugal, October 25–27, 2014. As with previous CELDA conferences, the purpose was to address the main issues concerned with evolving learning processes and supporting pedagogies and applications in the digital age. There have been advances in both cognitive psychology and computing that have affected the educational arena. The convergence of these two disciplines is increasing at a fast pace and affecting academia and professional practice in many ways. Paradigms such as just-in-time learning, constructivism, student-centered learning, and collaborative approaches have emerged and are being supported by technological advancements such as simulations, virtual reality, and multi-agent systems.

These developments have created both opportunities and areas of serious concerns. This conference aimed to cover both technological as well as pedagogical issues related to these developments. The main topics included:

- Acquisition of expertise
- Assessing progress of learning in complex domains
- Assessment of exploratory learning approaches
- Assessment of exploratory technologies
- Cognition in education
- Collaborative learning
- Educational psychology
- Exploratory technologies (such as simulations, VR, i-TV, and so on)
- Just-in-time and learning-on-demand
- Learner communities and peer support
- Learning communities and Web-service technologies
- Learning paradigms in academia
- Learning paradigms in corporate sector
- Lifelong learning
- Pedagogical issues related with learning objects
- Student-centered learning

- Technology and mental models
- Technology, learning, and expertise
- Virtual schools and universities

The CELDA 2014 Conference received 78 submissions from more than 20 countries. Each submission was reviewed in a double-blind review process by at least two independent reviewers to ensure quality and maintain high standards. Out of the papers submitted, 25 were accepted as full papers for an acceptance rate of 32 %, 17 were accepted as short papers, and 2 were accepted as reflection papers. A special issue with elaborated versions of five selected papers from CELDA 2014 along with a featured article by CELDA organizers Dirk Ifenthaler, Demetrios Sampson, and Michael Spector has been published in *Technology, Knowledge and Learning*—see http://link.springer.com/journal/10758/20/2/page/1.

As with previous CELDA conferences, authors of the selected best papers were invited to contribute elaborated versions to an edited volume. This book contains those contributions. The invited keynote speaker at CELDA 2014 was Jan Elen, and his contribution entitled "Reflections on the Future of Instructional Design" is the *opening chapter* (Chap. 1) in this volume. Elen addresses the field of instructional design as a technological field of inquiry aiming to build on a strong theoretical base. Elen argues for gathering unobtrusive data in actual settings and using those data to build an engineering science that can improve based on the systematic review of data and the construction of a reliable knowledge base.

The remainder of the book is divided in to four parts, each of which was edited by one of the CELDA organizers. The final chapter is a look forward authored by the CELDA organizers.

Part I is entitled "A Global Conversation About Competencies and Challenges for Twenty-First-Century Teachers and Learners," which was a featured theme of the conference. There are four chapters in the opening part of the volume that are centered around the invited presidential panel that opened the conference—that panel had the same title as this part of the book.

Chapter 2 by Lynne Schrum, Dale Niederhauser, and Neal Strudler is entitled "Competencies, Challenges, and Changes: A US Perspective on Preparing Twenty-First-Century Teachers and Leaders." That chapter focuses on the many challenges that teacher educators and educational leaders face in preparing the next generation of teachers in America. The pressures created by standards and regulations along with the rapid expansion of technologies and an evolving notion of literacy are addressed. Teacher preparation programs in universities are struggling to respond to those pressures while being less well equipped in terms of technology than many of the schools into which graduating teachers will be placed.

Chapter 3 by Rose Dolan is entitled "Initiation and Implementation: Changes to Teacher Education in Ireland" and presents a historical perspective of how Ireland has responded to the challenges and pressures discussed in Chap. 2. Ireland's Education Act of 1998 led to the formation of the Ireland Teaching Council which produced four policy documents, a revised code of conduct, and a number of documents pertaining to initial teacher preparation (ITE). While Ireland's educational

system is not nearly so complex as the American system, the significance of high-level policy guidance with support and follow-through is clearly illustrated in Dolan's contribution.

Chapter 4 by Ronghuai and Junfeng Yang entitled "Digital Learners and Digital Teachers: Challenges, Changes, and Competencies" examines the influence of technology on learning and the need to properly prepare teachers. The American frameworks of pedagogical content knowledge (PCK; Shulman, 1986) and technological, pedagogical, and content knowledge (TPCK; Mishra & Koehler, 2006) are discussed in detail with regard to the need to properly prepare Chinese teachers and students in the twenty-first century.

Chapter 5 by Nicole Bellin-Mularski, Dana-Kristin Mah, and Dirk Ifenthaler is entitled "Preservice Teachers' Perspectives of School Development." This contribution involves a study of 951 preservice teachers aimed at exploring the complexity of factors influencing innovation and school development in Germany. The findings of this research study suggest that competency-based training programs focused on school development are needed. Stronger collaborations between preservice and in-service teachers are recommended, potentially supported through social networking. The need for additional empirical research aimed at the complex and multifaceted nature of schools and how they are organized, developed, and situated to respond to changing needs and technologies is made clear in this chapter.

Part II is entitled "Changing Learning and Instructional Paradigms," which was a theme that emerged from the papers presented at the conference. This part contains five chapters that cover various frameworks and strategies that have the potential to transform learning and instruction.

Chapter 6 by Sylianos Sergis and Demetrios Sampson addresses the issue of analytics and in the form of a multilevel framework to integrate and analyze data collected across different school layers so as to provide ongoing formative feedback to school leaders.

Chapter 7 by Kay Wijekuma, Bonnie Meyer, and Puiwa Lei reports the results of a study of English language learners investigating the impact of teaching five text structures along with two forms of support: Spanish scaffolding (both English and Spanish texts) and an English hybrid version that allowed students to hover over words to see the Spanish version. The results of such support were generally positive.

Chapter 8 by Norsamsinar Samsudin, REngasamy Premila, Jessnor Elmy Mat Jizat, Hariyaty Ab Wahid, and Norasibah Abdul Jalil reports an investigation of school-based assessments in Malaysia. While the level of teacher understanding of readiness to implement school-based assessments was found to be high, the study also showed a negative relationship between teacher understanding and readiness and their workload levels. This study suggested that heavy teacher workloads are a barrier to progressive school improvement in Malaysia as they appear to be in other parts of the world.

Chapter 9 by Sandra Ribeiron, António Moreira, and Christina Pinto da Silva focuses on the important topic of digital storytelling. They argue that storytelling has long held an important place in education and society more generally. Digital storytelling has the potential to address important emotional issues that can either

enhance or inhibit learning. The act of telling stories can promote self-reflection and develop trust and dialogue among learners. The use of technology to support storytelling, then, has the important potential to foster interpersonal interactions that can promote social responsibility and emotional intelligence.

Part III is entitled "Assessments and Analytics for Teachers and Decision Makers," which represented a second emergent theme from papers presented at the conference.

Chapter 10 by Martha Carey and Catherine Schifter addresses the controversial issue of standardized testing in the context of the USA. They argue, as have many others, that such assessments create disadvantages for many students. Their solution approach involved providing evidence that contextually driven formative assessments can help alleviate the problems with standardized assessments.

Chapter 11 by Steve Bennett, Trevor Barker, and Mariana Lilley examines the use of electronic voting system clickers. They conducted a series of studies in a master's-level course on media design that had the entire class use clickers to provide peer feedback on multimedia resumes developed by classmates. As the methodology evolved, the notion of peer grading was replaced by free and open feedback in response to a set of standard questions about the designs. They note some resistance on the part of students and cite limitations, while pointing out that as the rubrics and scoring evolved, students became more receptive, and there are efficiencies in using this kind of feedback on student-created artifacts.

Chapter 12 by Said Hadjerrouit reports a case study involving collaborative writing in a wiki-based environment in a teacher education course on Web 2.0 technologies. There are a number of issues reviewed and examined in this study, including collaborative work in small groups, the distribution of work within a group, the role of a technology such as a wiki in supporting group work, and the value and impact of comments within the wiki. One innovative aspect of this study is that it involved using one of the technologies being examined as a tool to support course work. The author notes that a wiki-based approach to learning and instruction is not well developed and much more research in this area is required.

Chapter 13 by Timothy Arndt and Angelo Guercio focuses on student-centered analytics in postsecondary education. The motivation for their work is the difference in the interests and preferences of students (which they call do-it-yourself analytics) and those of universities and colleges (typically referred to as learning analytics). The authors present a framework for the development and implement of student-centered analytics and propose a research stream that will address the efficacy of student-centered analytics in comparison with the efficacy of learning analytics.

Chapter 14 by Peter Rich and Matthew Langton reviews the notion of computational thinking. They conducted a Delphi study to develop a consensus definition of computational thinking that might clarify educational issues and guide the development of courses aimed at promoting computational thinking. Many have promoted the notion of computational thinking as an important twenty-first-century competency, but given the variety of views about computational thinking, it is not clear what skills and competencies should be taught to whom and when. This effort is a step in helping to resolve those questions.

Part IV is entitled "Changing Tools and Learning Environments" and represents a third emergent theme from papers presented at the conference.

Chapter 15 is by Cheolil Lim, Sunyoung Kim, and Jihyun Lee. They investigate and report the impact of turning two university lecture courses (calculus and nonlinear systems) into flipped classroom courses. The results suggest that not all students liked or benefited from the flipped classroom approach. However, the studies also suggest that it is possible to design and manage a large course using a flipped classroom approach, although the design had to be adjusted to fit the particular course. Students tended to like the increased interaction with the instructor and efficiency of viewing assignments online via video-based lectures. Lessons learned from the two different implementations of a flipped classroom approach are discussed in detail in the last part of this chapter.

Chapter 16 by Lee Schlenker and Sébastian Chantelot examines a scenario-based approach for improving management education. They review the research on the use of scenarios and design thinking and use that review as the basis for the approach they call DSign4Practice (not to be confused with the Design4Practice program developed at Northern Arizona University in 1994). Their DSign4Practice framework involves a community of practice with interconnections among place, platform, and people. The notion of creating support for the co-creation of participatory learning places is fundamental to the framework. They conclude with a call to implement the framework and conduct research on its efficacy.

Chapter 17 by Leila Mills looks at the role of informal learning in developing and supporting interest and learning in science, technology, engineering, and mathematics at the high school level. She used an instrument called Possible Science Selves in a pre-/post-study of students on a field trip to the Laser Interferometer Gravitational Wave Observatory Science Education Center in Livingston, Louisiana. The results showed that students with a low desire to become a scientist prior to the field trip were significantly higher in that desire after the trip compared with those who reported a strong desire to become a scientist or who had high confidence in their academic skills. However, in general, there was an increase in reported desire to become a scientist after the field trip. She cites the limitations of the study and suggests additional studies to explore the impact of informal learning on interest in science-related learning and careers.

Chapter 18 by Cristina Gomes, Mauro Figueiredo, José Bidarra, and José Gomes examines gamification in music learning. The development of the Flappy Crab game application for mobile devices and its initial use in music education are reported. The game was developed using the UNITY 3D® game engine and initially tested informally. Results suggest that students liked the game and participated in many game-related activities. Additional studies are planned based on the positive outcomes using the prototype game.

Chapter 19 by Cindy Kröber and Sander Münster reports on the creation and evaluation of an educational application in the area of cultural heritage—in this case, the cathedral in Freiburg, Germany. The instructional approach involved project-/problem- and team-based learning at the college level with students involved in interdisciplinary studies in art history, linguistics, and geoscience. The

focus of the project was on aspects of the architecture within the cathedral that had implications for communicating with visitors that could then be presented in visual form through a mobile application. Creation of such a visitor application was motivating for students and created a need to understand a number of issues in the various disciplines involved. The benefits of such applications within an interdisciplinary curriculum are discussed along with lessons learned from the effort.

Chapter 20 by Peng Yan and colleagues discusses the issues involved in designing intelligent tutors. An intelligent tutoring system developed for Virtual Cell, an educational game, is reported in terms of its use in a cellular biology course. The game contains a number of information resources which are needed to succeed in specific game scenarios. The game contains four modules: (a) organelle identification, (b) electron transport chain, (c) photosynthesis, and (d) osmosis. Initial findings suggest that students gained the desired knowledge and competencies. Additional games based on their goal-based and immersive virtual approach and framework used are suggested.

The final chapter (Chap. 21) by the conference organizers is entitled "A Synthesizing Look Forward in Teaching, Learning, and Educational Leadership in the Digital Age." In the final chapter, the authors address the need to align teacher preparation, the design and development of learning environments, evaluation and ongoing support, teaching and learning standards, and education policies. Without alignment across all aspects of an educational system, it is unlikely that promising efforts to integrate technology effectively will be taken to scale or that steady progress in learning and instruction will occur. That chapter concludes with a call for serious efforts to create dynamic, multidimensional links among educational researchers, practitioners, teacher educators, and policy makers.

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