Preface

AN OVERVIEW OF THE SUBJECT AREA

Knowledge society has placed new requirements on the education sector with respect to the level of support needed by individuals and organizations, and raised widespread awareness of an educational system that is not limited to childhood and adolescence, but supports learning as a lifelong activity. In this vein, educational institutions have recently undergone a series of transformations changing their organizational structures and teaching practices as well as the way they are serving local communities and the public in general. For example, the educational system is moving from the early notion of access based on defined routes and discrete courses to one more centrally concerned with the “accessibility” of institutions throughout life and the suitability and flexibility of their curricula for a diverse student audience.

Digital technologies can support each stage of the learners’ journey. The typical approach to integrating technology in education begins with the context in which technologies operate. Often, the approach is content-driven as software tools aim to support student progression in particular subject matter areas. Learning management systems, multimedia software, and virtual learning environments are examples of technologies that follow this approach. In the context of lifelong learning, however, the learning process has become more complex as lifelong learners have heterogeneous backgrounds and differ in traits such as skills, aptitudes and preferences for processing information, constructing meaning from information, and applying it to real-world situations. It is, therefore, imperative to focus on new approaches to manage the complexity of the learning experience and accommodate learner’s needs in order to maximize the effectiveness of e-learning and lifelong learning.

Particularly in lifelong learning, technology is needed to assist learners to access, compose, and manage their learning under varying circumstances and settings, such as institutional, informal, and work-based. Moreover, in this context, e-learning is not only centered on the individual learner but also becomes a collaborative and community-based process. Thus, it is essential to ensure that learners are experiencing an appropriately increased learning challenge and autonomy as well as independence by becoming more aware of their own studying and thinking processes. This demands that tools and guidance are provided to support this process of planning a lifelong learning pathway through the various courses, levels, and stages of a formal educational system, as well as in informal learning contexts. At the same time, available tools should go beyond self-directed learning, towards the autonomous and dynamic creation of lifelong learning communities and distributed e-learning services. Accordingly, learning technologies are moving away from typical computer-assisted learning tools, e.g. educational multimedia software, or even Virtual Learning Environments and Learning Management Systems, such as Blackboard and Moodle that strictly operate within a formal learning context.

To address these challenges, the integration of: innovative models, methods and technologies for the creation, storage, use, and exchange of knowledge resources and user-generated content, design tools for
learning activities and units of learning, competence development programs, and networks for lifelong learning is investigated worldwide. It is expected that a successful integration of advanced technologies could enrich educational approaches along several dimensions: (i) advanced networking architectures, knowledge building tools, and groupware can support building of learning communities and collaboration among teachers, lifelong learners and communities; (ii) modeling tools, online simulators, Web-based planning tools, e-portfolio systems, and Web-based, information rich open learner models can foster learner engagement with the lifelong learning process, promote reflection, and lead to the development of further lifelong learning skills; (iii) authoring systems, learning design tools, assessment tools, and personalized learning environments can transform teaching, learning, and assessment by bringing together instructional activities, learners and technological standards.

For example, advanced technologies that employ decentralized solutions have been developed: online communities created by online collaborative tools, blogs, wikis, webcasts, webinars and social networking applications have been adopted in the teaching practice. Moreover, several consortia and initiatives around the world have been established with the aim to support the development of new e-infrastructures and services for lifelong learning, such as the E-Learning Framework (www.elframework.org) promoted by JISC (UK) and DEST (AUS), the IMS Abstract Framework (www.imsglobal.org/af/), the Open Knowledge Initiative (www.okiproject.org), the TENCompetence Project and the European Learning Grid Infrastructure Project (www.ELeGI.org).

This lifelong learning e-infrastructure is being composed mostly of open-source, standards-based, sustainable and innovative technologies, and is expected to provide easy access to facilities that enable the lifelong development of competencies and expertise in the various occupations and fields of knowledge. In this context, advanced technologies make possible to integrate in-house and open source components with commercial applications by agreeing upon common service definitions, behaviors, data and user models, and protocols within educational organizations and federations. This way permits the development of modular and flexible distributed systems, where components can be added, removed, or replaced more easily than in traditional models of e-learning systems, and where new applications or systems can be composed from collections of available services. It is, of course, necessary that the use of this technology is grounded in broader instructional theories to be effective. To this end, technologies should be seamlessly integrated with pedagogy and embedded in the organizational practice in order to deliver lifelong learning and engage learners in an empowering way.

WHY THIS BOOK IS NEEDED

Lifelong learning is recognized as a critical educational objective in order to meet ever-changing societal and professional demands. Educational institutions operating in an evolving educational landscape require informed decision-making and planning through successfully matching technologies, curriculum targets, lifelong learners’ needs, and organizations’ level of learning technology integration. This book brings together a wide range of contributions about the development of infrastructures for e-learning and lifelong learning and on how these can be integrated in teaching practice. It complements available literature on lifelong learning that concentrates on relevant policy matters, and societal, pedagogical, and economical issues relating to or affecting lifelong learning.

The book provides a comprehensive overview of the state-of-the-art in relevant technologies covering theoretical approaches, models, architectures, systems, and applications in real world settings. In par-
ticular, it explores advanced architectures and platforms, and presents studies of technologies adoption, development, and use for lifelong learning, showing experimental results from systems and applications that employ advanced e-learning and lifelong learning technologies to support real practices.

**WHAT READERS CAN EXPECT FROM THIS BOOK**

The book is a collection of original research and development work in technology for lifelong learning, and could be used as a one-stop reference for those working in the area providing insight into the future of lifelong learning technologies. It may benefit readers from different disciplines helping them to gain global understanding of the various issues involved in designing, developing, and deploying technologies for lifelong learning. Book chapters are self-contained and cover various aspects of lifelong learning systems, including creating, managing and modeling content and technologies, integration with teaching practice, instructional design, e-learning and lifelong learning delivery, open problems, and research issues.

This volume can make a valuable contribution assisting readers in the analysis and implementation of e-learning technologies, supporting professional development in educational organizations, and the implementation of advanced e-learning and lifelong learning technologies.

**HOW THIS BOOK IS ORGANIZED**

The book is organized in three sections. In Section, “Systems, Models and Architectures,” technical contributions that aim to address user and organizational needs through new systems, models and architectures for the development of institutional technological infrastructures for lifelong learning, are presented. Section 2, entitled “Managing Digital Educational Content and Resources,” includes contributions that focus on technologies that support creation, organization, delivery, and use of digital content and educational resources, which are a vital element of modern institutional infrastructures for the delivery of engaging lifelong learning experiences. Lastly, Section 3, entitled “Developing and Accrediting Skills and Competences,” directs attention to the use of technologies for skills development and support of lifelong learners.

In what follows, an overview of the book chapters is presented.

**Section 1: Systems, Models and Architectures**

“Techniques, Technologies and Patents Related to Intelligent Educational Systems” by Prentzas and Hatzilygeroudis presents state-of-the-art technologies/techniques of a new generation of educational systems, called Intelligent Educational Systems-IESs. IESs can be used effectively in different contexts. They can accommodate a diverse set of lifelong learning requirements, possessing the capability to personalize instruction to the needs and skills of lifelong learners, and can be integrated into workplace learning and personal development. The chapter reviews technologies and techniques used in IESs and surveys corresponding patents. It covers open issues and problems and discusses solutions that build on Artificial Intelligence methods and recent patents.

Santos and Boticario in “A General Framework for Inclusive Lifelong Learning in Higher Education Institutions with Adaptive Web-Based Services that Support Standards” present a service-oriented
framework to support full participation of disabled students in the learning process. Their approach, which combines universal design principles with personalization technologies, follows the complete life cycle of service adaptation and is designed for higher education institutions. It takes into account standards and specifications that try to cover a wide range of possible user needs, and provides inclusive personalization support through dynamic contextual recommendations. The authors explore aspects of this framework in a case study that concerns two European universities specialized in distance learning.

Rodosthenous, Kameas and Pintelas in “Diplek: An Open LMS that Supports Fast Composition of Educational Services” investigate the domain of open-source educational systems. Their chapter describes Diplek, a platform developed using service oriented architecture to enable easy access to educational content and activities for novice learners and instructors with limited IT skills. The authors describe the design and development of the software, which is intended to be used in small educational settings, where computer experts are hard to reach and the need for an easy to use LMS is prominent. Diplek offers a set of special tools and can be operated even without an Internet connection or a Web browser, e.g. in situations where computing equipment is old and the connection between workstations is limited to a LAN.

In “Social, Personalized Lifelong Learning”, Cristea, Ghali and Joy look at how the social Web is changing the way in which instructors and students communicate with each other, as well as the methods of creating and sharing knowledge. The authors’ aim is not only to create personalized learning content but to use content creation and delivery as a means to provide new ways of learning and better learning experiences, customized to a specific learner or group of learners. The authors discuss some well-known models and frameworks for designing personalized e-learning, and show how an existing framework can be extended in order to cover the more complex relationships that emerge when social aspects are considered in lifelong learning and e-learning systems. Their approach allows students to contribute to the authoring phase with different sets of privileges, and differentiates between collaborative authoring (e.g. editing other users’ content, tagging, rating), and authoring for collaboration. The chapter presents the theoretical fundamentals for the framework extension, as well as an implementation and a prototype evaluation. Their findings support the need for an approach that would blend individualized/personalized learning with social learning experiences in future learning environments.

“Mash-Up Personal Learning Environments” by Wild, Mödritscher and Sigurdarson exploits previous research in personal learning environments and end-user development to propose a new concept in educational systems design, named mash-up personal learning environment. Mash-up personal learning environments enable learners to utilize an open, heterogeneous set of tools to communicate with each other, access content and tools into a learning network, and collaborate with others on different learning activities. The chapter examines the new concept in relation to existing models for personalized adaptive learning and explains the adaptation mechanisms for learning environment’s construction and maintenance. It demonstrates this approach with a prototypical implementation and describes its use in a lifelong learning scenario.

Kurilovas and Dagiene in “Technological Evaluation and Optimization of E-Learning Systems Components” examine the technological quality of e-learning systems components, i.e. learning objects, learning object repositories, and virtual learning environments. The authors analyze existing technological quality evaluation models and methods, and propose a form of evaluation that is organized along two dimensions: learning software “internal quality” and “quality in use.” The first one, “internal quality”, is a descriptive characteristic that describes the quality of software irrespective of the context of use, whilst the second one, “quality in use”, is an evaluative software characteristic that is obtained by making a judgment based on criteria that determine the value of a software for a particular project or use/
The proposed approach is further investigated in terms of optimal parameters, and an additive utility function based on multiple criteria, ratings, and weights, is formulated to optimize the learning software characteristics with respect to learners’ needs.

Section 2: Managing Digital Educational Content and Resources

Barbosa and Maldonado in “Collaborative Development of Educational Modules: A Need for Lifelong Learning” acknowledge that lifelong learning has to accommodate needs of a diverse student population. Their work emphasizes the development of “open and collaborative learning materials” through systematic and innovative mechanisms for creating educational content. The authors focus on issues of content modeling aiming at helping developers to determine the relevant parts of a knowledge domain and to structure concepts and related information of a module. Their aim is to create educational modules that can be easily transferred to different institutions and learning environments and can effectively support non-traditional environments, motivating the transition from lecture-based to self-directed and lifelong learning. The produced modules promote better the development of lifelong competences and expertise in several related knowledge domains, engaging learners and teachers in an empowering way. The authors illustrate the applicability of their approach with an example of collaborative development for an educational module in the “software testing” domain.

In “Collaborative Learning Design within Open Source E-Learning Systems: Lessons Learned from an Empirical Study”, Kordaki, Siempos, and Daradoumis investigate collaborative learning design from the instructors’ perspective. They conduct a study where a group of prospective computer technology professionals are asked to design collaborative learning courses on Moodle—a well-known open source Learning Management System—for students studying computing. The authors’ study reveals a number of serious problems faced by the participants, especially those with limited experience in learning design, such as lack of aligning collaborative tasks with appropriate assessment methods. The authors propose the design and development of a set of computer-based collaborative learning patterns that reflect a variety of collaboration methods in order to support instructors. These learning design patterns are content free and could be used as scaffolding elements for the design of collaborative learning activities for online and blended courses. Lastly, the chapter provides some examples of designs using patterns within LAMS.

Birnholtz, Baecker, Laughton, Mak, Causey, and Rankin in “Building Bridges: Combining Webcasting and Videoconferencing in a Multi-Campus University Course” investigate lifelong learning scenarios where participants are geographically distributed. This creates the need for designers to support meaningful learning and instruction using flexible system configurations for content delivery. The authors present a novel system that bridges videoconferencing and webcasting technologies and a study of its use for the delivery of a multi-campus university course. Their system uses webcasting to deliver content and allows webcast viewers to periodically participate more actively via on-demand, temporary two-way videoconferencing links that become a part of the streamed webcast that is visible and audible to all. The authors present an analysis of interaction and awareness in distance learning contexts. Their results suggest that designers should consider issues of awareness and interaction when making educational materials available to lifelong learners via distance learning technologies. Lastly, the chapter presents a list of design guidelines for developing these technologies further.

In “Video-Lectures over Internet: The Impact on Education,” Ronchetti looks at how multimedia content in the form of video is used for delivering online lectures. The chapter reviews the various directions that research has taken over the last 10 years to support and enhance this technology for educational
purposes, and discusses the pedagogical soundness of the idea of using videos over Internet for teaching and learning. It presents overwhelming evidence from the literature in favor of this technology as a creative way to change the didactic paradigm of teaching and create resources that can be eminently suitable for informal lifelong learning or self-study for students, who cannot physically attend classroom lectures. The author also discusses ways to increase the value of video-lectures for e-learning and lifelong learning through the use of advanced functionalities/features.

Gutierrez-Santos in “Adaptive Sequencing of Information for Lifelong Learners” investigates issues of reusing learning materials from different sources, and of adapting educational resources to different learners instead of using a one-size-fits-all strategy. The author focuses on the problem of combining and sequencing resources, exploring how to adapt sequences, and how to share them among systems by using the semantics of the well-known IMS Learning Design (LD) standard. The chapter suggests an approach, based on graphs, that is designed for scalability and flexible enough to allow defining cycles in the sequencing process. It relies on hierarchy and compartmentalization to facilitate reuse. The author explores the possibility of using IMS LD as a medium to interchange adaptive sequencing and explains the main challenges involved in this task, providing lessons learnt in the process about the limits of the IMS LD.

Section 3: Developing and Accrediting Skills and Competences

Dunlap and Lowenthal in “Learning, Unlearning, and Relearning: Using Web 2.0 Technologies to Support the Development of Lifelong Learning Skills” analyse Web 2.0 technologies, such as blogging, social networking, document co-creation, and resource sharing tools, with respect to their potential for helping educators to achieve teaching objectives, and students to develop lifelong learning skills in changing the social and the professional contexts. The authors explain how educators can use Web 2.0 technologies to create learning experiences that have the potential to help students develop skills and dispositions, e.g. autonomy, reflection, and collaboration, which are needed to become effective lifelong learners. They share several ideas for using Web 2.0 technologies and make recommendations for instructional designers and decision makers in educational institutions.

In “Technological Aids to the Efficient Assessment of Prior Learning”, Joosten–ten Brinke, Van der Klink, Kicken, and Sloep examine lifelong learning Assessment of Prior Learning (APL). The authors emphasize the importance of taking into account prior learning experiences and competences when designing lifelong learning courses in order to enhance employees’ further professional development and learning. The chapter discusses the major components of the APL procedure, including the current possibilities for exchange and operability (e.g. the IMS QTI and the IMS ePortfolio). It describes the workflow of APL and the instruments needed in this procedure. The authors explain how re-use of instruments, such as competence profiles, e-portfolios, and rubrics specifications, can reduce costs of conducting APL, and support assessors in their tasks. However, they identify several challenges involved, such as the need for more advanced metadata specifications, and for tools for indexing and browsing structures together with techniques for visualization of competence information objects. Despite the availability of some technical solutions, there is still absence of generally accepted competence profiles, which leads to serious interoperability problems. To alleviate this situation, the authors elaborate a new model of assessment for APL and validate its effectiveness.

In “Game Based Lifelong Learning,” Kelle, Sigurðarson, Westera, and Specht explore how game design patterns could be used for developing skills in lifelong learning scenarios. The authors start by examining
digital games as a means of learning and provide an overview of the current state of the art in this area. They argue that transforming learning activities into games can benefit both learners and course developers, particularly in lifelong learning courses that incorporate elements of distance learning or are run in mixed-mode. Learners’ self-motivation and a sense of “ownership of learning” have been acknowledged as critical factors for learning throughout life, and the authors demonstrate with some simple examples how game design patterns could be used to design learning activities.

Chang in “Formative Assessment and Feedback with Teacher Immediacy Behaviors in an E-Text-Based Context” focuses on the importance of constructive and beneficial feedback through assessment in an e-text-based context for the purpose of lifelong learning. Lifelong learners not only need individualized support, but also have high expectations from instructors in terms of timely and quality feedback. The author investigates issues of interaction between instructors and students and discusses teacher immediacy cues. The chapter also suggests practical strategies to exploit online communication tools and encourage students to engage in revisions of their work. Lastly, the author discusses how instructor’s technological skills can be underpinned by theoretical knowledge of the importance of feedback in delivering effective learning and lifelong learning experiences and an understanding of instructors’ role and behavior in this context.

**HOW TO USE THIS BOOK**

The book could be used as an advanced upper-level course supplement and resource for instructors. It also targets educational technologists and staff at educational institutions who research lifelong learning technologies or are involved in decision-making about relevant technologies and infrastructure.

*Educational technologists and software developers* could use this book as an informative introduction to the area. The book can play the role of a reference text as it captures the state-of-the-art and illustrates technical solutions for the development of e-learning and lifelong learning systems.

*Managerial and research staff* working in the areas of technology-enhanced learning, Web-based learning environments, and personalized learning will find in this book material that could help them to assess the benefits of the various technologies for e-learning and lifelong learning and make informed decisions about future research, development, and implementation.

*For instructors and e-learning systems developers,* this book offers chapters that go beyond the level of Learning Management Systems and Virtual Learning Environments. New technologies have been developed, and complex infrastructures are being increasingly implemented in educational organizations worldwide, and gaining understanding of how to embrace them effectively is critical for educational organizations.

Lastly, for *high-level undergraduate and postgraduate students,* this book offers examples of technologies’ design and implementation, covering key stages in their lifecycle and analyses of how they are perceived by users. It could be used as a source of reference and a guide for students taking modules or working on projects related to large scale Information Systems, especially in the context of educational organizations.

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