Ubiquitous and Pervasive Knowledge and Learning Management is the third book of our series. The initial goal was in the first year of the series to provide the state-of-the-art in Knowledge and Learning Management according to our perception for the key technological enablers that in the next years will influence critically the domain. In fact, we wanted to deliver our strategic point of view for the new era of Knowledge and Learning Management.

We started by providing, in Intelligent Learning Infrastructure for Knowledge Intensive Organizations: A Semantic Web Perspective, the Semantic Web insights for Knowledge and Learning Management. One year after this publication the evolution of Semantic Web, its adoption in business and industry, supports our argumentation that the future of Knowledge and Learning Management will have a critical Semantic Web dimension.

In the second book of the series, the Open Source for Knowledge and Learning Management: Strategies Beyond Tools, we wanted to concentrate on the evolution of the free and open source software (FOSS). Through an excellent combination of themes we wanted to initiate the scientific debate for the benefit of all the citizens and the governments of the knowledge society. Thanks to the contributing authors, this second edition is really a reference book for the area.

The third book is the one you hold in your hands. Ubiquitous and Pervasive Knowledge and Learning Management: Semantics, Social Networking and New Media to Their Full Potential analyzes how mobile and wireless networks, and ubiquitous and pervasive computing in general, support a new generation of knowledge and learning management systems aiming to provide services beyond time or geographical borders.

We are really happy. We feel that we have done a great job in this first year. Our edition strategy was from the beginning to develop reference books for big audiences. It is quite strange to realize that especially in academia after a few years the people you can collaborate with are the most competitive to you. This is why you
have to open up your mind and ask for collaborations by admitting your limited capacity to deliver more meaningful and greater results. We are really grateful to all the contributing authors of our editions because we share the same beliefs.

In this journey we wanted to go beyond the typical scholar books flavor. We wanted to develop three books that give answers to significant questions but also set new challenges for critical thinking about the deployment of knowledge and learning management for the common wealth.

Having a huge network of collaborations, and being part of big networks of excellence in knowledge and learning management, Semantic Web, open source, ubiquitous and pervasive computing, we tried to create synergies that the audiences of the books could exploit. In business strategy a major lesson is to be able to understand that the pair explore and exploit is a key adoption mechanism. In these three edited books we have explored the state of the art for knowledge and learning management as affected by three critical and in fashion technological evolutions: Semantic Web, open source, ubiquitous and pervasive computing.

But in parallel we have tried also to promote the discipline. In a parallel process, we are more than happy that we undertook and delivered, or are currently developing, a great number of special issues in prestigious journals. We mention just a few of them.

Special issues planned to be published in 2007:

1. **IEEE Transactions on Knowledge and Data Engineering**: Special Issue on Knowledge and Data Engineering in the Semantic Web Era (Guest Editors: Gottfried Vossen, Miltiadis Lytras, and Nick Koudas)

2. **IEEE Transaction on Education**: Special Issue on Open Source for Engineering Education: Pedagogical strategies beyond tools (Guest Editors: Miltiadis Lytras and Walt Scacchi)

3. **IEEE Internet Computing**: Special Issue on Semantic Based Knowledge Management Systems (Guest Editors: John Davies, Miltiadis Lytras, and Amit Sheth)

4. **Computers in Human Behavior**: Special issue on Advances of Knowledge Management and the Semantic Web for Social Networks (Guest Editor: Miltiadis Lytras)

5. **International Journal of Technology Management**: Special issue on Knowledge Management in the Health, Pharmaceutical and Clinical Sectors (Guest Editors: Miltiadis Lytras, Ambjörn Naeve, Constantine Makropoulos, and Vipul Kashyap)

6. **Journal of Knowledge Management**: Special issue on Competencies Management: Integrating Semantic Web and Enhanced Learning approaches for effective Knowledge Management (Guest Editors: Miltiadis Lytras, Miguel Angel Sicilia, and Ambjörn Naeve)
7. **International Journal of Knowledge and Learning**: Special Issue on *Knowledge Society: A roadmap for government consultation* (Guest Editors: Miltiadis Lytras, Thomas Devenport, and Larry Prusak)


9. **International Journal of Knowledge and Learning**: Special Issue on *Learning and Interacting in the Web: Social Networks and Social Software in the Web 2.0* (Guest Editors: Sheizaf Rafaeli, Stephen Downes, Miltiadis Lytras, and Ambjörn Naeve)

10. **International Journal of Knowledge and Learning**: Special Issue on *Empirical Surveys on the Adoption of ICTs in Schools: From Wishful Thinking to Constructivist Learning and Beyond* (Guest Editors: Griff Richards, Dragan Gasevic, Weihong Huang, and Miltiadis Lytras)

11. **International Journal of Teaching and Case Studies**: Special Issue on *Information Systems: The new research agenda the emerging curriculum and the new teaching paradigm* (Guest Editors: John Carroll and Miltiadis Lytras)

12. **International Journal of Teaching and Case Studies**: Special Issue on *Teaching Knowledge Management: Integration into Curriculum, Teaching Strategies and Teaching Case Studies* (Guest Editors: Dov Te’eni, Nick Bontis, and Miltiadis Lytras)

13. **International Journal of Teaching and Case Studies**: Special Issue on *Teaching Semantic Web: Integration with CS/IS Curriculum and Teaching Case Studies* (Guest Editors: Dov Te’eni, Nick Bontis, and Miltiadis Lytras)

14. **IJ of Management in Education**: Special Issue on *Exploiting Information and Communication Technologies for Effective Management of Education: Towards Interactive Managerial and Leadership Styles in Schools* (Guest Editors: Miltiadis Lytras, and Maria Mantziou)

**Already Published**


For the second year of the Knowledge and Learning Society series, we emphasize the applications domains of knowledge and learning management. In fact, we want to provide our strategic point of view for the kind of applications that the technological enablers of knowledge and learning management as described in the first three editions will be realized. Thus, four more editions have been scheduled for late 2007:

- **Knowledge Management Strategies: A handbook of applied technologies** (Editors: Miltiadis D. Lytras, Meir Russ, Ronald Maier, and Ambjörn Naeve)
- **Technology Enhanced Learning: Best practices** (Editors: Weihong Huang, Dragan Gasevic, and Miltiadis D. Lytras)
- **Knowledge and Networks: A social networks perspective** (Editors: Stephen Downes and Miltiadis D. Lytras)
- **Semantic Web Engineering for the Knowledge Society** (Editors: Jorge Cardoso and Miltiadis D. Lytras)

Currently, we are preparing for the third year of the series, targeting specific pillars of the knowledge society. Although the final decision has not been made, we are thinking of five more editions along the following themes:
We live in an era in which we have modified our traditional assumptions for the provision of information technology supported services. In fact, we live in an era where the information highways enabled by information networks provide unforeseen opportunities for knowledge dissemination.

The traditional simplification of IT, namely the knowledge representation / knowledge retrieval, two-fold approach has gained new insights from the ubiquitous and pervasive computing.

We do believe that this edition contributes to the literature. We invite you to be part of the exciting knowledge and learning management community, and we look forward to your comments, ideas and suggestions for future editions.

August 2006
Miltiadis D. Lytras
Ambjörn Naeve

Structure/Editing Strategy/Synopsis of the Book

When dealing with ubiquitous and pervasive computing, it makes no sense to try to be exhaustive, not only because of the fast pace in technologies that support ubiquitous computing, but mostly because of the many aspects of the domains. Moreover, when you are trying to investigate the new insights of ubiquitous and pervasive computing to knowledge and learning management, then the mission becomes even more complex.

This is why from the beginning we knew that our book should be selective and focused. In simple words, we decided to develop a book with characteristics that would help readers follow several paths through the contents. We also decided to open the book to large audiences. While we could pursue through our excellent contacts and great network of collaborators a publication aiming to promote the discipline, we decided it would be most significant (from a value-adding perspective) to develop a reference book. And this is what we made with the support of great contributors: a
reference book for Ubiquitous and Pervasive knowledge and learning management providing an excellent starting point for further studies in the topics. Having already the experience of the edition of *Intelligent Learning Infrastructure for Knowledge Intensive Organizations: A Semantic Web Perspective* and getting feedback from hundreds of researchers from all over the world, we decided to keep the same presentation strategy. We have tried, and we think we have succeeded, in developing a book that has three characteristics:

- It discusses the key issues of the relevant research agenda.
- It provides practical guidelines and presents several technologies.
- It has a teaching orientation.

The last characteristic is a novelty of our book. Very often, editions seem like a compilation of chapters but without an orientation to the reader. This is why every edited chapter is accompanied by a number of additional resources that increase the impact for the reader.

In each chapter we follow a common didactic-learning approach:

- At the beginning of each chapter authors provide a section entitled **Inside Chapter**, which is an abstract-like short synopsis of their chapter.

At the end of each chapter there are some very interesting sections, where readers can spend many creative hours. More specifically, the relevant sections are entitled:

- **Internet Session**: In this section authors present one or more Web sites relevant to the discussed theme in each chapter. The short presentation of each Internet session is followed by the description of an **Interaction**, where the reader (student) is motivated to have a guided tour of the Web site and to complete an assignment.

- **Case Study**: For each chapter, contributors provide “realistic” descriptions for one case study, that readers must consider in order to provide strategic advice.

- **Useful Links**: Authors refer to Web sites, with content capable of exploiting the knowledge communicated in each chapter. We decided to provide these links in every chapter, even though we know several of them will be broken in the future, because their synergy with the contents of the chapter can support the final learning outcome.
• **Further Readings:** These refer to high quality articles available both on the Web and electronic libraries. We have evaluated these resources as being of significant value to readers.

• **Essays:** Under this section a number of titles for assignments are given. In the best case, essays could be working research papers. The general rule is that we provide three to six titles for essays, and in their abstract title readers can find an excellent context of questioning.

The edited book consists of 11 chapters. We will try in the next paragraphs to give an overview of the contents and also to explain the strategic fit of each chapter to our vision.

In Chapter I, *Pervasive Computing: What is it anyway?*, Emerson Loureiro, Glauber Ferreira, Hyggo Almeida, and Angelo Perkusich (Federal University of Campina Grande, Brazil) give an excellent introduction to pervasive computing providing the rich picture of the domain.

In fact, they introduce the key ideas related to the paradigm of pervasive computing. They discuss in depth pervasive computing concepts, challenges, and current solutions by dividing it into four research areas. Such division makes it possible to understand what is really involved in pervasive computing at different levels. They provide readers with introductory theoretical support in the selected research areas, giving an excellent introduction for the exploitation of pervasive computing for knowledge and learning management.

In Chapter II, *“Neomillennial” Learning Styles Propagated by Wireless Handheld Devices*, Edward Dieterle, Chris Dede, and Karen Schrier (Harvard Graduate School of Education, USA) give fresh ideas and innovative ways for the exploitation of ubiquitous and pervasive technologies for learning. According to their strategic point of view, as the digital-aged learners of today prepare for their post-classroom lives, educational experiences within classrooms and outside of schools should reflect advances both in interactive media and in the learning sciences. Two recent research projects that explore the strengths and limitations of wireless handheld computing devices (WHDs) as primary tools for educational innovations are Harvard University’s Handheld Devices for Ubiquitous Learning (HDUL) and Schrier’s Reliving the Revolution (RtR). These projects provide rich data for analysis using their conceptual framework, which articulates (a) the global proliferation of WHDs, (b) society’s movement toward “ubiquitous computing,” (c) the potential of WHDs to enable sophisticated types of instructional designs, and (d) WHD’s fostering of new, media-based learning styles.

In Chapter III, *Mobile Education: Lessons Learned*, Holger Nösekabel (University of Passau, Germany) encourages readers to apply their critical thinking. He initiates an interesting debate by acknowledging that mobile education, comprising learning, teaching, and education-related administrative services delivered via mobile technologies, has incited several projects and discussions in the last years.
When reviewing these projects, it becomes apparent that most of them are technology-driven, and only a few were formally evaluated at the end. However, certain lessons, chances, and obstacles can be identified which may be helpful for further development in this sector.

One critical issue is the distribution of costs for mobile services. As both educational institutions and students act on a limited budget, it is necessary to choose an infrastructure which meets the requirements of the users and addresses all relevant obstacles. Consequently, there is no single ideal technological alternative, but each project needs to make a situational choice.

Readers will really value this chapter, and Nösekabel’s critical point of view will give significant answers to several questions.

In the same line with Nösekabel’s work, Chapter IV, *Ubiquitous Applications in Education*, by Kostas Kolomvatsos (National & Kapodistrian University of Athens, Greece) deals with issues directly connected to ubiquitous computing, such as its features, types of devices used, and pedagogical goals. The advantages and disadvantages of ubiquitous environments are fully examined and some initiatives are presented and discussed.

In Chapter V, *Using Multimedia and Virtual Reality for Web-Based Collaborative Learning on Multiple Platforms*, Gavin McArdle, Teresa Monahan, and Michela Bertolotto (University College Dublin, Ireland) discuss the benefits that 3D environments offer the e-learning community. They outline how this type of system emerged and describe some currently available systems using these new technologies. In particular, they describe in detail a virtual reality environment for online learning developed in their research group and the features it provides. They also discuss the extension of this system to a mobile platform so that users have anytime, anywhere access to course materials. Finally, they put forward some thoughts on future technologies and discuss their possible contribution to the development of a truly ubiquitous and pervasive learning environment. We fully agree with their point of view that future e-learning systems will be much different from the text-based monolithic systems that currently dominate the market.

In Chapter VI, *Using Emotional Intelligence in Personalized Adaptation*, Violeta Damjanovic (Salzburg University, Austria) and Milos Kravcik (Open University Nederland, The Netherlands) provide significant insights for the critical theme of adaptation in ubiquitous and pervasive learning environments. The process of training and learning in Web-based and ubiquitous environments brings in a new sense of adaptation. With the development of more sophisticated environments, the need for them to take into account the user’s traits, as well as user’s devices on which the training is executed, has become an important issue in the domain of building novel training and learning environments. This chapter introduces an approach to the realization of personalized adaptation. Because they are dealing with the stereotypes of e-learners, having in mind emotional intelligence concepts to help in adaptation to the e-learners real needs and known preferences, they have called this system eQ. It stands for using of the emotional intelligence concepts on the Web.
In Chapter VII, *Accessing Learning Content in a Mobile System: Does Mobile Mean Always Connected?*, Anna Trifonova (University of Trento, Italy) points out an important functionality of a ubiquitous mobile system, and more specifically its application in the learning domain. This functionality is the possibility to access the learning material from mobile devices, like PDAs (personal digital assistants) during their off-line periods and the technique to approach it, called hoarding. The chapter starts with an overview of a concrete mobile learning system, Mobile ELDIT, to give a clear idea of when and how this problem appears and why it is important to pay attention to it. Later, a description of the development approaches for both general and concrete solutions are discussed, followed by a more detailed description of the important hoarding steps.

In Chapter VIII, *A Choreographed Approach to Ubiquitous and Pervasive Learning*, Sinuhé Arroyo and Reto Krummenacher (Digital Enterprise Research Institute, Innsbruck, Austria) introduce a conceptual choreography framework and show its tremendous interest for ubiquitous and pervasive applications. Choreography is the concept of describing the externally visible behaviour of systems in the form of message exchanges. As information about various sensors, services, and user applications have to be integrated in ubiquitous and pervasive environments to provide seamless assistance to users, it is indispensable that means to map heterogeneous message exchange patterns and vocabularies are provided. The authors’ aim is to give the reader an understanding of the principles and technologies underlying the choreography framework of SOPHIE: semantic descriptions of message exchange patterns are used to overcome heterogeneity in communication regardless of the concrete application domain.

In Chapter IX, *Semantic Knowledge Mining Techniques for Ubiquitous Access Media Usage Analysis*, John Garofalakis, Theodoula Giannakoudi, Yannis Panagis, Evangelos Sakkopoulos, and Athanasios Tsakalidis (University of Patras, Greece) present an information acquisition system which aims to provide log analysis dealing with ubiquitous access media by use of semantic knowledge. The lately emerging figure of the Semantic Web, the ontologies, may be used to exalt the Web trails to a semantic level so as to reveal their deeper usage info. The presented architecture, intended to overcome mobile devices’ trail, duplicates problems and detect semantic operations similarity of server Web services, which are often composed to provide a function. The references that supplement the chapter provide publications that mainly discuss log file mining and analysis and semantic similarity. Useful technology-used URL resources are also provided.

In Chapter X, *To Ease the Dilemma of Help Desk: The Application of Knowledge Management Techniques in Manipulating Help Desk Knowledge*, Nelson Leung and Sim Kim Lau (University of Wollongong, Australia) describe the development of help desk, ranging from help desk structures to support tools. This chapter also discusses the application of knowledge management techniques in the development of a proposed conceptual knowledge management framework and a proposed re-distributed knowledge management framework. While the conceptual knowledge
management framework proposes a standard methodology to manage help desk knowledge, the proposed redistributed knowledge management framework allows simple and routine enquiries to be re-routed to a user self-help knowledge management system. The proposed system also enables help desk to provide technical knowledge to user 24 hours a day, 7 days a week. Regardless of time and geographical restrictions, users can solve their simple problems without help desk intervention simply by accessing the proposed system through portable electronic devices.

In Chapter XI, *Discursive Context-Aware Knowledge and Learning Management Systems*, Caoimhín O’Nualláin, Adam Westerski, and Sebastian Kruk (DERI Galway, Ireland) look at the research area of discursion and context-aware information as it relates to the user. Much research has been done in the area of effective learning, in active learning, and in developing frameworks through which learning can be said to be achieved with some possibility of being measured (i.e., networked learning and Bloom’s Taxonomy). Having examined many such frameworks, they found that dialogue plays a large part, and in this chapter they specifically examine dialogue in context of the user’s background and social context. They provide a quality discourse analysis model which achieves in more detail a picture of the user’s actual level of knowledge.