Preface

The objective of *Multiplatform E-Learning Systems and Technologies: Mobile Devices for Ubiquitous ICT-Based Education* is to provide researchers, e-learning adopters and practitioners with the most current information about various critical issues regarding design frameworks, the appropriate use of pedagogies, the adoption and extension of existing standards, the design of user interface and innovative tools, the adaptation, transformation and delivery of integrated learning content, the appropriate users’ evaluation methodologies, and the scaffolding of existing mobile learning experiences toward multiplatform e-learning systems.

Multiplatform e-learning system is not mobile learning as per se, it is more comprehensive than mobile learning in various aspects. A simple definition of multiplatform e-learning systems is to regard learning systems that generate support and provide appropriate learning content concurrently to a proliferation of mobile devices such as wireless laptops, PDA, mobile phones, digital interactive TVs, iPhones, game consoles etc. In this context, an e-learning system that can support and engage learners through a multitude of access devices or objects is called a multiplatform e-learning system. Multiplatform e-learning system (sometime also known as a multi-device e-learning environment or as ubiquitous learning) is an emerging technology that opens a new research domain.

As in many new researches in emerging technologies, there are always challenges and risks involve in proposing such a book. However to engage and promote in a new research domain, the benefits and opportunities deriving from producing the book outweighed the risk. With the contributions from many outstanding authors and reviewers, and a small contribution from the editor, together we have managed to produce a first book in Multiplatform E-Learning Systems and Technologies for Ubiquitous ICT-Based Education. In the process of compiling the book, the term mobile learning is still widely used. It is hope that the publication of this book would accelerate the diffusion of multiplatform e-learning systems research into the main stream of ubiquitous ICT-based research and that researchers should begin thinking of a multitude of accessing platforms scenario instead of a single device.

In presenting *Multiplatform E-Learning Systems and Technologies: Mobile Devices for Ubiquitous ICT-Based Education*, from my engineering and information system background I am mindful about the strong need for theoretical foundation and practical usefulness. Therefore within this book, the frameworks and learning theories provide the foundation for development, design methodologies and integration provide the essential routes for successful implementation, innovative tools illustrate many alternative scenarios for engagement in ubiquitous ICT-based learning and various innovative case studies demonstrate validated learning experiences. This approach provides researchers and adopters the ease of understanding and absorption of critical knowledge and issues relevant to Multiplatform E-Learning Systems and Technologies for Ubiquitous ICT-Based Education.

The rest of this preface introduces the book in more details and position the situation and future challenges for Multiplatform E-Learning Systems research.
THE SITUATION AND FUTURE CHALLENGES

E-learning systems have now been adopted by many universities. With the advent of the Internet, the e-learning systems have been transformed into web based learning systems where content can be accessed beyond the conventional classroom and lab boundaries. In recent years, there has been a proliferation of devices capable of accessing the Internet, ranging from tablet PCs to mobile devices including telephones, smart phones and personal digital assistants (PDA), iPhones, game consoles and even appliances such as televisions, microwave ovens and refrigerators. Most of these devices are capable of accessing e-learning systems. However, till now, most popular e-learning systems such as Blackboard and WebCT are limited in delivering appropriate content to these proliferations of devices. Conventionally these e-learning systems are designed for personal computer usage. With the proliferation of access devices there is a need for these e-learning systems to extend their support to and provide appropriate content for these devices. Such an e-learning system that supports this multitude of devices is called a multiplatform e-learning system in this context. In this new context, many aspects differ from the original context. Firstly most of the mobile devices such as PDAs and smart phones are designed for telecommunication usage. These devices are characterized by a small screen, low memory, low power and distinctly different ways of interaction and navigation compared to desktop computers. When learners use these devices to access and interact with e-learning content instead of making a phone call, how do they feel about the interaction? What are the relevant factors that need to be considered even though the learning content may be identical? Furthermore, in this new context even if the access platform is similar to a desktop computer, other aspects may still differ from the original context. For instance, in most cases the connection bandwidth is likely to be lower than a school’s local network. E-learning systems typically do not perform bandwidth estimation to make changes to content. The content remains the same irrespective of the changing context. In some cases the bandwidth might be too low for the delivery of multimedia content. Is it possible that some alternate ways of delivering content such as offline or plain text delivery could make learning more satisfying and useful than waiting endlessly for downloads? How might these alternative ways of delivering content influence learners? For instance, the affective components such as motivational factor of accessing the e-learning systems might be different at school than on the move. While on the move, different affective factors such as urgency may trigger students to explore the e-learning system. Can we extract and utilise learner’s affective components? As teachers’ help are not readily available on the move, a lot of self motivation is required. Would the present of urgency and absence of teachers’ help influence learner?

While many attempts have been made to develop e-learning systems that can be accessed only through single devices such as desktop computers or certain mobile devices, multiplatform e-learning systems have not been well researched. With the escalating speed at which new mobile devices are being launched and wireless infrastructures are being developed, there is an ever-increasing need to acquire an understanding of the characteristics and learning experiences of multiplatform e-learning systems from various perspectives to support future Ubiquitous ICT-Based Education. It is hope that this book is timely to support such an endeavour.

OVERVIEW OF THE BOOK

This edited book is intended to address the latest development relevant to multiplatform e-learning systems and technologies for mobile devices and ubiquitous ICT-based education. It comprises contributions from leading researchers and practitioners all over the world in the field of multiplatform e-learning
systems and technologies for mobile devices and ubiquitous ICT-based education. Inevitably this new
environment provides both opportunities and challenges ahead. One aspect this book addresses is the
integration and extension of current LMS towards multiplatform e-learning environment. For com-
mercial and open source LMS providers, this provides an opportunity to extend the reach from single
PC accessing device to various mobile devices. The practical nature of the book provides readers with
real and proven knowledge and state-of-the art technologies on the design of multiplatform e-learning
systems and technologies for mobile devices and ubiquitous ICT-based learning. Other aspects the book
addresses are the frameworks in blended learning scenarios, heterogeneous pervasive environment, and
designing with effective pedagogical systems.

Thus, this book presented extensive and yet critical issues relevant to the current technologies. Each
chapter provides its research findings and briefly discusses on future research and how it will be useful in
supporting multiplatform e-learning systems and technologies for mobile devices and ubiquitous ICT-
based education.

The book is organized along four dimensions of theoretical and practical research. Section 1 addresses
the framework and learning theory issues. This will help the reader to understand the foundation that sup-
port ubiquitous ICT-based learning. Section 2 addresses the design and integration issues. This will help
the reader extend their theoretical understand into practical system. Section 3 addresses some practical
tools that are useful to engage learners in various scenarios. This will help reader to consider various
field learning activities. Section 4 provides various case studies. This will help reader understand the
expected benefits and challenges should the reader intents to deploy similar technologies and systems.

The book has been organized into four sections of 20 chapters. A brief description of each of the
chapters follows:

**Section 1: Frameworks and Theories**

In **Chapter 1**, Tim de Jong, Alba Fuertes, Tally Schmeits, Marcus Specht and Rob Koper describe
a multi-platform extension of learning networks that provide mobile, contextualised learning content
delivery and creation. They illustrate a possible extension to contextualise and more authentic forms of
learning mediated by mobile devices. The chapter conclude with an outlook describing the components
necessary to integrate multi-platform e-learning software in existing learning scenarios to achieve a
larger-scale adaptation.

In **Chapter 2**, Michele Ruta, Floriano Scioscia, Simona Colucci, Eugenio Di Sciascio, Tommaso
Di Noia, and Agnese Pinto propose a ubiquitous learning approach useful in acquiring knowledge in
the traditional educational setting and capable of solving cross-environment everyday problems. The
chapter introduces a lightweight and semantically meaningful matchmaking process to retrieve the most
suitable learning resources. They proposed a generalised framework and algorithm and demonstrated
with an application using semantic-based Bluetooth/RFID discovery protocols.

In **Chapter 3**, Wan Ng, Howard Nicholas, Seng Loke and Torab Torabi address the issues of effective
learning system design for various mobile devices. They review various pedagogical models and theories
applicable to mobile learning. Using scenarios and case studies they demonstrate various alternatives and
challenges for each pedagogical model. A personal learning workflows and group learning workflows
approach were proposed to work within varied pedagogical models.

In **Chapter 4**, Paul Hayes and Stephan Weibelzahl exploit text messaging for supporting learning in
a variety of educational settings. This chapter demonstrates how the use of text messaging can contrib-
ute towards enhanced quality of learning. In particular the chapter focuses on the use of text messaging
as a means of improving immediacy between instructors and students in third-level education. This
chapter conclude with a discussion on the integration of text messaging for improving immediacy in Multiplatform E-Learning Systems.

In Chapter 5, Jonathan Bishop describes the Ecological Cognition Framework (ECF) that provides a thorough understanding of how actors respond to and influence their environment. Utilising the ECF the chapter shows that for an e-learning system to be an effective teacher it needs to be able to create five effects in the actors that use it. The effects are the belonging effect, the demonstration effect, the inspiration effect, the mobilisation effect, and the confirmation effect.

Section 2: Design and Integration

In Chapter 6, Juan Manuel González Calleros, Josefina Guerrero García, Jaime Muñoz Arteaga, Jean Vanderdonckt, and Francisco Javier Martínez Ruiz present a structured method for automatically generating User Interfaces for e-learning environments. Their method facilitates automated generation over multiple computing platforms while maintaining portability and consistency between the multiple versions. The method starts with a definition of the learning scenario where the different goals, jobs and tasks are described and stored in a template with the aid of FlowiXML, a learning process authoring tool and UsiXML, a User Interface eXtensible Markup Language tool.

In Chapter 7, Daniel C. Doolan, Tracey J. Mehigan, Sabin Tabirca, and Ian Pitt discuss the use of Bluetooth enabled mobile devices for cross platform application within the classroom setting to allow students to interact with subject matter in a new and interactive way using the ICT resources that present in our daily lives. The chapter provides an evaluation on the use of such cross platform learning applications and demonstrated that learning process is enhanced.

In Chapter 8, José Rouillard presents a solution to deliver content over a heterogeneous networks and devices. The chapter discusses work in interface adaptation and plasticity and illustrate examples of context-aware adaptation. In particular the chapter illustrates an adaptive pervasive learning environment that take place in a zoo. The system is based on contextual QR Codes, where information is presented to learner at the appropriate time and place, and according to a particular task.

In Chapter 9, David Millard, Yvonne Howard, Lester Gilbert, and Gary Wills describe a methodology for co-design in m-learning that includes stakeholders’ inputs from the domain in the technology design team. The method emphasises ubiquitous learning design process that considers the social and professional context. A case study that supports nurses’ placement illustrates the effectiveness of the co-design methodology.

In Chapter 10, Kiyoshi Nakabayashi presents a learner-adaptive self-learning environment for both mobile phones and personal computers. The learner-adaptive function has been implemented using SCORM 2004 specifications to enable offline learning using mobile phones. The functionality and usability of the system was evaluated and validated through two trial experiments.

In Chapter 11, Marc Alier Forment, María José Casany Guerrero, and Jordi Piguillem Poch analyze the complexities involved in the integration of Learning Management Systems (LMS) and ubiquitous learning. The chapter describes some standard interoperability architectures and related research and development projects that will allow better integration and interaction between the LMS and the m-learning applications. The chapter illustrates a case example with Moodbile that demonstrates a rich mobile client application with persistent storage capabilities and offline functionality.
Section 3: Innovative Tools

In Chapter 12, Dawn Woodgate, Danaë Stanton Fraser, Amanda Gower, Maxine Glancy, Andrew Gower, Alan Chamberlain, Teresa Dillon, David Crellin argue the relationships that exist between science education and public engagement in science, and ‘formal’ and ‘informal’ learning contexts. The chapter describes four case studies involving various mobile technologies, tools and platforms for ubiquitous ICT-based science-related learning inquiries and activities.

In Chapter 13, Mattias Rost and Lars Erik Holmquist present a set of tools to support groups of students who are doing field studies. The tools include a wiki for gathering field notes and their group work material, a mobile application for capturing data (photo, video, audio, and text) and automatically uploading to the wiki, and a set of web tools which run on top of the wiki for increasing the awareness between students, and for browsing the captured data. The chapter describes the implementation of these tools and report on the experience.

In Chapter 14, Peter Byrne and Brendan Tangney present the design, implementation, and evaluation of a mobile learning application called the Stop-Motion Animation and Reviewing Tool (SMART). The application enables users to create animations on a mobile phone and is part of a larger generic suite of open-system software to facilitate the development of cross platform applications in the area of digital narrative production.

Section 4: Innovative Cases

In Chapter 15, Siu Cheung Kong presents a multiplatform e-learning system called the “Graphical Partitioning Model (GPM)” for learning knowledge of fraction equivalence. The chapter presents a case study on the use of the mobile version GPM for the learning of the targeted topic in a mobile technology supported environment. The case study reveals that there is a potential for the flexible use of the dual-version GPM to foster deep learning.

In Chapter 16, Kin-Choong Yow and Boon-Chong Seet describe a new platform for mobile and interactive learning between the professor and students during lectures. The new platform enables interactions through Multimedia Messaging Service (MMS) capable devices such as PDAs, Laptops, or Tablet PCs that are connected on the campus-wide Wireless LAN. The system enables and encourages response to questions or provides instance feedback on the lecture.

In Chapter 17, Joan Richardson and John Lenarcic describe a case study on the use of Short Message Service (SMS) to augment and support the provision of student administrative services. The system utilised SMS technology to deliver physical class locations, availability and web addresses of iPod resources, important events, alerts for multimedia, examination schedules, and, assessment feedback by ‘pushing’ information to students.

In Chapter 18, Patricia Kahn and Edward Chapel present a campus wide innovative mobile technology service program. The program, which included a custom designed, high speed, rich media and GPS (location based services) capable cellular network as well as a rich array of cell phone based applications enabled students to customize their mobile phone for 24/7 access to the University’s teaching and learning, information, and administrative resources. The chapter describes how the applications enhanced the learning environment.

In Chapter 19, David Metcalf and David Rogers argue that an important part of multiplatform or blended learning is designing learning environments that take full advantage of the relative strengths and weakness of the various platforms employed to meet learning objectives. The chapter examines applications in which mobile learning takes advantage of the flexibility afforded by the platform. A case
illustrates the possibilities presented by physical hyperlinks through the use of Near Field Communications, QR codes, and image recognition software.

Finally in Chapter 20, Shinichi Hisamatsu presents an interactive exhibition system for museums, which combines learning based on interactions with multiple physical objects and knowledge transmission. The system enable user to handle and look at an actual physical object and able to talk directly to the user. This “conversation” with the object as the user “grasps” and “feels” the object deepens the user’s understanding of and interest in the object.

At the end of this book there is also a comprehensive index defining most of the terms that will be useful to reference for the exact meaning used by various authors in the book.

**OPPORTUNITIES**

Multiplatform E-Learning Systems and Technologies and Ubiquitous ICT-Based Education research is definitely in its early stage of research life cycle. There is a need to understand various aspects of the technologies pertaining to effective use of the technology to achieve satisfactory and effective learning outcomes. While the underlying technology may be ready for deployment there is indeed a lack of validated pedagogical theory to support effective design and development. This vacuum represents an opportunity for future research. There is also an opportunity to investigate various extensions of LMS to make appropriate interaction and delivery of existing content to various devices and new platforms. Indeed, a future volume may be necessary to continuously address the issues. Nevertheless, it is hope that this book will be a timely publication for both academics and practitioners who are interested in the design and development of future Multiplatform E-Learning Systems and Ubiquitous ICT-Based learning environments.

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