Preface

OVERVIEW

Information communications technology (ICT) has been found to be one of the most potent tools for promoting equity and access to education, and a great resource in bridging the gap of the digital divide. ICT affects almost all of our everyday activities, be it business, defense, or space exploration. Being informed of the latest information has become essential for survival. Educational enterprises also benefit from the advantages and technological learning tools offered by ICT. ICT is indispensable for creating effective distance education learning environments. Consequently, the developments in *human computer interaction* (HCI) now assume greater significance, with our increasing reliance on the plethora of smart electronic devices that enable seamless access to our computer files from almost anywhere, anytime. Since the advent of the Internet, geographical boundaries no longer present barriers to communication. The global nature of this book's authorship provides a testimony of the trends in HCI toward collaborative international partnerships in a social context of shared knowledge. Today, there is more awareness for effective HCI through the increased laptop usage that is emerging as a commonplace information management tool. Moreover, laptop computers are already being adopted for basic operations in and around the home for e-mail, scanning interesting materials for school homework projects, and controlling household appliances.

INTEGRATING INTERACTIVITY INTO LEARNING

Within the education sector, ICTs are widely believed to offer new options, based on a paradigmatic approach, to individualize the instructional requirements of diverse cohorts of students. More specifically, multimedia and Web-based courseware development is seen to accentuate a presumed requirement for highly graphical *(or visual)* instructional resources. While most electronic courseware may appear to allow a learner to proceed at their own pace, the assumption is commonly made by the designers of such courseware, that to facilitate learning all learners are capable of assimilating graphical instructional material with their current experiential knowledge. Often, there is little or no consideration for differences in cognitive styles (McKay, 2000).

There is a consequential need to accommodate co-existing instructional paradigms in any computerized learning/courseware authoring process. This inevitably requires the dynamic evaluation of task knowledge level requirements (Dick, Carey, & O'Carey, 2004) to respond to individual cognitive styles and to deduce the student's knowledge acquisition requirements. Now with the reality of the *Semantic Web* (Berners-Lee, Hendler, & Lassila, 2001; Emonds-Banfield, 2006), meta-knowledge acquisition strategies are thus even more essential to provide the mechanism for dynamic knowledge analysis and for seemingly free flowing knowledge-mediated instructional processes.

DEFINING EFFECTIVE HCI

Although agreement on what constitutes HCI has not been reached (Hewett, Baecker, Card, Carey, Gasen, Mantei, Perlman, Strong, & Verplank, 2004), practicing professionals from the Association for Computing Machinery offer this working definition of HCI:

Human computer interaction is a discipline concerned with the design, evaluation, and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them.

Yet another focus that takes a view that reflects a human-dimensional quality for HCI:

"...HCI is about designing computer systems that support people so that they can carry out their activities productively and safely." (Preece, Rogers, Sharp, Benyon, Holland, & Carey, 1994)

These two views have much in common despite the mechanistic orientation of the first, where there is an emphasis on the technology per se, while the latter reflects a sense of social connectedness, showing a priority for the *human-dimension* of computer interaction.

How then can we define *effective HCI*? As before, one view will concentrate on the machine-fit and adaptation of the ICTs, while the other will emanate from an inherent drive for social organization and the comfortable working environmental effects of the ICTs (Hewett et al., 2004). Given that the general audience of this edited book will largely be novice-educational courseware designers, and in the interest of preserving space and leaving room for the insightful contributions from our authorship, we support the *human-dimension when we promote this meaning:*

Effective HCI means having a trusted, interactive and communicative computing environment that lets users decide whether to trust it for a particular purpose, or not; furthermore, effective educational HCI is about knowing how to develop a learning design that provides access to an educational information system that is easy to use, offering a safe environment for knowledge and cognitive skill development that supports the joy for life-long learning.

CURRENT PRACTICE

Due to the multi-disciplinary orientation of HCI, and indeed the authorship of this edited book, each chapter may be read in isolation from the complete work; it may appear that various concepts are covered a number of times, in separate ways. This is the intention in offering a reading framework that is appropriate to the multiple viewpoints that surround ICT in the practice of education. Naturally, the authorship hopes that the overall perspective on what constitutes *effective HCI* for enhanced learning will generate considerable interest in the relationships between *cognitive psychology*, *educational technology research, instructional science*, *and life-long learning*, which have not previously been elaborated in a unifying context.

The overall intention of this book is therefore to bring forward current practice in the form of a useful handbook on HCI for novice courseware designers and those interested in designing learning resources within the education and training sectors. As mentioned earlier, observing the increased acceptance and importance of ICT in the general community and perhaps more specifically outside the education arena, the authors go beyond a purely mechanistic vein that leaves aside the semiotic context or *human-dimension* so necessary for the success of an *effective HCI* learning environment. Consequently, the chapters in this book are devised to generate interest in e-learning best practice in corporate performance that is applicable to the education sector. So doing, it brings forward traditional instructional design expressed as *effective HCI* frameworks that have succeeded in business, in a language that is familiar for teaching and learning institutions in schools and institutions of higher education.

AUDIENCE

This book will be of interest to industry training developers, corporate trainers, courseware designers, government sector specialists, infrastructure policy makers, educational technology practitioners (schoolteachers, higher education), postgraduate students, and anyone with a keen eye for spotting the applicability of the chapter material for their own learning environment.

SCHOLARLY VALUE AND CONTRIBUTION

The chapters in this book will directly compare and contrast e-learning in a variety of higher education, corporate and elementary/secondary school settings. As such, it provides a range of positive outcomes for linking information management techniques that exploit the educational benefits of Web-based learning in computer supported collaborative learning environments. Through the global nature of the authorship, their diverse cultural factors impact on the educational aspects of HCI to reveal practical approaches for increasing the *human-dimension* of HCI through enlightened case studies that effectively utilize ICT tools. Commendable books on HCI that are currently available (de Souza & Preece, 2004; Preece, 2000; Preece, Rogers, & Sharp, 2002) are mostly for use in both corporate and educational sectors. These texts offer excellent online resources as teaching tools, for both the facilitators as well as students. Other experts provide some hints of HCI guidelines (Shneiderman & Plaisant, 2005; UsabilityNet, 2006); however, there is a distinct lack of other monographs that address the issues that surround the *human-dimension* of HCI in an educational setting.

At the time of preparing for this book, the educationalists in need of practical solutions to solving their courseware design problems would find it difficult to gain access to the professional practice of educational ICT tool development. Often, the books that are available represent a generalist's view of HCI. As such, they do not cover the pedagogical content that educational technologists/corporate trainer development specialists require. While others provide excellent historical accounts of HCI, it is possible to read valuable material on cognitive perspectives (Carroll, 2003), but they do not address strategies that can be easily translated as pedagogy models.

CONTRIBUTIONS

This book is organized into 14 chapters, which fall into four main themes that offer practical examples of: *Technology Management and Change*, *Collaborative Learning Through HCI*, *Teacher and Student Use of HCI*, and *HCI in Educational Practice*.

Section I. Technology Management and Change

There can be no doubt that we are witnessing a critical shift in the ways people view teaching and learning. Most noticeable is the tendency to move away from a traditional classroom approach where the teachers' reliance on educational technology for their presentation of learning resources is minimal to one where ICT tools are maximized. None of these techno-driven classrooms would operate without the strategic decisions that would need to be made for the organizational change management necessary to support the increased focus on HCI. These first four chapters deal with classroom management techniques, which reveal the importance of the global online learning environment.

Chapter I: Visualizing ICT Change in the Academy: This opening chapter serves as an excellent example to introduce the issues that exist in universities for learners and the ways in which universities might respond to the needs of learners in the 21st century. Set in Canada, it presents a well-researched study of the literature that validates the context for the policies necessary for change management, with higher education. An argument is

made that the strategic adaptation of the academy's structures, cultures, economies, and pedagogical praxes to the knowledge economy can help build a future where academy-based distributed learning networks will transmit ICT-mediated learning opportunities around the world, thus providing flexible access for a wide range of learners to fully participate in the global learning society. The author posits attunements to policies and practices to support institution-wide involvement in ICT initiatives.

Chapter II: HumanComputer Interaction for Computer-Based Classroom Teaching: Based in Germany, the authors of this chapter have captured the spirit of excellence in bringing ICT into the classroom. Their approach combines the traditional techniques of talk-n-chalk with technological aids that provide effective collaborative knowledge development through their expertise and management of the ICT tools they employ to support their instructional strategies. It investigates different input devices on their usage and interactivity for classroom teaching and argues that pen-based computing is the mode of choice for lecturing in modern lecture halls. It also discusses the software design of the interface where digital ink, as a first class data type, is used to communicate visual contents and interaction with the ICT.

Chapter III: Project Student Rescue: Online Learning Facilitation in Higher Education to Improve Retention Rates for Distance Learners: This chapter, set in Australia, provides a collective view of distance education in a consortium of seven universities. It raises awareness for effective online tutoring support facility to increase retention rates of online learning programs. Distance learning students often still need and require the support of a learning facilitator within the online learning environment. Preliminary studies at Open Universities Australia have shown that additional learning facilitation by online tutors have increased student motivation and student retention rates in certain critical first year subjects. This chapter describes an ongoing project that is currently being conducted at the Open Universities that investigates the impact of additional online tutorial support to increase student retention whereby the computer and Web-based environment is utilized to facilitate the student-tutor *(learning facilitator)* interaction.

Chapter IV: Enhancing Learning Through Mobile Computing: Once again from Australia, this chapter explores teaching and learning alternatives that shift the discussion away from the pedagogy of traditional classrooms to effective ways in which to engage students in their learning through flexible educational strategies. The chapter presents the students' view of their experiential learning, providing a refreshing and energetic account of the new-age technologies. The authors examine technology management and change from a student's perspective. They have given Tablet PCs to multimedia students to enable mobility and flexibility and to investigate what this increased HCI means for students who are learning design. They employ the principles of ethnographic action research as the methodology for their study and report their findings from surveys conducted and focus group meetings. This chapter explores how HCI has become mobile through the use of wireless networks, blogs, and customized agent software.

Section II. Collaborative Learning Through HCI

Innovations in online training and skill acquisition processes are being driven by demands on the human workforce to maintain their competency and knowledge in a period of rapid technological change and international competitiveness (Rosenberg, 2001). The potential for Web-based learning programs to offer a medium of collaboration, where conversation, discussion, and exchange of ideas that enables learners to work and learn together has naturally excited considerable interest. Asynchronous learning networks (ALNs) is a term used to describe a style of learning that involves an instructor who leads a class in separate transactions amongst individual learners through some form of communication media. ALNs are the subject of intensive research into context-mediated knowledge exchange. However, productive access to distributed knowledge sources requires new advances in the learning sciences (Shank, 2001), and the complexity issues in sharing experiential knowledge using ALNs and Web-based ICT educational tools commands urgent investigation. The next two chapters take up this challenge, providing interesting accounts of how the authors went about increasing their students' knowledge development.

Chapter V: Online Discourse: Encouraging Active Student Participation in Large Classes: Facilitating the learning environments for large classes can present many headaches for both teachers and learners alike. This chapter provides an account of an Australian study that investigated the effects of dealing with smaller groups from a large student cohort. The chapter demonstrates how asynchronous discourse within small groups can enhance the learning opportunity for students in large classes. It shows how ICTs encourage students to share their conceptual knowledge, and through this, to develop critical analytical and reflective skills. The HCI creates a learning environment that is flexible; it enables students to consider and respond to different views over time, and leads to closer relationships if designed to enable small group discourse. The research recommends that the best HCI will occur where ICTs are utilized effectively to augment rather than replace the face-to-face learning environment.

Chapter VI: Facilitating Social Learning in Virtual Communities of Practice: Italy is home base for the next author, yet the collaborative learning strategies described here extend the classroom much further through the virtual space provided by the powerful ICT tools and the Internet. The discussion provides a voice from both sides of the machine/human-dimensional environment of HCI. On one hand the author concurs that the machine-dimension of virtual collaborative learning spaces must deal with the complexity of the software issues to enable the virtual space to succeed, while also saying that the virtual community of practice does require a human intervention to succeed.

The chapter introduces communities of practice as a means to explore HCI in online collaborative environments. Through a wide review of the literature on communities of practice and their virtual counterparts, it argues that the focus for successful interaction design in these communities lies on those sociability and usability aspects that allow greater participation in social learning. It also argues that the facilitator assumes a fundamental role in guiding a virtual community of practice to accomplish work-related informal learning activities in a climate of trust and collaboration. The author hopes that understanding the special opportunities provided by virtual communities of practice will advocate for their widespread and routine use.

Section III. Teacher and Student Use of HCI

Until now much of the discourse surrounding online learning relates to the fall out of techno-catch-up experienced by the education sector while it struggles with the transition from being a print-based learning environment to one that supports online courseware delivery (Anderson & Elloumi, 2004). Trial-and-error has been the order of the day for many of the Web-based educational programs that involve distance education, digital library services, e-commerce, and learning systems' management. The popularity of HCI for teaching and learning within the literature is limited to collections of disparate activities, where the boundaries between teacher and students are well defined. However the six chapters in this next section integrate the facilitation of learning, with a seamless approach toward HCI and the classroom experience.

Chapter VII: Design-Personae: Matching Students' Learning Profiles in Web-Based Education: This chapter from Australia uses a theoretical case study example to explain to novice-courseware designers how to employ HCI in flexible student-centered learning programs. The authors propose a *Student Empowerment Model* to articulate an individual student's wants, desires, and expectations. Ever since the enthralling book *Rethinking university teaching: A framework for the effective use of educational technology* (Laurillard, 1993), the literature has burst forth with a plethora of new and exciting ways for teacher and student use of ICT to enhance learning. This chapter mirrors the enormous spread of professional practice involved in bringing about effective HCI for Web-based education.

Chapter VIII: Enlivening the Promise of Education: Building Collaborative Learning Communities Through Online Discussion: This chapter is set in the Malaysia, providing the reader with literature that supports the context upon which the analysis takes place. The importance of acknowledging the social environment is gaining momentum (Wallace, 1999). However, we still have much to understand about the effects of the human-dimension on online behavior (Preece, 2000). This interesting chapter explains a student-centered virtual discussion forum that cultivates social interdependence. An important dimension in education is interaction, that is, in the coming together of a number of people to discuss, debate, and deliberate about issues of common concern. In distance education, such social environments are as much present in online learning contexts as they are in face-to-face learning contexts such as tutorials. This chapter expands the notion of teacher and student use of HCI to focus on integrating HCI in the curriculum through the use of online discussion forums at Open University Malaysia to build collaborative online communities using common principles of teaching and learning.

Chapter IX: APEC Cyber Academy: Integration of Pedagogical and HCI Principles in an International Networked Learning Environment: Taiwan and the U.S. stand to provide an excellent international context for linking pedagogy to HCI in a practical environment. One of the many strengths of this chapter is the tying of the Asia Pacific Economic Cooperation (APEC) Cyber Academy framework to pedagogical principles. The authors' expertise and knowledge of instructional design are evident in their choice of their Cyber Camp learning modules that offer effective HCI. The APEC Cyber Academy provides learning opportunities through collaboration and HCI in an international networked learning environment. The HCI tools are employed to support the pedagogical principles that are steeped in constructivism and self-regulated learning. These tools, including video chat room, forum, intelligent agent, peer evaluation assistant, learner profile, and interpersonal communication system, have fostered a conducive learning environment and attracted more than 10,000 K-12 participants from 22 countries to engage in online learning activities.

Chapter X: Tangible User Interfaces as Mediating Tools within Adaptive Educational Environments: This Australian-based chapter draws on work from the UK to deal with mechanisms that integrate adaptive experiential awareness of effective HCI in classrooms. The author describes a learning ecology that involves interesting multi-relationships between students/teachers, cognitive diversity, and pedagogical choice. The chapter proposes tangible user interfaces as an effective HCI that can scaffold rich classroom experiences if they are coupled and generated within multi-pedagogical frameworks that adopt concepts such as multimodality, multi-sensoriality, and multi-literacies. It provides an overview of some necessary conditions for these tools to be effective, arguing that tangible user interfaces and multi-pedagogies are efficient when they are conceptualized as part of adaptive educational environments—teaching and learning ecologies where learners and teachers are seen as co-creators of content and of new ways of interacting with such content.

Chapter XI: Building the Virtual into Teacher Education: This Australian-based chapter describes the online environment and the evolving context to provide novice-teachers with some wonderful insight into the evolution of a virtual learning environment. The authors provide a detailed motivation for their approach, which is also backed by their referenced literature. Traditional teacher and student design and use of HCI are contested, as two teacher educators *(with the assistance of Web designers)* worked to unsettle known practices of schooling. The authors advocate new learning pedagogies and share how a virtual primary school alongside face-to-face teaching is helping pre-service teachers to manage purposeful change. The environment has been built with attention to being dynamic and unpredictable. Novice teachers have a placement in this virtual school.

Chapter XII: Integrating Human Computer Interaction in Veterinary Medicine Curricula: This Canadian chapter moves the discussion on effective HCI to a position that reflects the serious nature of global issues that impose on us all. The authorship is an impressive collection of 11 professional practitioners expressing the desire to differentiate between what they teach and the manner in which this teaching is carried out. The chapter discusses contemporary global challenges facing veterinary educators and summarizes some of the economic, social, political, and technological pressures underlying curricular and pedagogical change initiatives. Integrating HCI into veterinary medicine curricula, as a strategy for implementing pedagogical transformation, is reviewed. Computer-assisted learning (CAL) projects recently developed at a veterinary college are described. Results of

studies evaluating the effectiveness of CAL approaches to HCI integration within the veterinary medicine curricula are reported, and future research directions are proposed.

Section IV. HCI in Educational Practice

This fourth and final group of two chapters is about the practicalities of existing educational program delivery. The first falls with the professional practice of *educational and training design—support systems and models* to present a clearly explained and interesting chapter of an obviously well designed postgraduate course. It provides an excellent case study that outlines the issues and problems encountered in running the course, offering solutions to the dilemmas that face many distance education learning environments. The second chapter deals with *simulation and managerial gaming issues.* While this chapter may have been placed last in the book by some Freudian quirk, it is by no means without substance; it offers a rare and insightful approach toward holistic instructional strategies that employ *effective HCI* to address the complexity of the real world problems architectural students will need to face as professionals.

Chapter XIII: Problem-Based Learning at a Distance: Course Design and HCI in an Environmental Management Master's Program: The use of HCI in an environmental management master's program. Ralph Horne and Jon Kellett present their experiences of incrementally developing a master's course from face-to-face mode to HCI. Using a case study approach they show how the design process works in practice. Drawing on theory from the established literature and using their own experience and external examiners' comments as a guide, the authors take the reader through the educational design process, which culminates in an attractive and valuable virtual learning product. Their chapter demonstrates the complex range of issues that influence the design of successful HCI.

Chapter XIV: An Integrative Approach to Teaching 3D Modelling in Architecture: The argument presented here is that computer courses in architecture must reach beyond the comfortable cushion of conventional teaching practices and provide students with a way to come to grips with the complexity present in real world problems. It provides as evidence a digital graphic literacy course for architecture students using transformer robot toys as a metaphor for introducing the concept of adaptive kinetic architecture, a form of complex dynamic systems. The transformer robot toy is the manipulative device with which students develop 3D digital modeling and rendering skills and make a tangible connection to dynamic architectural systems. The course approach is described, and observations about the students' work are offered. Further investigation is proposed to ascertain the most appropriate delivery for reciprocal and complementary knowledge.

CONCLUSION

The collective contributions from authors based in many different countries identify the complexity of the visual learning environment and outline prospects for customizing Web-mediated learning. Progress is thus possible in linking research outcomes to actual learning contexts. The prospect of customized learning shells, tailored dynamically to the requirements of individual students, has stimulated contemporary research into knowledge mediation, and the associated meta-knowledge acquisition strategies, of actual learning contexts within asynchronous learning frameworks (Fredericksen, Pickett, Shea, Peiz, & Swan, 2000).

Within the context of online asynchronous learning platforms, there is a noticeable shift from traditional teaching methods, which act as the sole content provider, toward a multiple mentor-guiding approach. This approach supports learners through the process of knowledge acquisition, largely directed by the learners themselves, reflecting the lack of understanding of the effect of Web-based learning on the population at large. Web-based pedagogy is complex, and instructional courseware designers need to ensure that careful attention is paid to implement sound and well-founded instructional design principles (Merrill, 2002).

While multi-sensory instruction is known to improve a student's capacity to learn effectively, the overarching role of knowledge-mediated HCI has been poorly understood in the design of instructional strategies that integrate contextual components in asynchronous learning frameworks. The limitations of contemporary approaches to instructional design appear to lie in the failure to recognize and accommodate learning process dynamics, specifically the interactive effects between cognitive style and instructional format, and the need to adapt the instructional format dynamically. It may be concluded that the mechanism to achieve such dynamics lies in the concurrent acquisition of knowledge about the learner's cognitive performance within a contextual framework defined by a knowledge level analysis of task difficulty.

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