Proceedings of the Fifth IASTED International Conference
WEB-BASED EDUCATION
January 23-25, 2006, Puerto Vallarta, Mexico

A GLOBAL, COLLABORATIVE, E-LEARNING ECOSYSTEM: AN ACADEMIC/INDUSTRY PARTNERSHIP IN ACTION

Elaine Lawrence
University of Technology Sydney
Australia
elaine@it.uts.edu.au

Brian Garner
Deakin University
Geelong Campus, VIC
Australia
brian@deakin.edu.au

Stephen Newton
354/8 Lachlan St
P.0 Box 123, Broadway, 2007
Waterloo 2017
Australia
steven@estrategies.com.au

ABSTRACT
A number of apparent failures in the use of education technology should provide a warning as universities and training institutes progress their strategy and management plans for elearning. Fundamental problems in the academic environment relate to the lack of training in new technologies available to academics responsible for elearning. No less importantly the synergies among commercial providers of Asynchronous Learning Network (ALN) software, pedagogical knowledge and experiential learning requirements have not been addressed in the vision and strategy statements provided by senior management. The requisite solution is seen to be a framework for all stakeholders to evaluate e-learning proposals to ensure the effectiveness and value propositions are based in reality. What can we learn from the e-business environment and, in particular, the Cisco Network Academy Program (Academy Connection) that would inform the structure and deliverables required to support the proposed framework? This proposed framework also needs to accommodate value propositions for the diverse student cohorts involved in e-learning, having particular regard to professional practical requirements.

KEY WORDS
Collaborative Knowledge Management, knowledge workers, collaborative learning

1. Introduction

An area where the Internet is proving invaluable is in online education where the commercial potential is enormous. Several commercial firms have already recognized this global trend and some universities are also realizing that strategic partnerships with multinational companies, such as Cisco, Microsoft and Oracle, are a viable solution for the delivery of technical education. In academia and the corporate world, research is ongoing into new instructional techniques and advanced technologies to support accelerated and more effective learning such as Collaborative Learning [1]. *The technologists (at Cisco) are learning all about pedagogy, curriculum task analysis and sequencing, psychometrically sound testing, rubrics, student reflection, stems and distracters, national and local standards and much more* [2]. Academics from around the globe (including one of the paper's authors) are participating as online curriculum authors, online examination writers and quality assurance personnel working in concert with industry technologists.

Section 2 describes the role of the knowledge technologist in the eKnowledge economy and the role of company proprietary programs at UTS. In Section 3, the authors outline the methodology of their paper. Section 4 describes the implementation of the program and its impact while Section 5 deals with the conclusion and points the way to further research.

2. The role of the knowledge technologist in the eKnowledge Economy

In the global economy, knowledge is a key resource and knowledge workers will be the dominant group in the future workforce. Today knowledge workers are mainly people with considerable theoretical knowledge and learning, such as doctors, lawyers, teachers and chemical engineers. However, remarkable growth in the number of *knowledge technologists* - computer technicians, software designers, analysts in clinical labs and paralegals has been predicted [3]. The manual work of knowledge technologists is based on a substantial amount of theoretical knowledge which can only be acquired through formal education. These knowledge technologists could become the dominant social and political force over the coming decades [3]. Information Technology professionals' learning processes must evolve and expand throughout their career [4]. In fact, [4] points out that because of the rapid explosion of knowledge in this area, *IT professionals in industry, academia and the public service must engage in continuous learning for the purposes of acquiring new knowledge and updating and enhancing old skills.*

The global networking company Cisco recognized the above issue as well as the skills shortage in well-qualified, trained networked administrators and engineers. They set up the Network Academy program (Academy Connection) to provide online top quality training materials and trained instructors to address the issue. It is the largest e-learning laboratory in the world [5]. Launched in October 1997 with 64 educational institutions in seven states in the United States, the Networking Academy has spread to more than 150 countries. Since its inception, over 1.6 million students have enrolled at more than 10,000 Academies located in high schools, technical schools, colleges, universities, and community-based organizations [6]. In the Internet Economy, educational institutions and learners alike are adapting to the advent of e-learning. This new educational model levels the playing field by providing access and opportunity for lifelong learners of all ages in any location [5]. Knowledge workers require systematic and organized preparation which is currently only provided by a few countries. Continuing education for well trained and knowledgeable adults will become mandatory and, in fact, the knowledge society may never stop [3].

2.1 The role of company proprietary programs

Global companies are engaged in setting themselves up within *virtual enterprises* at the hub of loosely knit alliances of local companies linked by global electronic, transport and human networks. Such enterprises are project based and developed around complex networked information systems. The information system is the virtual enterprise - it is the headquarters and can be based virtually anywhere in cyberspace [7].

The Academy Connection courses provide all the learning materials for persons wishing to pursue certifications as networking associates and professionals as well as security and wireless specialist certifications. The Academy Connection initiative is unique for the internationalisation of the program itself assuring that a student, in any of those academies, will get the "same" quality of education. This quality assurance is attained by the effective use of IT, media and telecommunication tools, as well as inadequacy in management of groups required by this approach [8]. The program also offers sponsored course material for UNIX and Java Programming (for Sun), IT Essentials (Hewlett-Packard) and web design course material for the World Organization of Webmasters (WOW). The "Fundamentals of Web Design" course, sponsored by Adobe Systems, helps prepare students and instructors to take this certification exam. This industry-recognized certification will serve as one of the requirements for the instructor Web Design designation.

2.2 Universities under Challenge

The exponential growth of the Information Technology knowledge base and the changes in business environments wherein IT professionals apply their knowledge presents our profession with the challenge to remain current [4]. Technical certification is becoming an important issue in universities - so much so that many universities are now forming partnerships with commercial providers to make their degrees more relevant to both professional practice and the potential student [8] [9]. The Annual [10] 2003 Certmag salary survey of over 12000 respondents found that 61 percent have seen a greater demand for their skills since becoming certified, 64 percent said certification has improved their problem-solving skills, and 60 percent believe certification has contributed to increased productivity [11]. Universities in Australia (e.g. University of Technology Sydney, Charles Sturt University), Taiwan, Hawaii, Mexico and Canada (e.g. Dalhousie) have introduced certification as part of their undergraduate and postgraduate degrees. The authors have dual practitioner-researcher roles as one author is the lead author of version 3 of one of the new Academy Connection certification curricula as well as Program leader of a Masters of Internetworking, whilst the other authors have extensive research into experiential learning and running innovative courses [12] [13] [14] [15].

3. Methodology

This paper will characterize and communicate recent research paradigms in collaborative knowledge management, having regard to the issues of global complexity and inter-disciplinary harmonization requirements (e.g. in technical e-education), where scientific knowledge has to be aligned with professional practice, and with process knowledge in particular. The research here reports on the examination of a global international *Extranet*, known as the Academy Connection that could serve as an exemplar for the e-education of Knowledge Technologists. It follows on from previous research into global extranets such as the Cochrane Collaboration and the International Organization for Standardization (ISO) worldwide Extranet as well as legal and audit issues in networks. [16] [17].

The research domain of e-learning and management of online education is particularly challenging and this paper seeks to show how the Academy Connection is impacting on the diffusion of technical knowledge to universities. The management of the database of over one million students also serves as an exemplar to universities struggling to run their own online learning projects. Many of the insights on the Academy Connection in the paper come from one author who has been involved in running the program at the University since 2002 and who has been involved as an internetworking lecturer since 1999.

As an academic involved in the teaching of internetworking postgraduates, the leadership of the postgraduate program (n=350) and authoring part of the company proprietary courseware, this author is able to comment on three sides of the discussion. Author B has twenty five years experience in distance education, including online course material, whilst Author C, a consultant, brings a company perspective to the paper.

4. The Networked organization

Traditional management processes need to be revisited in order to cope with the complexity and management of e-learning and management issues. The principles behind the virtual organization of the Academy Connection could be adapted to this challenge. Such a structure has all members of the organization virtually and instantaneously linked with all personnel and information, both horizontally and vertically [18]. [19] states that the Academy Connection Electronic Teaching community has:

- **Shared values** –life long learning teachers who desire to empower students. Instructors must continually upgrade their own qualifications – for example in 2004, all instructors had to retool in order to be able to continue teaching as the curriculum for networking associates and professions had been upgraded to version 3. This retooling involved the completion of online tests as well as the completion of practical skills tests. The latter tests could be undertaken in the University laboratories under the supervision of the Curriculum leader or via NetLab (an online environment that allows people to configure routers and switches online).
- **Shared goals** – teachers who want students to have a basic insight in modern communication systems and technological literacy. It is particularly relevant for IT faculties to ensure that they have and use the latest in technology to prepare their students for the workforce.
- **shared experiences** – ongoing similar topics at the same time e.g. IP addressing, cable installation and router configuration
- **Shared communications channels** – the Academy Connection and an online self-service website. The latter website is designed to allow the Instructor Community to search the intelligent knowledgebase to find immediate answers to questions regarding the Academy Program. The innovative use of AOL Instant Messenger gives global instructors 24 * 7 access to skilled personnel at the US Academy ·nnection headquarters. For example, if an ·tor, is unable to track down an archived AIM assistant can take care of the real time.
- **Ideas to share with the community** for sharing technical and teaching knowledge such as the Instructor's Guide, helpful tools or ability to see what students at other academies are doing. In 2003 writing teams of academics from the United States, Australia, and Ireland collaborated to rewrite the online materials for version 3 of the academy programs. Some online tools that proved particularly valuable for the authoring teams were email, eRoom for management of data and new material as well as content management, Voice over IP phones, NetLab for laboratory assignments and AOL Instant Messaging

4.1 Collaboration Frameworks

The networked economy can create a sharing environment and one of collaboration and work aggregation. Such a model has been used in Evidence-based Medicine as illustrated by the Cochrane Collaboration [20] and the ISO Extranet [21]. The Cochrane Collaboration was inaugurated in 1992 with the aim of helping people make well-informed decisions about healthcare, by preparing, maintaining and ensuring the accessibility of systematic reviews of the effects of healthcare intervention. In the Knowledge worker arena, much of the work is knowledge work requiring the processing and managing of information. Such knowledge does not exist in isolated compartments. Its capacity to grow is enhanced by expertise that must be obtained from as wide an expert base as possible. This means people with different perspectives, experiences, age, gender, knowledge and cultural traits are required [18]. People worldwide provide the best base for enriching knowledge and creating worthwhile innovation - linking in with the Cochrane Collaboration principles of building enthusiasm, avoiding duplication and minimizing bias. Virtual organizations must be adaptable, resilient and innovative. Figure 1 illustrates the application of network characteristics and the **Cochrane Collaboration Principles** to objectives in order to achieve stated aims. The strategic use of technological infrastructure to establish and maintain a knowledge backbone can only survive when supported by a culture that embraces and facilitates the use of new technologies [22]. The term ***Collaborative Knowledge Management (CKM)*** has been refined by the researchers as the enabling framework for progressing the inter-disciplinary agenda, with four (4) key objectives in mind:

1. Provision of a uniform set of criteria (Critical Success Factors) for the distinctive nature of this Group Concept.
2. Demonstration, through current exemplars, of the scope and significance of this approach to complex information management problems, as defined in point one.

3. Development of a unifying set of principles for issues management, where problem domains are encountered that justify a Collaborative Knowledge Management solution; and
4. Critical examination of contemporary paradigms for knowledge management, focussing on the scope for interdisciplinary research in the evaluation of emergent disciplines for tacit knowledge integration within a ***CKM*** framework..

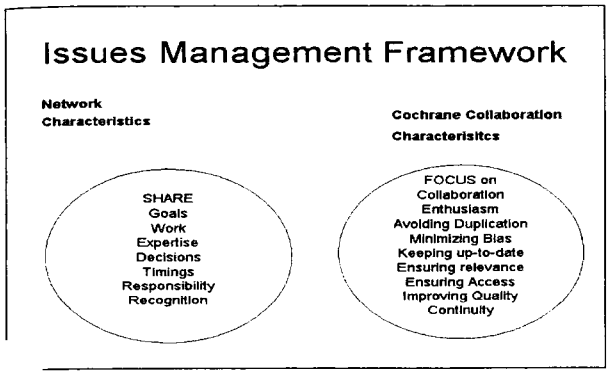

Figure 1 Issues management framework showing the linkage between Network Characteristics and the Cochrane Collaboration Characteristics. [21]

CKM stresses the human component of knowledge. However, throughout the 1990's many organizations downsized, reengineered or restructured. In doing so, many of these organizations found that by shedding staff they had also inadvertently shed corporate knowledge. [23] cite the case of Ford, where new car developers wanted to replicate the success of the original Taurus design team. The developers found that processes had not been recorded and that none of the existing staff remembered the original project. In 2000, the Australian telecommunications giant, Telstra, admitted that, by restructuring, they had lost the knowledge of their core business, the network.

4.2 Educating Knowledge Workers

Knowledge workers must have strong technical capability, skills in communication and persuasion, ability to lead and work effectively as a member of a team, understanding of technical forces that profoundly affect engineering decisions and a commitment to lifelong learning. This education model should be active, project based learning, horizontal and vertical integration of subject matter, introduction of the math and science concepts in the context of the application; close interaction with industry, broad use of information technology, a faculty devoted to developing emerging professionals as mentors and coaches [19] [24].

4.3 The Academy Connection Training Model

The CCAI (Cisco Certified Academic Instructors) model utilizes the 'Train the Trainers' model. The program organizes academy institutions into a hierarchy, ranging from Local Academies at the lowest level, through Regional Academies and Cisco Academy Training Centers (CATC) to Super CATCs. Any staff member who intends to conduct Cisco-based classes must be trained to deliver those classes by staff from an Academy one or more levels higher up in the hierarchy. Students in Local Academies range from people in upper levels of high schools through the technical and further education (TAFE) system to some universities. Some Academies are directly part of these institutions while others are run separately by the consulting/external education arms of the institutions. A small number of commercial for-profit colleges are also Academies [25]. The Networking Academy delivers web-based content, online assessment, student performance tracking, hands-on labs, instructor training and support, and preparation for industry standard certifications [5].

Academy Connections instructors are expected to pursue continuing education opportunities. There is a public non-profit organization called the Cisco Learning Institute (http://www.ciscolearning.org/) created by Cisco to further educational research and produce leading edge education tools such as Virtuoso. CLI Virtuoso focuses on a personalized learning experience to provide customized, on-demand curriculum based on learner needs and requirements.

4.3 The Model is working

A decision was taken at UTS to embed the curriculum into its IT program at both graduate and undergraduate levels. The Graduate programs typically attract practicing professionals as well as those seeking retraining. The first six months of the graduate program will typically fast track a retrainee into the essential knowledge and skills of a networking professional. Currently we have 334 postgraduate students studying for our graduate programs in Internetworking. The downturn in the IT sector does not seem to have had an impact on these postgraduate courses. At undergraduate level the courses are pitched to provide essential network knowledge (as compulsory or core subjects) as well as allowing for a major. Both groups get the benefit of being in a supportive learning environment as well as being prepared to take industry certification if they so choose.

The alternative is that students, to gain a position, will do these certifications via intensive and expensive courses. The economic benefit to a student is clear enough. At UTS our courses prepare students to sit for their Cisco Certified network Administrator (CCNA) and Cisco Certified Network Professional (CCNP) Certifications. Details are found at http://iwork.uts.edu.au. The essence

of the UTS implementation of *incorporating* the Cisco material into post and undergraduate degrees was to provide the following educational outcomes:

1) Students should have a sound, theoretical and experiential, laboratory based, hands-on educational experience which should develop their enthusiasm to become investigative, motivated, lifelong learners

and

2) Students should be highly skilled and ready to take industry certification. This gives students the opportunity to combine the gaining of industry certifications within the context of a traditional education [23].

5. Conclusion

The training of effective knowledge technologists and academics will continue to be a topic for research for some time to come. As pointed out by [4], *Knowledge acquisition is often akin to building a beach by adding grains of sand. Celebrate the buckets of sand when they come; learn to recognize and cherish the individual grains*. In our paper, we have argued that the Academy Connection model might be an interesting exemplar to follow. Research has found that IT professionals pursue certification so that they can contribute to mission-critical functions of a business enterprise. It is argued that certification allows people to obtain skills that can help the business grow and /or have high earnings [26].Obviously many people are against certification and take many opportunities to criticize it [26]. However we should contrast the public's understanding of IT certification, which is so small, with knowledge and understanding of certification in the medical, legal or accounting professions. Is the importance and integrity of a network any less significant than that of a tax return? How can you quantify the value and critical risk of a network that monitors pharmaceutical production or supports an intensive care unit or air traffic control? [26].

References

[1] Handzic, M. and Jamieson, R. *A Knowledge Management Research Framework for Electronic Commerce,* IFIP 8 Conference, Salzburg, June 2001, p. 239

[2] Ward, G. 1998 The Cisco Network Academy Program, http:.//cisco.netacad.net

[3] Drucker, P. The Next Society, A Survey of the near Future, special insert, The Economist, November 3, 2001

[4] Smith, D, Moores, T and Chang, J. Prepare your mind for learning, *Communications of the ACM* September 2005, Volume 48, No 9.

[5] Academy Connection http://cisco.netacad.net, 2005

[6] E-LEARNING http://ciscolearning.org/elearning/benefits.html

[7] Angell, I *The New barbarian Manifesto: How to survive the Information Age*, Kogan Page, London, 2000

[8] Felix Navarro, K. *Converging our Sensorial and Digital Networks in Education*, 6th World Multiconference on Systemics, Cybernetics and Informatics, SCI 2002, Orlando, July 14 –18, 2002

[9] Lawrence, E. Szewcow, U. and Felix Navarro, K. *E-education: Implications for Knowledge Transfer via Global Co-operative Education*, Sixth International Conference on Computer Based Learning in Science, University of Cyprus, Nicosia, Cyprus, 5 - 10 July 2003

[10] Sosbie, T. *Paying Off Nicely*—CertMag's 2003 Salary Survey http://www.certmag.com/articles/templates/cmag_feature.asp?articleid=523&zoneid=9, 2003

[11] Mckay, E., Garner, B.J. And Okamoto, T, Kinshuk, R. Lewis, K. Akahori, R. Kemp, T. Okamoto, L. Henderson and C.-H. Lee, Eds: *Understanding the Ontological Requirements for Collaborative Web-based Experiential Learning*; International Conference on Computers in Education 2002, Auckland, NZ, IEEE Computer Society, 356-357

[12] McKay, E., Garner, B.J. and Okamoto, T. *Management of Collaborative Web-based Experiential Learning* in 'Computers and Advanced Technology in education (CATE 2003). Held June30-July2, 2003. Rhodes, Greece: IASTED. 409-414

[13] Garner, B.J. *Quality Model for Multi-level Course Specification and Delivery* – Quality Education at a Distance Conference held at Deakin University Management Centre 3-6 February, 2003

[14] Garner, B.J. *Collaborative Knowledge Management Requirements for Experiential Learning (CKM)*; Proceedings of ICALT 2001, Massey University, New Zealand.

[15] Lawrence, E. & Garner, B. *Global eT@xation: Competing Visions*, 14th Bled Electronic Commerce Conference, Bled Slovenia, June 2001

[16] Lawrence, E & Garner, B. *Legal and Audit issues in Peer-to-Peer Networks,* IFIP WG8.4 Multi-disciplinary solutions to industry & government's e-business challenges, Salzburg, Austria, 18–19 June 2004

[17] Newton, S. *Electronic Business: Critical Success Factors For Implementation -A Case Study of a Manufacturer of Electronic Parts*; Collecter 99, Wellington, New Zealand.

http://www.collecter.org/coll99/, 1999

[18] Frizz, D. *Our Electronic teaching Community*, http://cisco.netacad.net/cnacs/prot-doc/columns/otl/980831.html, 1998

[19] Lawrence, E. & Garner, B. *Harmonizing Global Internet Tax: A Collaborative Extranet Model*, South African Computer Journal, No. 24, November 1999, pages 119-127.

[20] Garner, B., Lawrence, E. & Culjak, G. *Interdisciplinary research into Collaborative Knowledge Management*, Developing a Dynamic, Integrative, Multi-Disciplinary Research Agenda in E-Commerce/E-Business, IPIP 8 Conference, Salsburg, June 2001p 297-299

[21] Malhotra, Y. *Virtual Corporations, Human Issues and Information Technology*, Brint, http://www.brint.com/interview/astdint.htm, 1998

[22] Davenport, T., & Prusak, L., *Working knowledge : how organizations manage what they know.* Boston, MA: Harvard Business School Press, 1998.

[23] Lawrence, E. Szewcow, U. and Felix Navarro, K. *E-education: Implications for Knowledge Transfer via Global Co-operative Education*, Sixth International Conference on Computer Based Learning in Science, University of Cyprus, Nicosia, Cyprus, 5 - 10 July 2003

[24] Colville, J. *Implications for universities of teaching company-based programmes: supping with the devil*? 8th IFIP World Conf. on Computers in Education (WCCE 2005). 4- 7 July 2005, Stellenbosch, South Africa.

[25] Gabelhouse, G. Certmag's Salary Survey, http://www.certmag.com/issues/dec00/feature_gabelhouse.cfm, 2000

[26] Thatcher J. *Certification Bashing – Myths & Realities,* 2002, https://www.certmag.com/issues/feb02/feature_thatcher.cfm

IASTED

A Publication of the International Association
Science and Technology for Developme

Proceedings of the Fifth IASTED International Conference on

WEB-BASED EDUCATION

Editor: V. Uskov

ISBN:0-88986-541-8
ISSN:1482-7905

ACTA Press

Anaheim | Calgary | Zurich

Proceedings of the Fifth IASTED International Conference on **Web-based Education**, held January 23 - 25, 2006, Puerto Vallarta, Mexico.

SPONSORS

The International Association of Science and Technology for Development (IASTED)
- Technical Committee on Education

World Modelling and Simulation Forum (WMSF)

COLLABORATING ORGANIZATIONS

- Brazilian Association on Open and Distance Education (ABED), Brazil
- Council of Researches in Education and Sciences (COPEC), Brazil
- The IEEE Technical Committee on Learning Technology
- Interlabs Research Institute, Bradley University, USA
- The International Society for Engineering Education (IGIP)
- The International Academy of Open Education (IAOE)
- The Japanese Society for Information and System in Education (JSISE), Japan
- AIMtech Centre - Centre for Innovative Applications of Internet and Multimedia Technologies, City University, Hong Kong, PRC
- Midstate College, USA

EDITOR

V. Uskov – Bradley University, USA

SPECIAL SESSION

E. Prasolova-Førland – Norwegian University of Science and Technology, Norway

INTERNATIONAL PROGRAM COMMITTEE

M. Allegra – National Research Council, Italy
L. Anido – University of Vigo, Spain
B. Aris – University of Technology Malaysia, Malaysia
E. Barberà – Oberta University of Catalunya, Spain
M.N. Bunch – Midstate College, USA
H [illegible]rkhart – University of Basel, Switzerland
[illegible] – Queen Margaret University College, UK
J. Cerny – University of Calgary, Canada
M.M. Ciampi – Council of Researches in Education and Sciences, Brazil
C. Constantinides – Concordia University, Canada
A. Cristea – Eindhoven University of Technology, The Netherlands
P. Cristea – "Politehnica" University of Bucharest, Romania
A. D'Atri – Luiss 'Guido Carli' University, Italy
C. da Rocha Brito – Council of Researches in Education and Sciences, Brazil
N. Dabbagh – George Mason University, USA
V. Devedzic – University of Belgrade, Serbia and Montenegro
D. Dicheva – Winston-Salem State University, USA
A. El-Hajj – American University of Beirut, Lebanon
J. Flowers – Ball State University, USA
F. Flueckiger – University of Applied Sciences of Southern Switzerland, Switzerland
B. Garner – Deakin University, Australia
A. Goh – Nanyang Technological University, Singapore
P. Grew – Università di Milano, Italy
H. Haga – Doshisha University, Japan
T. Hampel – University of Paderborn, Germany
H. Haugen – Stord/Haugesund University College, Norway
T. Honda – Ibaraki University, Japan
H.H.S. Ip – City University of Hong Kong, PRC
A.D. Ivannikov - Informika, Russia
S.N. Kamin – University of Illinois at Urbana-Champaign, USA
Kinshuk – Massey University, New Zealand
P.A.M. Kommers – University of Twente, The Netherlands
A. Lazakidou – University of Piraeus, Greece
T. Leacock – Simon Fraser University, Canada
C.-H. Lee – University of Pittsburgh, USA
A. Leh – California State University, San Bernardino, USA
E. Levner – Holon Academic Institute of Technology, Israel
A. Lisounkin – Fraunhofer Institute for Production Systems and Design Technology, Germany
H.K. Matthies – Hannover Medical School, Germany
C. Montgomerie – University of Alberta, Canada
G.D. Nag – National Informatics Centre, India
D. Nichols – University of Waikato, New Zealand
C. Nikolopoulos – Bradley University, USA
A. Ninck – University of Applied Sciences, Switzerland
I.P. Norenkov – Moscow State Technical University, Russia
T. Okamoto – University of Electro Communications, Japan
N. Osawa – National Institute of Multimedia Education, Japan
C.E. Palau – Polytechnic University of Valencia, Spain
E. Prasolova-Førland – Norwegian University of Science and Technology, Norway
G. Salter – University of Western Sydney, Australia
D. Sampson – University of Piraeus, Greece
L.B. Sheremetov – Mexican Petroleum Institute, Mexico
M.-A. Sicilia – University of Alcala, Spain
S. Sirmakessis – Research Academic Computer Technology Institute, Greece
M. Tahernezhadi – Northern Illinois University, USA
M. Wentland Forte – University of Lausanne, Switzerland
H.-D. Wuttke – Technical University of Ilmenau, Germany
J. Yorke - University of Plymouth, UK

ADDITIONAL REVIEWERS

T. Bopp – Germany
M. Caeiro – Spain
T.W. Calvert – Canada
T. Connolly – UK
S. Dixit – India
B. Eßmann – Germany
L. Ferrario – Italy
K. Goshi – Japan
M.H. Hamza – Canada
E.J. Kazlauskas – USA
N. Krdzavac- Serbia and Montenegro
G. La Russa – Finland
M. Lehtonen – Finland
M. Llamas Nistal – Spain
A. Munro – Norway
A. Oliveira – Portugal
P. Pouyioutas – Cyprus
J. Santos – Spain
N.C. Schaller – USA
Z. Sevarac – Serbia and Montenegro
V. Shanmugasundaram – USA
G. Shimic – Serbia and Montenegro
M. Stansfield – UK
A. Vantaggiato – Puerto Rico
B. Vassiliadis – Greece
H.-D. Wuttke – Germany
T.G. Wyeld – Australia

For each IASTED conference, the following review process is used to ensure the highest level of academic content. Each full manuscript submission is peer reviewed by a minimum of two separate reviewers on the International Program Committee/Additional Reviewers list. The review results are then compiled. If there is a conflict in reviews, the paper is sent to a third reviewer.

ACTA Press
P.O. Box 5124
Anaheim, CA 92814–5124
USA

ACTA Press
#80, 4500 – 16 Ave. NW
Calgary, AB T3B 0M6
Canada

ACTA Press
P.O. Box 354
CH–8053 Zurich,
Switzerland

Publication Code: 504

TABLE OF CONTENTS
WBE 2006

SOFTWARE SYSTEMS, TOOLS, AND PRODUCTS

LEARNING OBJECTS AND DIGITAL LIBRARIES

PROJECTS

Welcome to the WBE-2006 International Conference!

Welcome to the 2006 International Conference on Web-Based Education (WBE-2006) in Puerto Vallarta, Mexico.

As in previous WBE conferences, this professional meeting provides an excellent opportunity for faculty, scholars, administrators, and practitioners to meet well-known experts from all over the world and to discuss innovative ideas, research, and the best practices in various topics of Web-based education (WBE) and Web-based training (WBT). The scope for WBE-2006 is broad and exciting, covering a wide range of important topics, including: innovative Web-based teaching and learning technologies, communication technologies and collaborative Web-based learning, testing and assessment issues of online education, state-of-the-art hardware and software applications for WBE, scientific virtual laboratories, online degree and certificate programs, virtual colleges and universities, corporate online universities, collaboration on national and international projects in WBE area, and many other related issues.

The WBE international conference continues to be very well perceived by the international community of researchers, educators and practitioners in WBE and WBT areas, attracting excellent contributions and active participation by WBE/WBT experts. We would like to thank all of the authors, from more than 40 countries all over the world, who each made a particular effort to contribute to the WBE-2006 international conference.

Each paper has been reviewed by several members of the WBE-2006 International Program Committee (IPC) and other qualified referees. We would like to thank all 58 IPC members from 24 countries and more than 40 referees for their help with the review process. Without their strong support, the creation of such a broad conference program would not be possible. It is because of all these great efforts that the final conference program consists of only top quality contributions.

We are also indebted to organizations that made this conference possible, specifically,

- the International Association of Science and Technology for Development (IASTED),
- the International Society for Engineering Education (IGIP),
- the IEEE Learning Technology Technical Committee (IEEE LTTC),
- the Japanese Society for Information and System in Education (JSISE),
- the Brazilian Association on Open and Distance Education (ABED),
- the International Academy of Open Education IAOE (Russia),
- the City University of Hong Kong and AIMtech Centre - Centre for Innovative Applications of Internet and Multimedia Technologies (Hong Kong, China),
- the Council of Researches in Education and Sciences COPEC (Brazil),
- the InterLabs Research Institute at Bradley University (U.S.A.), and
- the Midstate College (U.S.A.).

We would like to thank all these organizations for their strong support of the WBE-2006 conference activities.

In addition to our conference delegates, we are also delighted to welcome several individuals who will be giving special presentations at WBE-2006.

The WBE-2006 Keynote Speaker is Dr. Piet Kommers, Editor-in-Chief of the *International Journal on Web-Based Communities* and Professor at the University of Twente in The Netherlands. The title of his presentation is "Web-Based Learning Communities: Improving Tools and Methods". The WBE-2006 Invited Speaker is Dr. Lisa Neal, Editor-in-Chief of the *eLearn Magazine*. The title of her presentation is "The Future of Learning".

Besides these exciting speeches, WBE-2006 also includes a special session on "Web-based 3D Collaborative Virtual Environments in Education" organized by Dr. Ekaterina Prasolova-Førland (Norwegian University of Science and Technology - NTNU, Norway), and a tutorial on "Modeling with Flash" organized by Dr. Linda Wright-Smith (Cameron University, USA).

This year's conference will continue to keep alive multiple traditions of WBE professional meetings. One of them is the formal and informal discussion of various hot topics and issues relevant to WBE and WBT. Here we would like to propose at least 5 areas that are of great interest in the WBE/WBT community and provide several pieces of relevant information from the most recent professional publications. We hope this will stimulate useful and productive informal discussions over the next three days.

1. What is the future of WBE/WBT? What kind of changes should we expect in 5, 10, or 20 years?

The main question is: what will be the primary educational uses of the Internet and World Wide Web in the next 5, 10 or even 20, years? What kind of changes should we expect in WBE and WBT during this period?

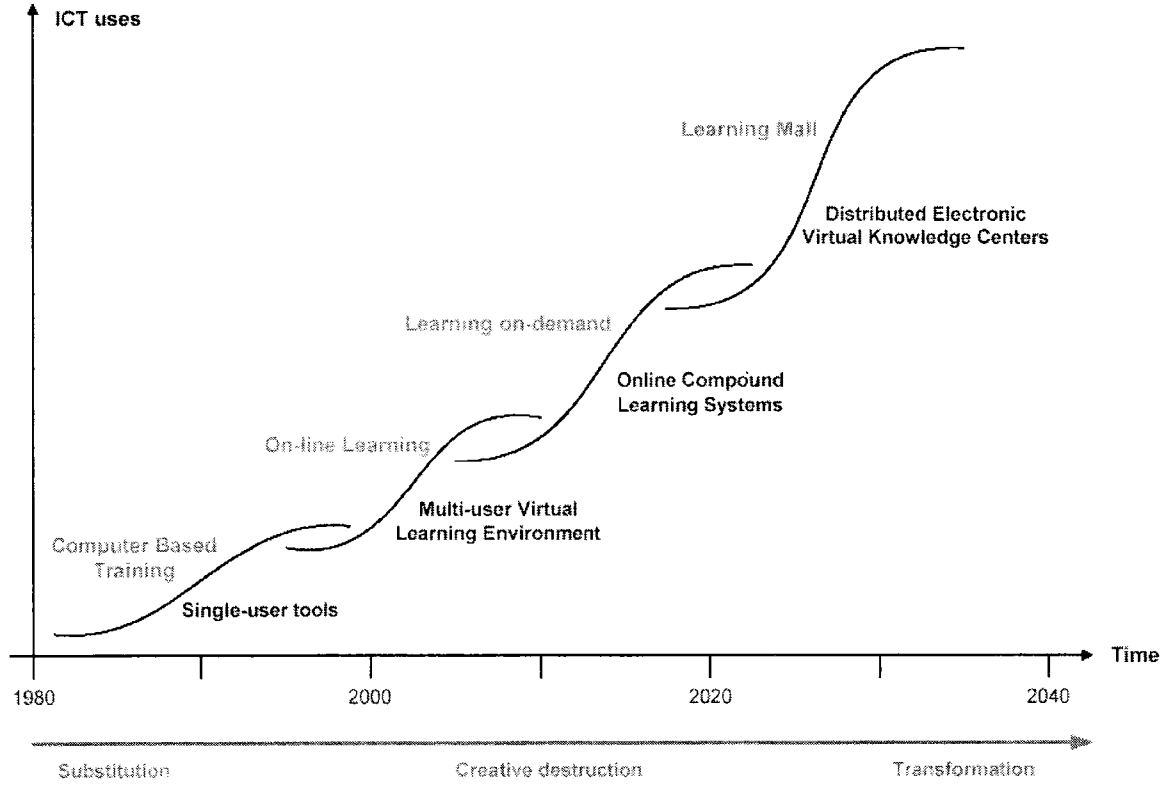

Figure 1.
Successive Stages of Educational Technologies and Practices
(adopted from *Piet van der Zanden and Wim Veen, 2004*)

Table 1.
How Much Change the Internet Will Bring to Education in the Next Decade (2005-1015)?
(adopted from *Pew Internet & American Life Project, Experts survey, February 2005)*

Number of respondents: 1,869 from both industry and academia												
Respondents were asked the following: On a scale of 1-10 with 1 representing no change and 10 representing radical change, please indicate how much change you think the Internet will bring to education in the next decade. The results are represented as the percentage of experts and interested members of the public who predicted change that each point on the scale.												
	1	2	3 (%)	4 (%)	5 (%)	6 (%)	7 (%)	8 (%)	9 (%)	10 (%)	Total: <= 5 (no change and no radical change) (%)	Total: > 5 (change and radical change) (%)
Education	*	*	1	3	5	8	16	21	19	24	9	91

2. What are the most popular current and future technologies for WBE/WBT?

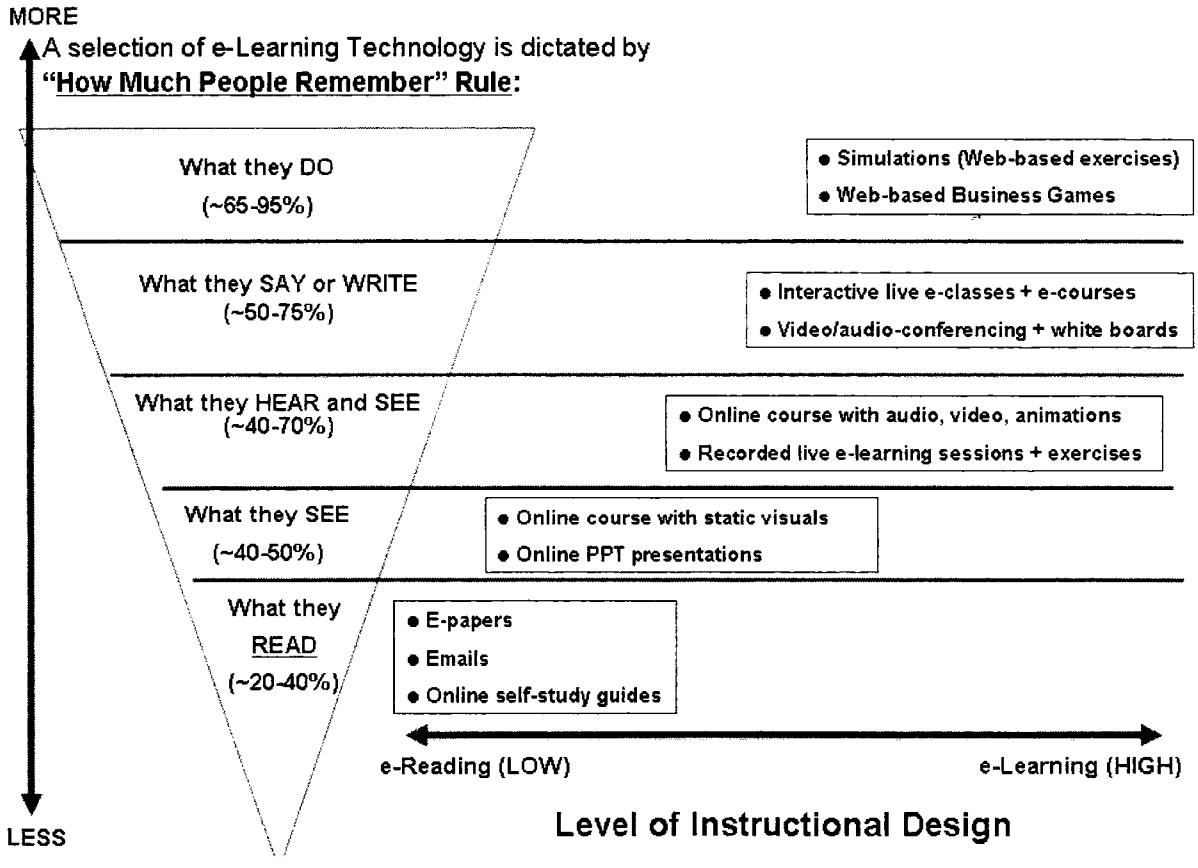

Figure 2.
Relationship of the "How Much People Remember" Rule, Level of Instructional Design and Instructional Technologies for Web-Based Education
(adopted from *Edgar Dale, 1969, Nick van Dam, 2003, and Vladimir Uskov & Alexander Uskov 2005*)

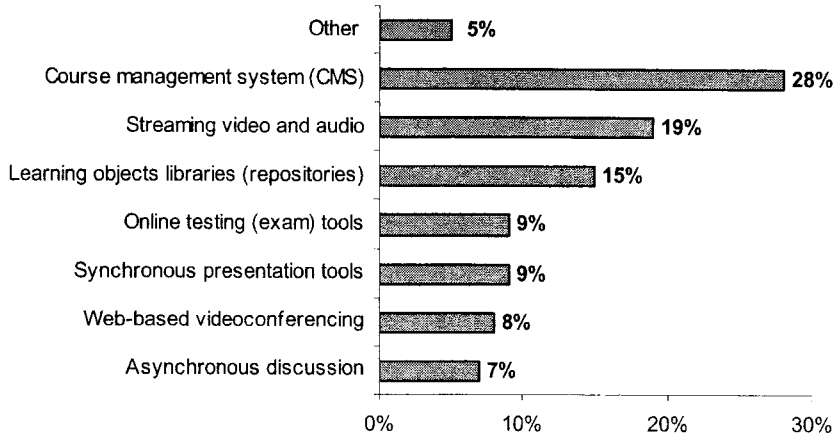

Figure 3.
Technologies That Will Greatly Impact the Delivery of Online Learning in Your Organization During the Next Five Years (2005-2010)
(adopted from *Curtis Bonk, a presentation at !MPACT2004 Annual WebCT User Conference*)

3. What level of expertise is needed to be a good WBE Teacher/Educator and WBT Trainer? Is there a "digital divide" between current tech savvy students and WBE teachers and faculty?

In October 2005, the EDUCASE Center for Applied Research published a report entitled "Student and Information Technology, 2005: Convenience, Connection, Control and Learning". It outlines profiles of current college-age senior and freshman students (Table 2) regarding technologies used by students. The questions are: What is a "technological profile" of modern WBE teacher, instructor, and facilitator? Are current educators ready for real technical and Web-based teaching and training?

Table 2.
Technologies Used by Students
(adopted from *Judith Borreson Caruso and Robert B. Kvavik, October 2005*)

Activity	Number of respondents N	Senior students (%)	Freshman students (%)	Total (%)
Creating, reading, sending email	17,865	99.7	99.7	99.7
Writing documents for academic coursework	17,902	99.1	98.7	98.9
Surfing the Internet for information to support your coursework	17,936	98.7	98.1	98.4
Class activities and studying using an electronic device	17,961	96.4	96.0	96.2
Creating, reading, sending instant messages	17,782	74.2	89.7	81.1
Downloading (or listening to) music or videos	17,891	68.2	83.8	75.1
Online shopping	17,905	77.2	65.3	71.9
Creating presentations (using PowerPoint)	17,909	73.2	54.6	65.0
Accessing information for a course using CMS	17,910	64.6	61.0	63.4
Creating spreadsheets or charts (using Excel)	17,943	71.2	51.7	62.5
Playing computer games	17,865	57.3	64.9	60.7
Creating graphics (Photoshop, Flash)	17,837	49.3	47.2	48.7
Creating Web pages (Dreamweaver, FrontPage)	17,821	26.1	23.4	24.9
Creating and editing video/audio (Director, iMovie)	17,854	23.4	25.0	24.1

4. What are the most important elements for the success of WBE/WBT? What are the greatest challenges to implementing WBE/WBT?

What are the main components of successful WBE and WBT programs? What challenges must organizations address before implementing WBE/WBT programs?

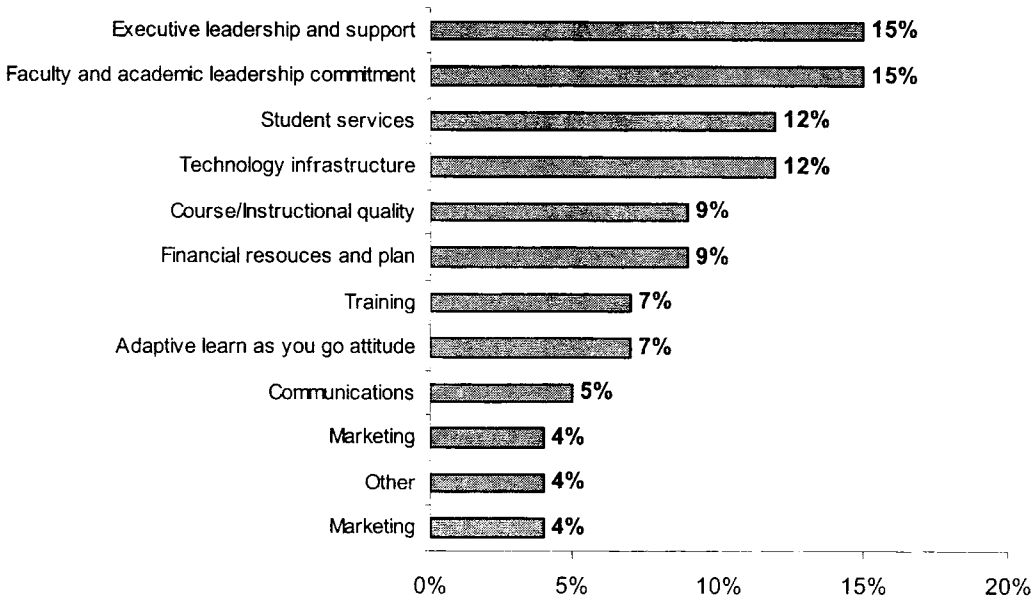

Figure 4.
Most Important Ingredients for Successes [of Internet Supported Learning]
(adopted from *Rob Abel, Alliance for Higher Education Competitiveness Inc., "Internet Supported Learning", February 2005*)

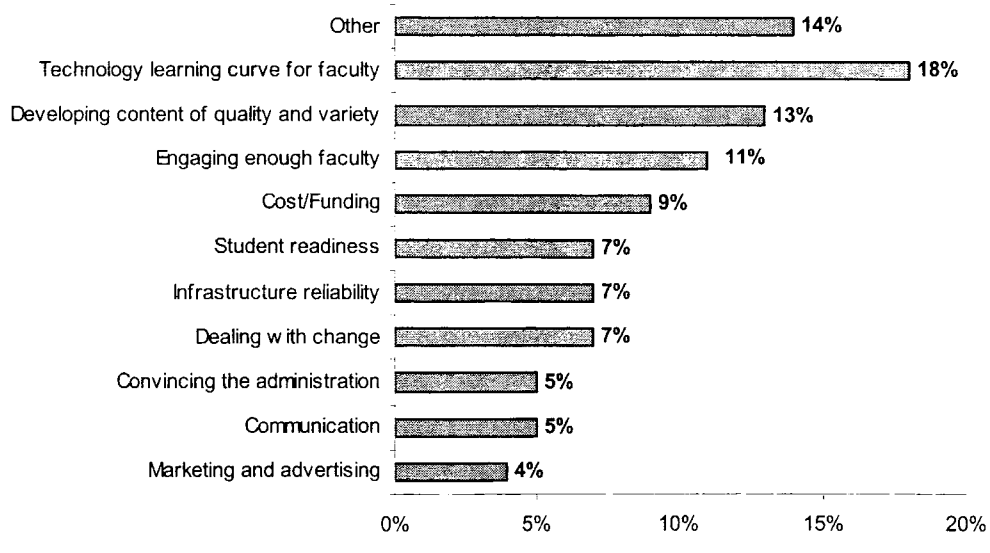

Figure 5.
Greatest Challenges to Implement the e-Learning Initiatives
(adopted from *Rob Abel, Alliance for Higher Education Competitiveness Inc., "Internet Supported Learning", February 2005*)

5. What are the most suitable applied areas for Web-based (technology-based) education and training?

Table 3 reflects recent findings regarding the relationship between student preferences of using technology in the classroom and varying academic disciplines (engineering, business, etc.). The question is: what applied areas are most suitable for Web-based teaching and learning? What areas are Web-based teaching and learning technologies the most efficient in?

Table 3.
Student Preferences for Use of Technology in Classrooms by Discipline (Major Area)
(adopted from *Diane G. Oblinger and James L. Oblinger, Editors, "Educating the Net Generation", 2005*)

Discipline	Prefer "No Use of Technology" (%)	Prefer "Limited Use of Technology" (%)	Prefer "Extensive Use of Technology" (%)
Engineering	4.8	24.4	67.8
Business	1.3	28.2	64.3
Life Sciences	4.8	35.3	56.3
Physical sciences	5.7	40.9	51.8
Social sciences	7.9	44.4	44.2
Education	3.5	47.9	42.9
Humanities	7.7	47.9	42.9
Fine arts	9.0	46.9	39.3

We hope this preliminary list of topics, as well as the multitude of other issues related to WBE, will help generate creative informal discussions between conference attendees. The WBE-2006 Final Program reflects titles of topics to be discussed during regular conference sessions.

On top of this, WBE-2006 will continue other traditions of WBE professional meetings as well. The attending WBE-2006 IPC members and invited international referees will meet during the conference and select the winner of the prestigious "WBE-2006 Best Paper Award". The WBE-2006 conference will also host the 5th International Competition of Ph.D students for those who perform research in Web-Based Education. The winner of that competition will receive the "WBE-2006 Best Ph.D. Student Presentation Award". Continuing another WBE tradition, the winning papers of those two awards, as well as the papers by WBE-2006 keynote and invited speakers and five additional papers presented by WBE-2006 delegates and selected by IPC members and session chairs, will all be published in full in the Special Issue of the *International Journal on Advanced Technology for Learning* (ISSN: 1710-2251).

We expect that the WBE-2006 conference will be an outstanding international forum for the exchange of ideas and results on advanced WBE and WBT, and believe that it will provide a strong foundation for further progress in WBE and WBT areas. We hope that the WBE-2006 delegates and guests will enjoy their stay in Puerto Vallarta, Mexico and that we will all be able to visit the many attractions of this lovely place.

Dr. Vladimir Uskov, Chair
WBE-2006 International Conference