

*Possible methodologies:* Case studies; surveys of actual use of/ access to different tools in real learning contexts; focus groups; digital tracking of use of specific tools; discourse analysis; measurement of learning outcomes

*Related studies/partners:* JISC, UK; EDUCAUSE, USA; Stephen Downes, Canada; George Siemen, Canada; Linden Lab/ Philip Rosedale; SupercoolSchool; Mark Lee and Catherine McLoughlin, Australia

*Possible outcomes:* new designs for learning; more precision in choice of Web 2.0 tools; better understanding of the market for Web 2.0-based learning; identification of areas where learner support is most needed (and not needed).

## **Conclusions**

As indicated earlier, this list is not intended to be comprehensive, and topics and priorities will change over time. Actual research projects are likely to span all three areas. In the meantime, though, the aim of this document is to stimulate consideration of how research can best inform practice in terms of using technology for teaching and learning.

If you feel an important area for research has been missed, please send me an e-mail.

Tony Bates,  
Tony Bates Associates Ltd

Tony.bates@ubc.ca

*Related studies/possible partners:* David Wiley, MERLOT, Harvey, MIT Open CourseWare, USA; U.K. OpenLearn project; David Porter, BC campus, UBC (OLT), Canada; selected universities; possibly software development companies.

*Possible outcomes:* policies and a methodology for content management; development of theory and practice in digital content management; the creation of an archive of searchable digital learning resources; commercial spin-off companies and partnerships; a global network of resource sharing.

11. Web services: The generic term of web services covers a multitude of different technology developments, but basically these are integrated technologies that allow students, staff and administrators to do their work over the Web. (Technically, the term 'Web services' has a specific meaning in IT, being used to describe the processes and software that allow different software systems to be integrated and accessed through the web.). Typical web services are online registration, fee payment, purchasing, stock control and distribution, student portals and e-portfolios. This often means accessing and integrating data across different software and networks in a seamless but secure web-based manner. Web services is an area that should be of high priority for R&D, as more and more students become 'virtual' and depend on the Internet for almost all their services. Specific areas that require further R&D are student portals, e-portfolios, web presence, next generation integrated web service software, synchronous communications technologies, mobile computing and communications, and content management. Ideally, this research should be integrated with educational and management research projects.
- Possible methodologies:* Literature review; web searches; software development; market research; development and monitoring of innovative web services; cost-benefit analysis; student surveys and questionnaires; case-studies.
- Related studies/potential partners:* Richard Katz, EDUCAUSE, USA; UBC's e-strategy, Canada; HEKATE, USA; large web-based corporations (e.g. e-Bay; amazon.com.)
- Possible outcomes:* better services to students and staff; new software development; innovative services; spin-off consultancies and marketing of U of G products and services.

12. Web 2.0 tools. These are the new generation of tools that give the end user (learners, in an educational context) power to generate their own digital materials. The most significant area of research is the design of learning environments using Web 2.0 tools: what tools and what structure (if any) is needed to support learning activities? Who should manage or design such learning environments (learners, teachers, commercial software companies, institutions)? What are the implications of user-created content for assessment of learning? For what kinds of learners and in what kinds of context do Web 2.0 tools provide most benefits (or limitations) for learning? What should the relationship be (if any) between Web 2.0 tools and LMSs? This area of research in particular requires a strong inter-disciplinary approach between computer scientists, educational designers and subject experts.

*Possible methodologies:* literature search; development of theory about the nature of virtual learning; better understanding of the needs of online students; development of technology to help students with physical disabilities to access the web; improvement in student administrative services and learner support; more tailored programme design to suit multiple needs of learners; higher completion rates

*Related studies/potential partners* Otto Peters, Ulli Bernath, U. of Oldenburg, Germany; Gilly Salmon, Robin Mason, OU, Ormond Simpson, UK; Liz Burge, U. of New Brunswick, Jane Brindley, Cindy Underhill, UBC, Canada; Chuck Dzuiban, U. of Central Florida, USA; Terry Evans, Deakin U., Australia; universities involved in campus-based e-learning

*Possible outcomes:* improved marketing; higher completion rates; better or improved learner support/student administrative services; greater access for students with disabilities; development of theory about those studying in virtual environments.

It can be seen that there is a wide variety of possible research in the areas of teaching and learning, and many other potential competitors or partners. Some of these topics are related to possible studies in both planning and management, and research into e-learning technologies. It will be important for a department or research centre to focus on those areas of research into e-learning teaching and learning where it has unique advantages or can provide unique resources for research.

## Technology research

One significant area of technological development in e-learning is:

10. Content management and design: New developments in e-learning such as learning objects, learning resource management platforms, and e-portfolios are forcing a re-examination of course design and delivery methods. The key issue is the re-use of digital materials, and the implications of this for teaching and learning. This is a wider issue than just course design, learning objects, open content or technology research, although all are related. First of all, what are the epistemological and course design implications of 'context-free' learning objects or open content? What (if any) should be the main pedagogical and educational categories used for tagging? What will be the theoretical models that should drive the selection of tagging criteria? What are the cost implications of designing, tagging, storing, and delivering learning objects? What design, management and business models allow for the cost-effective re-use of digital learning materials? What new models of course design could be developed and what would their advantage be over existing models of course design? How will the move to open content and open source affect the design of courses and business models? What should a particular institution's position be on open content? So far the development of re-usable digital materials has been primarily technology-driven or supplier-driven. Research in this area needs to bring technology, education, and information/library sciences together.  
*Possible methodologies* Literature review; Web searches; Delphi studies; innovative object/course design and monitoring; pilot learning resource archives; case-studies; interviews; business modelling

*Related studies/possible partners* Jonassen, Penn State, USA; Harasim, SFU, Janes, U of Saskatchewan, Anderson, Athabasca Univ., Canada; McLaughlin, Australian Catholic U; Univ. of Aalborg, Denmark; Faculties of Education in other universities.

*Possible outcomes:* better course design; better student engagement; higher quality learning outcomes; guidelines for online designers and instructors; unexpected consequences (good and bad)

8. Synchronous web teaching: The expansion of broadband networks, more powerful desk-top computers and new compression technology is enabling real-time communication over the Internet and mobile telephony. This includes desk-top video-conferencing, video and audio streaming, document sharing, and multi-point desk-top audio and video communications. This raises a number of challenging design issues for e-learning. What are the relative roles for synchronous and asynchronous communications technologies? What are the access and cost issues involved in using synchronous technologies? How do students (and teachers/professors) respond to less flexibility but more immediate contact? What are the implications for student and instructor workloads and methods of online teaching?

*Possible methodologies:* development of theory for synchronous and asynchronous teaching; prototype software development, driven by educational theory development; innovative course design and monitoring; Web searches and participation in synchronous events; cost-benefit analyses; commercial spin-off companies and partnerships;

*Related studies/potential partners* Learn Alberta, Canada; corporate e-learning companies; telecom and software companies;

*Possible outcomes:* a theory for selective use of synchronous and asynchronous communications technologies; innovative software development and course designs integrating synchronous and asynchronous communications technologies; commercial spin-off companies and partnerships

9. 'Virtual students' and 'digital natives': This area of research would focus on the experiences of online learners, and the skills/weaknesses of those brought up on digital technologies (generations x and y). This covers a wide area of possible research, but might include the following: What qualitative differences between 'presence' and 'virtuality' are important for learning or for more general educational purposes? What kind of course designs suit 'digital natives'? Are there certain categories or descriptions of students who prefer or perform better in virtual environments? What students suffer in a virtual environment or are denied access to virtual environments? What can be done to enable students with physical disabilities such as visual impairment or hearing loss to access web-based learning? How do students from different cultural backgrounds/international students respond to the online environment or online teaching methods? What are the key variables that influence different cultural responses to virtual education? What broader effects (if any) does studying virtually have on social and cultural participation? What unique administrative services are required by online students? How well are student services provided at a distance to virtual students? What improvements would virtual students like to see in student services?

compare different course design methods; researchers in conventional universities; researchers in open/ virtual universities;  
*Possible outputs:* guidelines on designing effective e-learning; development of theories of instruction; suggestions for training faculty and instructional designers; input to the design of programs; new designs for e-learning based on measures of learning outcomes

6. Quality assurance. This is closely lined to (5) above, but focuses on the whole process of quality assurance, from academic peer review of content and teaching methods, methods of course design, learner support, administrative effectiveness, to program evaluation. What are the main drivers/ forces that are pushing for quality assurance in e-learning? What is the policy context for this? What are the processes needed to ensure the quality of e-learning programs? How and why do these differ (or need to differ) from those for conventional teaching? What quality assurance processes for e-learning are already in place? How successful have they been? How could they be improved? What alternatives are there to the quality assurance approach? How well would or do quality assurance processes work in a particular context? How would/ should this impact on accreditation agencies and their work?

*Possible methodologies:* literature review; case-studies; interviews

*Related studies/possible partners* MacNaught, Australia; WCET, USA; professional accreditation agencies; teachers' unions; Quality Assurance Agency, UK; The British Open University; The Open University of the Netherlands.

*Possible outputs:* better acceptance of e-learning by professional associations and professors; strengthening of internal processes; international standards/ processes for quality assurance of e-learning; improvement to accreditation processes.

7. Collaborative learning, critical thinking, problem-based learning and knowledge construction: The Internet has opened up the possibility of communications at a distance not just between teacher and students, but also between remote students. This has supported a move away from didactic teaching to the social construction of knowledge. However, there are numerous research issues around this development that needs to be explored. What subject areas or learning outcomes lend themselves most to online constructivist approaches? When is it not appropriate? What are the unique features of e-learning that promote this form of learning over and above that of conventional classrooms? What tools or techniques support collaborative learning, critical thinking and the construction of knowledge online? What can online instructors do to support these forms of learning? Are there other constructivist learning processes facilitated by e-learning? What will be the impact of synchronous online technologies such as web conferencing on constructivist approaches? How does one assess these forms of learning? How do constructivist approaches to learning fit with local cultures and traditions?

*Possible methodologies:* literature review; analysis of online discussion forums; analysis of course design; analysis of student assessment; introduction and monitoring of online instructor intervention strategies; interviews (students and instructors); comparative studies; cultural studies

4. Best practices in system-wide or national planning and management of e-learning: What roles should government play in supporting the development of e-learning? What are the policies and practices in other jurisdictions? Where does e-learning fit within national development? What policies (if any) should government develop to control for-profit or out-of-state e-learning initiatives? How can governments assess value (rate of return) for their investment in e-learning?  
*Possible methodologies*: literature review; case-studies; Delphi studies; surveys/interviews  
*Relates studies/possible partners*: Cunningham et al, 'The Business of Borderless Education'; IIEP/UNESCO; OECD; Mexican/state governments; World Bank; possibly major providers of telecom/Internet services  
*Possible outputs*: identification of government strategies/gaps in strategy; advice to governments on their roles (and when not to get involved) in supporting e-learning; performance measures for national investment in e-learning

Research into the planning and management of e-learning will require a time commitment from senior management as well as researchers. It will be necessary also to identify local, national and international partners for such research. However, research into the planning and management of e-learning has not received much attention in academic circles (i.e. there is little competition), and such research should yield quick and substantive results in an area where there is considerable interest by policy-makers. Such research will position an institution well as a leader in the field of e-learning.

### Teaching and learning

This area is probably the one with the most interest for the majority of academic staff. It is also the area where there will be most competition (and opportunities for partnership).

5. Methods of course design. There is a wide variety of different methods of designing e-learning. What are the main methods currently used? What are the costs and the effectiveness of different approaches to course design? Under what circumstances do each of the different models of course design operate to best effect? What do teachers/professors need to know about course design? What are the barriers to the project management model, and what can be done to remove such barriers? What new course designs are emerging around the use of learning objects, e-portfolios, web conferencing, social networking and other e-learning developments? What is the relationship between course design, theories of learning, e-learning and epistemology?  
*Possible methodologies*: literature reviews; monitoring of course design and its output; innovative course design and monitoring; surveys and interviews; case-studies; measurement of learning outcomes; comparative studies  
*Related studies/possible partners*: Bates and Poole, UBC; Harasim, SFU; Kanuka and Anderson, Athabasca, Canada; Paloff and Pratt, Dick and Carey, Moore, USA; numerous theoretical models of course design in literature, but few

2. The costs and benefits of e-learning: How does one measure the costs and benefits of e-learning? What is the relationship between course design and costs? What are the main drivers of the costs of e-learning, and how do these differ from the costs of conventional education? What is the unit cost per student in a particular program? What is the marginal cost per student and what does this imply for planning? How do the costs of instruction within a program compare with other, similar programs within a particular institution, with other virtual institutions and with conventional institutions? What are the program's primary cost areas? How does one measure and allocate the spin-off benefits and overhead costs? What are the implications of the studies' findings for funding, budgeting and accounting in a program? How do costs and methods of costing e-learning differ between schools and universities? What are the implications of the studies for expansion or contraction of the higher education and/or school system?

*Possible methodologies*: cost-benefit analysis; organizational analysis; case-studies; literature review

*Related studies/possible partners*: Athabasca University (CIDER); Thomas Hülsmann, Univ. of Oldenburg; WCET, USA; Sloane Foundation, USA; EDUCAUSE, USA; Martin Carnoy, Stanford University.

*Possible outputs*: international standards/agreed methodology for cost-benefit analysis of e-learning; improved business plans for cost-recovery / for-profit operations; better internal budgeting and accounting; activity-based costing; better information for internal evaluation of programs and initiatives; improve a department's/institution's positioning for future investment.

3. Best practices in the institutional planning and management of e-learning: What are the unique challenges in planning and managing e-learning (compared with conventional education)? How can e-learning support the strategic goals of an institution? Where should e-learning be focused (target groups, specific subject areas, etc.)? What strategies are essential for the successful implementation and management of e-learning? What strategies can ensure faculty / teacher support and commitment to e-learning? How should e-learning be organized? In particular, what should be centralized and what decentralized? How does one decide? What are the measures of success for e-learning? What measures of success / performance indicators can be developed for managers of e-learning? What are the implications for the training and professional development of university / school managers and leaders?

*Possible methodologies*: literature review; case-studies; Delphi studies; surveys; management diaries / structured self-reflection.

*Related studies/possible partners*: COIMBRA group of universities / HECTOR report; EDUCAUSE; Athabasca University (CIDER); William Massey, Stanford University; University of Phoenix Online; Tom Carey, University of Waterloo, Canada

*Possible outputs*: more selective use of e-learning in conventional institutions; performance measures for the operation and management of e-learning; higher quality learning as a result of better-prepared and supported teachers / professors; more effective use of resources; deeper and more extensive change within an institution; identification of unpredicted side-effects of e-learning (good and bad).

## MAP OF RESEARCH INTO E-LEARNING

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Tony Bates,  
Tony Bates Associates Ltd

### Introduction

This document is intended as a background paper to assist in the development of long-term plans for research into e-learning. The goal of this paper is to stimulate and focus discussion, in this case on the potential areas of research.

### Map of research

The following is inevitably a personal view of the main priority areas for research into e-learning. Although it covers a wide range of possible areas for research, I do not claim that it is comprehensive. Indeed, the purpose of this paper is to stimulate suggestions for other research areas and topics that have been omitted in my own analysis.

Research into e-learning can be seen as consisting of three main areas of interest:

- (a) the management of e-learning
- (b) teaching and learning online
- (c) e-learning technology: design, development and evaluation.

### The management of e-learning

Within the area of management are the following possible topics:

1. The design of virtual institutions: what were/are the main drivers or forces leading to the establishment of a virtual institution? How does one define a virtual institution? What are common features of virtual institutions, and what are core differences between them? What is their mandate, jurisdiction/area, level of funding, number of students, staffing, and organization? What difficulties did they encounter, and what strategies did they use to overcome their difficulties? What are their measures for success? What are their limitations? What lessons can be learned from such a study for government or private sector stakeholders, for managers of such institutions, and for education and social policy analysts?  
*Possible methodologies*: Web and literature searches; case-studies  
*Related studies/possible partners*: OECD study of e-learning; IIEP study of virtual universities; WICHE study of virtual colleges; Latin American agencies such as the Inter-American Bank, International Organization of Universities, ILCE, etc.  
*Output*: classification system/ definitions; success measures; understanding of relationship between political and social environment and policy-making; boundaries/niches for virtual learning; organizational strategies to support virtual learning.