

**The Role of Organizational Sub-cultures in Higher Education Adoption of
Open Source Software (OSS) for Teaching/Learning**

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Abstract

This paper contrasts the arguments offered in the literature advocating the adoption of open source software (OSS) – software delivered with its source code – for teaching and learning applications, with the reality of limited enterprise-wide deployment of those applications in U.S. higher education. Drawing on the fields of organizational management, information systems, and education, the author argues that the gap between the advocacy for OSS teaching and learning applications and the enterprise-wide deployment of OSS for teaching and learning is a consequence of the divergent perspectives of two organizational sub-cultures – the technologist and the academic – and the extent to which those sub-cultures are likely to embrace OSS. This alternative conceptualization of the gap between advocacy and enterprise-wide adoption also includes recommendations for closing the advocacy-adoption gap.

Introduction

As new information and communications technologies (ICTs) continue to emerge, institutions of higher education are increasingly faced with the need to anticipate what impact these new technologies will have on teaching, learning and research. The technology expectations of students who were born digital (Palfrey and Gasser, 2008; Caruso and Salaway, 2008), as well as the financial challenges posed by the current economic downturn, are forcing institutions to improve efficiencies and enhance organizational performance while adopting new technologies to remain competitive. Open Source Software (OSS) – software that is distributed with its source code according to the criteria established by the Open Source Initiative (Open Source Initiative, 2006) - is already recognized by the U.S. Government as a means of advancing infrastructure efficiencies in a time of flat budgets (Beizer, 2008), and there are indications that the new Administration will strengthen government commitment to FOSS. In higher education, campus-wide OSS adoption for technical infrastructure applications (e.g., databases, operating systems) reflects this same commitment. However, campus-wide adoption of OSS for teaching and learning is still limited, despite the use of selected OSS applications by individual faculty or departments (Williams van Rooij, 2007a; Green, 2008).

Technologies for Teaching/Learning

There is a wide variety of learning technologies available. These include, among others, multimedia software tools to create audio/visual files; e-commerce applications that enable transaction processing and electronic payment, and asynchronous (not “real-time”) and synchronous (real-time) communication and collaboration tools for information sharing and group discussion (Zhang and Nunamaker, 2003). The multimedia tools are available as desktop applications that individual users can load onto their PCs/Macs and used by anyone skilled in using basic desktop productivity tools (e.g., spreadsheets, word processing, slides for presentations). To facilitate ease of use as well as stimulate usage of multiple products, vendors bundle several of their applications into a single platform. Adobe (<http://www.adobe.com>) is among the vendors well-known for bundling multiple applications for creating multimedia. These applications can also reside on an institution’s servers, so that multiple users can access

them and create multimedia e-learning applications from their desktops without having to purchase individual licenses or upgrades when new versions of the software are released. E-commerce applications, conversely, are server-based infrastructure software applications used by the institution's technology staff. Part of the institution's backend systems, these applications require technical expertise to use and maintain, and help manage the administrative side of e-learning.

In the late 1990s, the multimedia tools were integrated into single, stand-alone Web-based course management systems that were originally intended as administrative support for classroom instruction, but which have since evolved into enterprise-wide learning management systems (LMS) that also include social software tools such as blogs and wikis, as well as interfaces to an institution's student information and financial administrative systems. The dominant commercial LMS provider to higher education is Blackboard, having acquired WebCT, its largest competitor, in 2006. Blackboard is now in the process of acquiring Angel Learning, another LMS competitor. The leading OSS LMS products are Moodle (<http://www.moodle.org>), originally developed in Australia, but currently with a global user base that includes nearly 30,000 registered sites, one million courses, and available to anyone for downloading, and; Sakai (<http://www.sakaiproject.org>), a platform developed by a group of U.S. institutions that includes generic collaboration tools along with teaching and portfolio tools available under an Education Community License. Moodle is built on OSS technologies such as PHP, while Sakai is largely Java-based. Other FOSS LMS products include Claroline (<http://www.claroline.net>), available in more than 35 languages and used in 80 countries; .LRN (<http://www.dotlrn.com>), a system that has e-commerce and project management applications built in; ATutor (<http://www.atutor.ca>), developed in Canada and includes more than 17,000 registered user sites, and; Bodington (<http://www.bodington.org>), developed in the U.K. and implemented at the University of Leeds and the University of Oxford. The Western Cooperative for Educational Telecommunications (WCET) provides reviews and product comparisons to assist decision-makers in selecting the LMS – commercial or FOSS - that meets their institution's e-learning needs (EduTools, 2009).

Nearly all (97.5%) institutions of higher education have deployed at least one LMS campus-wide (Green, 2008), enabling them to maximize the use of technology investments to support multiple instructional models. Further, more than 3 in 4 (76.9%) have standardized on a single LMS enterprise-wide, primarily a commercial vendor product (EDUCAUSE CORE Data Service, 2007). Consistent with higher education's tradition of shared governance (American Association of University Professors, 2009), the decision to acquire and/or support enterprise-wide e-learning systems such as LMSs is made by the Chief Information Officer (CIO) and his/her staff in collaboration with the Chief Academic Officer (CAO), department chairs, and faculty (Green, 2004), although the final decision and funding usually resides with the technologists.

Organizational Culture and Sub-cultures in Higher Education

Organizational culture refers to the values, symbols, beliefs, stories, heroes, rites and shared assumptions that have special meaning for an organization's employees (Hofstede, 1980; Schein, 1985-2005; Parker, 2000; Hill and Jones, 2001). Organizational cultures are composed of discrete sub-cultures or clusters of ideologies, cultural forms and practices, the most distinctive sources of which are people's occupations. Centered around defined, interrelated tasks that create self-definitions and self-perceptions as well as perceptions of relationships to other sub-cultures, occupational sub-cultures can serve as potential sources of conflict concerning decisions about

such issues as the allocation of resources, future goals, changes in practices, and criteria used to evaluate performance (Trice and Beyer, 1993).

Higher education decision-making is influenced by organizational culture and sub-cultures, with an institution's specific mission contributing to the intensity of that institution's belief system. Understanding the culture and various sub-cultures provides administrators with information about how to increase performance and decrease conflict in particular groups (Tierney, 1988; Cameron and Ettington, 1988; Smart and St. John, 1996). More recent studies recognize that organizational cultures and sub-cultures are affected by changes in the environment in which the organization operates (Reschke and Aldag, 2000). Higher education adoption of OSS applications for teaching and learning enterprise-wide can be particularly challenging due to higher levels of public scrutiny and calls for evidence of organizational effectiveness. Such challenges also place pressure on organizational sub-cultures – particularly the academic and the technology occupational sub-cultures – to compete for scarce resources and capitalize on existing competencies with as little risk as possible.

Definitions

Members of the academic sub-culture include faculty, non-technical instructional and research support staff (e.g., instructional designers, library staff), and other non-technical staff under the Chief Academic Officer (CAO). Although institutional characteristics (Carnegie classification, number of students, public vs. private, for-profit vs. non-profit, etc.), culture, discipline, and other factors provide the context in which the academic sub-culture exists, concepts basic to this sub-culture include the pursuit and dissemination of knowledge through teaching and research, academic honesty, and academic freedom (Umbach, 2007; American Association of University Professors (AAUP), 2009). Commitment to these basic concepts means understanding the impact of technology on the processes of teaching and learning, on the role of sub-culture members, particularly the faculty, and on how student performance is assessed.

Members of the technologist sub-culture include the institution's information technology (IT) staff, academic computing as well as administrative computing, and the technical instructional and research support staff under the Chief Information Officer (CIO). As with the academic sub-culture, the technologist sub-culture operates within the context of its institution. Traditionally, this sub-culture has focused on maintaining an institution's cyber-infrastructure efficiently and effectively – what Fuchs (2008) calls “keeping the lights on” - and providing innovative technology platforms that support collaboration and strategic agility in teaching, learning and research. As the pace of technological innovation has increased, the essence of this sub-culture, i.e., what it means to be a technologist, is also changing. The challenges facing this sub-culture are clearly reflected in the results of EDUCAUSE's survey of the top ten issues of concern to higher education technology leaders over the past five years (Allison, DeBlois, and Committee, 2008), with funding an ongoing concern and enterprise-wide teaching and learning systems, particularly learning management systems (LMS), rising to the top ten. Consequently, the technologist sub-culture faces the challenge of managing risk while enabling the academic sub-culture to capitalize on the affordances offered by these systems (Lambert, 2008).

Culture, Sub-cultures and Technology Adoption

Organizational culture and sub-cultures also serve as lenses through which current and potential employee competencies as well as adoption risks are evaluated. The occupational sub-culture of technologists must be perceived as possessing the knowledge necessary to deploy and maintain a new technology (Kamal, 2006). For the academic occupational sub-culture, the ability to capitalize on the maximum learning affordances offered by various technologies based on solid pedagogy as well as on awareness of available technologies (Dabbagh and Bannan-Ritland, 2005) is a key input to adoption.

Methods and Sources

To explore the impact of organizational sub-cultures on OSS technology adoption requires a broad lens that goes beyond the field of education and includes scholarship in the fields of organizational science and management, and software engineering. Using the portal of the Association for Computing Machinery (ACM), as well as the EBSCO portal for electronic database searches of Business Source Complete, Education Resources Information Center, ScienceDirect, Dissertation Abstracts International, and the EDUCAUSE Center for Applied Research, a search of English-language books, book chapters, peer-reviewed journals, and professional associations with well-established peer review processes for conference papers and reports was conducted, with the same keywords – *open source software* and *organizational sub-cultures* - used for all searches. The searches returned a total of 6,847 unduplicated references. The scope of the search was then limited to adoption and deployment of open source software applications, and to occupational and work group sub-cultures, which excluded 4,040 of the references. Finally, 2,669 references that focused on OSS at the network infrastructure level rather than the non-technical application user level, where teaching and learning systems fall, were excluded, leaving a total of 89 resources to be included in this study.

Each resource was read, notes were taken on key points, and the notes uploaded into a text management and analysis software program. Emergent themes focusing on advocacy, on adoption barriers, and on similarities/differences between the technologist and the academic views on OSS for teaching and learning were identified. Narrative analysis was selected because only six of the 89 resources used systematic data collection with reported sample sizes.

Results

- Synthesis of the literature reveals synergy between OSS' adaptability and reusability principles and the academic sub-culture's constructivist principles that drive the design of teaching and learning environments (Koohang and Harman, 2005; Williams van Rooij, 2007a; Williams van Rooij, 2007b). Although constructivism is not the sole perspective in the academic sub-culture and faculty seek to ensure that technology remains in the service of pedagogy, and not the other way around, the academic sub-culture responds favorably to OSS for teaching and learning when, like any technological change, it is (a) evident, so that there is an awareness of OSS and of how OSS is being used for teaching and learning, (b) easy to use, without having to choose from a host of features, functions, and complex user interfaces, and (c) essential, so that the what's-in-it-for-me (WIFM) is clear, rather than being a mandate from above (Haymes, 2008).
- Despite the academic sub-culture's tendency to look favorably upon OSS for teaching and learning, the decision to adopt and deploy OSS for teaching and learning enterprise-wide requires the support of the institution's technologists. When it comes to OSS advocacy, CIOs

and Chief Financial Officers (CFOs) of large research institutions have been among the most vocal OSS proponents. These institutions tend to have a history of in-house software development, so that the adaptability of OSS source code fits well with current development paradigms at those institutions. The OSS software development paradigm is also cited by this group of advocates as an advantage of OSS over commercial vendor-produced software. OSS' lower total cost of ownership is cited as a particular advantage by OSS advocates in the technologist sub-culture (Burdett and Bassett, 2005; Hignite, 2004; Green, 2004).

- In marked contrast with the enthusiasm of technologists at large research institutions is the cautious pragmatism of technologists at most other types of institutions, with only one in seven (13.8%) institutions adopting a OSS LMS as the single campus standard (Green, 2008). The literature is generally consistent in identifying the barriers to enterprise-wide OSS LMS adoption: The difficulty in calculating the true cost of ownership of OSS LMSs; the lack of formal support mechanisms; the need for highly skilled and highly motivated technical personnel; the lack of efficient tools for migrating from commercial LMSs, and; the lack of interoperability with other campus systems (Molina and the EDUCAUSE Evolving Technologies Committee, 2006; EDUCAUSE Constituent Group, 2008; Williams van Rooij, 2007b). Intellectual property rights and identifying what software solutions have been patented – think of the Blackboard-Desire2Learn litigation – are also barriers to the building of a stable development and support community, along with uncertain funding sustainability, particularly for OSS applications created with grant funding (Lakhan and Jhunjunwala, 2008; Dalziel, 2003).

A visual representation of the gap between the advocacy for OSS teaching and learning applications among the two sub-cultures and the enterprise-wide deployment of OSS is shown in Figure 1.

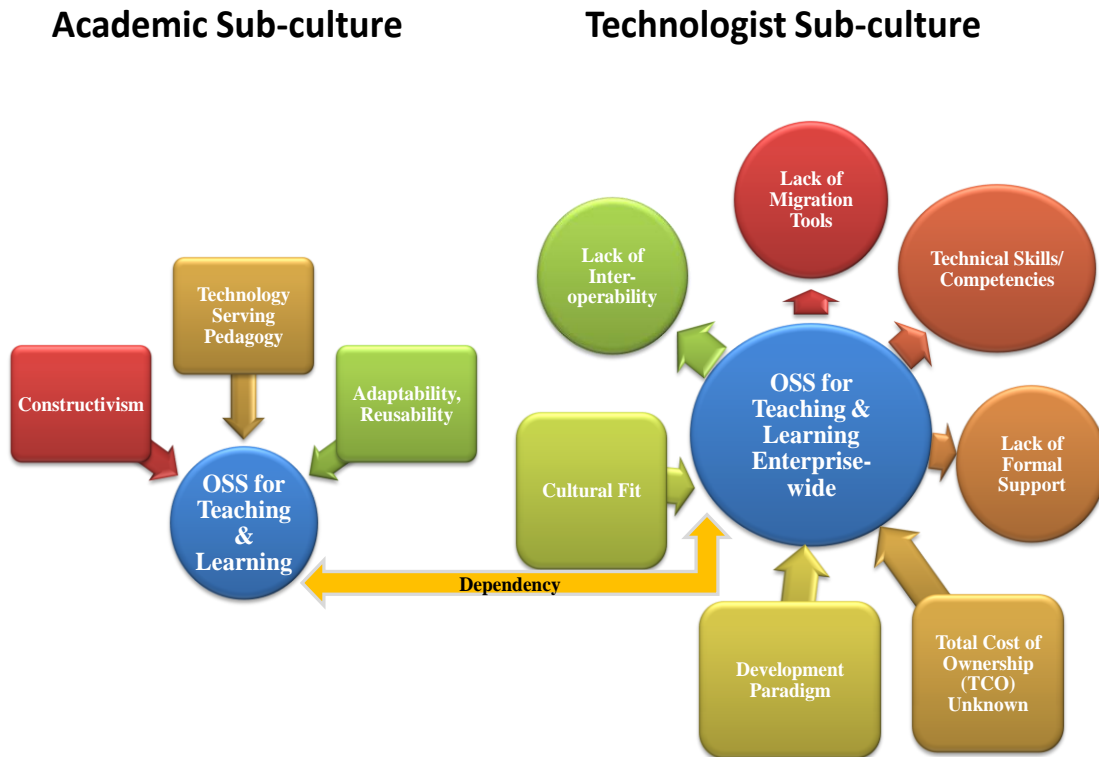


Figure 1. Perspectives on OSS for Teaching and Learning Enterprise-wide: Academic vs Technologist Sub-cultures

Conclusions/Recommendations

Implications for closing the advocacy-adoption gap include:

- Collaborative needs analysis/assessment.** Long before any go/no go decision about OSS vs. commercial systems for teaching and learning is made, representatives of both the academic and technology sub-cultures should work together to document and analyze user requirements from the perspectives of faculty, their instructional support teams, and even students. This enables faculty and instructional support professionals to identify the pedagogical affordances of technology that can shape pedagogical models and inform the design of teaching and learning. Approaches to identifying the pedagogical affordances of various technologies have been well documented (Bower, 2008; Suthers, 2006; Resta and Laferriere, 2007; Grainne and Dyke, 2004). Clearly defined user requirements then inform development of the technical system requirements. There are published guidelines to assist institutions in conducting OSS assessments (Business Readiness Rating, 2006; Navica, 2008). Individual institutions have placed their own OSS assessment models and migration experiences in the public domain (Chao, 2008; O'Laughlin and Borkowski, 2008; Uys and Morton-Allen, 2007), although there is room for improvement in terms of the number of institutions contributing hard data about their assessment and implementation approaches and experiences.

- *Dissemination of TCO data.* To better understand the true total cost of ownership, institutions that have already deployed OSS for teaching and learning enterprise-wide need to place hard data about support costs in terms of hours, skills/competencies, services provided to faculty, students and other instructional support staff, migration costs, documentation, deployment methods used (e.g., in-house vs. third party vendor services), etc., in the public domain. This would also enable institutions to compare current costs with the costs of migrating to OSS. Sharing of TCO data is potentially challenging given the different ways in which institutions calculate and track financial data (Wheeler and DeStefano, 2007). Nevertheless, case studies from “live” OSS sites can provide some starting points for other institutions seeking to explore the cost-value of enterprise-wide OSS for teaching and learning.

This paper offers research-based insights into the role of organizational sub-cultures as challenges and opportunities for the adoption of OSS for teaching and learning enterprise-wide. It is hoped that it provides teaching and learning administrators and practitioners with recommendations for addressing the challenges and capitalizing on the opportunities. It also may provide educators who use OSS applications with guidelines for teaching instructional technology graduate students to consider the organizational context when evaluating OSS as an alternative or complement to commercial vendor LMSs. Lastly, this paper contributes to the ongoing dialog about how teaching and learning professionals can capitalize on the affordances offered by OSS applications for designing instruction for the teaching and learning environment.

References

- Allison, D., DeBlois, P., & Committee, E. C. (2008). *Current issues survey report, 2008*. Retrieved May 18, 2009, from EDUCAUSE:
<http://www.educause.edu/EDUCAUSE+Quarterly/EDUCAUSEQuarterlyMagazineVolume/CurrentIssuesSurveyReport2008/162861>
- American Association of University Professors (AAUP). (2009). *Informal glossary of AAUP terms and abbreviations*. Retrieved May 27, 2009, from American Association of University Professors (AAUP) Web site:
<http://www.aaup.org/AAUP/about/mission/glossary.htm>
- Beizer, D. (2008). *5 tech tools with lasting appeal*. Retrieved June 1, 2009, from Federal Computer Week: <http://fcw.com/articles/2008/08/29/5-tech-tools-with-lasting-appeal.aspx>
- Bower, M. (2008). Affordance analysis-matching learning tasks with learning technologies. *Educational Media International* , 45 (1), 3-15.
- Burdtt, C., & Bassett, E. (2005). *Open source in Higher Education: Decision-making for open source adoptions*. Boston: Eduventures.
- Business Readiness Rating. (2006). *Business readiness rating for open source*. Retrieved June 2, 2009, from Business Readiness Rating:
<http://www.openbrr.org/wiki/index.php/BRRWhitepaper>
- Cameron, K., & Ettington, D. (1988). The conceptual foundations of organizational culture. In J. Smart (Ed.), *Higher education: Handbook of theory and research* (pp. 356-396). New York: Agathon.
- Caruso, J., & Salaway, G. (2008). *The ECAR study of undergraduate students and information technology, 2008*. Boulder, CO: EDUCAUSE Center for Applied Research.
- Chao, I. (2008). Moving to Moodle: Reflections two years later. *EDUCAUSE Quarterly* , 31 (3), 46-52.
- Dabbagh, N., & Bannan-Ritland, B. (2005). *Online learning: Concepts, strategies, and application*. Upper Saddle River, NJ: Pearson Education, Inc.
- Dalziel, J. (2003). Open standards versus open source in e-learning. *EDUCAUSE Quarterly* , 26 (4), 4-7.

- EDUCAUSE Constituent Group. (2008, October 20). *2008 Openness Constituent Group Meeting*. Retrieved June 1, 2009, from EDUCAUSE:
<http://www.educause.edu/wiki/Openness>
- EduTools. (2009). *Welcome to EduTools*. Retrieved December 27, 2009, from EduTools:
<http://www.edutools.info/index.jsp?pj=1>
- Fuchs, I. (2008). Challenges and opportunities of open source in higher education. In R. Katz (Ed.), *The tower and the cloud: Higher education in the age of cloud computing* (pp. 150-157). Boulder, CO: EDUCAUSE.
- Grainne, C., & Dyke, M. (2004). What are the affordances of information and communication technologies. *ALT-J: Research in Learning* , 12 (2), 113-124.
- Green, K. C. (2004). *Campus computing 2004: The 15th national survey of computing and information technology in American higher education*. Encino, CA: The Campus Computing Project.
- Green, K. (2008). *The 2008 national survey of information technology in U.S. higher education*. Encino, CA: The Campus Computing Project.
- Haymes, T. (2008). The three-e strategy for overcoming resistance to technological change. *EDUCAUSE Quarterly* , 31 (4), 67-69.
- Hignite, K. (2004, August). *An open mind on open source* . Retrieved May 25, 2009, from National Association of College and University Business Officers (NACUBO):
http://www.nacubo.org/Business_Officer_Magazine/Magazine_Archives/August_2004/An_Open_Mind_on_Open_Source.html
- Hill, C., & Jones, G. (2001). *Strategic management theory-An integrated approach*. Boston, MA: Houghton Mifflin.
- Hofstede, G. (1980). *Culture's consequences: International differences in work related values*. Thousand Oaks, CA: Sage Publications, Inc.
- Kamal, M. (2006). IT innovation adoption in the government sector: Identifying the critical success factors. *Journal of Enterprise Information Management* , 19 (2), 192-222.
- Koohang, A., & Harman, K. (2005). Open source: A metaphor for e-learning. *Informing Science Journal* , 8, 75-86.
- Lakhan, S., & Jhunjunwala, K. (2008). Open source software in education. *EDUCAUSE Quarterly* , 31 (2), 1-11.

- Lambert, H. (2008). Managing risk and exploiting opportunity. *EDUCAUSE Review* , 43 (6), 36-37.
- Molina, P., & Committee, E. E. (2006). Pioneering new territory and technologies. *EDUCAUSE Review* , 41 (5), 112-135.
- Navica. (2008). *Choosing the right open source product: Don't leave it to chance*. Retrieved June 5, 2009, from Navica: <http://www.navicasoft.com/pages/osmm.htm>
- O'Laughlin, N., & Borkowski, E. (2008, October 29). *Transitioning learning management systems: Making the move at the enterprise level*. Retrieved June 5, 2009, from EDUCAUSE: <http://www.educause.edu/Resources/Browse/OpenSource/17546>
- Palfrey, J., & Gasser, U. (2008). *Born digital: Understanding the first generation of digital natives*. New York, NY: Basic Books.
- Parker, M. (2000). *Organisational culture and identity: Unity and division at work*. London, U.K.: Sage Publications, Ltd.
- Reschke, W., & Aldag, R. (2000, August). *The business case for culture change*. Retrieved May 20, 2009, from Center for Organization Effectiveness: <http://www.greatorganizations.com/culturestudy.htm>
- Resta, P., & Laferriere, T. (2007). Technology in support of collaborative learning. *Educational Psychology Review* , 19 (1), 65-83.
- Schein, E. (1985). *Organizational culture and leadership*. San Francisco, CA: Jossey-Bass.
- Smart, J., & St. John, E. (1996). Organizational culture and effectiveness in higher education: A test of the "culture type" and "strong culture" hypothesis. *Educational Evaluation and Policy Analysis* , 18 (3), 219-241.
- Suthers, D. (2006). Technology affordances for intersubjective meaning making: A research agenda for CSCL. *International Journal of Computer-Supported Collaborative Learning* , 1 (3), 315-337.
- Tierney, W. (1988). Organizational culture in higher education: Defining the essentials. *The Journal of Higher Education* , 59 (1), 2-21.
- Trice, H., & Beyer, J. (1993). *The cultures of work organizations*. Upper Saddle River, NJ: Prentice Hall.
- Umbach, P. D. (2007). Faculty cultures and college teaching. In R. Perry, & J. Smart (Eds.), *The scholarship of teaching and learning in higher education: An evidence-based perspective* (pp. 263-317). New York: Springer.

- Uys, P., & Morton-Allen, M. (2007). *A suggested methodological framework for evaluating and selecting an open source LMS*. Retrieved June 5, 2009, from Charles Stuart University: <http://www.csu.edu.au/division/landt/interact/documents/2007%2006%2007%20Sakai%20Amsterdam%20Presentation%20FINAL.ppt>.
- Wheeler, B., & DeStefano, J. (2007, July-August). *Mitigating the risks of big systems*. Retrieved June 5, 2009, from Business Officer Magazine: http://www.nacubo.org/Business_Officer_Magazine/Magazine_Archives/July-August_2007/Mitigating_the_Risks_of_Big_Systems.html
- Williams van Rooij, S. (2007a). Open source software in higher education: Reality or illusion? *Education and Information Technologies* , 12 (4), 191-209.
- Williams van Rooij, S. (2007b). Perceptions of open source versus commercial software: Is higher education still on the fence? *Journal of Research on Technology in Education* , 39 (4), 433-453.
- Zhang, D., & Nunamaker, J. (2003). Powering e-learning in the new millenium: An overview of e-learning and enabling technology. *Information Systems Frontiers* , 5 (2), 207-218.