

ECI 795/895

DIFFUSION AND ADOPTION OF OPEN SOURCE LEARNING MANAGEMENT SYSTEMS IN EDUCATIONAL INSTITUTIONS

Rivals challenge Blackboard's dominance: Can it survive the re-invention of Open Source Learning Management Systems?

Randy Brooks

Old Dominion University

June 2011

Abstract: *This paper examines the U.S. higher education market that is expressing significant interest in migrating to open source Learning Management Systems (LMS). Reports and surveys of institutions using LMS systems are examined along with analysis of current the market. The diffusion of both open source and proprietary Learning Management Systems used in educational institutions is explored in this paper in the context of Roger's innovation diffusion model. This study seeks to understand if the present momentum to replace proprietary Learning Management Systems with open source solutions will continue with additional adopters. Most educational institutions implement Blackboard LMS. There is evidence that open source replacements Moodle and Sakai are becoming more prevalent. Open source infrastructure software (Linux, Shibboleth®) is used pervasively throughout educational establishments while proprietary software for LMS systems currently dominates market share. This study proposes that success with early open source infrastructure products have acted as a catalyst to accelerate adoption and re-invention of open source LMS products. As new technologies arrive at increasing speed, LMS must adapt to support these technologies or risk being replaced. The results indicate that the LMS market is volatile and in a state of transition. The diffusion of open source replacement LMS is sweeping through higher education institutions challenged by increasing budget constraints and the need to interface with mobile devices and embrace new technology.*

Key Words: *Learning Management Systems (LMS), Diffusion of Innovation, Open Source Software (OSS), Blackboard, Moodle, Sakai.*

Introduction

The LMS market place is in transition according to the National Survey of Information Technology in higher education (K. Green, 2010). Blackboard LMS has been the campus standard LMS and has dropped from 71 % in 2006 to 57 % in 2010 based on the results of survey participants. All competitors have gained market share during this time, including the proprietary competitive alternative product Desire2Learn. The motivation to change or reconsider is partly due to Blackboard's announcement of retiring legacy systems acquired in mergers. This has provided an opportunity for administrator and Chief Technology Officers (CTOs) to review their current LMS and evaluate it against new open source market options, such as, Moodle and Sakai. This study seeks to answer the following three research questions:

1. Will open source software LMS alternatives become a campus standard in educational institutions through diffusion of the open source LMS products and re-invention of earlier LMS innovations?
2. What is the motivation to remain with the current LMS or change to another product?
3. How will campus LMS strategy be linked to new LMS applications to enhance instructional resources and campus services since research indicates they are in the early stages of campus deployment?

Learning Management Systems in Education

A Learning Management System (LMS) is described as a software application that automates the administration, tracking, and reporting of training events (Ellis, 2009). Martin Dougiamas is the founder of Moodle LMS and was an early proponent of web based learning. His motivation to enter into the LMS market was due to LMS technology being developed for the institution rather than the student. In an early article discussing his thoughts on web learning, he stated, "I see early adopters leaping into these new technologies only to be discouraged by the lack of student participation, or the amount of time to develop, maintain or support an online course to give it life. (Dougiamas, 1999) "

The role of LMS is becoming increasingly importance with the influx of non-traditional students and e-learning initiatives throughout the educational field. LMS has become the virtual entrance into the university for both traditional students and on-line students enrolled in web based courses. Ellis states that LMS must provide a rich, engaging experience for the student and faculty by including the following features (2009, p. 1):

- Centralize and automate administration
- Use self-service and self-guided services
- Assemble and deliver learning content rapidly
- Consolidate training initiatives on a scalable web-based platform
- Support portability and standards
- Personalize content and enable knowledge reuse

This study is limited to the four largest LMS market share holders; Blackboard, Desire2Learn, Moodle, and Sakai. Two LWS products, Moodle and Sakai are available under the OSS model. Although, there is no cost for these OSS product licenses, the Total Cost of Ownership receives considerable discussion in literature. It is important that mission critical LMS applications be maintained, supported and operated properly to derive any benefit to the institution. Learning Management Systems are also known as Course Management Systems, in this paper both are collectively referred to as Learning Management Systems.

Theoretical Framework

The theoretical framework of this study is based in the context of Roger's innovation diffusion model and more precisely the five stages in the innovation-decision process (Rogers, 2003). The first three sequential stages in the process of innovation-decision are presented by Roger's as *knowledge*, *persuasion*, and *decision*. The resulting two stages are *implementation*, and *confirmation*. These stages are a major primary concern in this study since institutions are re-evaluating the current LMS and forming evaluation committees to investigate alternatives. Therefore, the focus is primarily looking into the re-invention of earlier implementations. Re-invention takes place after the decision process. It is a variation of the implementation phase as shown in figure 1.

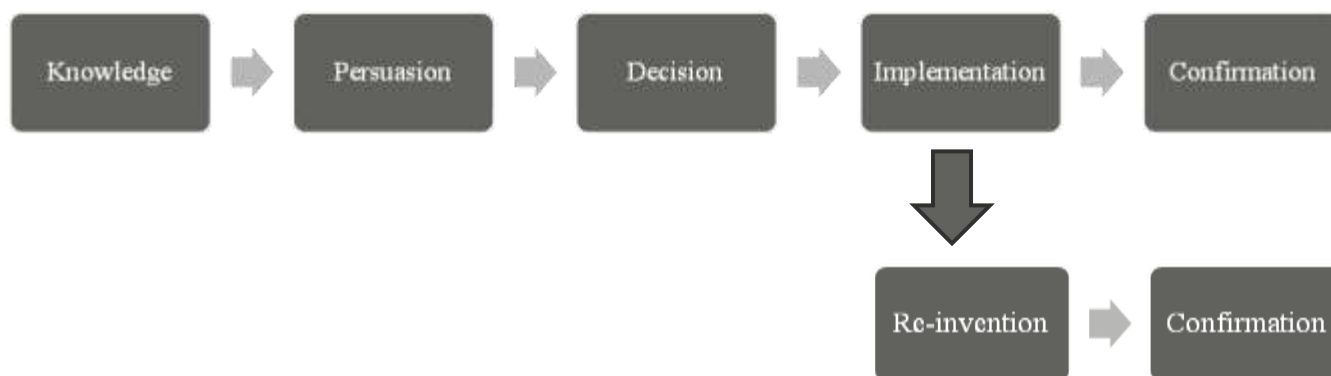


Figure 1. The innovation-decision process adapted from Rogers (2003, p.170)

Rogers describes the innovation-decision process as a process going from right to left in five stages as shown on the top of figure 2. The stages are summarized as follows (ibid., p. 169):

1. Knowledge - exposure to the innovation and understanding of how it functions
2. Persuasion - forming an attitude towards the innovation
3. Decision - adoption or rejection of the innovation
4. Implementation - using the innovation
5. Confirmation - reinforcement after making the innovation-decision

Roger's states that re-invention is the degree to which an innovation is changed by the end-user to suite a particular purpose (ibid, p. 180). Furthermore, he affirms that re-invention is more likely to occur when the technology is employed as a tool as with computer and internet applications. Roger's warns that researchers were concerned that re-invention has the potential to distort their findings since it may be difficult to separate and categorize adopter groups. Being generally positive about re-invention, Roger's explained support by providing the following rationale for re-invention (ibid, p.185):

Re-invention can be beneficial to adopters of an innovation. Flexibility in the process of adopting an innovation may reduce mistakes and encourage customization of the innovation to fit it more appropriately to local and/or changing conditions. As a result of re-invention, an innovation may be more appropriate in matching an adopter's preexisting problems and more responsive to new problems...

Method of Study

The most comprehensive information was found in highly available annual survey reports and presentations. A literature review was conducted to understand the LMS market and the opinions of leaders in the LMS field.

The founding director of The Campus Computing Project, Casey Green, has surveyed many institutions for the last several years. His insights into the diffusion of the both proprietary and Open Source LMS innovation are discussed and future trends examined. Figure 2 shows the percentage of LMS courses offered in public and private universities and colleges from 2000 to 2010. The bar chart shows the progressive growth of courses offering LMS in both public and private institutions of higher learning.

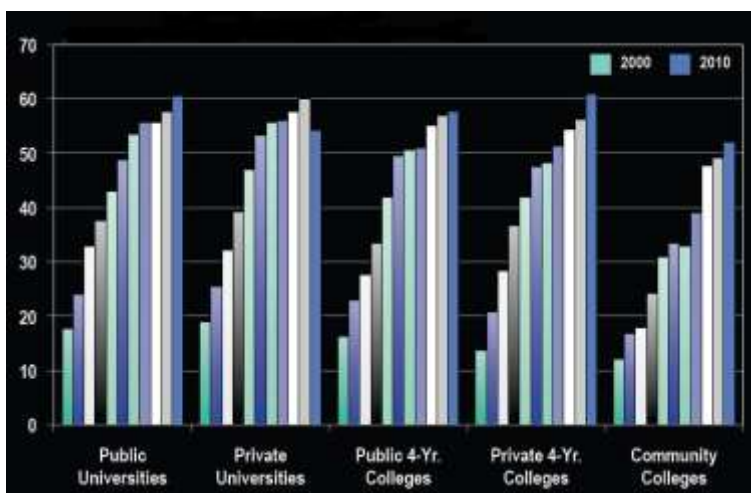


Figure 2. Percentage of courses using LMS from 2000-2010, adapted from Green (2010)

Research revealed that the four largest LMS market share holders are Blackboard, Moodle, Desire2Learn, and Sakai. Blackboard and Desire2Learn are proprietary software. Moodle and Sakai are open source software projects. Figure 3 shows the percentage of LMS market share each vendor holds as recent as fall of 2010.

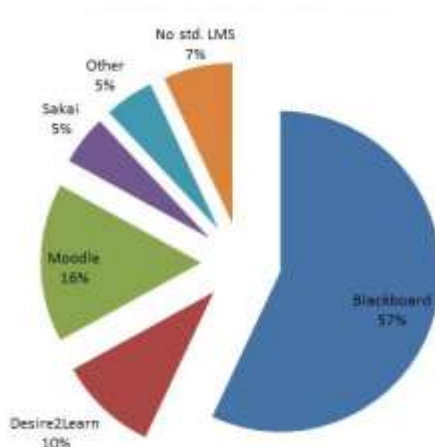


Figure 3. Market Share by Percentage, adapted from Green (2010)

Web sites for both Moodle and Blackboard contain product information and present marketing messages to prospective adopters. As expected from a commercial product, Blackboard's web site is more formal and is seeking sales leads from site visitors. Moodle is an acronym for Modular Object Oriented Dynamic Learning Environment. Its site is less formal and promoted communications between users of Moodle through the use of local MoodleMoot conferences in 80 languages.

A comparison paper describing both Blackboard and Moodle was discovered during the literature review (Momani, 2010). It provides a comprehensive and concise evaluation of the two LMS offerings. The following are Momani's descriptions of Moodle and Blackboard presented in the paper (ibid., 2010, p. 1-2):

Blackboard

Blackboard Inc., based in Washington, D.C. (USA) is the creator of a wide variety of software products and services for education programs. Blackboard Learning System is a course management system (CMS) allowing instructors to create or upload teaching and assessing material (e.g. lessons, discussions and assignments) and determines when students can access it. As a consequence to Blackboard's widespread use, pre-packaged course materials are provided by all major education publishers. Furthermore the system supports external content respecting the SCORM standard. Students can follow the lessons on-line, interact with the teachers, and with each other in different ways and access repositories of documents...

Moodle

Moodle is an open source community launched in 2001 that has grown out of a PhD research project by Martin Dougiamas. Version 1.0 was released on August 20, 2002... Moodle is perceived as high value in the education community, particularly higher education and further education... Moodle is one of the most user-friendly and flexible open source courseware products available. It has excellent documentation, strong support for security and administration, and is evolving towards Instructional Management Systems/ Shareable Content Object Reference Model (IMS/SCORM) standards...

Following are short descriptions about Desire2Learn and Sakai LMS products that hold third and fourth place in market share respectively. They both have been gaining market share and adoption.

Desire2Learn

Desire2Learn, Inc., based in Ontario, Canada, was founded in 1999 as a provider of enterprise eLearning solutions that enable institutions and other organizations to create teaching and learning environments that reflect their vision, values, goals, pedagogical approaches and branding (Desire2Learn.com).

Sakai

Sakai is an open source community that supports academic institutions, commercial organizations and individuals. Sakai refers to the LMS as a Collaboration and Learning Environment (CLE). Sakai is designed to be scalable, reliable, interoperable and extensible. Sakai was first released in March 2005 and originally funded by a grant from the Mellon Foundation (sakaiproject.org).

Open Source Software

Open source software (OSS) is software that has attributes established by The Open Source Initiative (OSI, 2010). There are several licensing models, but the commonality is that the source code is available and the product can be freely used without royalty or other fee. According to the Open Source Initiative the provisions open source software must comply with in order to meet the criteria are the following (2010) :

- Free Redistribution
- Source Code (availability)
- Derived Works (a derived work must contain the same license as the original)
- Integrity of The Author's Source Code
- No Discrimination Against Persons or Groups
- No Discrimination Against Fields of Endeavor
- Distribution of License
- License Must Not Be Specific to a Product
- License Must Not Restrict Other Software
- License Must Be Technology-Neutral

Some examples of OSS used extensively by educational institutions are Linux, OpenOffice, Firefox, Apache, and Shibboleth. These applications range from complete operating systems to security protection. For instance, OpenOffice is a full featured office productivity software replacement for Microsoft Office and has made substantial inroads into the market (Ghosh, 2006; Karjalainen, 2010). However, Microsoft has provided highly discounted student or educational licenses that counter the desire to embrace OpenOffice (<http://www.microsoft.com/student>). The Shibboleth System is an open source software package for web single sign-on authorization and access to computing resources (Shibboleth, 2010). According to the Apache Foundation, "The Apache HTTP Server Project is a collaborative software development effort aimed at creating a robust, commercial-grade, feature-full and freely-available source code implementation of an HTTP (Web) server." It is the most widely used web server in use today (Foster, 2010).

Participants and Data Sources

There are a total population of 4200, public, private and for profit degree granting universities offering on-line courses in the United States (IES, 2010). Participants identified in the survey represented about eight percent of the total population. Committee reports originating from educational institutions were used to provide study information. A 2006 MIT study on LMS presents examples of growth from 2001 to 2006 and stated a 414% increase in faculty participation and the number of students accessing Blackboard increased 136% (Landon, Henderson, & Poulin, 2006). These are tremendous increases in use; LMS is deeply imbedded as a tool for modern learning.

Data sources used include the Campus Computing Project's multi-year survey of over 523 respondents, using a web-based survey method. The survey period ran from September to October 2010 and 79% of the campuses responded in the previous year. It is apparent from figure 4 that Blackboard LMS is in decline based on survey results. The 2009 increase is explained by Blackboard acquiring a rival LMS system called WebCT.

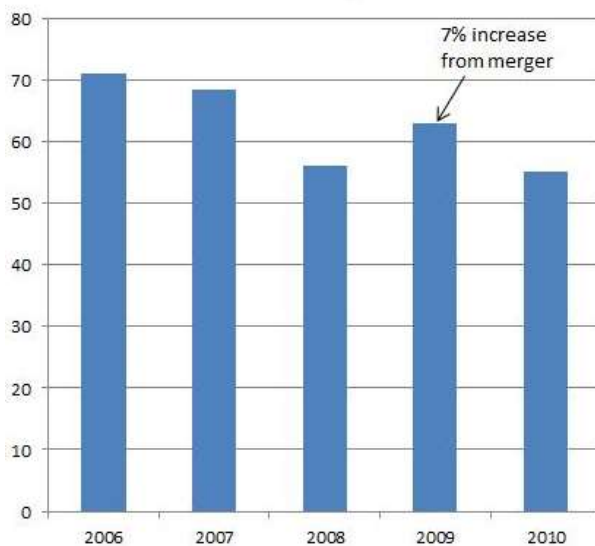


Figure 4. Percentage decline in Blackboard usage adapted from Green (2010)

During the 2010 EDUCAUSE Conference in Anaheim, CA, K.C. Green provided insight into the current LMS marketplace (EDUCAUSE, 2010). He noted that 86% of campuses use the same LMS for their online and on-campus courses. The most disruptive finding announced reveals that 47% are currently reviewing their LMS strategy and 27% report plans to replace their current LMS within two years. The data supports his conclusion that the LMS market place is in transition. Green maintains that quickly changing technology combined with high market demand results in a classic volatile market environment.

Green carries Ellis's point further by stating that students are equipped with knowledge about rich internet interaction, such as, video enable sites, social networking, and mobile applications. Students enter the institution with sophisticated knowledge of technology and its application. The user of LMS are "digital natives" that expect to interact with LMS using a number of sensory experiences for the purpose of learning and understanding.

Results

A 2006 report indicated the at there is significant interest in open source software products (Abel, 2006). He believes that the time for open source products in higher education will continue to be a serious threat to proprietary software applications. The following is an excerpt from the report:

Open source is gaining mindshare from four directions: spillover from commercial open source initiatives (such as Linux, Apache, OpenOffice), grant-funded open source initiatives in higher education specific application areas (course management, portal, financial systems, student portfolios), market-driven open source initiatives in higher education specific application areas (course management), and open source compatible higher education specific applications (course management, portal).

Five year later, we see that Abel's prediction were correct as shown in figure 5. This is corroborated with evidence that Green's work presented in The Campus Computing Project survey results. The S-shaped diffusion curve introduced by Rogers (2003, p. 113) demonstrates the adoption of Moodle's LMS as we look back from 2003 data to the present.

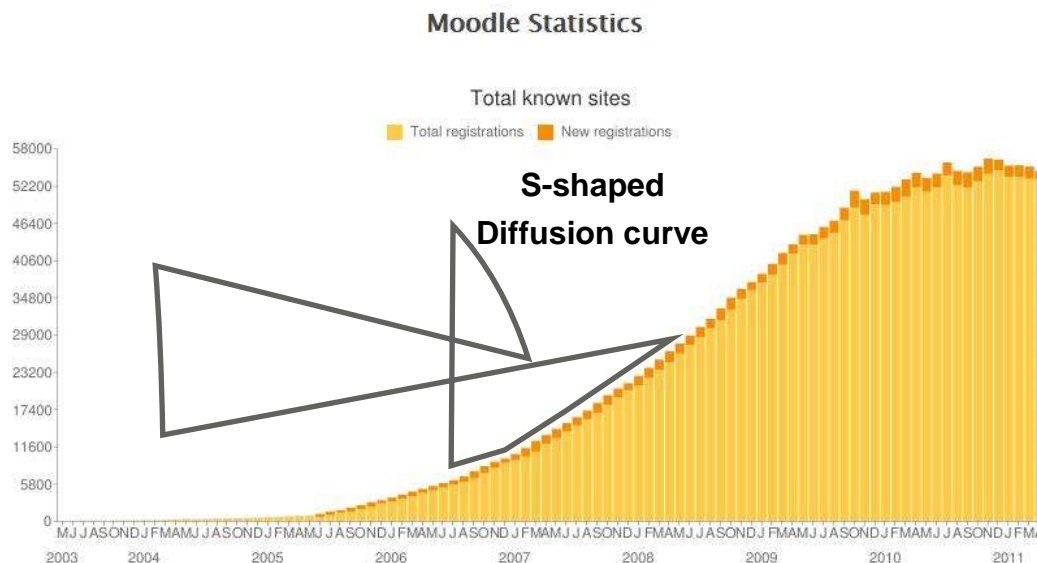


Figure 5. Moodle statistics adapted from Moodle.org (2010)

Lack of Barriers

One reason open source may be a good choice in combatting the barriers is due to successful infrastructure projects currently used at institutions. Two-thirds of CIOs have considered or are actively considering open source with a leading edge of about 25% of all institutions actively engaged in implementing higher education specific open source applications of some type (Carey & Gleason, 2006). As we have seen, the adoption of LMS is quite large and e-Learning initiatives are used commonly in academia. In the past, the three greatest challenges in implementing the e-Learning initiatives were (Abel, 2006):

- Technology learning curve for faculty
- Developing content of quality and variety
- Engaging enough faculty

Helping faculty learn e-Learning technology is further supported by open source's traditionally low initial cost, trailability, and community support. In an article on the impact of open source on learning, the authors present the advantages that weight in favor of open source solutions (Lakhan & Jhunjhunwala, 2008).

- No License fee – open source licenses are free
- Flexibility – open source software is highly customizable
- Service continuity – community network of supporter and invested users
- Continuous improvement – software is being improved by a community of users for all to benefit

In a LMS survey of the 20 instructors at The University of North Carolina, Chapel Hill, 17 expressed a preference for Sakai over Blackboard (C. Green, 2009). Consequently, after in-depth evaluation a trial of Sakai was deemed desirable and initiated during the 2008-2009 academic year. Calvin College is a very early innovator being one of Blackboard's first 40 customers in 1999. In an open letter to faculty, the LMS evaluation committee recommended replacing Blackboard by a "less expensive open source alternative. (Jeltema, 2009) "

Conclusion

Responses to the questions posed at the beginning of this paper are presented along with summary explanations of the research data.

1. Will open source software LMS alternatives become a campus standard in educational institutions through diffusion of the open source LMS products and re-invention of earlier LMS innovations?

Open source LMS are becoming commonplace and with increased budgetary pressure and open communication channels common in academia the continued adoption of LMS open source alternatives appears very positive. Data presented suggests that there is movement away from Blackboard and open source Moodle is gaining adoption with the late majority.

As of April, 2011, Bloomberg BusinessWeek reported the following update on a potential Blackboard buyout (MacMillan, 2011, p. 1), “Blackboard Inc. (BBBB), a maker of online educational courseware, said it hired Barclays Capital as its financial adviser after receiving unsolicited buyout offers. The shares surged 29 percent, the biggest gain since June 2004. The sources of the buyout offers weren’t disclosed. Blackboard is evaluating the bids as well as interest from other potential acquirers, the company said in a statement.” There is further speculation in the marketplace the Google or Microsoft may be interested in purchasing Blackboard as an entrance into the volatile LMS market. Interestingly, Bboogle (pronounced ba-boogle) is a project intended to integrate Google applications into Blackboard’s LMS (Northwestern, 2010). It aims at leveraging the collaboration features of the Google Docs platform by integrating them in Blackboard.

2. What is the motivation to remain with the current LMS or change to another product?

The three most compelling reason to remain or change is cost, user satisfaction, and Information Technology (IT) Department previous experience with other open source initiatives. License contract renewal is a major motivator to explore options. In the case of WebCT, a Blackboard acquired LMS product that support is scheduled to expire, both cost and user satisfaction are being reviewed by university committees. Sentiment is best summarized in a University of Charlotte evaluation committee report, “The conclusion of the Committee is that Moodle offers a number of potential benefits, particularly with respect to adaptability, ease of learning and use, and relevance to UNC Charlotte’s current and projected instructional mission. (Croy, Smelser, & McAlpin, 2008)”

The absence of licensing fees permits redirecting resources for new technology experimentation and training. Migration cost to open source systems can be mitigated through the use of conversion tools that are freely available within the community. These allow older courseware to be moved from Blackboard to other LMS products without large manual effort.

Many students working in Information Technology download OSS and become experts in open source infrastructure products like Linux or Java. Their success at building useful applications is contagious. It leads to building more robust applications than those commercially available as people give feature rich applications back to the community.

3. How will campus LMS strategy be linked to new LMS applications to enhance instructional resources and campus services since research indicates they are in the early stages of campus deployment?

There is little doubt that the LMS used by students in the future will be quite different than current systems. The changing nature of computing today is exemplified by explosive use of social networks, automatic location notification through cell phone locators, and rich content delivery systems. Dougiamas believes that the systems will move to be more student centric with a more collaborative approach to e-Learning. He mentioned in a video interview that institutions procure these system and not students (Feldstein, 2010). As student demand more input into the features and functionality of LMS as e-Learning itself grows in market share, there will be a more collaborative approach to how LMS function and its role in the institution.

Embracing an open computing approach using open source software is practical for institutions in the business of learning when faced with higher costs. In order to be competitive, institutions must be committed to the adoption of new technology innovations and re-invention. Looking beyond the application used today and the current operating models; higher education institutions must commit to working on a collaborative environment. This will link the administration, faculty and students together in cohesive learning environment that is sure to change as future technology is adapted for educational usage. LMS product decisions made today set a direction that will have significant impact on future interoperability thus becoming more attractive to members of the LMS user community for decades.

References

- Abel, R. J. (2006). Best Practices in Open Source in Higher Education *The State of Open Source Software* (pp. 37). Lake Mary, FL: The Alliance for Higher Education Competitiveness, Inc.
- Carey, P., & Gleason, B. (2006). Vision 2010: The Future of Higher Education Business and Learning Applications. *Innovate*, 3(1), 6.
- Croy, M., Smelser, R., & McAlpin, V. (2008). Report of the Learning Management System Evaluation Committee (pp. 4). Charlotte, NC: University of Charlotte.
- Dougiamas, M. (1999, February). *Developing tools to foster online educational dialogue: Teaching in the Disciplines/ Learning in Context*. Paper presented at the Proceedings of the 8th Annual Teaching Learning Forum, Perth, Australia.
- EDUCAUSE (Producer). (2010, June 6). The 2010 Campus Computing Survey: Two Decades of Data, Information, and Insight About IT Planning and Policy Issues. Retrieved from <http://www.educause.edu/E2010/Program/SESS041>
- Ellis, R. K. (2009). Field Guide to Learning Management Systems. 1-7. Retrieved from http://www.astd.org/NR/rdonlyres/12ECDB99-3B91-403E-9B15-7E597444645D/23395/LMS_fieldguide_20091.pdf
- Feldstein, M. (Producer). (2010, June 6, 2010). Interview with Martin Dougiamas. [video] Retrieved from <http://vimeo.com/15933942>
- Foster, M. (2010, December 1). Web Server Survey Retrieved June 1, 2010, from <http://news.netcraft.com/archives/category/web-server-survey/>
- Ghosh, R. (2006). Study on the Economic impact of open source software on innovation and the competitiveness of the Information and Communication Technologies (ICT) sector in the EU. Retrieved from <http://www.flossimpact.eu>
- Green, C. (2009). Sakai Pilot Evaluation Final Report (pp. 74). Chapel Hill, NC: University of North Carolina at Chapel Hill.
- Green, K. (2010). *Campus Computer Survey*. Paper presented at the EDUCAUSE, Pittsburg, PA.
- IES. (2010). Institute of Education Sciences. from U.S. Department of Education <http://nces.ed.gov/fastfacts/display.asp?id=80>
- Jeltema, M. (2009). Blackboard replacement - an open letter to faculty Retrieved June 1, 2010, from <http://www.calvin.edu/it/academic/hoot/comments/blackboard-replacement-an-open-letter-to-faculty/>
- Karjalainen, M. (2010). *Large-scale migration to an open source office suite: An innovation adoption study in Finland*. University of Tampere, Tampere, Finland. Retrieved from <http://acta.uta.fi/english/teos.php?id=11357> (ISBN 978-951-44-8216-8)
- Lakhan, S. e., & Jhunhunwala, K. (2008). Open Source Software in Education. *EDUCAUSE QUARTERLY*, 2, 33-40.
- MacMillan, D. (2011). Blackboard Hires Barclays to Evaluate Offers; Shares Surge Retrieved June 6, 2011, from <http://www.businessweek.com/news/2011-04-19/blackboard-hires-barclays-to-evaluate-offers-shares-surge.html>
- Momani, A. (2010). Comparison between Two Learning Management Systems: Moodle and Blackboard. Hail, Saudi Arabia: Department of Computer Science, University of Hail.
- Moodle. (2010). Moodle Retrieved May 30, 2010, from www.moodle.org
- Northwestern. (2010). Bboogle Retrieved June 10, 2010, from <http://projects.oscelot.org/gf/project/bboogle/>
- OSI. (2010). Open Source Initiative Retrieved June 5, 2010, from <http://www.opensource.org/>
- Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York ; London: Free Press.
- Shibboleth. (2010). A Project of the Internet2 Middleware Initiative Retrieved June 1, 2010, from <http://shibboleth.internet2.edu>

