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Standardization of Learning Management Systems

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SIGNATURE PAGE

This research paper was prepared by Deborah J.B. Richard under the direction of Dr. John M. Ritz in the OTED 636, Problems in Occupational and Technical Studies. It was submitted to the graduate program director as partial fulfillment for the requirements for the Master of Science degree.

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Again, THANK YOU.

Deborah J.B. Richard

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CHAPTER I

INTRODUCTION

There are numerous organizations world-wide that are dedicated to promoting standardization for the e-learning community, but the standards endorsed by these organizations vary and often do not allow different training courses to co-exist on a single Learning Management System (LMS). The problem is that not only do different disciplines follow different standards, which cause difficulties for organizations attempting to implement a LMS with courses that cross discipline boundaries, but courses from different vendors that follow the same standard are not necessarily compatible (Barr, 2009). For example, organizations that support the U.S. military are required by the Department of Defense (DoD) to follow the Sharable Content Object Reference Model (SCORM) standards, while the medical field follows American National Standards Institute (ANSI) standards. This is an example where two different disciplines could benefit. DoD trains medical personnel and if one standard were to be followed the same training could be used by both the private sector and the government.

Since the e-learning community has not yet evolved to the level of Hyper-Text Markup Language (HTML) used by the Internet for LMSs, organizations have compatibility issues when purchasing e-learning courses. However, Internet alternatives such as Moodle and Cloudcourse (by Google) are available to all educators. It is imperative that all developers use one standard to allow a cohesive e-learning environment.

The specific standards that will be evaluated are Shareable Content Object Reference Model (SCORM), Aviation Industry CBT (Computer-Based Training) Committee (AICC), and Extensible Markup Language (IMS) compliance standards. Although SCORM is more a reference model and not a standard itself, it does strive to integrate "specifications into a cohesive, usable, holistic model" (The MASIE Center, 2002, p. 1) to define interoperability between the standards.

The approach used for this descriptive case study was to investigate the various approaches for providing standards of e-learning courses in each organization and evaluate technological developments and user requirements to promote interoperability of LMSs.

Statement of Problem

The study problem was to determine if Shareable Content Object Reference Model, the Aviation Industry CBT (Computer-Based Training) Committee, and Extensible Markup Language standards are compatible as they pertain to the effective and productive use of a Learning Management System for e-learning courses among systems. For a Learning Management System to be beneficial and effective for any organization and users, the implementation must be seamless to both organizations and users. This means that organizations must be able to host all training courses they determine are beneficial to the organization regardless of the course developer or standard implementation. It is vital that all e-learning courses and standards learn to work as well together as the Internet and provide positive learning experiences for users.

Research Goals

The goals of this descriptive case study and a description for each are as follows.

1. Evaluate the Shareable Content Object Reference Model, Aviation Industry CBT (Computer-Based Training) Committee, and Extensible Markup Language standards. The e-learning business needs to recognize the need for commonality among standards. Different Learning Management Systems support different standards and organizations need to specifically ask the vendor if a course will function on their system.
2. Evaluate how these standards can be portable among Learning Management Systems. Establishing how standards are implemented to promote portability is an important factor because vendors implement standards slightly differently and a course that is produced as compliant for one standard might not work on the same standard system. Examples of working systems are the Internet and DVD movies. The Internet uses Hypertext Transfer Protocol and Hyper-Text Markup Language to be universally compatible. Connecting to the Internet is independent of the operating system and there are multiple software programs to perform web browsing. For example, both Netscape Navigator and Opera browsers work on Microsoft, Macintosh, and Unix/Linux operating systems. The second example is a DVD movie that

shows the same movie regardless if it is a Sony or Toshiba player. The e-learning organizations claim to support portability among systems; however, when implementation time occurs, the systems do not necessarily work together. Developers need to know the specifications of standards in order to provide workable solutions. The workable solution may be the elimination and combination of separate standards in order to fully achieve one Internet-like solution.

Background and Significance

While there is no lack of information available on e-learning standards, there is a lack of information sharing between the different standards organizations. Standards organizations such as the International Federation for Learning-Education-Training Systems Interoperability (LETSI), IMS Global Learning Consortium (IMS GLC), and the American National Standards Institute (ANSI) all hold regularly scheduled conferences and seminars that are attended by their individual memberships. There is a lack of information and gaps in knowledge because of the deficiency in communication even between departments in user organizations. For example, two different departments at the University of Michigan belong to different standards organizations – one to a medical standards organization, MedBiquitous (MedBiquitous website, 2010), and the other to the Masie Consortium with member organizations from all disciplines (Learning, 2010).

Organizations experience much higher costs over time when changing systems or attempting to simultaneously implement products from several vendors (Barr, 2009). The problem with e-learning today is that LMSs do not work together which causes "higher risk, slower growth and barriers to innovation" (Barr, 2009, p. 1). For example, a management training game that would have worldwide appeal is only plausible for a handful of customers with compatible systems so investing a lot of money into the product does not make good business sense (Barr, 2009). If all LMSs had a HTML-like standard there could be independent, international, and cross-discipline distribution of e-learning. Additionally, Barr (2009) pointed out that vendor lock-in would be eliminated with standards because one LMS, or individual e-learning courses, could be replaced with another without the cost or time investment of translating all courses from one system to another.

Everson (2009) countered Barr's assessment. Part of Everson's agreement with Barr is that the e-learning community is "without standards – both technical (i.e., interoperability) standards and learning standards to guide investments" (Everson, 2009, p. 1). However, Everson argues that more emphasis needs to be placed on learning standards as does Mayo (Science, 2009). In order to move the e-learning community forward "instructional designers, curriculum developers, and tests developers" (Bush & Mott, 2009, p. 1) need to come together to include interoperability into e-learning.

The benefits of e-learning standards for LMS courses are significant because users, implementers, developers, and vendors would all benefit from

consistency. The main objective was to determine the commonality of the SCORM, AICC, and IMS standards to allow the same seamless use of LMSs as the Internet enjoys today.

Limitations

The methodological boundaries for this descriptive case study were the inclusion of only three organizations (LETSI, IMS, and ANSI) and only the SCORM, AICC, and IMS standards. Other standards organizations follow SCORM, AICC, or IMS standards as well with the only difference being their membership base. The conceptual methodology is to evaluate the standards that each organization implements and maintains to find similarities for common ground and compromises.

Assumptions

The ADL Newsletter (2009) pointed out that the e-learning industry will not fall into complete compliance when it comes to implementation of standards in the next several years. Based on that statement, the assumptions for this study are: (1) an evaluation of standards will reveal the only way courses and systems will work together is if an e-learning course is developed using the lowest possible standards requirements, which does not produce an effective or attractive training course; and (2) development and implementation of these standards is limited to the organization a developer belongs to or follows which maintains (and retards) the current level of portability among LMSs (ADL Newsletter, 2009).

Procedure

The process for this study was to evaluate the standards for providing technological e-learning courses, and collecting survey data regarding the interoperability of LMSs in use. This was accomplished by locating LMSs that are available that meet SCORM, AICC, and IMS standards. This was followed by collecting and summarizing the survey data to establish usability among standards. Once consistency can be determined between standards it may be possible to propose an effective communication scheme that will benefit not only developers, users, and implementers, but the vendors themselves to promote transition of the e-learning industry to the current success of the Internet.

Definitions of Terms

The terms used for this descriptive case study are identified as follows.

ADL – Advanced Distributed Learning – Develops and implements learning technologies within the United States' federal government and Department of Defense. International specifications and standards for designing e-learning content are promoted through government, industry, and academia (ADL, 2010).

AICC – Aviation Industry CBT Committee – International association of technology-based training professionals that develop guidelines in support of the aviation industry for delivery of Computer-Based Training (CBT) (AICC, 2008, 2010).

ANSI – American National Standards Institute – Founded in October 1918, ANSI "oversees the creation, promulgation and use of thousands of norms and

guidelines that directly impact businesses in nearly every sector" and accredits "programs that assess conformance to standards" (ANSI, 2009, p. 1).

CBT – Computer-Based Training – Training and instruction that uses a computer as the main medium for instructional delivery. It is provided through the use of a computer that guides the learner through the course (PCMag, 2010).

HTML – Hyper-Text Markup Language – Coding language used to create web pages for the Internet that can be viewed using a browser like Internet Explorer or Navigator. It is the "publishing language of the World Wide Web" (W3C, 2009, p. 1).

HTTP – Hypertext Transfer Protocol – Internet protocol to transfer web page files (W3C, 2009).

IMS – Extensible Markup Language (XML) – Developed by the World Wide Web Consortium (W3C) for web pages that allow designers to create and define their own tags making markup symbols unlimited (W3C, 2009).

IMS GLC – IMS Global Learning Consortium – "IMS GLC is a non-profit collaboration among the world's leading educational technology suppliers, content providers, educational institutions, school districts, and government organizations dedicated to improving education and learning through the strategic application of technology" (IMS, 2010, p. 1).

LETSI – Learning, Education, Training Systems Interoperability – An international federation (that includes K-12, higher education, and corporate job

training) that focuses on the interoperability of standards for Learning Management Systems (LMS). "LETSI is a non-profit consortium of e-learning adopters and associations, standards bodies, systems integrators, policy makers, and educational product and services vendors" (LETSI, 2009, p. 1).

LMS – Learning Management System – A software application that automates the management, tracking, and reporting of student progress for e-learning courses. LMSs also handle student registration and deliver training over the Internet (Ellis, 2009).

Moodle – Modular Object-Oriented Dynamic Learning Environment. Free course management system for educators to house online courses. Open source that is free for teachers, universities, schools, industry, and government (Moodle, 2005).

SCORM – Shareable Content Object Reference Model – Technical standards for e-learning software products that dictate how programmers write code so that it will be compatible with other e-learning software. "SCORM governs how online learning content and Learning Management Systems (LMSs) communicate with each other" (Rustici Software, 2009, p. 1). SCORM is only a technical standard and does not address instructional design or pedagogical concerns (Rustici Software, 2009).

W3C – World Wide Web Consortium – An international community that works with organizations and the public to develop web standards (W3C, 2009).

Summary and Overview

Not only do different disciplines follow different standards for LMS course development, but courses from different vendors that follow the same standard may not work on a compliant LMS. Wide-spread Internet use has been developing since the 1970s but the e-learning field is still evolving. Organizations like LETSI, IMS GCL, and ANSI have only been developing compliance standards for e-learning since the mid-1990s. Developers need to use one standard to allow a cohesive e-learning environment for the industry to evolve to the current level of the Internet.

This chapter discussed the problem statement and research goals in addition to the background and significance of LMSs. This was followed by the limitations, assumptions, and procedures that were used in the research. The chapter concluded with a list of terms to be used throughout this paper.

Chapter II is a Review of Literature. Because the LMS and e-learning fields are relatively new and still rapidly changing and evolving, there are still problems with content interoperability and the literature to support uniformity. Standard organization goals as well as the SCORM, AICC, and IMS standards included in this research are presented. This is followed by a discussion of the interoperability of LMSs and software evaluation questionnaires found on the internet to provide LMS solutions.

Chapter III provides the Methods and Procedures to determine if a recommended solution that was SCORM, AICC, and IMS compliant was available. There are an increasing number of choices for companies to have an

effective and productive LMS that is both standard compliant and web-based. This chapter covers the population demographics, design of the survey instrument, methods of data collection used, and concludes with the procedures used for statistical analysis.

Chapter IV presents a summary of the findings and the response rate of the survey questionnaire used. The survey included Likert-scale questions in addition to providing an opportunity for respondents to add comments.

Chapter V presents a summary of the research and conclusions the researcher made based on the research goals. The chapter concludes with recommendations to provide standardization of LMSs and areas for further research.

CHAPTER II

LITERATURE REVIEW

The literature review for this descriptive case study was a discussion of the of the standard organizations' goals followed by a description of Shareable Content Object Reference Model (SCORM), Aviation Industry CBT (Computer-Based Training) Committee (AICC), and Extensible Markup Language (IMS) standards to promote the interoperability of Learning Management Systems (LMS). The descriptions are followed by three software evaluations to compare the options available based on SCORM, AICC, and IMS compliance criteria. Two evaluations, one from Technology Evaluation and one from Capterra, both recommend a LMS based on the information provided. Joomla LMS is a web-based LMS that supports the three standards being reviewed.

The standard organizations recognize there is a wide variety of users of LMSs from different communities, with "different technological and pedagogical requirements" (LETSI, 2008, p. 1), but they all need learning material that operates across systems. ADL continues the SCORM 2004 development for interoperability between systems "that represent pedagogical, technical, and business models different from those supported by [Learning, Education and Training] LET standards today, including SCORM" (SCORM 2.0 Project, 2010, p. 1) that need to be supported. The need to have a LMS to manage content and deliver training should no longer be necessary with web-based software that is available today. The innovative e-learning that is required today will not be

portable across LMSs because only the simplest courses can be portable, which strengthens the argument for Internet-like implementation (Barr, 2010).

The LMS and e-learning fields are relatively new (wide spread use starting in the early 1990's) and still rapidly changing and evolving, as such there are still problems with content interoperability. Because of the field's newness, current standards are still based on 20-year-old pedagogy and student experiences that were developed based on the client-server era prior to computer networks. The need of having a LMS to manage content, deliver training, and track course completion is no longer necessary with web-based software that is available today (Barr, 2010). The innovative e-learning that is required today will not be portable across LMSs because only the simplest courses can be portable (Barr, 2010).

Standards Organization Goals

Standards in general make products work together, like light bulbs that fit into lamps and files being transferred over the Internet. Some organizations are concerned with activities that help their organization like the American Society of Mechanical Engineers (ASME), and others like the Institute for Electrical and Electronics Engineers (IEEE) that "develop technical standards that cut across many industries" (StandardsLearn, 2009, p. 2). The standards organizations included here for e-learning are the International Federation for Learning-Education-Training Systems Interoperability (LETSI), IMS Global Learning Consortium (IMS GLC), and the American National Standards Institute (ANSI),

which deal with a particular industry and “focus on developing standards for products used by their industries (StandardsLearn, 2009, p. 2).

LETSI has five working groups, one of which is the Architecture Working Group (AWG) that “oversees the development and maintenance of a uniform architecture for LETSI development efforts” (LETSI, 2010, p. 1). The AWG is working from the following assumptions for the development of SCORM 2.0: (1) Learning, Education and Training (LET) practices have evolved beyond the current deployment and delivery environments; (2) communication protocols and models need to support Institute of Electrical and Electronics Engineers (IEEE) communication protocols; (3) development needs to be more modular and architecturally adaptable; (4) the new framework needs to utilize and adapt existing, mature services, protocols, data models, standards, and specifications; (5) the current LMS providers will not be faced with technical barriers or other system providers; (6) consumers will be able to mix and match tools from various providers; and (7) the architecture needs to support dynamic provisioning, late binding, or at-runtime content or service delivery (LETSI Architecture Working Group, 2010).

The second organization is IMS GLC which “is a non-profit collaboration among the world's leading educational technology suppliers, content providers, educational institutions, school districts, and government organizations dedicated to improving education and learning through the strategic application of technology” (IMS, 2010, p. 1). Their “mission is to enable and lead a new

generation of learning and a new era of learning impact through the development and adoption of innovative technologies" (IMS, 2010, p. 1).

The final organization is ANSI who "facilitates the development of American National Standards by accrediting the procedures of standards developing organizations…Accreditation by ANSI signifies that the procedures used by the standards body in connection with the development of American National Standards meet the Institute's essential requirements for openness, balance, consensus and due process" (ANSI website, 2010, p. 1).

SCORM, AICC, and IMS Standards

Software standards permit various computer applications to communicate and be integrated into system solutions. The goal of e-learning standards is to be able to reuse all content level, which includes smaller units in addition to entire courses (Horton & Horton, 2003). In order to reuse content, the development of e-learning standards should be durable, accessible, manageable, reusable, affordable, and interoperable (Kanendran, Savarimuthu, & Kumar, 2005).

Establishing if all SCORM, AICC, and IMS products work together and are reusable is difficult because there is a wide variety of users from different communities, with "different technological and pedagogical requirements" (LETSI, 2008, p. 1), but they all need learning material that operates across systems. The three standards included in this research are described below.

SCORM is a set of specifications that generate small, reusable e-learning objects and "should be perceived as a learning systems model, versus only a

content object reference model" (Clem, 2010, p. 4). "It is not a standard [per se] but a reference model for a suite of standards developed by other bodies" (Kanendran, Savarimuthu, & Kumar, 2005, p. 55). SCORM-compliant courseware is a result of the Defense Department's Advanced Distributed Learning (ADL) initiative that allows courseware components to be merged with other compliant components to provide training materials in a modular repository. SCORM combines the IEEE, AICC, and IMS specifications into one document for ease of implementation (Boggs, 2006) and is discussed below.

> The ADL Initiative created an international community to collaboratively develop a cost-effective distributed learning model that is consistent across national and organizational borders. To achieve this goal, ADL worked with the Institute of Electrical and Electronics Engineers (IEEE), the Aviation Industry CBT (Computer-based Training) Committee (AICC), the IMS Global Learning Consortium, Inc., and the Alliance of Remote Instructional Authoring & Distribution Networks for Europe (ARIADNE). These organizations develop guidelines and specifications that make learning software accessible, interoperable, durable, and reusable. Whenever possible ADL adopts, clarifies, harmonizes, synchronizes, and applies the documentation that these standards organizations develop. ADL promotes the application of standards with reference implementations and tools to assess compliance to the requirements (LETSI, 2009, p. 1).

Based on that foundation, new technologies that are evolving include the following:

- Immersive learning environments: simulations, games, virtual worlds
- Collaboration tools: wikis, chats, social networking
- Intelligent tutors and other software agents
- New forms of assessment
- Hosted Learning activities of all kinds available on the web (LETSI, 2009, p. 1).

The second standard is AICC. This standard pertains "to the development, delivery, and evaluation of training courses that are delivered via technology" (Boggs, 2006, p. 1), usually through a LMS. The AICC Computer-Managed Institution (CMI) current specification is similar to the ADL's SCORM approach that was initially developed in the 1990's with managed instruction, evaluation of learner performance, multiple content sources, internet delivery, interoperable content that should run on any LMS, and interoperable descriptions of learning activities with standardized fields and vocabularies (LETSI, 2009).

A course that states it is "AICC compliant" is vague because there are nine different guidelines and a developer can chose to comply with one or nine and still receive an "AICC compliant" rating. This means that interoperability between vendors is not guaranteed. The nine AICC guidelines and recommendations include: (1) CMI systems, (2) Computer-Based Training (CBT) courseware, (3) courseware delivery stations, (4) digital audio, (5) operating/

windowing system, (6) CBT peripheral devices, (7) courseware interchange, (8) digital video, and (9) icon standards – user interface.

The final standard is IMS. This learning information services concept is based on interoperability, service-orientation, component base, behaviors and data models, and multiple bindings to enhance LMS exchange by defining interoperability through person, group, membership, course, or outcome management (IMS, 2010). IMS describes a course's structure (metadata and content packaging) but it does not address browser-to-server communication. IMS standards outline the way software must be programmed (IMS, 2010). Specifications within IMS are produced for "locating and using e-learning content, tracking learner progress, reporting learner performance, and exchanging records between administrative systems such as LMSs" (Kanendran, Savarimuthu, & Kumar, 2005, p. 56).

Interoperability of LMSs

The two goals of a LMS are to "get the right content to the right person at the right time and to record the event" (Aldrich, 2005, p. 295). A LMS is similar to a course management system used in higher education (Blackboard) in that it provides different modes of learning, announces classes, and provides collaborative tools (Rothwell, Butler, Hunt, Li, Maldonado, Peters, & King-Stern, 2006). In 2005 the cost per user was between $12 and $50 and the yearly investment ranged from $20,000 to $1,000,000 (Aldrich, 2005). These costs vary based on subject matter, vendor, and level of student interactivity.

The biggest and most vital requirements of a LMS are the abilities to integrate it with the company's existing systems and to coordinate traditional learning events such as classroom time and conferences, in addition to content management, registration, tracking, and scheduling (Aldrich, 2005). These requirements prompt the need for SCORM, AICC, and IMS standards to work together seamlessly because the true test of innovation is viable and sustainable standards (DevLearn Conference, 2009). When a company invests in a SCORM compliant LMS and future needs require additional classes, the company should not lose a training course or have to purchase a new LMS because the course will not operate on their existing system.

Theoretically, vendors do not resist the idea of standardized interoperability specifications because this promotes integration within a company's existing system (ADL, 2010). "Vendors were pleased to have an organization like the ADL initiative. Vendors realized that an environment that enabled interoperable e-learning content, removed from the vagaries of hardware or software changes, would actually create a multitude of potential new business lines. ADL and SCORM vendors and implementers have proven that, regardless of the sector, content can be shared across organizational and functional lines" (ADL, 2010, p. 1).

Software Evaluations

Technology Evaluation Questionnaire

The evaluation procedure was to (1) define business needs and produce a solution list by answering questions regarding business needs and technology

requirements, (2) compare the solution list based on selected criteria from the answers, (3) analyze each solution based on its strengths and weaknesses related to business needs, and (4) present the results and get free reports.

TechnologyEvaluation's questionnaire began with "learning solution requirements". A sample of questions and responses are provided below.

- The type of a solution was a LMS with custom content authoring and publishing, and a suite solution with a combination of capabilities.
- The industries selected were defense, banking, education, health care, and higher education.
- The organizational structure selected was a division of a large corporation with an operating budget of less than $1 million and two-ten sites, with 51-100 users and a total budget of $25,000 to $75,000.
- The services to be provided were customization and integration as part of the implementation, training and support; yearly maintenance; and software provided as a service through a SaaS [Subscription or Leasing Agreement].
- Two to five concurrent administrators were chosen to ensure there was a backup administrator available.
- Licensing choices chosen were ASP, pay per use, and software lease.
- Vendors not located in the United States or Canada and vendors who could not provide English were also disqualified.
- Functional requirements selected included analytics, blended learning, certification tracking, content creation and management, virtual

classrooms, document and e-learning management, and instructor scheduling.

- The implementation period was within two to six months with a “completely custom system developed, product customization, implementation services, and outsourcing some application development and maintenance”.
- The research was performed for a new system, replacing a legacy system, integrating multiple systems, and replacing a current supplier for operational efficiency.
- Windows server was the operating system platform to be used along with Microsoft SQL server for the [Data Base Management System] (DBMS) platform.
- Standards compliance was needed for SCORM 2004 (version 1.3), AICC, IMS, and ADA Section 508.
- Technology requirements included HTTP, Microsoft BizTalk, Microsoft .NET platform, and web services for SOAP, UDDI, and WSDL.
- Legacy and third-party system integration requirements included access to database definitions and screen information, available APIs [Application Program Interface], corporate portal, native/embedded, and other LMS or LCMS platform.
- The prospective product needed to provide flexibility between functional modules between each area; the vendor is amenable to working with third-party tools and software; total portal access to the system; ‘rich client’ and

HTML web browser access to the Internet; sharing of system data, automatic processes, and workflow; the product can be outsourced via an [Internet Service Provider] (ISP); and the vendor is amenable to providing source code.

Capterra Questionnaire

The questionnaire required desired platform, number of users, software features, location, revenue, number of employees, and a budget estimate. The responses were as follows:

- The platform chosen was web-based.
- The number of users was 50 to 99.
- Software features included administrative reporting, AICC compliance, blended learning, course catalog, course interactivity, custom user interface, e-learning management, individual development plans, instructor scheduling, instructor-led classes, legacy system integration, multimedia environment, offline learning, online learning, SCORM compliance, and self-registration.
- The United States was the location picked.
- Annual revenue was below one million, and number of employees was 100 to 499.
- The budget estimate was left blank.

Joomla LMS

This LMS represents its own open source LMS that meets the SCORM, AICC, IMS, and other standards' requirements. Listed below are some of the features.

- General system features include a multi-language interface, user-friendly interfaces, Internet access, and centralized administration.
- Course features include category grouping, a student home page, import and export of courses, and the ability to create courses with templates.
- Subscriptions for courses can be paid online, with payment methods such as PayPal, or using a published subscription.
- Documents can be uploaded as a zip file for a content package, links can be created for any document, documents can be read and edited in a web browser, and files can be added from a shared document library.
- Other features offered include learning paths, quizzes, conferences, tracking, grade book, links, drop box, attendance, homework, help, forums, and chats.

Summary

Conformant applications using SCORM, AICC, and IMS Common Cartridge standards should work with other conformant applications to provide "consistent student experience across systems" (Barr, 2010, p. 2). When standards began to emerge in the late 1990s they were supposed to remove

learning content from a delivery application thereby creating “an independent content development industry, open[ing] the possibility of sharing development costs for broad-market materials, and accelerate eLearning adoption by reducing the risks of vendor lock-in” (Barr, 2010, p. 2).

This chapter covered the organization goals in addition to the SCORM, AICC, and IMS standards included in this research. This was followed by a discussion of the interoperability (or lack thereof) concerning LMSs and the general goals of a LMS. Software evaluations used from Technology Evaluation and Capterra were summarized in addition to the Joomla LMS web-based solution.

The following chapter presents the methods and procedures used to determine the population, design of the survey, data collection methods, and the statistical analysis used to determine the standardization of LMSs.

CHAPTER III

METHODS AND PROCEDURES

The major purpose of this descriptive case study was to determine if SCORM, AICC, and IMS standards are compatible as they relate to a useable LMS. This chapter explains the methods and procedures employed to gather data for this study. A description of the population is provided followed by the instrument design used to gather study data. This chapter also includes the data collection procedures and concludes with a synopsis of the statistical analysis used.

Population

The population for this descriptive case study initially included 16 end-users, developers, and standards organization representatives using a LMS. The responses were then analyzed to determine the satisfaction of the respondent's use of a LMS currently in use or proposed.

The individuals that composed the initial population included the following: three DoD employees, two DoD contractors, one DoD consultant, four individuals that work for a standards organization, five editors of e-learning publications, and one training company. However, after further research and discussions with several training professionals, it was determined that editors of e-learning publications were not appropriate candidates because they were not typically end-users or developers. Editors of e-learning publications are not using a LMS and only publish current technologies and trends being used in the industry. They were replaced with training association members.

The individuals that made up the revised population include the following: two standards organization employees, two government employees, two DoD consultants, four members of professional training associations, and six DoD contractors who are currently working with a LMS in some manner.

Instrument Design

A survey was used as the instrument for this descriptive case study to examine the compatibility of e-learning courses using a LMS. The questions polled the 16 users on their role, current standards used, planned standards implementation, interoperability issues, platform, and client base.

Question 1 inquired about the respondent's LMS responsibilities and Question 2 inquired about standards organization affiliations. Question 3 asked the participant to specify their current LMS and Question 4 inquired as to which standards were currently being used. Questions 5 through 8 and 12 through 20 used a five-point Likert-scale that required a response of strongly agree, agree, neutral, disagree, and strongly disagree in addition to providing space to add supplemental information or expand on the question. The points assigned to the Likert-style questions were one point for strongly disagree and five points for strongly agree.

Questions 4 through 8 were designed to determine the respondent's satisfaction with their current LMS. Questions 9 through 14 inquired about proposed LMS standards if the respondent's organization was considering changing from their current LMS. Questions 15, 16, and 17 were developed to determine if the respondent's organization purchased, developed in-house e-

learning courses, or was a vendor of e-learning. Question 18 asked about any difficulties of housing e-learning courses from different vendors. Satisfaction with the development and implementation of standards was the topic of Question 19. The final survey question, Question 20, inquired whether the respondent felt that all standards should work together. The survey is included as Appendix A.

Methods of Data Collection

The surveys to collect data regarding LMS compatibility were sent using email. The initial surveys were sent on June 10, 2010, along with the cover letter (included as Appendix B). The cover letter identified the purpose of the study, explained the protection procedures for the participants, endorsed the study, and provided notification of agency.

Additionally, the cover letter informed the respondents of their role in the study and their consent to use their responses in a abstract manner. Returning the completed survey indicated their desire to participate and share their experience and expertise. The respondents were given seven days to complete the survey. Data collection delays were followed up with an email, telephone call, or both to increase the response rate.

Statistical Analysis

Once the surveys were returned, descriptive statistics were used to categorize and tabulate the data collected. A frequency of answers was used to provide a summary of roles, standards usage, and interoperability issues. The mean was calculated for the Likert questions. The frequency and number of responses were calculated to determine what standards were being used, what

platforms were being used (and planned to be used), and what interoperability issues have been encountered. These findings were presented as percentages after the responses were calculated. Although there was space provided for additional comments, only one respondent supplied any additional information.

Summary

This chapter covered the population, instrument design, methods of data collection, and statistical analysis used to find a standardization of e-learning courses used for LMSs.

A survey was used for data collection after the population of users, developers, and implementers was identified from private industry and government. The survey used gave respondents the opportunity to provide comments in addition to rating their satisfaction with current standard usage and implementation. The statistical techniques employed to interpret the data were covered.

Chapter IV presents the response rate and findings of the research survey. Survey questions represented with a Likert-scale are discussed with percentages. Although space was provided for open-form comments, only one respondent took advantage to clarify responses, which are provided with the appropriate question.

CHAPTER IV

FINDINGS

The purpose of this study was to determine if SCORM, AICC, and IMS standards can co-exist on a LMS. This chapter analyzed the data collected from the Standardization of Learning Management Systems survey, which was designed to gather respondent opinions regarding LMS interoperability. The specific topics included the response rate and report findings from the survey in addition to the findings from an Internet search for a LMS solution that was SCORM, AICC, and IMS compliant. Tables using a Likert-scale were used for survey Questions 5 through 8 and 12 through 20 are included to summarize survey question responses. The scale ranged from Strongly Agree (SA) as five points, Agree (A), Neutral (N), Disagree (D), and Strongly Disagree (SD) worth one point.

Response Rate

The Standardization of Learning Management Systems survey was initially emailed to 16 respondents on June 10, 2010. Because of the low response rate, follow-up email and telephone calls were performed June 25-27, 2010. Two of the respondents were not able to participate – one because they were working on their own survey and one because the government agency the respondent works with was in the midst of making a decision between in-house development versus an on-line solution like Moodle. This situation forced the researcher to find similar participants in addition to modifying the population to exclude training publication editors (who are not typically users of LMSs) and add

training association members during the period July 12-28, 2010. The response rate is shown in Table 1.

Table 1

Response rate

Number Sent	Number Collected	Total Response Rate
16	14	87.5%

Report Findings

Survey Demographics

The revised population included the following: two standards organization employees, two government employees, two DoD consultants, four members of professional training associations, and six DoD contractors. The purpose of Question 1 was to identify the roles and responsibilities of the respondents. These roles are summarized as:

- Course/content development – 2
- Monitor e-learning products – 1
- Courseware manager – 3
- Verification of course content – 2
- Technical analysis – 1
- Learning product configuration – 1
- Training Director/upper management – 4

Question 2 identified the respondent's standards organization affiliation. LETSI, IMS, and ANSI were shown in addition to specifying an 'Other' or 'N/A' organization. Ten respondents of the 14 (71.4%) had no standards organization

affiliation. Of the four respondents that had affiliations, two respondents belonged to one organization, one belonged to both LETSI and IEEE, and one belonged to LETSI and ADL. Of the membership affiliations provided, two belonged to LETSI (12.5%), one to ANSI (6.3%), and none to IMS. Three respondents (18.8%) chose the 'Other' category, which included IEEE, ADL, and SCORM. Because respondents could 'check all that apply' (n=16), Table 2 shows the total tabulated data of standards organization affiliations.

Table 2

Standards organization affiliation

LETSI	IMS	ANSI	Other	None
2(12.5%)	0(0%)	1(6.3%)	3(18.8%)	10(62.5%)

Note. Frequency of response is followed by percentage (rounded to one decimal point); total number of responses, n=16.

Current LMS

Questions 3 through 8 requested information regarding the current LMS. Question 3 was an open-ended question that requested the LMS currently in use. Six of the respondents (42.9%) used a LMS that was developed by the company/government agency and were only used internally. This situation lead to total customization, which on one hand was beneficial to the organization because it was tailored to their specifications. Conversely, other organizations could benefit from the e-learning courses and the organizations could save money in the long run because there were probably similar courses that had already been developed that were being used by other organizations. Tailoring a

course that had already been developed was normally less expensive than starting from scratch.

Three of the respondents (21.4%) that developed courses or tested courseware had multiple LMSs. This meant that e-learning courses developed should be transportable. The commercially specified LMSs included: ILIAS (open source); OutStart, Saba, Meridian, SumTotal (which were Learning Content Management Systems (LCMS)); SkillPort (LMS that can host off-the-shelf (OTS) and custom content); AtlasPro (Government Off-the-shelf (GOTS)); and Blackboard (educational institution LMS). Five of the respondents (35.7%) did not specify a LMS. The responses were summarized as:

- Customized/developed internally – 6 (42.9%)
- Multiple – 3 respondents (21.4%)
- Blank, no response – 5 respondents (35.7%)

Question 4 inquired about the current LMS standards used and the respondent could 'check all that apply'. Four of the 14 respondents (28.6%) indicated that they were using both SCORM and AICC standards, and one respondent (7.1%) was using IMS as well as SCORM and AICC. Development of e-learning courses that satisfied multiple standards was a good indication that these e-learning courses were transportable among LMSs.

Six of the respondents (42.9%) were only using SCORM. Three respondents (21.4%) indicated 'not applicable'. Because respondents could 'check all that apply' (n=20), Table 3 shows the total tabulated data of standards being used with SCORM being the dominant choice.

Table 3

Current LMS standards used

SCORM	AICC	IMS	Other	None
11(55.0%)	5(25.0%)	1(5.0%)	0(0%)	3(15.0%)

Note. Frequency of response is followed by percentage (rounded to one decimal point); total number of responses, n=20.

Question 5 used a Likert-scale to ask whether users could access the current LMS anytime/anywhere through the Internet. Six respondents (42.9%) 'Strongly Agreed', and five (35.7%) 'Agreed' that access to the LMS was good. This meant that 11 of the 14 respondents (78.6%) felt users had good access to training at anytime. However, it did not mean that e-learning courses were web-based as employees may be going through a portal to access a LMS.

One respondent (7.1%) 'Disagreed' and two (14.3%) made no choice for user accessibility. The mean was 3.71 and the mode was 5 (Strongly Agree). The user's ability to access the current LMS is shown in Table 4.

Table 4

Users can access the current LMS anytime/anywhere through the Internet

SA	A	N	D	SD	No Response
6(42.9%)	5(35.7%)	0(0%)	1(7.1%)	0(0%)	2(14.3%)

Note. Frequency of response is followed by percentage (rounded to one decimal point); total number of respondents, n=14; the mean (rounded to two decimal points) is 3.71; and the mode is 5.

A Likert-scale was used again for Questions 6, 7, and 8 to determine user, instructor, and information technology administrator satisfaction, respectively.

Question 6 had 14 responses. Two respondents (14.3%) 'Strongly Agreed' and seven (50.0%) respondents 'Agreed' that users were satisfied with the current LMS. Two respondents (14.3%) were 'Neutral' and one respondent (7.1%) 'Disagreed' that users were satisfied. Two respondents (14.3%) had no response. The mean was 3.21 and the mode was 4 (Agree).

The percentage that agreed (64.3%) the users were satisfied was slightly less than the 78.6 percent rate for Question 5 that users could access the LMS anytime/anywhere. This indicated that although the access was there the LMS or the e-learning courses themselves were less than satisfactory. The results are shown below in Table 5.

Table 5

Satisfaction with current LMS – User

SA	A	N	D	SD	No Response
2(14.3%)	7(50.0%)	2(14.3%)	1(7.1%)	0(0%)	2(14.3%)

Note. Frequency of response is followed by percentage (rounded to one decimal point); total number of respondents, n=14; the mean (rounded to two decimal points) was 3.21; and the mode was 4.

Question 7 regarding instructor satisfaction with the current LMS had 14 responses. Two respondents (16.7%) 'Strongly Agreed' and eight (66.7%) respondents 'Agreed' that instructors were satisfied with the current LMS. One respondent (8.3%) was 'Neutral' and one respondent (8.3%) 'Disagreed' that instructors were satisfied. Two respondents (14.3%) had no response. The mean was 3.36 and the mode was 4 (Agree).

This meant that 83.4 percent of the instructors were satisfied, which was greater than the users that were satisfied (64.3%). The reason for this was not covered in the survey. The results of instructor satisfaction are shown in Table 6.

Table 6

Satisfaction with current LMS – Instructor

SA	A	N	D	SD	No Response
2(14.3%)	8(57.1%)	1(7.1%)	1(7.1%)	0(0%)	2(14.3%)

Note. Frequency of response is followed by percentage (rounded to one decimal point); total number of respondents, n=14; the mean (rounded to two decimal points) was 3.36; and the mode was 4.

Question 8 regarding administrator satisfaction with the current LMS had 14 responses. One respondent (7.1%) 'Strongly Agreed' and seven (50.0%) respondents 'Agreed' that administrators were satisfied with the current LMS. Two respondents (14.3%) were 'Neutral' and two respondents (14.3%) 'Disagreed' that administrators were satisfied. Two respondents (14.3%) had no response.

The percentage that agreed that administrators were satisfied (57.1%) was lower than instructor (83.4%) or user (64.3%) satisfaction. Again, the reason for this was not covered on the survey. The mean was 3.07 and the mode was 4 (Agree). The results are shown in Table 7.

Table 7

Satisfaction with current LMS – Administrator

SA	A	N	D	SD	No Response
1(7.1%)	7(50.0%)	2(14.3%)	2(14.3%)	0(0%)	2(14.3%)

Note. Frequency of response is followed by percentage (rounded to one decimal point); total number of respondents, n=14; the mean (rounded to two decimal points) was 3.07; and the mode was 4.

Proposed LMS

Questions 9 through 14 requested information regarding a proposed LMS under consideration. Only one respondent indicated they were planning to purchase or build a LMS in the next two years, but half of the respondents did answer Questions 11 through 14.

Question 9 was an open-ended question that requested a LMS being considered. The responses were summarized as:

- None under consideration – 3 respondents (21.4%)
- Blank, no response – 11 respondents (78.6%)

Question 10 was related to the time-frame for implementation of a new LMS. The choices were one to 12 months, 12 to 24 months, or 'Other'. Only one respondent indicated they were planning on making a change in the next 12 to 24 months, while the other 13 respondents indicated 'None'. The one respondent (7.1%) that did indicate they were planning on making a change within the next year or two, did not indicate which LMS they were planning on

implementing in Question 9 above. Thirteen (92.9%) gave no response. Table 8 displays a summary of responses.

Table 8

Proposed timeframe for implementation of new LMS

1-12 months	12-24 months	Other	No Response
0(0%)	1(7.1%)	0(0%)	13(92.9%)

Note. Frequency of response is followed by percentage (rounded to one decimal point); total number of respondents, n=14.

Question 11 inquired about the proposed LMS standards to be used and the respondent could 'check all that apply'. Ten (71.4%) of the 14 respondents made a choice. From the sample, one (7.1%) of the 14 respondents indicated they planned to use both SCORM and AICC standards. Five (35.7%) of the 14 responses were only looking at SCORM compliance. However when using the population of 16 which included the five (31.3%) participants that did not respond, six (37.5%) would be using SCORM, one (6.3%) would use AICC, and none would use IMS or another standard. Four respondents (25.0%) indicated it was not applicable. Again, as in Question 4 for the current standard, SCORM would be the most used standard. Table 9 shows the tabulated data.

Table 9

Proposed LMS standards to be used

SCORM	AICC	IMS	Other	N/A	No Response
6(37.5%)	1(6.3%)	0(0%)	0(0%)	4(25.0%)	5(31.3%)

Note. Frequency of response is followed by percentage (rounded to one decimal point); total number of responses, n=16.

Question 12 used a Likert-scale to ask whether users would be able to access the proposed LMS anytime/anywhere through the Internet. Of the seven responses made, two respondents (28.6%) 'Strongly Agreed', and four (57.1%) 'Agreed' that access to the LMS was good. One respondent (14.3%) was 'Neutral'. Using the entire population (n=14), only two (14.3 %) 'Strongly Agreed', four (28.6%) 'Agreed' and one (7.1%) was 'Neutral'. Seven respondents (50.0%) made no response. The mean was 2.07 and the mode was 4 (Agree). The user's ability to access the proposed LMS is shown below in Table 10.

Table 10

Users can access the proposed LMS anytime/anywhere through the Internet

SA	A	N	D	SD	No Response
2(14.3%)	4(28.6%)	1(7.1%)	0(0%)	0(0%)	7(50.0%)

Note. Frequency of response is followed by percentage (rounded to one decimal point); total number of respondents, n=14; the mean (rounded to two decimal points) was 2.07; and the mode was 4.

A Likert-scale was used again for Questions 13 and 14 to determine instructor and information technology administrator proposed satisfaction. Seven responses were received for both questions.

Question 13 was based on instructor satisfaction with the proposed LMS. Using the sample, two respondents (28.6%) 'Strongly Agreed' and three (42.8%)

'Agreed' that instructors were satisfied with the proposed LMS. One respondent (14.3%) was 'Neutral' and one respondent (14.3%) 'Disagreed' that instructors were satisfied with the proposed LMS. Using the population with seven (50.0%) respondents giving no response, two respondents (14.3%) 'Strongly Agreed' and three (21.4%) 'Agreed'. One respondent (7.1%) was 'Neutral' and one (7.1%) 'Disagreed'. The mean was 1.93 and the mode was 4 (Agree). Table 11 shows instructor satisfaction with the proposed LMS.

Question 14 was based on administrator satisfaction with the proposed LMS. Of the seven responses for the sample, one respondent (14.3%) 'Strongly Agreed' and four (57.1%) 'Agreed' that administrators were satisfied with the proposed LMS. One respondent (14.3%) was 'Neutral' and one respondent (14.3%) 'Disagreed' that administrators were satisfied with the proposed LMS. Using the population with seven (50.0%) not responding, one (7.1%) respondent 'Strongly Agreed' and four (28.6%) agreed. One (7.1%) respondent was 'Neutral' and one (7.1%) 'Disagreed'. The mean was 1.86 and the mode was 4 (Agree). Table 11 shows administrator satisfaction with the proposed LMS.

Table 11

Satisfaction with proposed LMS – Instructor & Administrator

	SA	A	N	D	SD	No Response
Instructor	2(14.3%)	3(21.4%)	1(7.1%)	1(7.1%)	0(0%)	7(50.0%)
Administrator	1(7.1%)	4(28.6%)	1(7.1%)	1(7.1%)	0(0%)	7(50.0%)

Note. Frequency of response is followed by percentage (rounded to one decimal point); total number of respondents, n=14. The mean (rounded to two decimal

points) for instructors was 1.93; and the mode was 4. For administrators the mean (rounded to two decimal points) was 1.86; and the mode was 4.

E-Learning Courses

Questions 15, 16, and 17 used a Likert-scale to determine if the respondent's organizations purchased e-learning courses or developed their own courses in addition to developing courses for other organizations. Nine organizations (75.0%) developed courses for other organizations but only five (41.7%) of those also developed their own in-house courses. One organization (8.3%) purchased as well as developed their own e-learning in addition to developing courses for other organizations.

Eleven respondents answered Question 15 for the purchase of e-learning courses, four (28.6%) of whom 'Strongly Agreed' and two (14.3%) that 'Agreed' that they purchased e-learning courses. Two respondents (14.3%) were 'Neutral' to purchasing. Two respondents (14.3%) 'Disagreed' and one (7.1%) 'Strongly Disagreed' that they purchased e-learning courses. Three respondents (21.4%) did not respond. The mean was 3.00 and the mode was 5 (Strongly Agree). The results for purchasing are shown in Table 12.

Table 12

Purchase e-Learning courses

SA	A	N	D	SD	No Response
4(28.6%)	2(14.3%)	2(14.3%)	2(14.3%)	1(7.1%)	3(21.4%)

Note. Frequency of response is followed by percentage (rounded to one decimal point); total number of respondents, n=14. The mean (rounded to two decimal points) was 3.00; and the mode was 5.

There were 12 responses to Question 16 regarding internal development of e-learning courses. Using the sample, five respondents (41.7%) 'Strongly Agree' and four (33.3%) 'Agree' that they developed internal e-learning courses. Two (16.7%) were 'Neutral' and one respondent (8.3%) 'Disagreed' that they developed internal courses. For the population, 35.7 percent (five) 'Strongly Agreed', 28.6 percent (four) 'Agreed', 14.3 percent (two) were 'Neutral', and 7.1 percent (one) 'Disagreed'. There was a 14.3 percent (two) no response rate. The mean was 3.50 and the mode was 5 (Strongly Agree). The results are shown in Table 13.

Question 17 also had 12 responses. From the sample, seven respondents (58.3%) 'Strongly Agree' and two (16.7%) 'Agree' that they developed e-learning courses for clients. 'Neutral', 'Disagree', and 'Strongly Disagree' each had one respondent (8.3%). The population was seven (50.0%) 'Strongly Agree' and two (14.3%) 'Agree'. 'Neutral' and 'Strongly Disagree' each were one respondent at 7.1 percent. Two respondents (14.3%) "Disagreed' and one (7.1%) did not answer. The mean was 3.64 and the mode was 5 (Strongly Agree). The following comment was written about development of e-learning courses for other organizations.

> In the past, we have developed Best Practices and have some exemplar content that has been developed with our input.

The results for e-learning course development are shown in Table 13.

Table 13

E-Learning course development – In-house & Client

SA	A	N	D	SD	No Response
Develop In-house					
5 (35.7%)	4 (28.6%)	2 (14.3%)	1 (7.1%)	0 (0%)	2 (14.3%)
Develop for Others					
7 (50.0%)	2 (14.3%)	1 (7.1%)	2 (14.3%)	1 (7.1%)	1 (7.1%)

Note. Frequency of response is followed by percentage (rounded to one decimal point); total number of respondents, n=14. For in-house the mean (rounded to two decimal points) was 3.50; and the mode was 5. The mean (rounded to two decimal points) for client development was 3.64; and the mode was 5.

Standards Interoperability

The last three survey questions dealt with standards interoperability for LMSs. Specifically, Question 18 asked about encountering difficulties trying to implement different e-learning courses. Two of the respondents (14.3%) 'Strongly Agreed' and two of the respondents (14.3%) 'Agreed' that problems were encountered attempting to house different e-learning courses. The largest number of respondents (five) which was 35.7 percent were 'Neutral'. Three respondents (21.4%) 'Disagreed' and one respondent (7.1%) 'Strongly Disagreed' that there were problem housing different e-learning courses. One respondent (7.1%) did not respond. The mean was 2.86 and the mode was 3 (Neutral). The following comment was provided:

The ADL Initiative has developed an ADL Repository. Although it is not a widely used repository (by outside agencies), we have no difficulty housing the content we store.

The difficulties encountered housing e-learning courses are summarized below in Table 14.

Table 14

Encountered difficulties housing e-learning courses

SA	A	N	D	SD	No Response
2(14.3%)	2(14.3%)	5(35.7%)	3(21.4%)	1(7.1%)	1(7.1%)

Note. Frequency of response is followed by percentage (rounded to one decimal point); total number of respondents, n=14; the mean (rounded to two decimal points) was 2.86; and the mode was 3.

Satisfaction with the development, implementation, and promotion of standards was survey Question 19. One respondent (7.1%) and five respondents (38.5%) 'Strongly Agreed' and 'Agreed', respectively. Four respondents (30.7%) were 'Neutral' and three respondents (23.1%) 'Disagreed'. One respondent (7.1%) did not participate in this question. The mean was 3.07 and the mode was 4 (Agree). One respondent provided the following comment.

> Standards are often a necessary evil. While they are difficult to implement, the effort is normally worthwhile. ADL developed the SCORM specification which has greatly increased interoperability among LMSs. While far from perfect, there has been much good derived from SCORM.

The results regarding promotion of standards are shown in Table 15.

Table 15

Promotion of standards

SA	A	N	D	SD	No Response
1(7.1%)	5(35.7%)	4(28.6%)	3(21.4%)	0(0%)	1(7.1%)

Note. Frequency of response is followed by percentage (rounded to one decimal point); total number of respondents, n=14; the mean (rounded to two decimal points) was 3.07; and the mode was 4.

The final survey question, Question 20, was the topic of this paper – should all e-learning standards work together seamlessly like the Internet. Of the 14 respondents, six (42.9%) did 'Strongly Agree' and seven (50.0%) 'Agreed'. One respondent (7.1%) was 'Neutral'. The mean was 4.36 and the mode was 4 (Agree). One participant provided the following comment:

> I would suggest that possibly instead of forcing these standards to interoperate, that a new web-based solution may be a better alternative. Much research is required, so it may be quite awhile before we have a truly interoperable environment for e-learning.

The results for having all standards work together seamlessly like the Internet are shown in Table 16.

Table 16

All standards should work together seamlessly

SA	A	N	D	SD
6(42.9%)	7(50.0%)	1(7.1%)	0(0%)	0(0%)

Note. Frequency of response is followed by percentage (rounded to one decimal point); total number of respondents, n=14; the mean (rounded to two decimal points) was 4.36; and the mode was 4.

LMS Solutions

An Internet search to locate LMS solutions that were SCORM, AICC, and IMS compliant was performed and two evaluators were selected. The companies selected were Technology Evaluation and Capterra, both offering to evaluate requirements and provide a solution. Both have searchable knowledge bases to provide solutions as determined from questionnaires completed by the client to define business needs. A list of the recommended solutions is then provided. Based on the findings, there were a few choices for companies to have an effective and productive LMS that is standard compliant for SCORM, AICC, and IMS as well as web-based.

Only one (5.8%) of the 17 companies was SCORM, AICC, and IMS compliant; three (17.6%) were SCORM and AICC compliant; and one (5.8%) was only SCORM compliant. There were nine companies that were web-based but only one (11.1%) of those was SCORM compliant.

The results from Capterra recommended six providers that matched 100 percent of the criteria. While this was the case for the web-base criterion, there was nothing to be found on the individual company websites that specified any product was either SCORM or AICC compliant. There was no option for IMS standards on the questionnaire and no company website claimed this compliance.

The Joomla LMS was open source; web-based; and SCORM, AICC, and IMS standard compliant. It differs from Moddle and Cloudcourse mentioned in Chapter 1, because it can be housed on a company's intranet as well as being open source which provided flexibility in installation and usability.

Summary

This chapter provided the summative findings from respondents concerning the standardization and interoperability of LMSs. The sections included response rates with report finding narratives and summary data that were grouped by category. The chapter concluded with a synopsis of LMS solutions available to companies looking for a LMS that was SCORM, AICC, and IMS compliant.

Data collection ended on July 30, 2010, with 14 of the 16 surveys being returned, which was a 87.5 percent response rate. The report findings were summarized as follows.

Survey demographics – reported roles that included developers, testers, and management; and that the majority of respondents (62.5%) do not belong to any standards organization.

Current LMS standards – described by LMS type found that 42.9 percent of respondents used a LMS that had been customized or developed internally; SCORM was the most used standard at 55.0 percent; and the satisfaction of users (42.9% strongly agreed users could access the current LMS anytime/anywhere and 50.0 percent agreed that users were satisfied with the LMS), instructors (57.1% agreed instructors were

satisfied with the current LMS), and administrators (50.0% agreed administrators were satisfied).

Proposed LMS standards – no respondent provided a LMS that was being considered; only one of the 14 respondents planned to implement a new LMS in the next two years; SCORM was the most popular proposed standard at 37.5 percent; six respondents (42.9%) agreed that users would be able to access the proposed LMS anytime/anywhere; and 35.7 percent of the respondents agreed that instructors and 35.7 percent of administrators were satisfied with the proposed LMS.

E-learning courses – almost half (42.9%) of the respondents purchased e-learning courses; 64.3 percent developed courses in-house; and 64.3 percent of the respondents developed e-learning courses for others.

Standards interoperability – encountering difficulties housing e-learning courses was experienced by 28.6 percent of the respondents; six respondents (42.8%) were satisfied with the promotion of standards while only three (21.4%) were dissatisfied; 13 of the respondents (92.9%) agreed that all standards should work together seamlessly.

Of the LMS solutions found, only one of 17 companies was SCORM, AICC, and IMS compliant. Of the 15 web-based solutions, only one was SCORM compliant.

The final chapter, Chapter V, provides a Summary, Conclusions, and Recommendations utilizing the findings presented in this chapter to accomplish standardization of LMSs. Additionally, conclusions will be drawn based on the

research goals presented in Chapter I and respondent data. Recommendations will also be presented for LMS standardization and further research.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Standards organizations world-wide, developers, and implementers should recognize the need for standardization of Learning Management Systems (LMS) to allow different e-learning courses to co-exist on a single LMS. Because vendors can implement the same standards differently, co-existence needs to include e-learning courses developed by different vendors using the same standards as well as different standards. However, the e-learning community has not yet evolved to the level used by the Internet for LMSs, causing organizations to have compatibility issues when purchasing or developing e-learning courses. The approach used was to investigate the standards of e-learning courses in each organization and evaluate technological developments and user requirements to promote interoperability of LMSs.

This chapter includes a summary of the research study to determine the possible standardization of LMSs as well as conclusions the researcher made based on the survey results. Recommendations based on the conclusions and suggestions for further research are also included.

Summary

This study was performed to determine if Shareable Content Object Reference Model (SCORM), the Aviation Industry CBT (Computer-Based Training) Committee (AICC), and Extensible Markup Language (IMS) standards are compatible as they pertain to the effective and productive use of a LMS for e-learning courses among systems. The main reason for conducting this study

was that standards' organizations such as the International Federation for Learning-Education-Training Systems Interoperability (LETSI), IMS Global Learning Consortium (IMS GLC), and the American National Standards Institute (ANSI) all hold regularly scheduled conferences and seminars that were attended by their individual memberships.

The problem with e-learning today is that LMSs do not work together, which causes growth barriers to e-learning innovation and implementation (Barr, 2010). If all LMSs had a HTML-like standard there could be independent, international, and cross-discipline distribution of e-learning. Additionally, vendor lock-in would be eliminated with standards because one LMS, or individual e-learning courses, could be replaced with another without the cost or time investment of translating all courses from one system to another.

The goals of this study were as follows:

- Evaluate the SCORM, AICC, and IMS standards for commonality.
- Evaluate how these standards can be portable among LMS.

The findings of this research were limited to including only three standards organizations and the three standards the researcher felt were the most widely used. This research study did not delve into the reasons users, instructors, or administrators, were satisfied with the LMS currently in use or the proposed LMS.

The population included for this study consisted of 16 e-learning course developers, analysts, and training department managers. The analysis determined the perceptions of these respondents toward their current and future LMS in addition to determining their opinions for standardization.

The 20 question survey was distributed on June 10, 2010, with a cover letter and survey. The survey had forced answer questions in addition to allowing the participant to add any comments to each question. The cover letter identified the purpose of the study, explained the protection procedures for the participants, endorsed the study, and provided notification of agency. The collection effort ended on July 30, 2010, and statistical methods were used to tabulate the data.

The researcher used descriptive statistical methods to organize the data once it was collected. The data from the questionnaires were then analyzed in aggregate form using response frequency, percentages, and mean.

Conclusions

The conclusion the researcher drew from the responses received overall was that most companies were floundering with standards and choices for implementing an LMS. Responses to the survey and conclusions from the researcher's investigation are presented by research goal.

The first research goal was to evaluate the Shareable Content Object Reference Model, Aviation Industry CBT (Computer-Based Training) Committee, and Extensible Markup Language standards. Based on the researcher's investigation, determining commonality between the SCORM, AICC, and IMS standards found that each standard centered on a different aspect of e-learning course development.

SCORM was not a standard but a reference model that incorporated IEEE, AICC, and IMS specifications. The AICC standard focused on

development and delivery of e-learning courses but developers could chose which one or all of the nine guidelines to follow. And the IMS standard concentrated on the programming of e-learning course structure. These standards could be portable if all developers followed the SCORM model because it included several standards and served as an umbrella model.

Since determining commonality between standards was the researcher's responsibility, only one survey question asked participants if they were satisfied with the development and promotion of standards. Almost half (45.6%) of the 13 respondents were satisfied and four (30.7%) were 'Neutral'. Three of the respondents (23.1%) were not satisfied with the development of standards. One respondent added the comment that "standards are often a necessary evil. While they are difficult to implement, the effort is normally worthwhile. ADL developed the SCORM specification which has greatly increased interoperability among LMSs".

The second research goal was to evaluate how the standards can be portable among Learning Management Systems. Establishing how standards are implemented to promote portability is an important factor because vendors implement standards slightly differently and a course that is produced as compliant for one standard might not work on the same standard system.

Question 3 asked the respondent to specifically name the LMS. Three (21.4%) respondents had multiple LMSs because they developed or tested e-learning courses while six (42.9%) had internally developed LMSs. Only two LMSs were being used by multiple participants (a government LMS and

SumTotal (a commercial Learning Content Management System)). Of the LMSs being used, four (28.6%) were using both SCORM and AICC standards, and 42.9 percent (six) were using only SCORM. This meant that if 71.5 percent of the respondents are using SCORM there is a possibility that these e-learning courses would be transferrable among the companies.

Questions 18 through 20 of the survey pertained to standards interoperability. Five of the 13 respondents (38.5%) were 'Neutral' regarding difficulties housing various e-learning courses. Four of the 13 (30.8%) 'Agreed' and four 'Disagreed'. The researcher concludes that 69.2 percent (nine) had difficulties whereas only 30.8 percent had no difficulties. The four that disagreed they had difficulties were using only a single LMS that was internally developed, whereas the other nine were using multiple LMSs to test or using a commercial product. The researcher's conclusion here is that if only one internally developed LMS is used with internally developed e-learning courses, there are no problems. The advantage in this situation is that there are no portability issues, however, the researcher would argue that the company is missing out on courses and spending larger amounts of resources (time and money) to develop training.

Question 20 was the topic of this research paper – all standards should work together seamlessly like the Internet which would make standards portable. All 14 respondents answered this question. Six (42.9%) 'Strongly Agreed' and seven (50.0%) 'Agreed' there should be a seamless solution. The one respondent that was 'Neutral' expressed the researcher's opinion by stating that "instead of forcing these standards to interoperate, that a new web-based

solution may be a better alternative. Much research is required so it may be quite awhile before we have a truly interoperable environment for e-learning".

Other survey questions gathered information the researcher felt were pertinent to the study. For example, Question 1 found that the LMS responsibilities of the participants included content development, verification of content, technical analysis, product configuration, and training department management. Question 2 found that only four (28.6%) of the 14 respondents belonged to a standards organization. Of those four, two belonged to two organizations and the others to only one organization. One director belonged to LETSI and IEEE, and one product configuration respondent belonged to LETSI and ADL. One manager belonged to SCORM and one content developer belonged to ANSI.

Question 5 was used to determine if users could access the LMS anytime/ anywhere. Of the 12 responses, 91.7 percent were content with access ability. Questions 6, 7, and 8 were used to determine the satisfaction of users, instructors, and administrators with the current LMS. Of the 12 responses, the least satisfied were administrators (66.7%) followed by users (75.0%). Instructors were the most satisfied group (83.3%) with the current LMS. The researcher did not receive any comments that would give insight to these satisfaction ratings.

Survey Questions 15, 16, and 17 were used to determine how many respondents purchased versus developed e-learning courses. Six of the 11 respondents (54.5%) purchased e-learning courses, nine of 12 respondents

(75.0%) developed their e-learning, and nine of 12 respondents (75.0%) developed e-learning courses for other organizations. Of the nine organizations that developed courses for other organizations, five (41.7%) also developed their own e-learning courses. Only one organization purchased and developed their e-learning courses in addition to developing for other organizations. One respondent commented that they had “developed Best Practices and have some exemplar content that has been developed with our input”.

Recommendations

The findings of this research suggest that an Internet solution is not only feasible but possible. During the research for this study the researcher found Internet solutions such as Moodle, Cloudcourse, and Joomla.

It is the researcher’s opinion that using an Internet solution would eliminate the problems currently being encountered with standards-based e-learning courses. The researcher can only speculate that the developers can program what the instructors want, but not what the users want to see. The e-learning courses could be mundane page-turners or overly complicated. Further research is needed to determine why users, instructors, and administrators are not 100 percent satisfied with e-learning. Are user’s unhappy with the interface? Is there too much or too little interaction to keep the user interested? Do instructors have difficulty presenting the desired information or testing user comprehension? Are administrators fighting network issues or bandwidth problems?

The researcher also believes the lack of affiliation is part of the standardization problem because with no organizational affiliation to receive any current standards implementation procedures, e-learning courses are being developed to work with only one LMS. And although the e-learning course may function on the LMS, the researcher believes the probability that it meets standards requirements is low. Unfortunately, the researcher could not find a programmer to participate in the survey, but hopes that programmer participation with standards organizations would be higher. If this lack of participation trend continues the possibility of transportable courses will continue to be a problem.

Developers and programmers should not be leery about changing their approach. There would be a larger market for e-learning courses because the courses could be used by more people in different industries. Management and marketing groups would have a larger market to sell to. There would be industry customization of courses. Standards organizations efforts would realize their contributions just as the World Wide Web Consortium has been recognized.

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APPENDICES

Appendix A: Survey

Appendix B: Cover Letter (eMail or U.S. Mail)

APPENDIX A

SURVEY

STANDARDIZATION OF LEARNING MANAGEMENT SYSTEMS

The purpose of this survey is to gather opinions regarding the interoperability of Learning Management Systems (LMS) and e-learning courses. In cooperation with Old Dominion University, your responses will be held in strict confidence for this study. The information you provide will be summarized with other responses and will not be attributable to any one person. Participation is voluntary and the information you provide will be kept confidential.

Directions: Please put a check mark that indicates your selection. Comment space has been provided for each question if you would like to provide additional information.

SA – Strongly Agree / **A** – Agree / **N** – Neutral / **D** – Disagree / **SD** – Strongly Disagree

1. Name: _____ _____ Confidential
2. Title: _____ _____ Confidential
3. Company: _____ _____ Confidential
4. Email: _____ _____ Confidential
5. LMS Responsibilities:

   _____

   _____

6. Standards Organization Affiliation (check all that apply) _____ Confidential

   _____ LETSI

   _____ IMS

   _____ ANSI

   _____ Other (Specify): _____

   _____ N/A

7. Current LMS (Specify) _____

8. Current LMS Standards Used (check all that apply)

_____ SCORM

_____ AICC

_____ IMS

_____ Other (Specify) _____

_____ N/A

9. Users can access the current LMS through the Internet anytime/anywhere

SA__ A___ N__ D__ SD___

Comments: _____

_____

10. Users are satisfied with the current LMS

SA__ A___ N__ D__ SD___

Comments: _____

_____

11. Instructors are satisfied with the current LMS

SA__ A___ N__ D__ SD___

Comments: _____

_____

12. Information technology administrators are satisfied with the current LMS

SA__ A___ N__ D__ SD___

Comments: _____

_____

13. Proposed LMS (Specify): _____

14. Planned purchase/build of LMS

    1-12 months___ 12-24 months ___ Other ____

15. Proposed LMS Standards (check all that apply)

    _____ SCORM

    _____ AICC

    _____ IMS

    _____ Other (Specify)

    _____ N/A

16. Users can access the proposed LMS through the Internet anytime/anywhere

    SA__ A___ N__ D__ SD___

Comments: _____

_____

17. Instructors are satisfied with the proposed LMS

    SA__ A___ N__ D__ SD___

Comments: _____

_____

18. Information technology administrators are satisfied with the proposed LMS

    SA__ A___ N__ D__ SD___

Comments: _____

_____

19. My organization purchases e-learning courses

SA__ A___ N__ D__ SD___

Comments: _____

_____

20. My organization develops our e-learning course internally

SA__ A___ N__ D__ SD___

Comments: _____

_____

21. My organization develops e-learning courses for other organizations

SA__ A___ N__ D__ SD___

Comments: _____

_____

22. My organization has had difficulty housing different e-learning courses

SA__ A___ N__ D__ SD___

Comments: _____

_____

23. I am satisfied with the development, implementation, and promotion of standards

SA__ A___ N__ D__ SD___

Comments: _____

_____

24. All standards (including SCORM, AICC, and IMS) should work together seamlessly like the Internet

SA__ A___ N__ D__ SD___

Comments: _____

_____

Thank you for your participation.

APPENDIX B

COVER LETTER (EMAIL OR U.S. MAIL)

117 Lynn Drive
Newport News, VA 23606
Date

Participant Name
Participant Address
Participant Address

Dear Participant:

There are many organizations world-wide that are dedicated to promoting standards for the e-learning community, but those endorsed by these organizations vary and often do not allow different training courses to co-exist on a Learning Management System (LMS). The problem is that not only do different disciplines follow different standards, but courses from different vendors that follow the same standard are not necessarily compatible.

I am a graduate student at Old Dominion University working on my thesis, the "Standardization of Learning Management Systems". The study problem was to determine the benefits of SCORM, AICC, and IMS compliance standards as they pertain to the effective and productive use of a LMS for e-learning courses among systems. I am trying to determine if all e-learning courses and/or standards can learn to work as well together as the Internet in addition to providing a positive learning experience for users.

Enclosed you will find a survey and postage-paid return envelope. Your participation in this study is voluntary. The attached survey should only take a few minutes of your time to complete. However, if you have a few additional minutes I have also provided space for comments after each question. Returning this survey demonstrates your desire to share your experience and expertise while contributing to this research activity. Your response will help in determining the possibility of a harmonious collection of e-learning courses that can be housed on an Internet LMS regardless of vendor. Your information will be safeguarded with confidentiality and used only in summative form.

By returning the completed survey you are acknowledging that you have been informed of the purpose of the study and your role. You also consent to participate and allow us to use your responses in our study. Thank you in advance for completing the survey by June 30, 2010. If you are interested in receiving a copy of the completed paper, simply check the box next to your email address. I appreciate your time and cooperation with this endeavor.

Sincerely,

Dr John M. Ritz, DTE
Professor
Old Dominion University

Deborah J.B. Richard
ODU Graduate Student
Email: DRich023@odu.edu

Encl: Survey Instrument, Return Envelope