STUDENT AND FACULTY PERCEPTIONS OF THE FEATURES OF MOBILE LEARNING MANAGEMENT SYSTEMS IN THE CONTEXT OF HIGHER EDUCATION

By

NILOU DERAKHSHAN

Bachelor of Information Technology in Information Systems Engineering

Multimedia University

Cyberjaya, Selangor, Malaysia

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Thesis Approved:

Dr. Pasha Antonenko

Thesis Adviser

Dr. Susan Stansberry

Dr. Jesse Perez Mendez

Dr. Sheryl A. Tucker

Dean of the Graduate College

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CHAPTER I

INTRODUCTION

The rapid advances in information and communication technologies have resulted in an explosion of new hardware and software technologies, network protocols, and development of interfaces that allow humans to manipulate these new devices. Whether we like it or not, information technologies are here and they are influencing our lives in ways that we cannot yet fully understand. One important technology that was developed with educators and students in mind is Learning Management Systems (LMSs) – a feature and data-rich online application for creating, managing, and sharing web-based courses and learning modules.

Among a variety of online learning applications and tools, LMSs have the potential of enhancing online learning environments and developing fully functioning virtual classrooms. The Internet technology and online LMSs have created new opportunities for learners and educators to interact, learn, and teach by eliminating the physical constraints of space and time. Learners can attend online classes from anywhere and at anytime, as long as they have access to a computer with Internet connectivity. LMSs provide all the required tools to create and manage online learning environments. Today, Blackboard™, Moodle, and Desire2Learn™ are the three leaders in the LMS industry. These products are use by various types of corporate organizations globally for

personnel training and professional development purposes as well as by many higher education institutions and K-12 schools.

LMSs enable easy, fast, and organized management of the knowledge and resources for individuals and institutions and provide features and tools for delivering of learning content and resources, assessing student learning, and monitoring learners' progress. Educators have the freedom to use text, hypertext, digital media, and any combination of multimedia and hypermedia to design and provide their students with interactive and engaging learning experiences.

In addition to being connected to the world via desktop computers, people accomplish many of their day-to-day tasks and solve problems using handheld devices with Internet connectivity. Every day, we spend much time interacting with each other using mobile handheld devices whose computing potential is greater than that of the supercomputers of 1980s and 1990s. Students and teachers use smartphones, tablets, netbooks, and other types of portable Internet-capable devices to communicate, collaborate, conduct research, create, share, and access multimedia and hypermedia, and socialize through social networking websites.

The new generation of today's handheld devices has the capability of yesterday's mainframe computers, but in a smaller size and more attractive designs. These "smart", "net", and "touch" devices have become usable and functional enough to produce an impact on the educational software industry, including LMS software. For many individuals, the primary purpose of cellular phones, for example, has changed from

voice-based communication to much wider applications – such as web surfing, e-book reading, music listening, shopping, socializing, and …learning.

Statement of Purpose

The purpose of this study was to explore how university students and faculty use handheld devices in their learning and teaching with a focus on understanding their perceptions of the usefulness of various LMS features that are available in desktop versions of LMSs but are often omitted in the mobile versions.

Research Questions

This study was conducted to address the following research questions:

1. What are the demographic characteristics of mobile LMS users among university students and faculty?
2. What are the current patterns of mobile LMS use by university students and faculty?
3. What are the university student and faculty perceptions regarding the usefulness of LMS features in the mobile version?

Significance of the Study

Even though mobile learning is growing very fast and it is been several years since the first versions of mobile LMSs were released, there has been little empirical research on the students' and instructors' needs relative to their use of mobile LMSs to learn or to teach. Mobile versions of LMSs are currently being developed with very little input from their target users – students and faculty. This study was designed to reveal the

perceptions of both learners and educators in the context of higher education on what mobile LMS features they would like to use when they access the LMS with their handheld devices.

CHAPTER II

LITERATURE REVIEW

Interactive Online Learning Environments

Globalization of today's society places increased demands for using technology and e-learning systems in higher education. Technology impacts the ways that people learn and make effective learning and teaching possible (Beetham & Sharpe, 2007). High-speed Internet enables learners and educators to have access to online learning materials 24 hours a day, 7 days a week, and 365 days a year (Bitter & Legacy, 2008). During the past decades the number of online courses of postsecondary institutions has increased dramatically (Durrington, Berryhill, & Swafford, 2006). In a large-scale study on distance education conducted by the National Center for Educational Statistics (2009), 78 percent of postsecondary institutions offered online courses and 81 percent offered distance education programs, which could also include interactive television and correspondence courses. Thus, appropriate technology tools must be used to create and support interactive online learning environments (Moore & Thompson, 1990). It is particularly suitable for students who are introverted and will not speak in face-to-face classes by offering them a chance to share their thoughts in online discussions. Furthermore, intervenes with instructors demonstrated that improved students'

reading and writing skills, technology skills, time management, and self-regulated learning skills.

Another advantage of interactive online environments is that they can provide, more opportunities for student, to interact with instructors individually. In other words, instructors provide more options for communication with online learners compared to students in traditional face-to-face courses for example, email, virtual office hours, video conferencing, and chat. (Shih, Ingebritsen, Pleasants, Flickinger, & Brown, 1998).

Flexibility is another important advantage of online learning environments for both students and instructors (Curtis & Lawson, 2001; Hurt, 2008). An online learning is particularly beneficial for students who are involved with family engagements, work schedules, or other responsibilities. Online learning environments also provide instructors with the opportunity to offer courses anytime and anywhere, to be more organized, and to stay in touch with students using online technologies from out of the office.

Despite the advantages that online learning environments offer there are also important limitations that need to be taken into account. For example, Haber and Mills (2008) investigated the issue of isolation in online learning environments. They selected three colleges out of the 28 Florida community colleges. Each of these colleges differed in the number of enrolled students, training protocols, and policies for online classes. They were also using different learning management systems, namely Web CT™, Blackboard™, and Desire2Learn™. At the time of this study, the number of credit and noncredit enrollment in the largest college was approximately 62,465; at the midsize college it was 44,000; and at the smallest college enrollment was 18,000 students. The results of this study showed that instructors in this study expressed concerns regarding

students' isolation, time required to design and implement online courses, and students' lack of knowledge and skills to troubleshoot technical issues.

Online learning frequently results in a lack of social interaction between students and instructors, and among students themselves. For many students, the lack of face-to-face contact leads to isolation and feeling of helplessness and frustration (Hurt, 2008). The second argument that instructors in Hurt's (2008) study expressed was required time to plan, develop, and design courses, as well as the teaching process itself (providing feedback, grading, participation in discussions). Another concern dealt with students' capability to access the course materials in online environments, which arose from students' lack of technical skills to use the features of the courses and troubleshoot technical problems. For non-technical students this resulted in feeling of out-of-the-loop and separation from the more technically students (Corbeil & Valdes-Corbeil, 2007). These issues underscore the importance of designing an interactive, and engaging online learning environment using tools that are learner and teacher friendly.

An online learning environment is an open and supportive setting to increase students' learning and interaction (Durrington, Berryhill, & Swafford, 2006). In order to create such an environment, instructors create discussion forums for students to ask questions and exchange ideas. Since in face-to-face classes discussion time is limited asynchronous online discussion provide a comfortable environment that increases students' confidence about participating in discussions (Gautreau, 2011). Instructors can encourage students by commenting on students' posts to show them that their contribution is valuable and appreciated (Durrington, Berryhill, & Swafford, 2006).

Social interaction in online learning can be facilitated using variety of communication techniques such as discussion boards, chat sessions, e-mail, and video conferencing. Typically three types of learning interaction are distinguished: interaction with resources, teachers, and peers (Curtis & Lawson, 2001). Students have access to information resources through digital libraries, and other sources available on the Internet. Even students in traditional face-to-face courses use online resources more and more frequently (Curtis & Lawson, 2001). Also, On-campus students have the opportunity of interacting with the instructors in seminars and classrooms therefore, they do not usually attempt to contact instructors individually. On the other hand, in online teaching students and instructors interact one on one more frequently – using information and communication technologies (ICT) (Curtis & Lawson, 2001). At the same time, online students reported that for them the interaction among students is very challenging and effective use of ICT in online learning could ease this problem (Curtis & Lawson, 2001). Appropriate and effective tools for student interaction are email, chat, video conferencing, discussion board, group pages, blogs, and so on (Gautreau, 2011). These tools can be used synchronously or asynchronously: e-mail and discussion boards are examples of asynchronous communication tools and live chat sessions and video conferencing enable synchronous interaction.

A combination of, synchronous and asynchronous communication tools is usually used to design effective online learning environments. Asynchronous tools offer the flexibility of 24/7 access to learning content such as, streamed recorded audio or videos, podcasts, and text-based resources (Skylar, 2009). On the other hand, synchronous tools

enable real-time interaction among students and instructors similar to traditional face-to-face instruction.

Effective combination of these tools is essential to create interactive, collaborative, and enjoyable online learning environments.

Learning Management Systems

A learning system is a collection of tools, which is used to manage the knowledge and resources of individuals and institutions and make them accessible to all learners. The technology that performs this function is generally known as the Learning Management System (LMS) (Rapuano & Zoino, 2006). LMS is "a collection of eLearning tools available through a shared administrative interface" (Nichols, 2003). A LMS provides a platform for content, delivery, and managing the learning and teaching process as well as accessibility for a range of users who are learners, instructors, content developers, and administrators (Tortora, Sebillo, Vitiello, & D'Ambrosio, 2002). Educational, business, and governmental organizations use LMSs to accomplish their instructional goals (Avgeriou, Papasalouros, Retalis, & Skordalakis, 2003). LMSs assist educators and corporate designers in producing online courses by facilitating planning, organization of content and resources and management of online learning course sequences (Jafari, McGee, & Carmean, 2006; Chao, 2008).

LMSs offer a variety of content development and delivery methods automate the process of student enrollment, management of records, reports, transcripts, and schedules. They also incorporate evaluation, assessment, and testing capabilities (Tortora, Sebillo, Vitiello, & D'Ambrosio, 2002). The important function of an LMS is to provide support

for interaction between participants through discussion board, chat, e-mail, and instant messaging as well as a mechanism to tracking student activity, and monitor their progress (Rapuano & Zoino, 2006).

The users of LMSs can be classified into three categories: learners, instructors, and administrators (Avgeriou, Papasalouros, Retalis, & Skordalakis, 2003). Learners are the main users of the LMS. Different features of LMS could facilitate student learning and increase their engagement to online courses. They interact with instructors and other students by using synchronous and asynchronous communication tools. A safe and supportive atmosphere for learning motivates students and results in improved learning outcomes (Avgeriou, Papasalouros, Retalis, & Skordalakis, 2003). Instructors use the system to create and present content, provide interaction opportunities, and evaluate the students' performance and provide feedback. Finally, administrators are responsible for managing the users of the LMS - learners and instructors, monitor the operational status of the system, and solve technical issues. Most LMSs mostly include the features that can be classified as content development tools, communication tools, productivity tools, and student involvement tools:

- Synchronous communication: real-time virtual classrooms with two-way voice, multipoint video, interactive whiteboard, application sharing, or file transferring
- Email: sending and receiving messages internally (within the LMS / externally)
- Discussions: posting questions and responses in a discussion board
- Calendar: schedule and share events and deadlines
- Blog: online journaling and reflection
- Instant messaging: sending private text messages to other users of the LMS

- Quizzes: online quizzes with a variety of question types
- Surveys and polls: receiving feedback from users
- Dropbox: submission of individual and group assignments
- Rubrics: definition of assessment criteria to provide structured feedback
- Gradebook: a grading system for assignment
- User pages: enabling learners to create a personal webpage
- Classlist: providing information about learners, their activities, and contact information

A Historical Perspective on Learning Management Systems

The history of LMSs goes back to 1960. During the last 50 years, many institutions and companies designed and developed various LMSs. This section provides historical review of popular LMSs.

PLATO™ - 1960.

In 1960 the University of Illinois at Urbana-Champaign developed technology and content for a computer-assisted instructional system, which is known as Programmed Logic for Automated Teaching Operations™ (PLATO, 2011). PLATO™ enabled users to design new lesson modules using the TUTOR™ programming language. Today, PLATO™ is an online learning system provider, which offers various solutions, curricula, assessments, and services for administrators, educators, and learners (Plato Website, 2011).

The Learning Manager™ - 1980.

Another generation of LMSs was introduced in 1980 as The Learning Manager™ (TLM™). TLM™ offered tools for developing, transferring, reporting, and managing instruction and learning materials for trainings (W-Win website, 2011). It was a popular solution for e-learning management, had a user-friendly interface, and provided customizable features and add-on capabilities. TLM™ users could be assigned different roles, such as students, instructors, teaching assistants, and administrators.

Andrew Project - 1982.

In 1982, Carnegie Mellon University and , ™ developed the Andrew. The objective of this project was to create a platform for computer-aided instruction. Andrew provided an integrated computing environment for online interaction. "The Andrew System is a set of computer tools that enables the user to write and edit documents, send and receive mail, read bulletin boards, write programs, and seamlessly access user and project files from any workstation" (Carnegie Mellon University, 2011).

EKKO™ - 1987.

EKKO™ computer-based conferencing system developed at NKI™. The first version of EKKO™ was designed and implemented during 1986. "During its most intensive period, EKKO™ served more that 3,000 users, including on-campus students, prospective students, distance students, former students, tutors, and administrative staff" (Paulsen & Rekkedal, 2001). The system included an email system, closed and open conferences for administrative, teaching and social purposes, and bulletin boards. Currently, NKI Nettstudier™, which is known as NKI Fjernundervisning™ or NKI Distance Education™, is the most popular online learning application in Norway and, supposedly, that it is the largest distance education institution in Northern Europe.

ATHENA - 1990-evolved.

The Athena project at Massachusetts Institute of Technology University in 1983 and evolved in 1990 into a campus-wide networked computer system that was used to write and share papers and communicate with other users. The use of this system as part of the instructional process included a simulator of complex systems, a laboratory instrument, a virtual laboratory, a tutor, a textbook, a blackboard, a special-purpose learning environment and, a communication medium (Balkovich, Lerman, & Parmelee, 1985).

HyperCourseware™ - 1990.

HyperCourseware™ was developed by Kent Norman at the University of Maryland in 1990. The objectives of this system were to provide learners with access to electronic copies of learning materials such as textbooks, lesson plans, calculators, lectures, discussions, and question and answer documents (HyperCourseware, 2011).

WebCT™ - 1996.

WebCT™ was developed at the University of British Columbia by Murray Goldberg in 1996. It was the first widely popular course management system, which was being used primarily in higher education. The main features of this LMS were discussion boards, mail system, live chat, and content that included downloadable documents and web pages (WebCT™, 2011). In 2006 WebCT™ was acquired by Blackboard™.

Blackboard™ -1997.

Blackboard™ was founded in 1997 and provides enterprise learning software applications and related services. Today, Blackboard™ is one the two or three most popular commercial LMSs, Blackboard™ is headquartered in Washington, D.C., with

offices in North America, Europe, Australia and Asia. Currently, Blackboard™ offers six platforms to improve different aspects of education: Blackboard Learn™ (a LMS), Blackboard Collaborate™ (a virtual classroom for synchronous instruction at a distance), Blackboard Connect™ (enables sharing time-sensitive information via voice, text, email, and social media), Blackboard Transact™ (offers students a secure way to shop on and off campus using their ID card), Blackboard Analytics™ (enables institution leaders to have easy, self-service access to important data), and Blackboard Mobile™ (a mobile version of the LMS) (Blackboard™, 2011).

Moodle - 1999.

Moodle is an open source LMS that has initiated by Martin Dougiamas in 1999 as a PhD research project at Curtin University of Technology (Perth, Western Australia). Open source stands for the term that users would be allowed to run the software, study it, change it, and redistribute copies with or without changes free of charge. The first version of Moodle was released on August 20, 2002. In 2003, the Moodle.com company was launched and since that has sponsored Moodle development. In 2007, more than 20,000 users registered their active Moodle sites and this number in 2011 increased to over 70,000 sites from 223 countries (Moodle website). Moodle is considered as high value education community, mostly higher education and advance education. Moodle provides educators with the tools to manage and promote online learning. These tools include dozens of official Moodle could be activity modules such as forums, lessons, surveys, quizzes, and wiki as well as modules and add-ons developed and shared by the Moodle community developers.

Desire2Learn™ - 1999.

Desire2Learn was founded in 1999. It provides e-learning solutions for K-12 schools, higher education, corporate and associates, healthcare, and government. According to the Desire2Learn website, Desire2Learn™ offers six platforms to improve different aspects of education: Learning Environment (a LMS), ePortfolio (provides capturing, reflecting on, and sharing learning experiences), Learning Repository (allows to develop and share reusable learning objects), Mobile (provides access to resources, services, course information and interaction on mobile), Analytics (a reporting system with predictive models), and Capture (enables the delivery of media presentations with audio, video, and visual aids, live an on-demand).

Sakai™ - 2004.

Sakai™ is a LMS that was built using a grant provided by the Mellon Foundation in 2004 when Stanford University, Michigan University, Indiana University, Massachusetts Institute of Technology University, and University of Berkeley began building a common Courseware Management System. In 2009 over 100 institutions were using the open source software of Sakai Collaboration and Learning Environment™ (CLE), in production settings ranging from 200 to 200,000 users ("Sakai™ is an enterprise-ready", 2009). Today this number has increased to over 350 educational organizations. Sakai™ offers two products. Sakai CLE™ is "a full-featured system supporting technology-enabled teaching, learning, research and collaboration for education" and Sakai OAE™ (Open Academic Environment) "is a scholarly space for research, teaching and learning" (Uys, 2011).

As this review shows, many LMS solutions were created during the last two decades. Few years later WebCT™ joined Blackboard™ and until today Blackboard™

has always owned the largest amount of market share. In 1999 Moodle and Desire2Learn™ started competing with other LMSs and Moodle as an open source system gained enormous success after Blackboard™.

Learning Management Systems in Higher Education

The use of LMS at higher education institutions is growing (Gautreau, 2011). According to the data of the 2010 national survey of information technology in U.S. higher education (campus computing project, 2010), Blackboard™ is the most popular learning management system in U.S. higher education (57 percent of market share), Moodle is the second most popular LMS (16 percent), and Desire2Learn™ is in the third place (10 percent). Other LMSs share only 10 percent of the market, and the rest of the market share that is seven percent belongs to non-standard LMSs (especially designed and developed for individual organizations). The chart below represents LMSs market share as of Fall 2010.

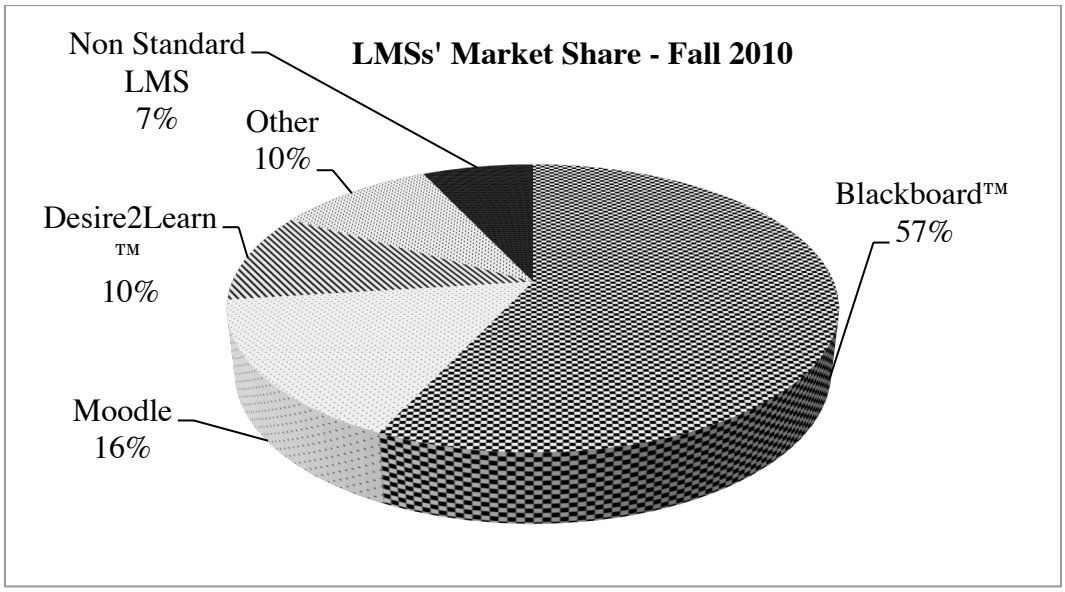

Figure 1: LMSs' Market Share (adapted from the campus computing project, 2010)

As it is shown in figure two, from the years of 2006 to 2010 the popularity of Moodle and Desire2Learn™ respectively increased and there was a slight decrease in the of Blackboard's™ market share. However, the recognition of Blackboard™ is still much higher compared to other LMS providers. In 2009 Blackboard™ acquired Angel™, the reason being Angel's™ excellent customer support culture and its record of innovation (About Bb, 2011). Conversely, Sakai did not have much success in increasing its market share. Finally, Moodle's reputation has been growing faster than other LMSs and if Moodle's growth and Blackboard's decline in popularity continues, Moodle could become the most popular LMS.

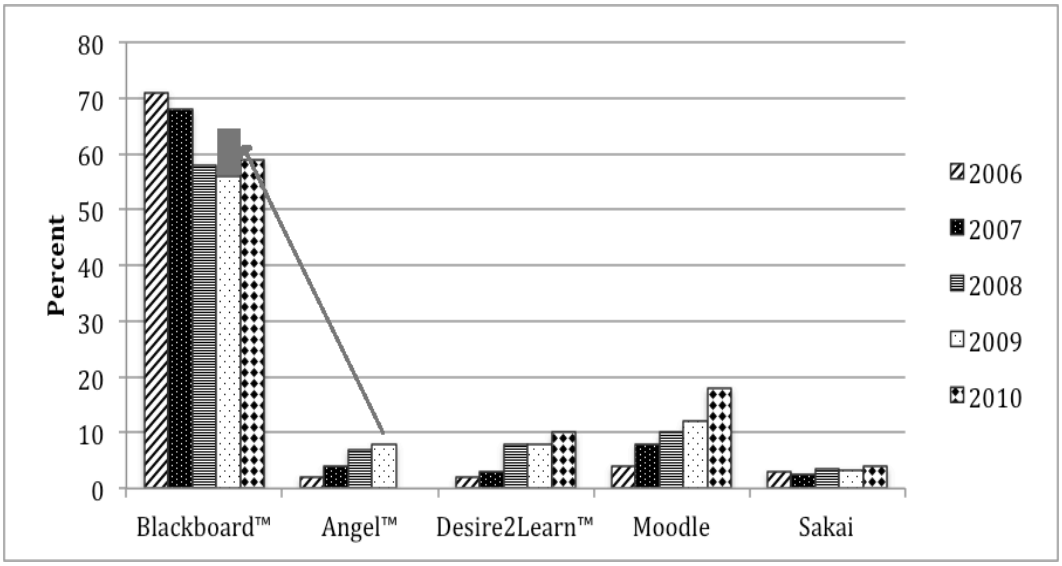

Figure 2: Changes in the LMS market share over time. This figure presents "the percentages for campuses reporting a single, campus-wide LMS" (adapted from the Campus Computing Project, 2010)

Online Learning, Internet, and Mobile Devices

Advances in ICTs have enabled the development of online LMSs, but our society is also becoming progressively more tech-savvy and "connected" via wireless information and communication technologies. Internet capable devices such as cellular phones, smart phones, tablets, laptops, netbooks, and e-readers have become part of the daily life of many people. The use of these devices is driven by our personal, professional, or educational needs.

Despite the global economic downturn, globally smart phones' market grew 16 percent in 2009 (Smart Phone Market Trends Report 2010/2011, 2011). Among the smart phones, the many innovations in the design, and functionality of iPhone™ and its applications have made it one of the most sought after smart phones on the market. According to Apple's™ fiscal report for the fourth quarter of 2009, Apple™ increased iPhone™ sales by seven percent to 7.4 million (Telecompaper, 2009). In 2010 Apple™ sold 14.1 million iPhones™ finishing the year with 91 percent growth over a year. Besides, in 2010 Apple™ sold 4.19 million iPads, and 9.05 million iPods (Apple™ reports fourth quarter results, 2010). Apple's™ App Store offered 65,000 applications and 30,000 iPad applications (Ritchie, 2010). Most of these applications are affordable to the general public varying in price from 99 cents to $9.99; plus there are many free applications for download (Humphries, 2009).

Release of Google's Android™ operating system for mobile devices has also contributed to the increasing popularity of mobile computing. Android™ has become number two mobile operating system - with a market share jumping from 3.9 percent in 2009 to 22.7 percent in 2010. Cost effectiveness and an extensive collection of

applications in Android Market™ are two reasons of this operating system (Arupchou, 2011).

The fourth generation of cellular wireless network, which is known as 4G networks is another contributor to the popularity of mobile devices. These contemporary, ultra fast networks offer multimedia services at low transmission cost and high data rate services. (Hui & Yeung, 2003). As a result, the number of mobile application and mobile versions of desktop software has increased dramatically. For instance, mobile versions of Yahoo Messenger™, Skype™, and Oovoo™ are available for free download. These applications are developed for most phones that have wireless data access, including, Android™ based phones, Blackberry™ and, iPhone™.

The use of mobile devices is not limited to communication and entertainment applications. Many productivity applications are currently available for the mobile platforms. For example, Google Docs™ for mobile allows accessing document lists, editing text documents and spreadsheets, converting photo to text, viewing documents, Portable Document Format (PDFs) files, images, and sharing and uploading of documents. In addition to these features, it streamlines teamwork allowing easy co-editing and sharing of documents in teams. One can work on group projects "on the road" and see the revisions submitted by group members in real time or they can review their notes or projects before attending class or doing presentations.

Books have also gone digital and for many people e-books are mow more desirable than books. Readers have the freedom to read e-books using e-readers like Kindle™ or Nook™, tablets, and smart phones. These devices can be set up to synchronize and the users may continue reading from where they stopped on a different

device. Finally, the popularity of social media and social networking applications like Facebook™ and Twitter™ also contributed to the exponential growth of mobile computing.

So, what do these trends mean for education? It is obvious that at the very least, educators take advantage of using mobile devices for educational purposes. Informal mobile learning is gaining momentum every day and it is expedient to consider implementing mobile learning in formal education.

Mobile Learning

One of the primary objectives of handheld devices is to provide opportunity for wireless, mobile communication and there is no doubt that "a framework for learning in the mobile age should recognize the essential role of communication" (Sharples, 2005). These goals are achieved via global access and freedom from space and time constraints.

Advances in the usability and functionality of mobile devices have resulted in the development of a new industry of development. Over 500,000 applications are currently available for iPhone™. From the educational perspective the important question is how these applications can be used in the teaching and learning process to motivate, engage, and educate today's students?

In general, the conceptual perspectives on mobile learning can be categorized as technocentric (learning using mobile devices), relationship to e-learning (an extension of e-learning), augmenting formal education (supplementing face-to-face teaching), and learner centered (learning from the learner's perspective) (Winters, 2006).

Mobile learning can be defined as "any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of learning opportunities offered by mobile technologies" (O'Malley, Vavoula, Glew, Taylor, Sharples, & Lefrere, 2003).

Effective use of mobile learning.

"Learners will be motivated if they feel they can be successful and that there is value in their learning" (Hodges, 2004). Attewell (2005) claimed that mobile learning helps learners recognize and reflection their existing abilities, improve their literacy, and numeracy skills. It can be used to persuade independent and collaborative learning. It also helps learners to identify areas that they need support and assistant. Mobile learning assists learners in staying more focused for longer periods and engages unenthusiastic learners, raises learners' self- esteem as well as self-efficacy.

The rapid changes in new technologies and access to content wirelessly anywhere and any time, allows learners to experience learning in a variety of settings and not just in schools (Milrad, 2006). Mobil learning can be used for group collaboration and class management, learning outdoors, self-learning, and podcasting (MLearning, 2011). In higher education, mobile devices can also be used to access course material, due dates for assignments, information about course outlines, class scheduling, and room changes (Guy, 2009).

In 2005, an avid proponent of mobile learning, Marc Prensky, claimed that students can learn almost anything with a cell phone. Listening, observing, imitating, questioning, reflecting, trying, estimating, predicting, speculating, and practicing are the most frequent, time-tested, and effective approaches to learning that can be supported by

cell phones (Prensky, 2005). Below are a few examples of the features that can be used for students learning according to Prensky (2005).

- Voice based features allow people to engage in language learning, literature, history, and other content accessible via podcasting and digital storytelling.
- Graphic Displays enable educational mobile applications in subjects such as astronomy and earth sciences, math, geography, writing, geographic information systems for field trips.
- Cameras can be used to collect data; it would enhance students' creativity, imagination, and innovation.
- Internet Browsers allows learners to access search engines, dictionaries, encyclopedias, and other online resources.

Table 1

Selected Productivity Tools for Mobile Devices

Productivity Tools	Usage
EverNote	Note taking, document organization.
Documents ToGo Premium	Editing of Word, PowerPoint, and Excel files from their iPhones.
QiPit	Turns iPhone into a scanner.
Spell Check	A spell checker and a dictionary.

WritePad	Advanced handwriting recognition software for print, cursive, or mixed handwriting styles.
TouchCalc	A calculator program that offers scientific mode, bit/integer mode, and statistics mode.
Speak it	Text to speech software that read emails, articles, and other documents.
Google Earth	Mapping application to learn a bout land formations, land use, altitude, longitude/latitude, etc.
Science Glossary	Includes a glossary of scientific terms and short biographies of key scientific figures in human history.

There are also many mobile productivity applications that can be downloaded free of charge at a low cost. Table 2 presents some selected productivity tools that can be installed on mobile devices and used in education.

Collaboration.

Using mobile interactive multimedia and communication in education offers new methods to support learning, collaboration and communication (Milrad, 2006). Activities that support collaborative learning are based on the role of social interactions in the process of learning (Naismith, Lonsdale, Vavoula, & Sharples, 2004). Online discussion and text messaging are two examples of exchanging information remotely. Collaborative games and social media creation application support social constructivism (Vygotsky, 1978) and increase learners' engagement and knowledge retention.

Best practices in instructional design for mobile devices.

Despite the fact that mobile devices are growing and improving at an exponential

rate, learning with mobile devices has some technical and economical limitations. The technical limitations include speed of data access, device size, screen size, input interfaces, and memory size; and economical considerations deal with cost of devices and cost of data access (Varadarajan, 2010). A review of best practices in instructional design for mobile devices helps mitigate these issues in mobile learning. The following is the list of best practices in mlearning *(*Crain, 2008; Varadarajan, 2010*)*.

- Limiting data entry in projects and assignments to avoid using keyboard more than needed.
- Avoiding costs to learner.
- Testing design approaches to deliver the most appropriate format for content or selecting types of multimedia.
- Providing offline options so learners have other options to download the content and activities other than mobile wireless connection.
- Minimizing graphical content to decrease the loading time and increase the available screen space as well as battery life.
- Placing non-essential links and learning materials at the bottom of the page to save more screen space.

Mobile learning design aspects

As mentioned before although mobile devices are being used for a variety of purposes, there are technical limitations and affordances that need to be taken into account. Small memory, short battery life, small screens, resolution, small keyboard, high costs of operation, varied standards and protocols, and in some cases security issues are instances of these technical limitations (Gafni, 2009).

From the quality perspective, mobile learning systems are included in the "wireless information systems" category and, thus, the quality of design should be measured according to the International Organization for Standardization / International Electrotechnical Commission (ISO / IEC 9126) quality characteristics (Gafni, 2009). As shown in table three, functionality, reliability, usability, efficiency, maintainability, portability, and quality in use are the seven quality characteristics that should be considered in designing mobile learning systems.

Table 2

ISO / IEC 9126 quality characteristics and sub-characteristics (adapted from ISO/IEC 9126-1, 2001 as cited in Gafni, 2009)

Functionality	Reliability	Usability	Efficiency	Maintainability	Portability	Quality in Use
Suitability	Maturity	Understandability	Time Behavior	Analyzability	Adaptability	Effectiveness
Accuracy	Fault Tolerance	Learnability	Resource Utilization	Changeability	Installability	Productivity
Interoperability	Recoverability	Operability	Efficiency Compliance	Stability	Co-existence	Safety
Security	Reliability Compliance	Attractiveness		Testability	Replaceability	Satisfaction
Functionality Compliance		Usability Compliance		Maintainability Compliance	Portability Compliance	

Functionality.

Functionality is the "capability of the software product to *provide functions* which

meet stated and implied needs when the software is used under specified conditions" (ISO/IEC 9126-1, 2001 as cited in Gafni, 2009).

Answering the following questions would help determine and potentially improve the functionality of the mobile learning interfaces.

Suitability: Does the system have the capability of providing appropriate functionalities to fulfill needs of users?

Accuracy: Does the system have the capability of providing appropriate result and information?

Interoperability: Does the system have the capability of interacting with other specified systems?

Security: Does the system have the capability of protecting information and data from unauthorized users?

Reliability.

Reliability of a mobile software interface refers to "the capability of the software product to *maintain* a specified level of performance when used under specified conditions" (ISO/IEC 9126-1, 2001 as cited in Gafni, 2009).

Addressing the following questions would help determine the reliability of mobile learning software.

- Maturity: Does the system have the capability of avoiding failure as a result of software errors?
- Fault tolerance: Does the system have the capability of maintaining the performance in specified level after system failure?
- Recovery: Does the system have the capability of recovering data after system

failure?

- Reliability compliance: Does the system have the capability of meeting the standards and regulation relating to reliability?

Usability.

Usability is "the capability of the software product to be understood, learned, used and attractive to the user, when used under specified conditions" (ISO/IEC 9126-1, 2001 as cited in Gafni, 2009).

The following usability issues must be analyzed when planning the usability of the mobile devices.

- Understandability: How much effort do users need to exercise identify the conception of the system?
- Learnability: How much effort do users need to exercise learn the application?
- Operability: How much effort do users need to be able to exercise control and operate the system?
- Attractiveness: Does the system have a graphical user interface that target users will find attractive?
- Usability compliance: Does the system meet the usability regulations and standards?

Efficiency.

Efficiency refers to "the capability of the software product to *provide appropriate performance*, relative to the amount of resources used, under stated conditions" (ISO/IEC 9126-1, 2001 as cited in Gafni, 2009).

The following questions would be considered to determine the efficiency of the

mobile learning interfaces.

- Time behavior: Does the system have the capability of providing appropriate response and processing times under specified circumstances?
- Resource utilization: Does the system have the capacity of managing the resources under specified circumstances?
- Efficiency compliance: Does the system have the capability of meeting the regulation and standards relating to efficiency?

Maintainability.

Maintainability refers to "the capability of the software product to be *modified*. Modifications may include corrections, improvements, or adaptation of the software to changes in environment, and in requirements and functional specifications" (ISO/IEC 9126-1, 2001 as cited in Gafni, 2009).

Maintainability of the mobile learning software can be determined by analyzing the following:

- Analyzability: How much effort is needed to diagnose the failure of the system and identify the parts that needed to be modified?
- Changeability: How much effort is needed for modification and system error elimination?
- Stability: What is the application tolerance regarding unpredicted effects of modification?
- Testability: How much effort is needed to validate the modification?
- Maintainability compliance: Does the system have the capability of meeting the regulation and standards relating to maintainability?

Portability.

Portability is "the capability of the software product to be transferred from one environment to another" (ISO/IEC 9126-1, 2001 as cited in Gafni, 2009).

Answering the following questions would help identify the portability of the mobile learning programs.

- Adaptability: Does the system have the capability of adapting to the variant environment without further effort?
- Installability: How much effort is needed to install the system in specified setting?
- Co-existence: Does the system have the capacity to co-exist with other software and sharing mutual resources?
- Replaceability: Does the system have the capability to be replaced instead of another specified software for the same purpose in the same setting?
- Portability compliance: Does the system have the capability of meeting the regulations and standards relating to portability?

Quality in use.

Quality in use is "the capability of the software product to enable specified users to achieve specified goals with effectiveness, productivity, safety, and satisfaction in specified contexts of use" (ISO/IEC 9126-1, 2001 as cited in Gafni, 2009).

The following list of issues must be analyzed to determine the quality aspect of the mobile learning systems or programs in use.

- Effectiveness: Does the software product have the capability to assist users in achieving specified objectives?

- Productivity: Does the software product have the capability to enable users to specify appropriate amounts of resources in specified settings?
- Safety: Does the software product have the capability to provide acceptable level of risk of destruction in specified settings?
- Satisfaction: Does the software product have the capability to satisfy users in specified circumstances?

Mobile Learning Management Systems

The popularity of mobile devices is the main reason for the increased emphasis that LMS providers have planed on designing and developing mobile versions of their main product. According to Woodill (2011), there are currently few companies that put an effort to design and develop LMS for the mobile platform. The list of such companies that already released mobile versions of their LMSs is limited to Blackboard™ and Desire2Learn™ plus, Moodle, and Sakai.

As for open source LMSs, the latest status of Moodle Mobile (MOMO) is "as-is" since, there were not enough resources to develop the project further. Available features on MOMO include forums, choices (polling), resources, communications, mobile offline learning objects (MLOs), semacodes (mobile tagging), mobile community, and mobile blogging. "Each release of Sakai for the past few years has had an embedded mobile portal (S. Keesler, personal communication, November 21, 2011)". In 2011 Sakai's CLE™ Technical Coordination Committee (TCC) Chair Megan May announced the release of Sakai CLE 2.8.0™, which features multiple mobile portal user interface improvements.

In reviewing mobile LMSs, Woodle (2011) has identified five levels for mobile LMSs' readiness for implementation in the context of mobile learning:

Level 0: LMSs that are not ready for mobile learning

Level 1: LMSs that are graphically remodeled for mobile devices (Moodle, Sakai™)

Level 2: mobile extensions for existing LMSs (MLE-Moodle, MOMO, Blackboard Mobile™)

Level 3: stand-alone, self-sufficient mobile LMSs (BlackBerry Pushcast™)

Level 4: innovative mobile LMSs that use new affordances of mobile devices (e.g. touch capabilities)

Blackboard™.

Blackboard Mobile Learn™ offers an interactive teaching and learning environment for the mobile platform, which enables students and teachers to have access to their courses and content on a variety of mobile devices. According to the press release archive, the first release of Blackboard™ for the mobile web platform was on July 14, 2009. Blackboard™ introduced MobilEdu™ that could deliver a set of campus life services and content to mobile devices and was uniquely named for different institutions. The features of MobilEdu™ included navigation through course catalogs and campus maps, e-mail, real-time updates on course schedules, campus events, news, and sports updates (Blackboard™ website, 2010). On June 15, 2010 Blackboard™ announced the release of mobile learning applications for all major mobile platforms including Android™, Blackberry™, iPhone™ / iPod Touch™, and iPad™ (Blackboard™ website, 2010). Currently, students and instructors may access documents in multiple formats,

post announcements, participate in discussions, upload different media as attachments to discussion boards and blogs, create content, comment in blogs and journals using, view their grades, and see the classlist (Blackboard Mobile™, 2011).

Figure three and figure four show poling results that the Blackboard™ team have reported, as students came to their website with questions about their products or whether their institution is utilizing them. Below are the statistics for the mobile devices and most desired features of Mobile Learn™ that students selected (D. Small, personal communication, September 29, 2010).

The total number of responses was 3508. Blackberry™ was the most popular device used among students (1223 responses) and iPhone was the second most used device (804 responses).

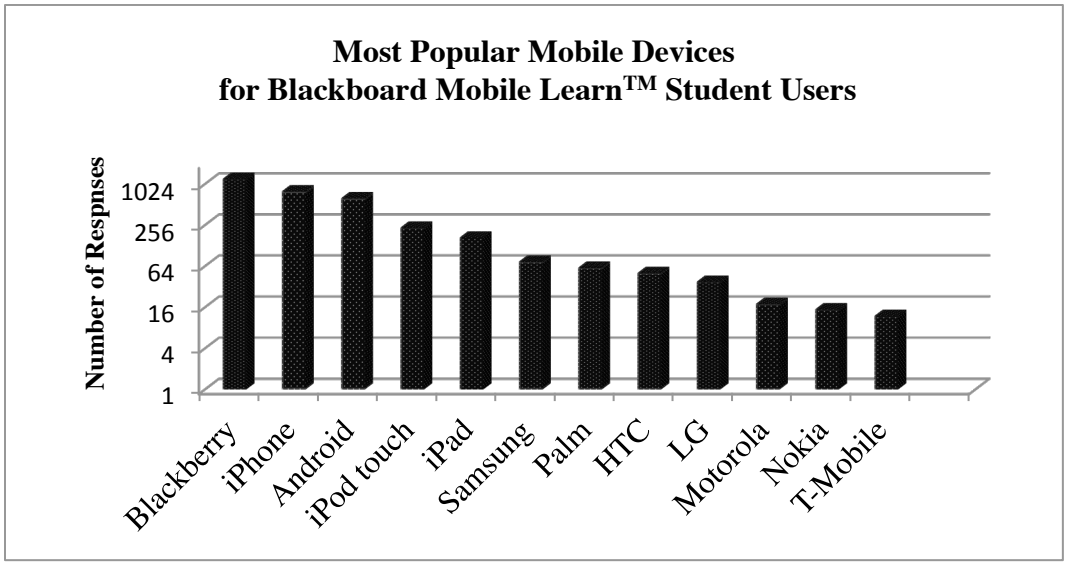

Figure 3: Most popular mobile devices for Blackboard Mobile Learn™ student users

Most requested features included as assignments, grades, and announcements and the least requested features were campus directory, maps, and athletics.

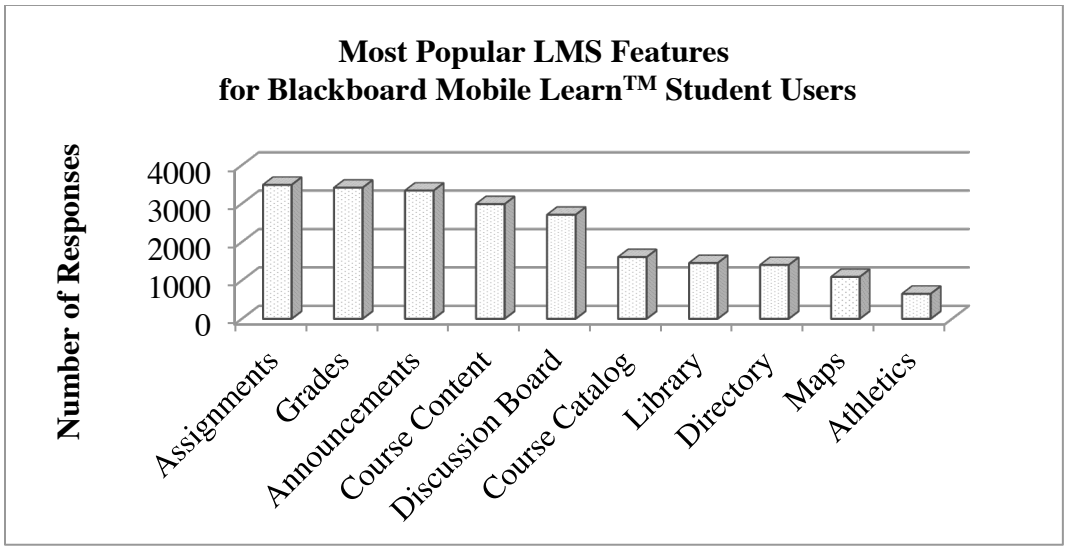

Figure 4: Most Popular LMS Features for Blackboard Mobile Learn™ Student Users

Desire2Learn™.

On July 21, 2008 Desire2Learn's™ president and Chief Executive Officer John Baker and Chief Operating Officer Jeremy Auger presented Desire2Learn 2GO™ (McLeod, 2008). D2L 2GO™ is a mobile learning application designed primarily for Blackberry™ smartphones (but compatible with other mobile devices). It helps learners and educators stay connected anytime and anywhere with each other and with their e-learning program. On October 7, 2010 Desire2Learn™ announced that their mobile application has been optimized to mobile browsing - with no downloading and installation required (McLeod, 2010). On March 22, 2011 Desire2Learn™ announced the released of the Desire2Learn Campus Life™ that could enable users to communicate, collaborate, and share information on the go – beyond the primary functions of standard LMSs (McLeod, 2011). Below are the screenshots of Desire2Learn 2GO™ that is being used at Oklahoma State University.

Figure 5: Screenshot of the main Desire2Learn 2GO™ page

Summary

In conclusion, the LMSs have evolved from the stand-alone desktop versions of the 1960s and 70s to sharable, web-based systems of the 1990s. Most of the LMSs that are popular today were developed more than a decade ago and these companies or individuals representing them (as in the case with Moodle) are making attempts to create mobile versions – to meet the needs of the "digital natives" who are using handheld, mobile devices for many of their needs. What is not clear at this point, however, is how mobile LMS interfaces should be designed to reflect the needs and goals of the primary users – teachers and students. This was the main goal of this study, which is described in detail in Chapter 3: Methodology.

CHAPTER III

METHODOLOGY

Research Questions

This study was aimed to exploring the perceptions of university students and faculty regarding their patterns of use and usefulness of various mobile learning management systems features. We designed two surveys (one for students and another one for faculty) to ask the participants to indicate which content presentation, communication, and assessment features of Desire2Learn they would like to see in the mobile version of this LMS. This study addressed three research questions:

1. What are the demographic characteristics of mobile LMS users among university students and faculty?
2. What are the current pattern of mobile LMS use by university students and faculty?
3. What are university student and faculty perceptions regarding the usefulness of LMS features in the mobile version?

Participants

Convenience sampling was used as the sampling method in this study. The.

The sample included 5,000 OSU students and faculty. The sample size was limited to 5,000 participants because this was the maximum sample size permitted by OSU to be used for research purposes. OSU's Institutional Research and Information Management provided a list of random email addresses for both students and faculty at OSU Stillwater and Tulsa campuses. The email addresses in this list belonged to three main categories of OSU students and employees: faculty teaching at OSU-Stillwater or OSU-Tulsa, OSU-Tulsa or OSU-Stillwater graduate students, and OSU-Tulsa or OSU-Stillwater undergraduate students. Below is the number of participants selected by the Institutional Research and Information Management services from each category.

1. 600 faculty teaching at OSU-Stillwater or OSU-Tulsa
2. 1,200 OSU-Tulsa or OSU-Stillwater graduate students
3. 3,200 OSU-Tulsa or OSU-Stillwater undergraduate students broken down as follows:
    - 800 Freshmen
    - 800 Sophomores
    - 800 Juniors
    - 800 Seniors

Of the 4,400 students, 335 students participated in our survey – 129 graduate students and 206 undergraduate students. Also, 52 professors completed our survey. The response rate that was project during research conceptualization and design was 10 percent. We received data from 8.6 percent of faculty members and 7.6 percent of students. Institutional Review Board approval (Appendix A) was received during the stage of research design conceptualization.

Instrumentation

The data were collected using two online surveys – one for students (Appendix B) and one for faculty (Appendix C). Surveys were implemented using LimeSurvey™, which is a secure, open-source, web-based survey management system. Each survey consisted of 14 questions to address the three research questions. Eight questions from the student survey and six questions from the faculty survey were designed to collect data on participants' demographics (Research question one). The participants were asked to provide information included ethnic background, major or academic area, gender, classification or rank, and a few other demographic questions. Four questions from the student survey and six questions from the faculty survey were designed to reveal the current patterns of using mobile Desire2Learn™ (D2L™) and the two remaining questions from both surveys were intended to determine the types of features these groups would like to use in a mobile LMS. The data collection was completely anonymous, but the participants had the option to provide their email address to participate in a drawing for 2 8GB iPod Shuffles™ and 5 $20 Walmart™ gift cards.

Setting

Currently, OSU's OCampus (http://ocampus.okstate.edu/) offers a number of graduate degrees online, as well as online undergraduate and graduate courses. OSU online learning degrees are offered by the colleges of Agricultural Sciences and Natural Resources, Arts and Sciences, Spears School of Business, College of Engineering, Architecture, and Technology, College of Education, and Human Environmental Sciences. OSU uses Desire2Learn™, which is a customizable learning management

system, to offer online courses or use it as a supplementary tool to enhance traditional face-to-face instruction. Online tutorials are provided for those students or faculty that need to learn more about using OSU's D2L™ system.

OSU's D2L™ installation provides the following instructional features (modules): Articles, Chat, Classlist, Discussions, Dropbox, Email, Glossary, Grades, Journal, Links, Locker, Pager, Picture Library, Quizzes, and Schedule. Faculty can add or remove each feature in their courses based on their preferences and understanding of instructional design. OSU also offers a mobile version of D2L™ (D2L 2GO™). Once the students log in to the mobile D2L™ site, they can find their courses, events, and news items. The other features that are currently available in D2L 2GO™ are content, grades, bookmarks, and calendar.

As common with mobile versions of dynamic websites, the number of features in D2L 2GO™ is limited and constitutes less than one third of the features of the desktop version. Thus, it was important to determine whether the existing and missing features would be perceived as useful for student and faculty needs. The data collected from students and faculty can inform decisions regarding which LMS features should be added to or removed from the current version of D2L 2GO™.

Procedure

One email was sent to the entire sample list to invite faculty and students to participate in the survey. Appendix D is the recruitment script (email) that was used to invite the participants and guide them to the online survey website.

The surveys were both available online from March 23, 2011 to April 30, 2011. The estimated time to complete the survey was about 10 minutes for either student and faculty versions. Appendix E is the informed consent form that was posted on the survey website. The purpose of the study, its primary benefits, participants' confidentiality, and potential of risks of participating were outlined in this document. In addition, contact information of the researcher was included to allow participants to contact her with any questions regarding the study. After this step, it was the participants' choice to continue with the surveys or leave the website. The email address of those participants who wanted to be enrolled in the drawing was sent directly to the researcher's OSU email and stored in an Excel table separate from the survey responses.

Data Analysis

All the collected data were exported from the survey management system to Microsoft Excel™ and later used for data analysis using Statistical Package for the Social Sciences™ (SPSS™) and Microsoft Excel™. First, the data were checked for completeness. Any cases with missing information (one faculty participant) were removed from the data files. Then, the data were analyzed during descriptive statistics – including measures of central tendency, distribution, and dispersion. Due to the nature of our research questions and the type of data, most of the data analysis for this study occurred at this level. In some cases, the researchers used inferential statistics to explore the data in more detail. Because the data did not meet the normality assumption, nonparametric statistics were used. Relationships in the data were explored with nonparametric correlation coefficients like Gamma, Spearman R, and Kendall Tau. Variance was explored primarily using Chi-square tests.

CHAPTER IV

RESULTS

In this chapter the results are presented based on this study's three research questions and divided into student data and faculty data. Our research questions were as follows:

1. What are the demographic characteristics of mobile LMS users among university students and faculty?
2. What are the current patterns of mobile LMS use by university students and faculty?
3. What are university student and faculty perceptions regarding the usefulness of LMS features in the mobile version?

Research Question One

The first research question that will be addressed is regarding the demographic characteristics of mobile LMS users among university students and faculty. Eight questions from student survey and six questions from faculty survey were designed to collect data on LMS users' demographics.

Participants' use of handheld devices..

Students. Relative to student respondents' use of handheld devices, about one third of them (33 percent) owned an iPhone™, which was the most popular portable device and this trend was especially pronounced among students majoring in Business. The next most popular device was Android-based phones (14 percent - primarily Engineering majors), 10 percent of student participants had other smartphones, six percent used Blackberry™ devices - mostly female students, four percent owned an iPod Touch™ (predominantly freshman students), three percent used an iPad™ (mostly senior students). Unlike the common belief that students today are "connected" through their mobile device, almost one third of students surveyed in this study had phones with no data plan and Internet access (30 percent).

Faculty. Again, iPhone™ was the most popular handheld device among faculty (44 percent) – particularly among Business Professors, while 30 percent of faculty had phones with no data plan. Only eight percent of faculty members had Blackberry™ devices (primarily Education Professors) and the same percent owned other brands of smart phones. Less than six percent used an iPad™, two percent used an iPod Touch™ and, surprisingly, only two percent had an Android™ phone.

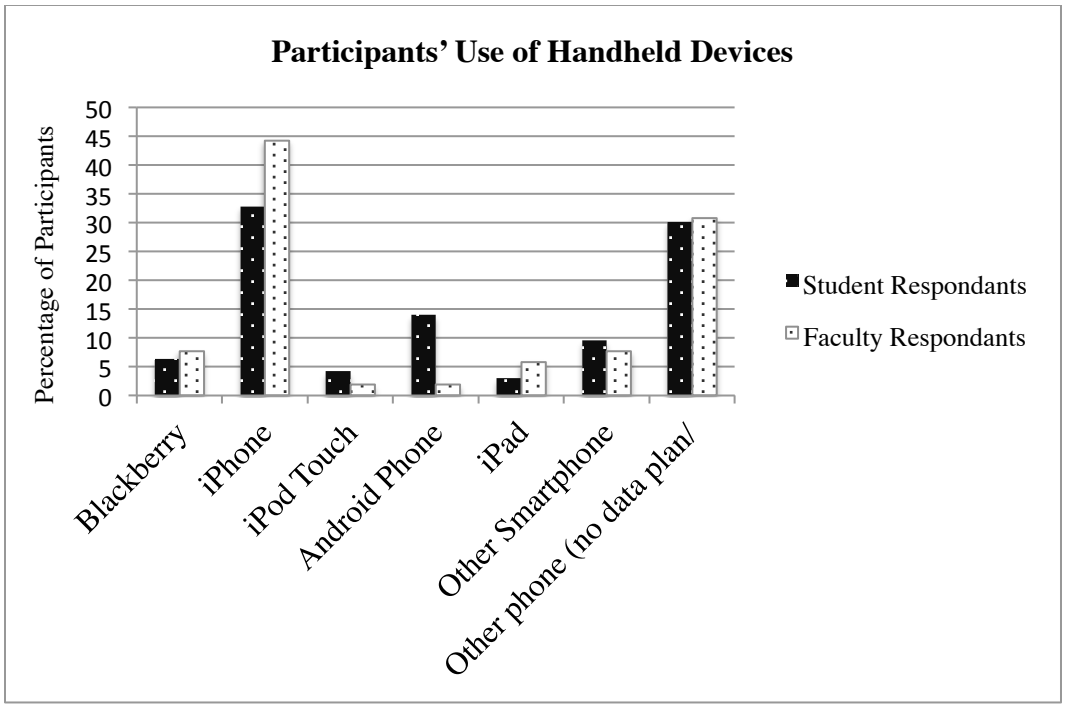

Figure 6: Comparison of Participants' Use of Handheld Devices

Experience with online courses using D2L™.

Students. Almost half of the student participants have never taken any online courses (45 percent) which was an unexpected finding, considering that the university had been offering online courses for a bout a decade. Among the students, more Engineering students reported never taking an online course and mostly Business students reported taking four or more online courses. Seventeen percent of the students have experienced taking only one online course, approximately one quarter of students reported that they had taken less than four courses (23 percent) and 18 percent have taken four or more than four online courses during their study at OSU.

Faculty. Nearly half of the surveyed faculty members have never taught any online course at OSU (52 percent). About six percent of them have taught only one

course and six percent taught less than four courses, and 37 percent of them taught 4 or more online classes at OSU using Desire2Learn. Thus, the results show that the faculty participants could be divided into two large groups: online instructors with significant online teaching experience and those who have never taught online (potentially because it was their choice not to teach online). Of all faculty members, Business professors were reported having taught "four or more" online courses most of all.

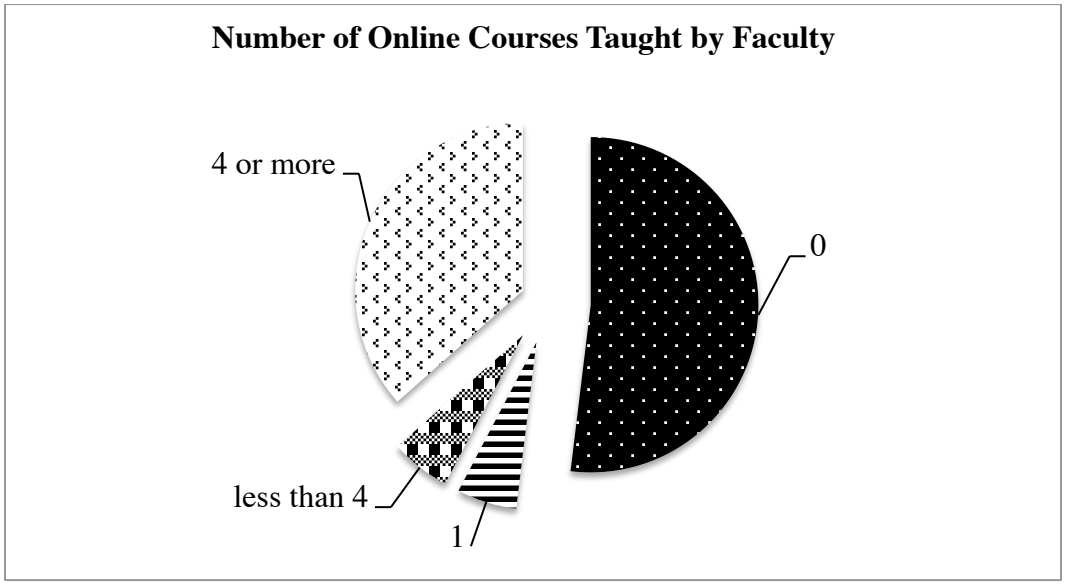

Figure 7: Number of Online Courses Taught by Faculty

Frequency of D2L use.

Students. This study's participants reported diverse patterns of D2L use. Approximately a quarter of students stated that they log in once a day (27 percent) – mainly freshman students, while 29 percent log in more than three times a day – primarily Engineering students and juniors. About one third of students (33 percent) log in more than three times a week – mostly Business students, and 11 percent of them log

in even less than once a week – predominantly graduate students. The figure below shows the frequency of using D2L.

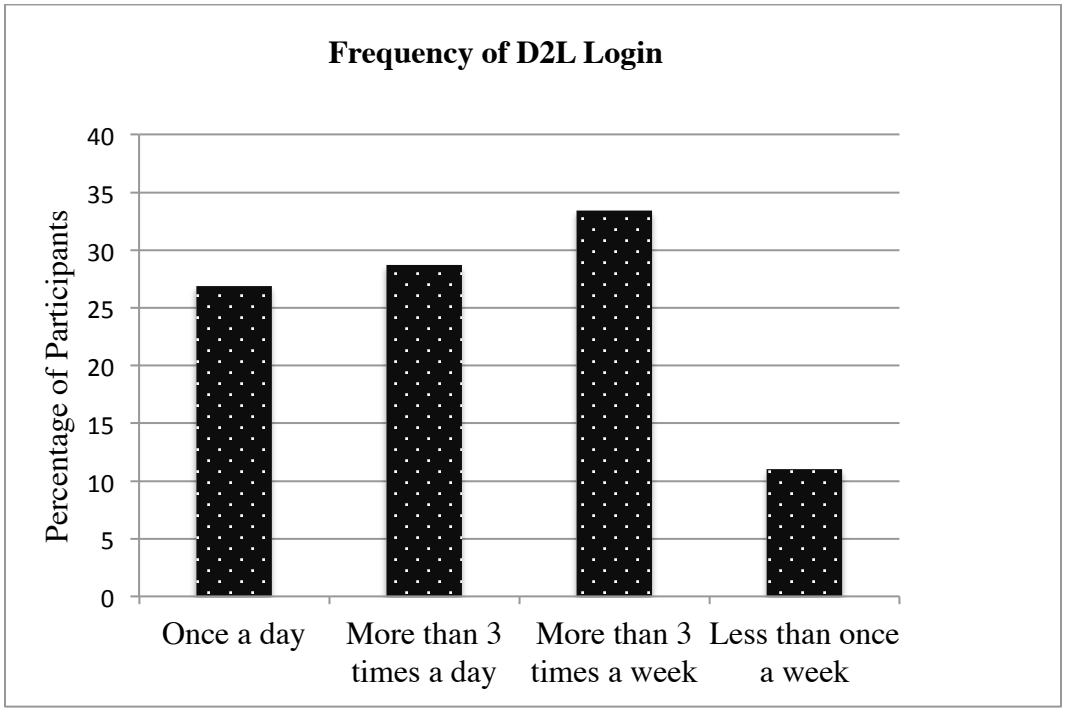

Figure 8: Frequency of D2L Use

Participants' gender.

Students. More than half of the students who participated this study were female (55 percent) and the rest of them were male (45 percent). Predictably, of the 66 engineering student participants 50 were male and only 16 of them female. Of the 40 social sciences students, 33 were female and only seven were male. The number of female students majoring in Education was twice the number of males. However, the gender distribution among Business students was relatively even – 38 female and 30 male students.

Faculty. Among the faculty members who participated in this research, nearly one third were female (33 percent) and 67 percent of them were male. There was no female faculty in the sample representing Engineering programs.

Ethnic or racial background.

Students. The majority of students who participated in this survey were white (78 percent). The racial diversity of the rest of the sample was as follows: nine percent Asian, six percent American Indian or Alaska native, three percent Black or African American and Hispanic or Latino each, and 0.6 percent Native Hawaiian or Other Pacific Islander.

Faculty. Ninety four percent of participating faculty members in this study were Caucasian. The other three races were Asian, Black or African America, and Hispanic or Latino with only two percent each.

Classification.

Students. The following chart shows the distribution of the participating classification. Most of the student participants were master's students (22 percent) and seniors (21 percent). The distribution of the number of PhD and freshman students was also similar, 16 percent each. The next classification of students was juniors at 15 percent. Finally, the lowest number of participants was sophomore student at 10 percent.

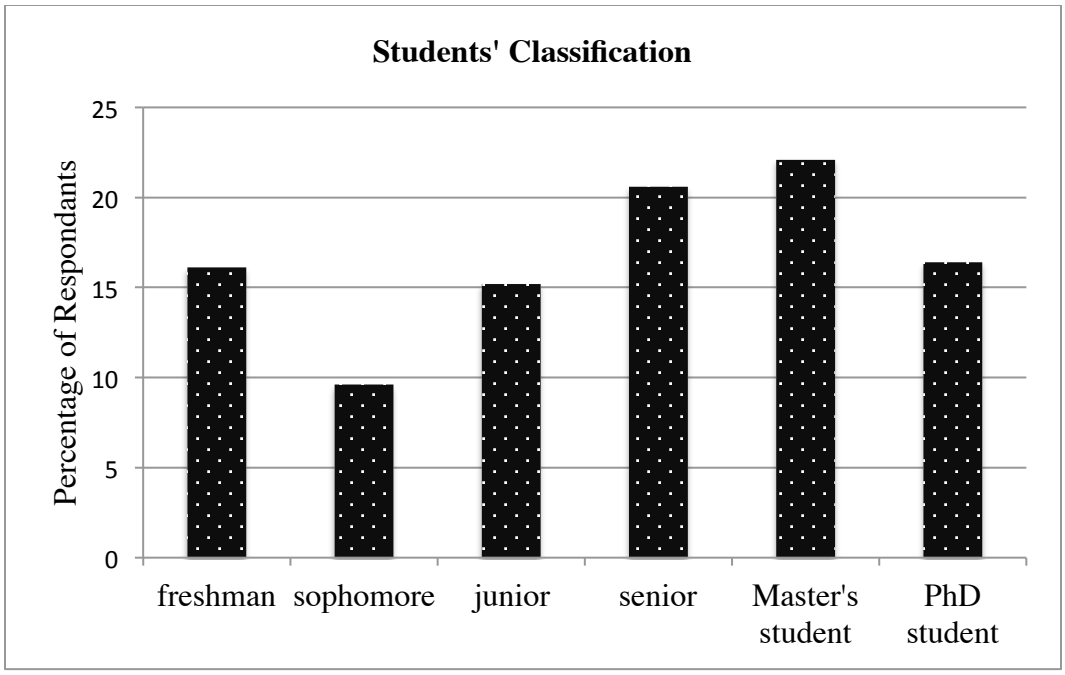

Figure 9: Students' Classification

Professors' rank.

Faculty. The number of Associate Professors (39 percent) who participated in this study was higher than representatives of other academic ranks. There were 31 percent of Assistant Professors and Full Professors each, while no Adjunct Professors took part in this study.

Students' major.

Students. Approximately one fifth of the student respondents were majoring in Business and Engineering, followed by Education (13 percent), Social Science (12 percent), and Agricultural Sciences (10 percent). The rest of the students who participated in this study represented Health/veterinary fields (five percent), Art and design and Humanities (three percent each). The remainder of student participants (14 percent) came

from other majors. The following graph shows the distribution of the student participants according to their major.

Academic area.

Faculty. Professors from Business and Education colleges accounted for most of the completed surveys in the sample (23 and 15 percent respectively), followed by faculty with Social Science (14 percent) and Engineering background (12 percent). Humanities and Agricultural Sciences faculty comprise 10 percent of the sample each. Only two percent of Art and design and Health/veterinary faculty participated in the study. Finally, the rest of the faculty (14 percent) had other academic background. The following chart presents the distribution of students' major and professors' academic background.

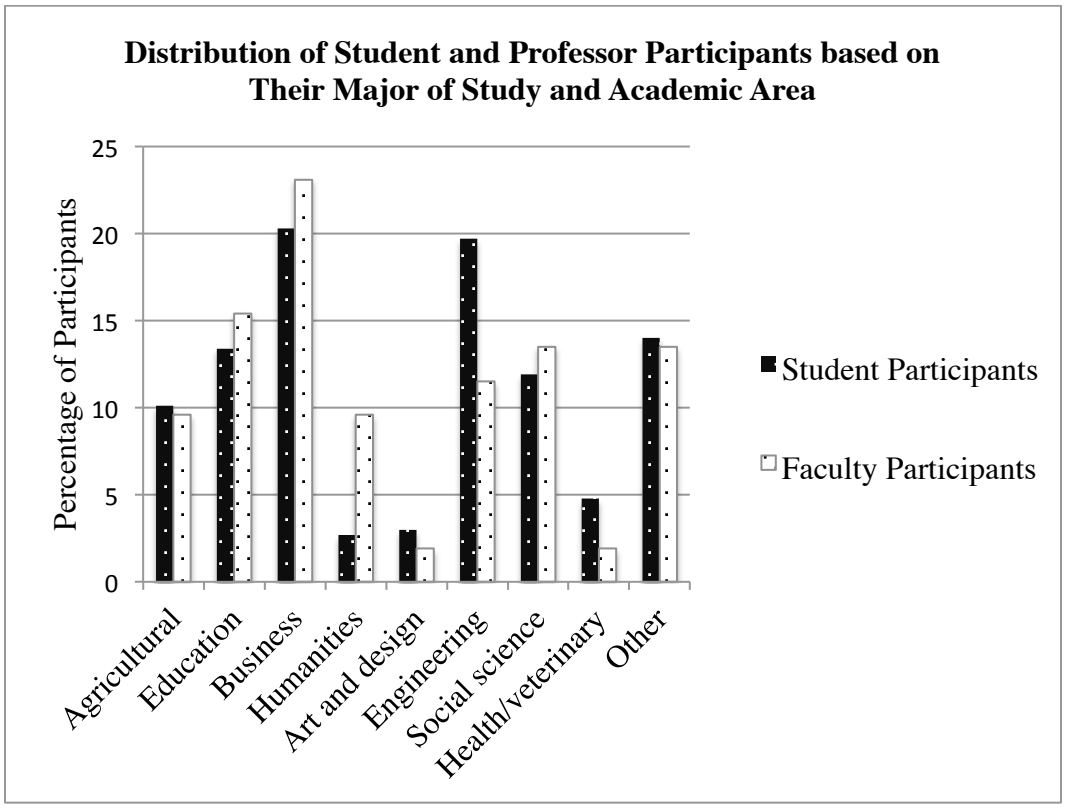

Figure 10: Distribution of Student and Professor Participants based on Their Major of Study and Academic Area

Cumulative GPA.

Students. More than half of the students who participated in this study had a cumulative GPA higher than 3.5 (55 percent). Twenty nine percent of the students reported a GPA of between three and 3.5. Less than one fifth of the students had a GPA lower than three. Only 13 percent of the students reported their GPA between 2.5 and 2.9 and the rest listed their GPA lower than 2.5 (three percent). The following table shows the distribution of students' cumulative GPA.

Table 3

Cumulative GPA of Students

Cumulative GPA	Number of Participants	Percent
Lower than 2.5	9	2.7
2.5 to 2.9	45	13.45
3 to 3.5	96	28.7
Higher than 3.5	185	55.2
Total	335	100.0

Summary.

Student participant demographics demonstrate that most student participants used an iPhone or had handheld devices with no data plan. The majority of students have never taken any online courses, however one third of the students accessed D2L more than three times a week. Both genders were equally represented among students and their

ethnic background was predominantly Caucasian. The majority of student participants were master's students and seniors. Most student participants majored in Business and Engineering. The cumulative GPA of more than half of the student sample was higher than 3.5.

Faculty participant demographics showed that most faculty members used an iPhone or had handheld devices with no Internet access. About half of the faculty members have never taught any online courses while approximately one third of them taught four or more. Two thirds of the faculty participants were male, and Caucasian, and more than one third of the faculty members were Associate Professors. Faculty members from Business and Education were most represented in the faculty sample.

Research Question Two

The second research question was aimed at discovering the current patterns of mobile LMS use by university students and faculty. Four questions of the student survey and six questions of the faculty survey were designed to address this question.

Level of comfort teaching with Desire2Learn.

Faculty. More than half of the surveyed professors reported that they were comfortable with D2L (29 percent) or quite comfortable (27 percent) teaching. Approximately one fifth of the professors specified that they are not very comfortable teaching online courses via D2L (19 percent) and 14 percent stated that they are not comfortable at all. The rest of the participants indicated that this question does not apply to them (12 percent). The table below shows the number of participants and the percent for each option. Among 14 faculty members that indicated "quite comfortable", 12 had

taught four or more online courses and only two of them had never taught any online courses. On the other hand, none of the faculty participants who reported "not comfortable at all" had ever taught any online courses. This finding was confirmed using several nonparametric correlation coefficients (both directional and symmetric measures). For example, Gamma, which many consider to be preferable to Spearman R or Kendall tau was significant at $p < .000$ ($G = .807$).

Table 4

Comfort of Teaching with Desire2Learn

Level of Comfort	Number of participants	Percent
Quite comfortable	14	26.9
Comfortable	15	28.8
Not very comfortable	10	19.2
Not comfortable at all	7	13.5
Not Applicable	6	11.5
Total	52	100.0

Accessing online courses on handheld devices.

The following chart shows the frequency of using handheld devices to access online courses by student and faculty participants.

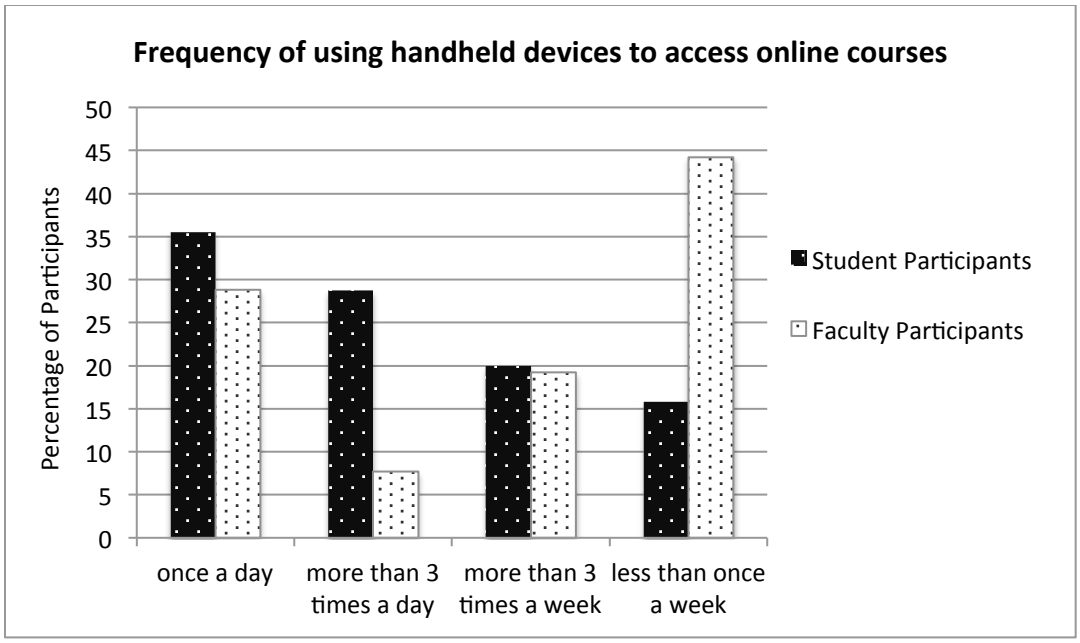

Figure 11: Frequency of using handheld devices to access online courses

Students. More than one third of the surveyed students (36 percent) indicated that they would prefer to access online courses on their handheld devices once a day (mostly students with a GPA of 3.0 or higher). Almost another third of the students (29 percent) preferred to access it more than three times a day (students with GPA between 2.5 and 2.9), while exactly one fifth of them expected to use it more than three times a week. The rest of the students (16 percent) wanted to access it less than once a week. The following chart presents the frequency of using handheld devices to access online courses by students' GPA.

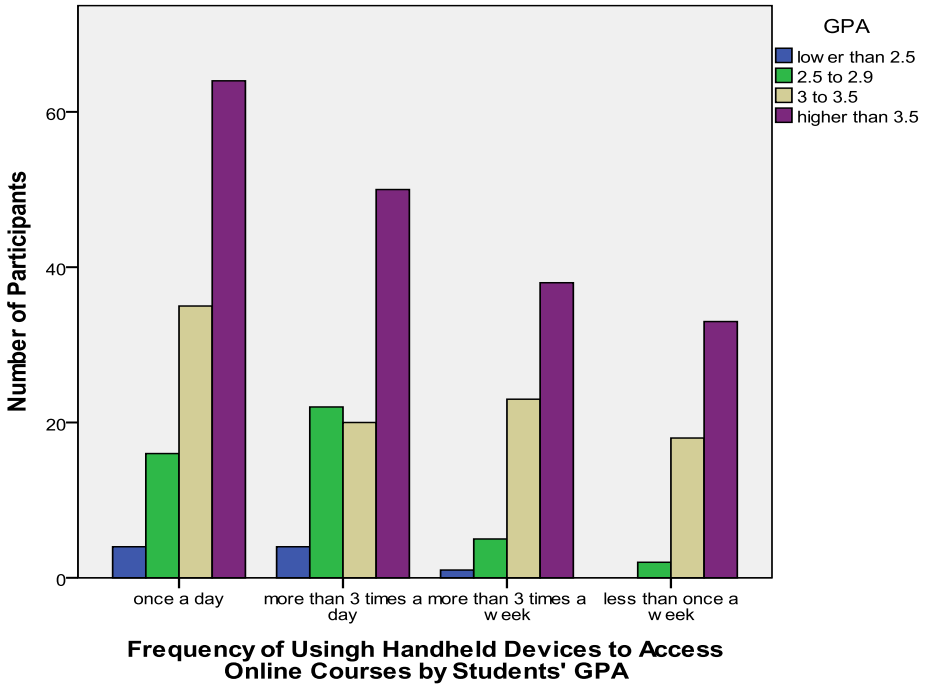

Figure 12: Frequency of Using Handheld Devices to Access Online Courses by Students' GPA

Faculty. The surveyed faculty members showed much less interest in using handheld devices to access online courses (44 percent). Total one third (29 percent) of faculty believed that once a day access would be quite enough while only eight percent preferred to have access more than three times a day and the rest wanted to use it more than three times a week (19 percent). It is interesting that most of Full Professors preferred to use it once a day and none of them indicated "more than three times a day". Assistant Professors and Associate Professors, on the other hand, mostly selected "less than once a week". The figure below shows the frequency of using handheld devices to access online courses by professors based on their rank.

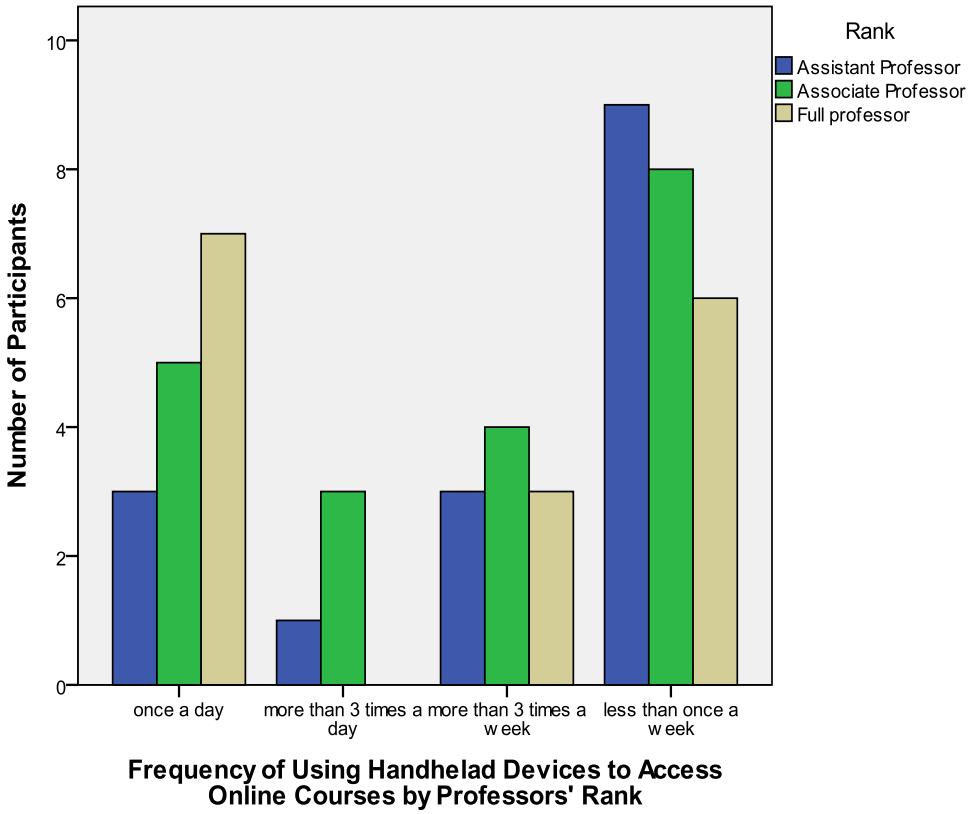

Figure 13: Frequency of Using Handheld Devices to Access Online Courses by Professors' Rank.

Locations of accessing online courses via handheld devices.

Students. More than half of the student respondents indicated that they prefer to access online courses through handheld devices while they are walking to or from class (51 percent). Nearly one third of them listed home as their favorite place (35 percent). Only five percent of students chose dorm and another five percent of them chose the library. Interestingly, only a small percentage selected gym as their preferred place to access online courses using handheld device (three percent).

Faculty. Faculty responses indicated patterns of accessing online courses using handheld devices that were quite different from those reported by students. Seventy one percent of surveyed faculty suggested home as the place that they would prefer to access online courses using handheld devices. The next preferred location was office (19 percent). Only six percent of faculty indicated while walking to or from class and four percent preferred the library. No faculty member chose gym as a favorite place to access online courses via handheld device.

The chart below shows the locations that student and faculty participants preferred to use their handheld devices to access online courses.

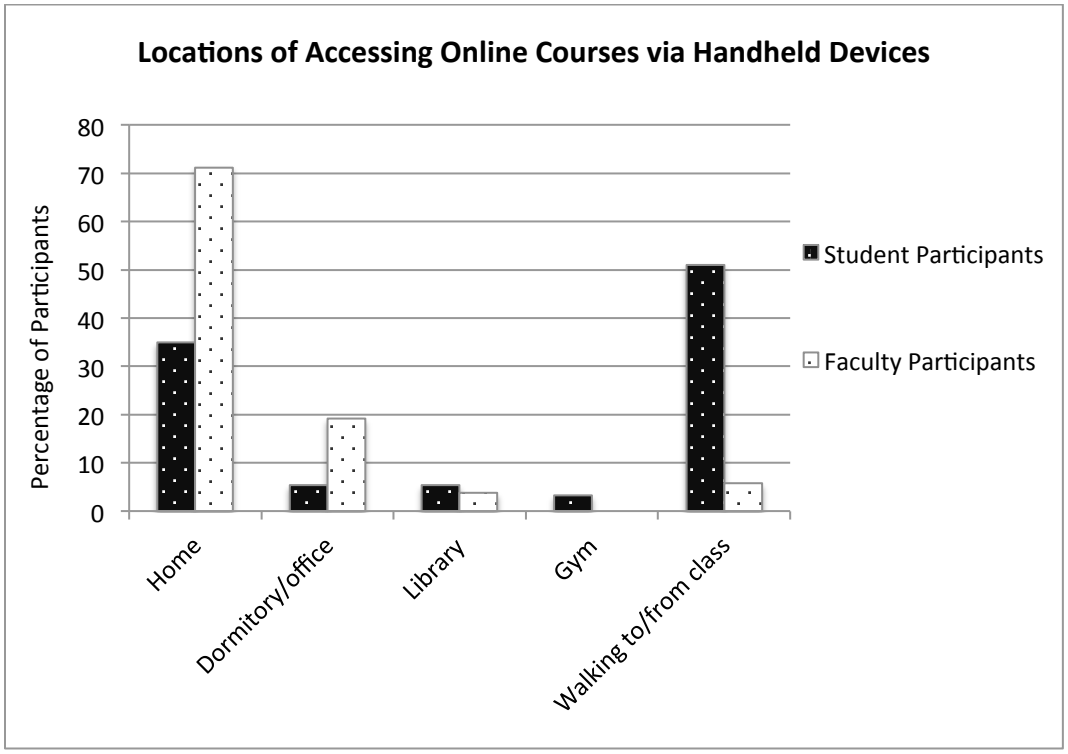

Figure 14: Locations of Accessing Online Courses via Handheld Device

Communication via text messaging.

Students. More than half of the participating students showed no interest in contacting their instructors via text messaging. Forty five percent selected strongly disagree (mainly Master's students) and 19 percent selected disagree. About one fifth of the students had a neutral opinion (30 percent), 10 percent agreed, and only five percent strongly agreed (mostly PhD students).

However, it appeared that text messaging is a common communication method among students since 41 percent of them strongly agreed and 33 percent of them agreed that they contact their classmates via text messaging (mostly female participants). About six percent of students disagreed and less 10 percent strongly disagreed (primarily graduate students) about communicating with their classmates using text messaging. The other students neither agreed nor disagreed (10 percent).

Faculty. Approximately half of the surveyed professors showed no interest in contacting other faculty members or teaching assistants via text messaging. More than one third of them strongly disagreed (37 percent) and 17 percent of them disagreed. Neither agree nor disagree, agree, and strongly agree were the options that respectively 15 percent of professors selected.

Preferred contact methods for faculty.

Faculty. Predictably, the preference of the faculty participants regarding the preferred method of contact in online courses was mostly e-mail (87 percent). Only 12 percent of professors preferred office hours (12 percent) and only two percent chose text messaging. No faculty member indicated phone and as it could be predicted no one listed Facebook as the preferred method to be contacted by students. E-mail was the only

method of preference for all Assistant Professors in the sample and, surprisingly, only Associate Professors expressed preference in being contacted during their office hours.

Faculty interest in designing online courses using a handheld device.

As shown in the table below, only nine percent of respondents definitely wanted to use their handheld device to design online courses. Twenty eight percent were clear about not using their handheld device for this purpose. About 40 percent wanted to use their handheld devices to add or modify course content (39 percent) and 24 percent indicated that they would use their handheld devices to add or modify course assignments.

Table 5

Interest in Designing Online Courses Using Handheld Devices

Level of Interest		Percent
Design	Definitely Yes	9.0
	Definitely No	28.4
	Add or modify course content	38.8
	Add or modify course assignment	23.9
Total		100.0

Summary. The current patterns of mobile LMS use by university students and faculty members were quite different. The majority of students reported that they would prefer to access online courses via their handheld devices once a day, while faculty members preferred to use it only once a week. There was a major difference in preference

of location for using handheld devices to access online courses. The majority of students access mobile D2L walking to or from class, while faculty members mostly access it from home.

A common communication method among students was reported as text messaging, but faculty members did not show interest in contacting other faculty or teaching assistants using it. Similarly, students would not prefer to contact professors via text messaging. On the other hand, email was reported as the most preferred method of contacts by university professors, while office hours was preferred by only 12 percent of them.

Another interesting finding was that more than half of the faculty reported that they are comfortable or quite comfortable in teaching with mobile D2L and more than two thirds of the faculty members showed interest in designing online courses using handheld devices to add or modify existing content and assignments.

Research Question Three

The third and final research question of this study intended to determine university student and faculty perceptions regarding the usefulness of LMS features in the mobile version. Two questions from both surveys were specified to address participants' perceptions.

Levels of popularity of LMS features on handheld devices.

For each feature, five options were provided (strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree). Student and faculty respondents could

indicate their desired features by specifying their level of agreement based on the provided scales.

The following chart represents the comparison of popularity of features between student and faculty respondents. The data chosen for this chart is based on the total number of responses: “strongly agree”. Grades and feedback, course calendar, announcement/news, assignment description, content, email, and university calendar were the most popular features for students. Email, announcement/news, course calendar, discussions, content, assignment submission, grades and feedback, classlist, and university calendar were the most popular features among faculty members.

Discussions, real time chat, and classlist were the only features that had more faculty support than students. Assignment submission was the only feature that faculty and student respondents expressed unanimity – regarding its usefulness for the mobile LMS. As for the rest of the features, students showed higher levels of appreciation than faculty.

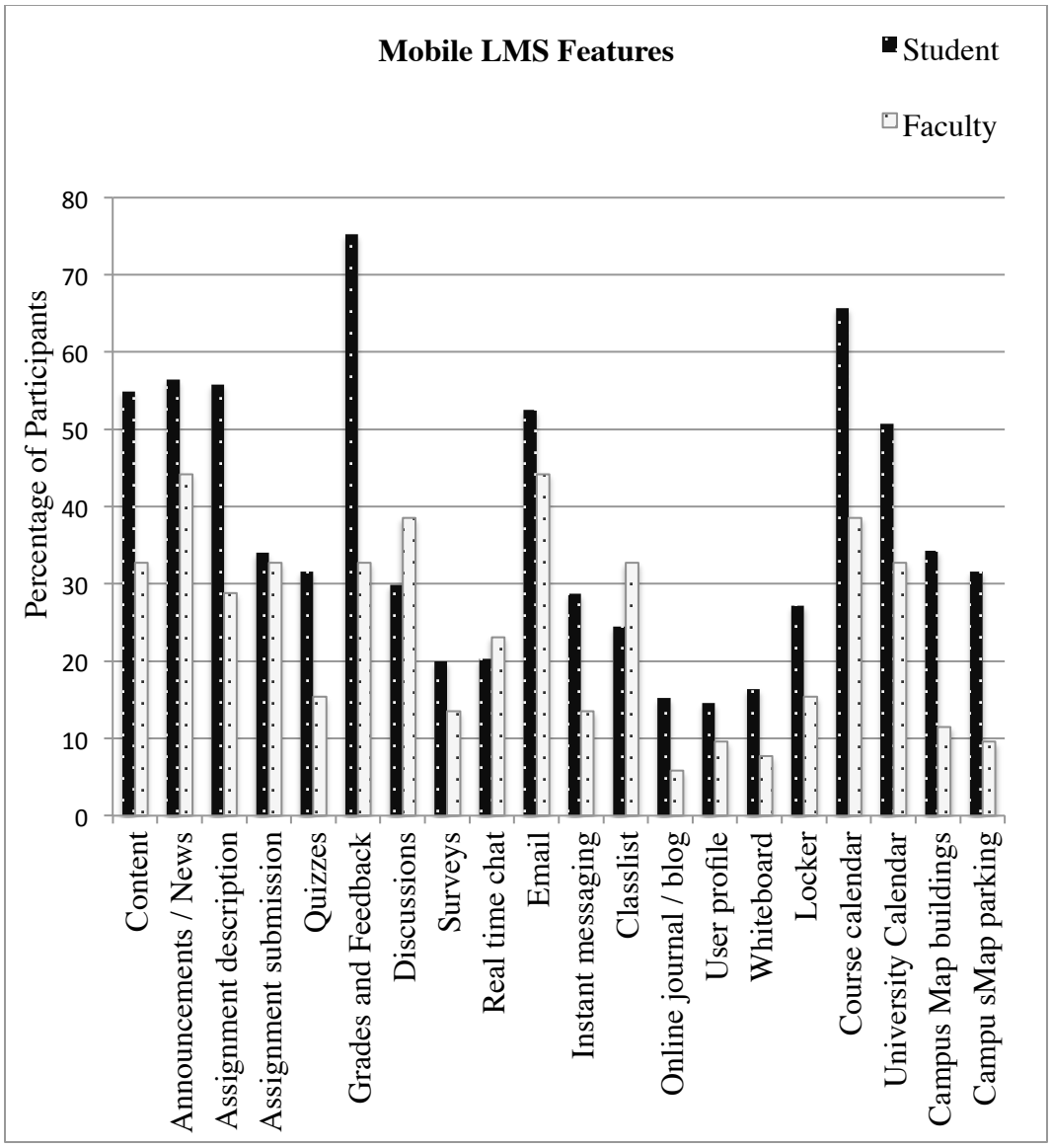

Figure 15: Preferences of Mobile LMS Features among Students and Faculty

Grades and Feedback.

Students. Grades and feedback was the most popular feature among student respondents with a total of 75 percent of students strongly agreeing (the highest number of responses was received from seniors, master's students, and freshman students respectively) and 17 percent agreeing that grades and feedback would be a useful feature

on the mobile version of D2L. Less than one percent disagreed, three percent strongly disagreed, and the rest of the students did not agree or disagree (four percent).

Faculty. Conversely, the faculty participants did not find grades and feedback as important and only 33 percent chose "strongly agree" (primarily Business and Education professors) and about a quarter of them (27 percent) selected "agree". Overall, a quarter of the surveyed professors did not find it useful for the mobile LMS, 14 percent listed "disagree" and 12 percent indicated "strongly disagree" - mainly professors from areas other than Business and Education. The other faculty members were neutral (15 percent).

The difference among faculty and student perceptions of the usefulness of the grades and feedback feature in a mobile LMS was further explored using Chi-square (the data did not meet the normality assumption for conducting most parametric statistics). There was a significant difference between student and faculty views regarding the usefulness of grades: $c^2(4, N = 387) = 59.78, p < .0001$.

Course Calendar.

Students. Course calendar was the second most popular feature among the students. Overall 90 percent of the students agreed or strongly agreed that course calendar would be a useful feature that can be used on LMS mobile version (25 and 66 percent respectively). Only two percent stated "disagree", five percent replied "strongly disagree", and three percent specified "neither agree, nor disagree".

Faculty. Course calendar was a popular feature among the faculty as well. It was the second most preferred feature for faculty (73 percent). Thirty nine percent of faculty – mostly Assistant Professors and Full Professors strongly agreed and 35 percent of them -

primarily Associate Professors – agreed. A total of about one fifth of the faculty did not feel that course calendar was a useful feature in a mobile LMS (17 percent strongly disagree and four percent disagree). The remainder of the sample (six percent) remained neutral.

Announcements/News.

Students. Announcements or news was the third most popular feature among student participants – primarily freshman and Master's students. More than half of the students strongly agreed (57 percent – mainly students majoring in Business) and a quarter of them agreed (26 percent – mostly Engineering students) that it could be very useful feature in a mobile LMS. About 10 percent were neutral (10 percent), only three percent disagreed, and five percent did not agree at all.

Faculty. Faculty respondents also showed interest in using announcements or news. It was the first most important feature for faculty members with approximately 60 percent (44 percent strongly agree – mainly Business and Engineering professors and 17 percent agree – primarily Social Science professors). Overall one fifth of the professors did not find this feature useful and replied "disagree" or "strongly disagree" (10 percent each). The other professors had neutral point of view regarding usefulness of announcement or news feature (19 percent).

Assignment description.

Students. Assignment description is another feature that almost 80 percent of the surveyed students reported as useful. More than half of the students (56 percent) strongly agreed and a quarter of them agreed. Almost 10 percent selected "neither agree and nor

disagree", and only three percent and five percent decided to disagree or strongly disagree respectively.

Faculty. Among faculty respondents 29 percent of them strongly agreed to use assignment description and about a quarter (23 percent) agreed that it could be a useful feature in mobile LMS. While one fifth of the professors (21 percent) were neutral, 15 percent of professors disagreed and 12 percent decided to strongly disagree.

As in the case with the grades feature, the overall pattern indicated that while students perceived assignment description as a useful feature for a mobile LMS, most faculty did not. This difference was explored using Chi-square (the data did not meet the normality assumption for conducting a t-test). There was a significant difference between student and faculty views regarding the usefulness of assignment description in a mobile LMS: $c^2 (4, N = 387) = 29.89, p < .0001$.

Email.

Students. Email is another feature that the majority of students found beneficial – especially female students. A Chi-square test demonstrated that the difference between males and females was significant at $p = .07$ ($c^2 (4, N = 387) = 8{,}68$). Fifty two percent of the students replied by selecting "strongly agree" – mainly students from Business College as well as seniors. Twenty seven percent of the students who specified "agree" mostly came from Engineering and tended to be Master's students. Only 11 percent responded "strongly disagree" or "disagree". The others responded "neither agree nor disagree".

Faculty. Email was the most popular feature (along with announcements/news) among faculty members. A quarter of faculty members agreed and 44 percent strongly agreed – primarily faculty members from Business and Education Colleges. Only four percent reported disagree, 12 percent strongly disagree, and 15 percent neither agree nor disagree – mostly Agricultural Sciences professors.

Classlist.

Students. About half of the votes of the student participants were given to the classlist feature (25 percent strongly agreed – mainly female students as well as freshman participants and 27 percent agreed – primarily students majoring in Engineering and Master's students). A little more than a quarter of students chose "neither agree nor disagree" and a less than quarter of students disagreed. Thirteen percent replied that they disagreed and 10 percent stated that they strongly disagreed.

Faculty. Classlist was one of the three features that faculty respondents showed more interest in than students. It was the third most popular feature (as were content, grades and feedback, university calendar, and assignment submission) among faculty members with 33 percent strongly agreeing – primarily Assistant Professors and 31 percent agreeing – mainly Associate Professors. Ten percent of them disagreed and 14 percent chose strongly disagree option. Another 14 percent replied neither agree nor disagree.

University Calendar.

Students. About 80 percent of surveyed students showed interest in having university calendar available in the LMS mobile version (51 percent strongly agreed and

28 percent agreed). Only five percent responded “strongly disagree”, another five percent replied “disagree” and 11 percent were neutral.

Faculty. University calendar was the third most popular feature among faculty participants – especially Business professors. Almost one third of them strongly agreed (33 percent) that university calendar would be useful on mobile LMS version and, similarly, 31 percent of them agreed (mostly Associate Professors). Seventeen percent of answers were “strongly disagree” (primarily from Agricultural Sciences) and only six percent responded “disagree”. Fourteen percent of them were neutral.

Content.

Students. Content was another popular feature among surveyed students since more than half of them chose “strongly agree” (55 percent) and 21 percent of them selected “agreed”. Eleven percent of students had a neutral opinion, four percent disagreed and nine percent chose to be strongly disagreeing.

Faculty. About one third of the professors (33 percent – primarily Full Professors) strongly believed that content would be a useful feature in the mobile LMS version and 15 percent of them agreed (generally Associate Professors). So, only about one half of the faculty (48 percent) perceived content as a useful feature in a mobile LMS. Approximately one fifth of professors had a neutral point of view (23 percent), 14 percent disagreed (mostly female professors) and 15 percent strongly disagreed. The rest did not agree or disagree (15 percent – mainly Assistant Professors).

The differences among faculty and students views regarding the content feature in a mobile LMS were statistically different ($c^2(4, N = 387) = 20.22, p < .0001$). While

students tended to report that this was a useful feature, most faculty did not consider it important for a mobile LMS.

Assignment submission.

Students. The distribution of students' opinions varied regarding assignment submission (i.e., Dropbox in D2L™). Thirty four percent of students strongly agreed – mainly Business students, almost a quarter of them agreed (21 percent), and 22 percent were completely neutral – primarily students majoring in Engineering. About one fifth of the students did not find assignment submission to be a useful feature on the mobile version of the LMS and decided to vote "disagree" or "strongly disagree" (12 percent each).

Faculty. Faculty respondents also showed similar response patterns. The number of "strongly agree" responses was the highest – mostly from Full Professors (33 percent), while "strongly disagree" was the lowest – mainly from Assistant Professors (14 percent), and about one fifth of the faculty had a neutral opinion who were mainly Associate Professors (21 percent). Seventeen percent of the faculty members disagreed, and 15 percent agreed that this is a useful feature for a mobile LMS – mainly female professors.

Discussions.

Students. One third (30 percent) of the surveyed students strongly agreed that discussions would be a useful feature for mobile LMS (primarily graduate students and senior students) and another quarter agreed (26 percent). While a quarter of students felt neutral toward this feature (26 percent), 11 percent disagreed and seven percent strongly

disagreed. Of all colleges, "strongly agree" was the first choice for Business students. The graph below presents the distribution of students' responses for the usefulness of the discussions feature based on their major.

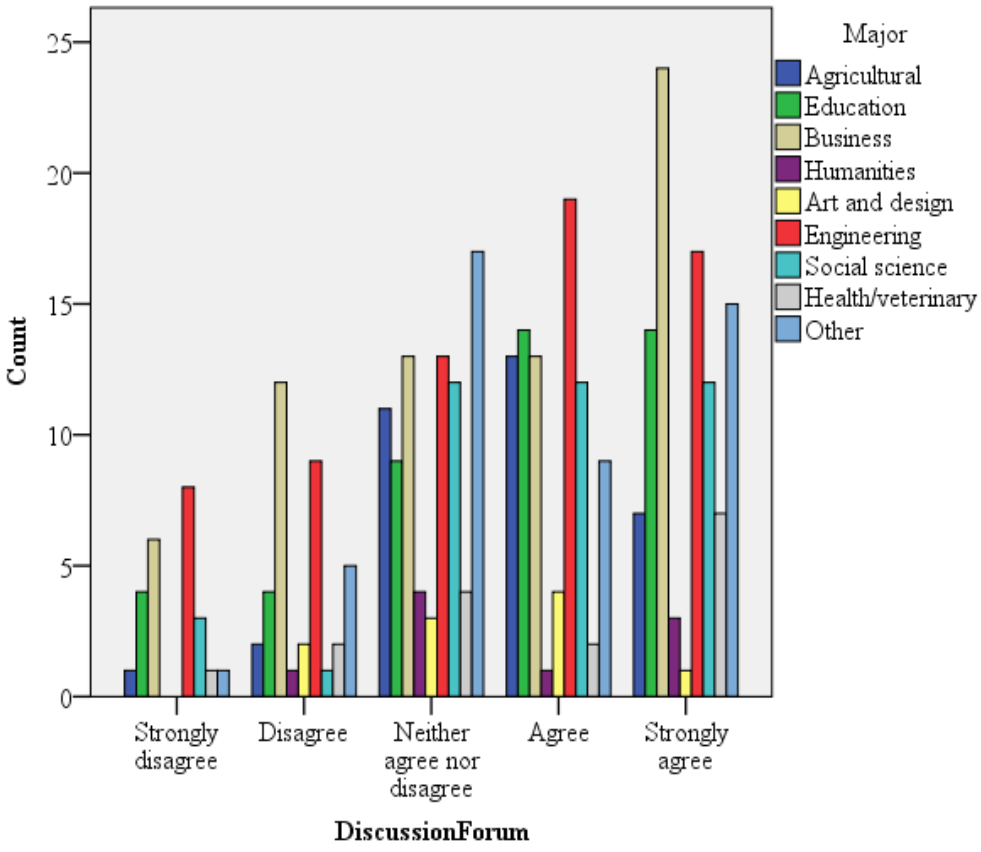

Figure: 16: Distribution of Responses for the Discussions Feature Usefulness by Students' Major

Faculty. Discussions was the second feature (along with course calendar) that received more faculty support than students. More than half of the faculty supposed that discussion could be a beneficial feature therefore, 39 percent responded strongly agree (primarily Business and Education Professors) and 17 percent replied "agree". However, "strongly disagree" and "disagree" options also each took 12 percent of the professors'

votes. Furthermore about one fifth (21 percent) of the faculty members were neutral – mostly professors from Social Sciences. The graph below displays the distribution of faculty members' responses for the discussions feature usefulness based on their academic area.

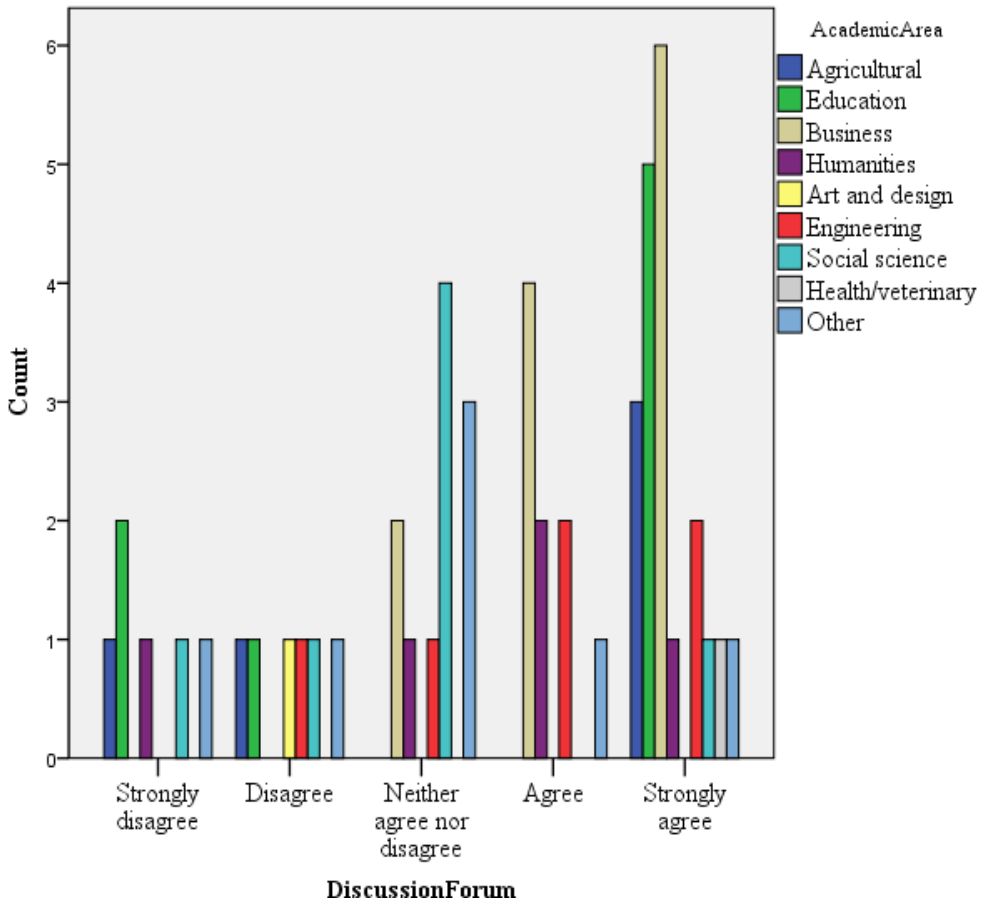

Figure 17: Distribution of Responses for the Discussions Feature Usefulness by Professors' Academic Area

Quizzes.

*Student*s. About one third of the student participants strongly agreed (32 percent – mostly seniors) and 19 percent agreed that quizzes are a useful feature to access it while the same percentage did not agree nor disagree. About one third of the students did not

believe in the usefulness of quizzes mobile version of the LMS feature since 17 percent disagreed and 13 percent chose "strongly disagree" - mostly male students.

Faculty. The distribution of opinions for faculty was similar to student responses. One third of the professors – mainly Education professors agreed that quizzes are a useful feature for a mobile LMS and another third did not believe that this feature would be useful on handheld devices. Approximately one third of them (35 percent) had a neutral opinion regarding the assignment submission feature.

Campus Map (Buildings).

Students. Map of campus buildings was reported to be useful by more than half of the student participants. About one third of the students strongly agreed (34 percent) – mostly freshman students, 23 percent agreed, and 18 percent decided to neither agree nor disagree. The remainder of the students, strongly disagreed and disagreed – 13 percent and 12 percent respectively.

Faculty. Overall, faculty did not find the campus map feature useful in a mobile LMS and only 12 percent replied "strongly agree" – primarily Assistant Professors and eight percent agreed. More than half of them stated "strongly disagree" (33 percent) – mainly male faculty members and a quarter of the faculty participants indicated "disagree". Less that a quarter of the faculty were neutral – mostly Associate Professors.

The difference between student and faculty perceptions regarding the value of the campus map feature for a mobile LMS was significant ($c^2(4, N = 387) = 30.28, p < .0001$).

Campus Map (Parking).

Students. Half of the student respondents specified that campus map for parking was a useful feature. Thirty two percent indicated "strongly agree" (mainly freshman and Engineering students) and 18 percent stated "agree". About one fifth of the students replied "neither agree nor disagree" (23 percent), 12 percent disagreed and 16 percent strongly disagreed.

Faculty. Most faculty participants did not find this feature useful. Only 10 percent stated "strongly agree" and six percent "agree". Twenty seven percent had a neutral opinion – mainly Associate Professors, 35 percent responded "strongly disagree" – mostly Business Professors and about a quarter "disagreed" – primarily Full Professors (23 percent).

As in the case with the maps of campus buildings, the difference between student and faculty use on the usefulness of the parking map feature for a mobile LMS was significant ($c^2(4, N = 387) = 25.4, p < .0001$).

Surveys.

Students. About 40 percent of surveyed students felt that surveys are needed in a mobile LMS. Exactly one fifth of the students strongly agreed and 23 percent agreed. About one third of the students were neutral (33 percent, mostly male students and undergraduate students), although 15 percent decided to disagree and 10 percent strongly disagreed.

Faculty. One quarter of the surveyed faculty – primarily Assistant and Full Professors from colleges other than Education and Business – agreed that survey is the feature that would be useful in a mobile LMS version and 14 percent of the professors strongly agreed – mainly from Engineering academic background. Less than a quarter of the professors (23 percent) had a neutral point of view and about one fifth of them (19 percent) replied "disagree" – mainly female faculty members or "strongly disagree" – mostly Assistant Professors.

Real-time chat.

Students. Only about one fifth of the students responded "strongly agree" and "agree" about the usefulness of this feature in the mobile LMS (20 and 19 percent respectively). Approximately one quarter of the students were neutral (27 percent). The rest of the students did not consider this feature useful thus, 18 percent stated "disagree" and 16 percent - "strongly disagree".

Faculty. The third feature that had more faculty support than student was real-time chat. About a quarter of professors mentioned that they are strongly disagreed that this feature could be useful (27 percent, mainly male participants and tenured professors) and one fifth of the professors (21 percent) also disagreed with its usefulness. Less than a quarter (19 percent) of faculty members were neutral while more than one fifth (23 percent) of them strongly supported its usefulness (mostly female participants at the Assistant and Associate Professor level) and only 10 percent agreed.

The gender difference in faculty participants' views on the usefulness of the chat feature was further explored using Chi-square. The difference was statistically

significant: $c^2(4, N = 387) = 25.4, p < .05$. Interestingly, the gender difference regarding the usefulness of the chat feature was not pronounced with student participants.

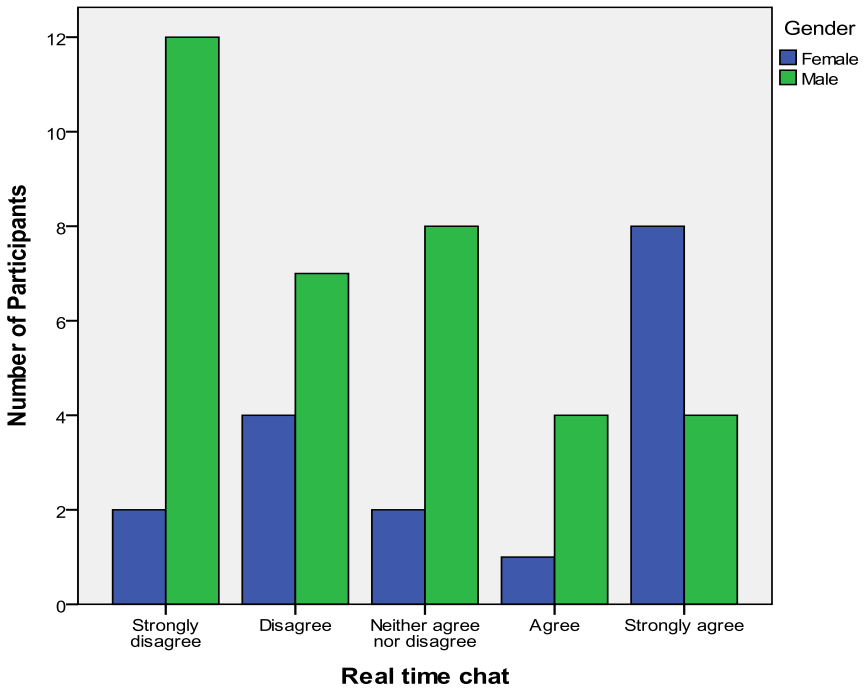

Figure 18: Distribution of Responses for the Real Time Chat Feature Usefulness by Professors' Gender

The remaining features were not popular among student or faculty respondents:

Instant messaging/Paging. About half of the students supported instant messaging or paging feature, and approximately half of the faculty participants did not find it a useful feature in mobile LMS. Twenty nine percent of students strongly agreed that this feature was useful but only 14 percent of faculty strongly believed that it was useful. Females tended to appreciate the usefulness of the paging feature more than male students and according to the results of a Chi-square test, this difference was statistically significant: $c^2(4, N = 387) = 45.87, p = .05$.

Locker. The locker feature had half of the student participants' support, while more than half of the faculty members did not find it a useful feature in mobile LMS. Similar to the student-faculty differences regarding the paging feature, 27 percent of students strongly agreed that this was a useful feature but only 15 percent of faculty strongly believed that it was useful. A Chi-square test demonstrated that this difference was statistically significant: $c^2(4, N = 387) = 20.24, p < .0001$.

Whiteboard. About two thirds of the student participants did not find whiteboard a useful feature in mobile LMS or were neutral. Similarly, 87 percent of faculty did not find this feature useful in a mobile LMS or selected "neither agree, nor disagree".

Online journal/blog. Fifteen percent of the student participants strongly agreed that online journal or blog feature was a useful in a mobile LMS. Most of these students were freshman. Conversely, only six percent of faculty selected "strongly agree" regarding the usefulness of blogs. Among the 16 faculty who strongly disagreed that this was a useful feature, interestingly 10 were male but only three were female.

User profile. User profile was the least popular feature among student participants. Approximately one third of the students agreed or strongly agreed, another one third of them disagreed or strongly disagreed, and the remaining one third persisted neutral regarding usefulness of user profile feature in mobile LMS. Faculty participants also showed little interest and half of them disagreed or strongly disagreed.

Other Comments.

The last item of student and faculty surveys was an open-ended question, to collect qualitative data about students' and faculty's experience of using OSU's Desire2Learn™ mobile site.

Faculty. Faculty provided the following responses:

- "It's a usable, nice looking site but I couldn't access content and assignments from my courses."
- "It was hard to find the actual classes...so much so that I did not go back to it through the semester..."
- "Missed discussion board"
- "No. I use D2L to supplement my traditional class (grades, Dropbox, assignment sheets), but I have very little interest in teaching online classes.
- "I cannot afford a data plan for my cell phone on my salary and would only use my mobile phone like this if OSU paid for faculty access this way."

Students. Students responses fell naturally into four categories: students were not aware of availably of D2L 2GO at OSU, positive feedback regarding D2L 2GO, negative feedback, LMS most desired features, and finally a few additional comments that some students provided.

*Not aware of the availability of D2L 2Go ™ at OSU***.** Many OSU students mentioned that they had never used D2L 2GO on their mobile or even heard of it. Below are some of the comments that students provided.

- "Did not know about this site until now."

- “Did not know it existed, but I will try soon.”
- “No, I was not aware of it! That’s awesome thought.”
- “I did not know this this website existed. Thanks for letting me know."

*Positive feedback***.** Students provided 13 positive comments. Below are a few selected comments.

- “It has a nice layout.”
- “Everything was useful that had info on it.”
- “Easy to locate modules, easy to access items: classes and which ones you're currently in. Calendar, etc.”
- “I like its simplicity and it’s ability to give you fast, easy access to D2L content on the go.”
- “No comment. It is really good.”
- “The functionality is much simpler and better overall in my opinion.”
- “I found it very helpful and easy to maneuver.”

Negative feedback. More than 20 of the students provided negative feedback since they could not use the website and could not navigate through the features and found it unfriendly.

- “I did not find this very useful.”
- “Overall it works but not really user friendly.”
- “It’s just really slow and inconvenient.”
- “It was very very difficult to use and very slow.”

- "It was confusing because couldn't find my way around."
- "I have used it. I didn't think it was any thing spectacular, but it worked."
- "It was fine. Not great. A little hard to figure out how to get to the content page to download course documents."

Seventeen students preferred the original website. These students were reluctant to use the mobile version of the site and found the original website more useful and easier to use and navigate.

- "The mobile version was not as user friendly as the full version. I quickly switched over to the full version."
- "I miss that not all classes are as easy to access as they are on the regular D2L."
- "The iPhone version of D2L is confusing, and I don't like it. I much prefer just the actual Full Site layout, which is what I always switch to when I access the site from my iPhone."

Most desired LMS features. Accessing grades was the most desired feature for the students. Below are more features that students stated in their responses.

- "I did not like that is just offered news and upcoming events. I mostly use my mobile device now to check grades on D2L so it would be helpful to have a "check grades" section."
- "I was able to check my grades which was very useful but I couldn't see the discussion which I needed to keep on track with everyday for my online class."
- "The problem is that it doesn't show my dropbox!"
- "Not being able to watch videos."

- "To view assignments, it is useful, but it would be better if the lecture videos could be viewed."
- "Being able to see full text of assignments."
- "Looking up lecture notes for a quiz."

Additional comments. Below are a few more selected comments that students provided.

- "I like how universal it is. D2L allows me to check my grades, assignments, and other vital information that makes me a better student."
- "Viewing the grades. I have it saved as a favorite on my phone."
- "Non of my current professors use D2L."
- "I am sorry, I am an old fashioned 40 year old student. I am not as tech savvy as my younger classmates. I know how to text, and send e-mails on my smart phone. However, I am still learning how to use it. Hope some of my answers help."

CHAPTER V

DISCUSSION OF RESULTS, IMPLICATIONS, AND CONCLUSIONS

According to this study's results, the patterns of using handheld devices and perceptions regarding mobile LMS's features were quite different among student and faculty participants. As expected, students indicated higher levels of interest in using a mobile LMS than faculty members. According to Prensky (2001), the generation of youth who are today's K-12 and even university students are "digital natives" and they natively speak the digital language of computers, handheld devices, and the Internet. On the other hand, instructors are mainly "digital immigrants" who speak an archaic language of pre-digital age. These differences can be seen in the results of this study.

Patterns of Using Handheld Devices

The patterns of using handheld devices to access online courses varied across users' demographics and depended on their experience using handheld devices and online LMSs. For example, the number of online courses that faculty members had taught was positively correlated with the faculty's level of comfort teaching with Desire2Learn™. More than half of the Full Professors reported that they have never taught any online courses, while Associate Professors have experienced teaching more online courses. Full Professors also reported that generally they do not use their handheld devices to access

online courses via handheld devices, compared with junior faculty. One could assume that Full Professors might not be very comfortable using technology to teach because they are at the far end of the "digital immigrant" spectrum, but, interestingly, Full Professors also showed more appreciation for mobile LMS features than other faculty ranks.

Most of this study's participants used iPhone™ or had other brands of handheld devices with no data plan. Despite the fact that iPhone™ is one of the most expensive handheld devices, there is a considerable number of students and faculty members who can afford the device and the data plan that comes with it. It should be mentioned that the owners of iPhone™ were mostly from Business College who possibly come from wealthier families (tuition for Business majors is higher than most other colleges).

Students' major and professors' academic area offer interesting insights regarding the differences in using handheld devices to access online courses. For instance, both students and faculty from the Business programs reported taking (or teaching) the highest number of online courses. On the other hand, Engineering students and faculty reported never taking (or teaching) an online course. This finding could also help explain why Business majors also showed more interest in communication features such as announcement/news, email, and discussions in a mobile LMS. Online students are used to employing these features to communicate, collaborate, share information, and discuss course content and assignments. Another important finding is that online courses were not popular among all colleges. It seems reasonable to assume that professors from the Engineering programs prefer the traditional, face-to-face class settings to teach courses,

as these courses involve a high number of hands-on, practical, and problem-based learning activities. Even though Desire2Learn™ has a built-in whiteboard feature, which could be used to demonstrate shapes and show formulas, Engineering faculty probably do not use it to augment their face-to-face courses (or do not know that exists).

As for the differences between student and faculty participants relative to their use of handheld devices, according to this study's results, students prefer to access online courses via handheld devices while walking to or from class but faculty indicated that they would prefer to access a mobile LMS from home. It is possible to conclude that faculty members mostly prefer to use mobile LMSs in unofficial settings or while they do not have access to their office computer. Also, while faculty spend most of the work day in their office, students generally spend more time going to the class buildings and studying in the breaks. Thus, expectedly, the majority of students reported their preference of using mobile LMSs "on the go".

The users' ability or familiarity with handheld devices also played a part in how comfortable they are while using (or learning how to use) mobile LMSs. For instance, one of the non-traditional, older students in this study's sample (i.e., a digital immigrant) shared that she or he was not very familiar with the mobile technology. For this user and similar individuals cognitive load would be high for learning how to interact with a mobile LMS and therefore they would not be comfortable using it. Designing intuitive and user-friendly interfaces for the mobile platform (including users who have little experience with handheld devices and mobile applications) presents a significant challenge to the designers of mobile software in general and mobile LMSs in particular.

Perceptions of the Usefulness of Mobile LMS Features

This study found interesting similarities and differences between the student and faculty perceptions regarding the usefulness of LMS features. For instance, course calendar was a popular feature among the student and faculty participants. Both students and faculty may need to have access to the course outline, due dates for assignments, exam dates, and other important dates anytime and anywhere to stay on schedule.

While this feature was perceived by both faculty and students as useful, this study also found several important differences among faculty and student views on the usefulness of mobile LMS features and tools. For example, grades and feedback was the most popular feature among all students, but university professors did not find it very useful in a mobile LMS. Grades and feedback are important for students because they help them evaluate their own learning based on their grades and feedback provided by the instructors. The same pattern of responses was observed for the assignment description feature. Assignment descriptions were reported as being very useful by students but not by faculty. Thus, instructors should be reminded of the importance of the assignment and grades related features in online LMSs, including their mobile versions.

Similarly, content was a feature in which students showed higher interest than faculty. This result may indicate that many faculty members still have not accepted handheld devices as an appropriate tool to deliver learning materials. It is reasonable to assume that many faculty members would still prefer more traditional ways of sharing content with students – such as print materials or computer devices with larger screens than handheld devices. This is an important finding that highlights the importance of

understanding student preferences regarding their learning and providing an impetus for faculty to design and develop course content that is compatible with mobile LMSs.

Another difference among student's and faculty's perceptions regarding mobile LMS features dealt with the campus maps of building and parking lots. Among student participants, freshman students were more interested in using such features as campus map (buildings and parking), class list, grades and feedback, and announcement/news features. It seems obvious that since freshman students are new to the campus environment, they need to familiarize themselves with the locations of buildings and parking lots, and get to know their classmates. As the results of this study show, they are also more eager to receive feedback from their instructors and browse the news and announcements than more advanced students. On the other hand, faculty participants did not find campus maps (buildings or parking) to be a useful feature in mobile LMSs. This could be explained by the fact that most faculty spend more time on campus over the years than students who come to study for four to six years. Thus, faculty would not necessarily need any support regarding the location of campus buildings or parking lots.

Three more features – blogs (online journals), locker, and instant messaging (paging) – were perceived as important by students but not by faculty. This shows that students appreciate the capability to store and have access to their files in the LMS's "locker" (including its mobile version), they would like to be able to read and contribute to the online journals in mobile LMS, and they would prefer to have access to an instant messaging tool within a mobile LMS. None of these features was deemed important by faculty participants.

Conversely, several mobile LMS features were perceived by faculty to be important but the student participants did not share this preference. Such modules as discussions, real-time chat, and classlist were the only features that attracted more faculty support than students. One can conclude that overall faculty place more emphasis than students on the capability to discuss and chat in a mobile LMS and have access to the list of enrolled students.

Assignment submission was the only feature that faculty and student respondents were unanimous about – regarding its usefulness for the mobile LMS. As for the rest of the features, students overall showed higher levels of appreciation for them than faculty, which is another indication that students – the "digital natives" are more willing (and potentially prepared) to use LMSs on their handheld devices than faculty.

While most of the differences in the preferences for the availability of mobile LMS features depended on whether the response was submitted by faculty or students, gender was an important demographic variable that influenced participants' responses regarding mobile LMS features – particularly the communication features. For example, female participants showed more interest in using such communication features as email, real-time chat, and text messaging (paging). This is consistent with prior research – women have been shown to appreciate and benefit more from discussion type activities and collaborative learning than men (Jones, Antonenko, & Greenwood, 2011).

Qualitative comments provided by the participants illustrate that those students who found that the mobile version of the D2L™ LMS to lack important features (as compared with the desktop version) pointed out that they experienced little user freedom

or control in using the mobile LMS. The mobile version of the LMS was too different from the desktop version for these users and they did not appreciate these differences. Those students who enjoyed the Desire2Learn 2Go™ primarily appreciated the simplicity of its interface, and did not mind dealing with the inconsistencies between the desktop version and the mobile version. These users mostly showed interest in using such features as grades and feedback, course calendar, assignment description, announcement/news, and content. D2L 2GO™ currently offers all these features, however, while some students appreciated the usability of this interface, there were many others that had difficulty navigating the mobile version of D2L™. Thus, determining the different parameters of what constitutes a user-friendly mobile LMS for different types of users and handheld devices is an important direction for future research.

As for the lack of the students' and faculty's familiarity with Desire2Learn 2GO™, several explanations could be provided. First, the university has failed to promote Desire2Learn 2GO™ appropriately. This is a new technology that the university should plan to educate students and faculty about the functionality, advantages, and limitations of this new interface. Another reason for this finding might be that one hundred and one students (or about one third of this study's sample) indicated that they have no data plan on their phone, which means that they cannot access Desire2Learn 2GO™ using their handheld device, even if they wanted to. Finally, not every professor reported using Desire2Learn™ (the desktop version) in their teaching, so they do not see a reason for using the mobile version of this LMS.

Implications for Mobile LMS Design

Implication 1: Mobile LMS must be flexible and customizable to adapt to the needs of most users. Since participants varied in their patterns of mobile LMS preferences and actual usage based on demographic characteristics, mobile LMS designers must create interfaces that are flexible and customizable. Icons to most of the features that are desirable for the majority of the target should be provided on top of the page in the "default view" of the application. For example, the most desired features by faculty members were email, announcement and news, discussions, and course calendar, thus these features should be accessible on the homepage with no additional clicks and screens required to navigate to the features. Additionally, features that are requested mainly by students need to be included to inform professors of students' needs and expectations from the LMS. According to this study's results, grades and feedback was the most popular feature among students, while the majority of faculty members did not find it very useful for a mobile LMS. Thus, it is important that LMS instructional designers and software engineers design an interface that provides access to multiple features, potentially through user customizations, which is a difficult undertaking considering the screen size limitations.

Implication 2: Mobile LMS's content should be available in the audio form, possibly through the use of text reader applications. The majority of students indicated that they would prefer to access mobile LMS while walking to or from class. This means that they would mostly use it "on the go" – for instance, in a car, public transportation, while walking or riding a motorcycle or bicycle. Therefore, it is important for mobile LMS designers to consider what kinds of content delivery methods are most appropriate for students. The small screen size of most handheld devices and the necessity to read

text would create difficulties for most students who are trying to access content while they are traveling to or from class. One potential solution is the use of text readers and, possibly, speech recognition applications to enable students to listen to instead of reading the content and to navigate the device by talking rather than touching the screen or pressing the small keys of handheld devices. It should be noted that several manufacturers of handheld devices have text reader tools available to their users (e.g., Blackberry™). Thus, it is important for mobile MS designers to collaborate with handheld devices manufacturers and use the Application Programming Interfaces (APIs) that are already available for these devices.

Implication 3: Mobile LMS's designers should provide a tool for bookmarking or saving the most important or relevant content for the users "on the go". Another suggestion is providing students with a tool to quickly access the most important content without having to go through a long list of links, paragraphs, or graphics. Users "on the go" should be able to pre-select the content they would like to review prior to traveling and access (and potentially share with other a study partner) the previously bookmarked content. Besides, a zoom feature would be useful to study the figures in more details, or read the small fonts of the Portable Document Format (PDF) files. Again, many handheld devices have this feature available, so the mobile LMS interface should be designed with an understanding of the affordances of the tools available on different devices.

Implication 4: Provide reminders for faculty to post detailed assignment descriptions and provide students with timely feedback and grades. Since grades and feedback was the most popular feature among students but wasn't deemed important by faculty, it is recommended that designers add a function to remind professors to provide

feedback for students and inform them regarding their learning process (for example, once-a-week reminders). Assignment description was another feature that was perceived as highly useful for students but not by faculty. Therefore, the mobile LMS interface should also inform instructors of the importance of providing detailed assignment descriptions (as does the desktop versions of LMSs).

Implication 5: Design an interface that is compatible with multiple handheld devices. The first release of Desire2Learn 2GO™ (2010) was a mobile application that was primarily designed for Blackberry™ devices. Later Desire2Learn ™ released Desire2Learn Mobile Web™, which could be accessed via Apple iOS™, Android™, and Blackberry™ devices. Obviously, the principles of universal design should be applied in any design situation – in this case to accommodate users with different handheld devices, but the problem is that different handheld devices may have different affordances and constraints (e.g., the availability of text readers, zoom functions, touch interface) and the mobile website would become more usable based on the types of the handheld devices. For example, it makes sense to use icons and other graphical representations for LMS features on touch screen interfaces (to be usable for people who navigate interfaces by pressing on things with their fingers) but for users that navigate the interfaces using the hardware keyboard keys, as on most non-touch devices, text links might prove more useful. These differences would affect users' experience in using the same application. However, rather than designing applications for multiple devices (e.g., an app for Apple App Store ™, an app for Android Market ™, an app for Balckberry's App World ™, an app for Nokia's Ovi Store™ etc.), it may be a good idea to design one web-based mobile

LMS interface that detects the type of device used by the user and adjusts the "look and feel" of the interface "behind the scenes", without user's intervention.

Conclusions

The patterns of using handheld devices and the perceived usefulness of mobile LMS features varied greatly among students and faculty and within each of these user groups based on demographic variables. Based on the variance reported in terms of prior knowledge and experiences of using handheld devices as well as expectations for using a mobile LMS, learners and educators will naturally attempt to use the mobile LMS to satisfy their personal needs and goals. Thus, it is important that designers of mobile LMSs design interfaces that are flexible and customizable to reflect the needs and goals of the highest number of target users. Handheld devices are personal and individuals spend much time and financial resources to customize the device and its software.

It is highly likely that mobile LMSs will soon be adopted by most students that use Internet capable handheld devices and, whether they want it or not, faculty will have to adjust their teaching styles, preferences, and update their teaching tools to include mobile interfaces as an essential instructional instrument in higher education. And as more and more information technology advances are made in our digital, connected, and global society, the "digital" or "mobile" "immigrants" will give way to the generation of teachers who grew up playing Angry Birds™ on their iPhones™, creating digital multimedia presentations without a keyboard or a mouse, and wirelessly collaborating with peers from other continents. While there is no denying the importance of providing students with traditional, face-to-face learning experiences, the needs of the global

society are such that much of the learning content, materials, and actual learning environments become digital – web-based and, more recently, mobile ready.

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APPPENDICES

Appendix A

Institutional Review Board Approval

Oklahoma State University Institutional Review Board

Date:	Thursday, March 17, 2011
IRB Application No	ED1160
Proposal Title:	Student and Faculty Perceptions of the Features of Mobile Learning Management Systems
Reviewed and Processed as:	Exempt

Status Recommended by Reviewer(s): Approved Protocol Expires: 3/16/2012

Principal Investigator(s):

Nilou Derakhshan
802 W. Highpoint Dr. Apt. 26
Stillwater, OK 74075

Pasha Antonenko
210 Willard
Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

☒ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Beth McTernan in 219 Cordell North (phone: 405-744-5700, beth.mcternan@okstate.edu).

Sincerely,

Shelia Kennison, Chair
Institutional Review Board

Appendix B

Student Survey of Mobile LMS Use

1. Which of the following handheld devices do you use most frequently?

{ } BlackBerry
{ } iPhone
{ } iPod Touch
{ } Android Phone
{ } iPad
{ } Other Smartphone
{ } Other Phone (No Data Plan/Internet)

2. How many online courses have you taken at OSU using Desire2Learn?

{ } 0
{ } 1
{ } Less than 4
{ } 4 or More

3. How often do you log in to OSU's online classroom - Desire2Learn (www.oc.okstate.edu)?

{ } Once a day
{ } More than three times a day
{ } More than three times a week
{ } Less than once a week

4. If you had an opportunity to access online courses on your handheld device, how often would you access your online courses using your handheld device:

{ } Once a day
{ } More than three times a day
{ } More than three times a week
{ } Less than once a week

5. If you had an opportunity to access online courses on your handheld device, which features would you want to use?

Content (e.g., lecture notes, readings, videos, podcasts):

Strongly Agree Agree Neither agree nor disagree Disagree Strongly disagree

Announcements / News:

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Assignment description:

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Assignment submission:

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Quizzes:

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Grades and Feedback:

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Discussion (Forum):

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Surveys:

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Real-time chat:

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Email (can be read or sent from inside an online course):

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Instant messaging / Paging

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Class list:

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Online journal/blog:

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

User profile (profile picture and personal information):

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Whiteboard (electronic version of a dry-erase board):

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Locker (to save assignments before submission):

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Course calendar (see due dates and add reminders)

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

University Calendar (to see important dates and holidays):

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Campus Map (buildings):

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Campus Map (parking):

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

6. Where would you prefer to access online courses using your handheld device?

{ } Home
{ } Dorm
{ } Library
{ } Gym
{ } Walking to/from class

7. Do you use your handheld device to contact your instructor via text messaging?

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

8. Do you use your handheld device to contact your classmates via text messaging?

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

9. What is your gender?
{ } Female
{ } Male

10. What best describes your ethnic/racial background?
{ } American Indian or Alaska Native
{ } Asian
{ } Black or African American
{ } Native Hawaiian or Other Pacific Islander
{ } White
{ } Hispanic or Latino

11. What best describes your classification?
{ } freshman
{ } sophomore
{ } junior
{ } senior
{ } Master's student
{ } PhD student

12. What best describes your major?
{ } Agricultural
{ } Education
{ } Business
{ } Humanities

{ } Art and design
{ } Engineering
{ } Social science
{ } Health/veterinary
{ } Other

13. What is your current cumulative GPA in college on a 4.0 scale?
{ } lower than 2.5
{ } 2.5 to 2.9
{ } 3 to 3.5
{ } higher than 3.5
14. Have you tested OSU Desire2Learn's mobile site at https://d2ltraining.okstate.edu/d2l/m/login? If you have, what functionality was useful and which features did you miss?

Please provide your e-mail address, if you would like to be entered in a drawing for 1 iPod Shuffles and 5 $20 Walmart gift cards:

Appendix C

Faculty Survey of Mobile LMS Use

1. Which of the following handheld devices do you use most frequently?

{ } BlackBerry
{ } iPhone
{ } iPod Touch
{ } Android Phone
{ } iPad
{ } Other Smartphone
{ } Other Phone (No Data Plan/Internet)

2. How many online courses have you taught at OSU using Desire2Learn?

{ } 0
{ } 1
{ } Less than 4
{ } 4 or More

3. How comfortable are you teaching courses via Desire2Learn (www.oc.okstate.edu)?

{ } Quite comfortable
{ } Comfortable
{ } Not very comfortable
{ } Not comfortable at all
{ } Not Applicable

4. If you had an opportunity to access your online courses on your handheld device, how often would you access your online courses using your handheld device:

{ } Once a day
{ } More than three times a day
{ } More than three times a week
{ } Less than once a week

5. If you had an opportunity to access online courses on your handheld device, which features would you want to use?

Content (e.g., lecture notes, readings, videos, podcasts):

Strongly Agree Agree Neither agree nor disagree Disagree Strongly disagree

Announcements / News:

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Assignment description:

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Assignment submission:

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Quizzes:

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Grades and Feedback:

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Discussion (Forum):

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Surveys:

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Real-time chat:

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Email (can be read or sent from inside an online course):

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Instant messaging / Paging

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Class list:

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Online journal/blog:

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

User profile (profile picture and personal information):

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Whiteboard (electronic version of a dry-erase board):

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Locker (to save assignments before submission):

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Course calendar (see due dates and add reminders)

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

University Calendar (to see important dates and holidays):

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Campus Map (buildings):

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

Campus Map (parking):

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

6. Would you be interested in designing online courses using your handheld device? (Check all that apply.)

{ } Definitely Yes
{ } Definitely No
{ } I'd like to be able to add/modify course content once in a while
{ } I'd like to be able to add/modify course assignments once in a while

7. Where would you prefer to access online courses using your handheld device?

{ } Office
{ } Home
{ } Library
{ } Gym
{ } Walking to/from class

8. What is your preference regarding the method students use to contact you with questions?

{ } Phone
{ } E-mail
{ } Text messaging
{ } Facebook
{ } Office hours

9. Do you use your handheld device to contact other faculty or Teaching Assistants via text messaging?

Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

10. What is your gender?
{ } Female
{ } Male

11. What best describes your ethnic/racial background?
{ } American Indian or Alaska Native
{ } Asian
{ } Black or African American
{ } Native Hawaiian or Other Pacific Islander
{ } White
{ } Hispanic or Latino

12. What is your rank?

{ } Adjunct Professor
{ } Assistant Professor
{ } Associate Professor
{ } Full professor

13. What best describes your academic area?

{ } Agricultural
{ } Education
{ } Business
{ } Humanities
{ } Art and design
{ } Engineering
{ } Social science
{ } Health/veterinary
{ } Other

14. Have you tested OSU Desire2Learn's mobile site at https://d2ltraining.okstate.edu/d2l/m/login? If you have, what functionality was useful and which features did you miss?

Appendix D

Recruitment Script (email)

Appendix B: Recruitment Script (e-mail)

I am an Oklahoma State University Educational Technology masters student conducting research on the perceptions of OSU students and faculty regarding the usefulness of mobile learning management systems under the direction of Dr. Pasha Antonenko. I invite you to participate in a 14 question, 10 minute survey that will ask you to provide responses on which content presentation, communication and assessment features of Desire 2 Learn you would like to see in the mobile version of this learning management system.

At the end of the survey, you will have the option to provide your OSU e-mail address, if you would like it to be entered in a drawing for 2 iPod Shuffles and 5 $20 Walmart gift cards.

If you would like to participate, please find the link to the survey below. The link will take you to an information page providing more details about the research that will allow you to make an informed decision to participate. Thank you for considering participation in this study.

http://www.XXXXXXXXXXX.XXXXX

Nilou Derakhshan
Educational Technology Master's student
School of Educational Studies
Oklahoma State University
220 Willard Hall, Stillwater, OK 74078
nilou@okstate.edu

Appendix E

Informed Consent

Appendix E: Informed Consent (to be posted on the survey website)

Title: Student and Faculty Perceptions of the Features of Mobile Learning Management Systems

We are inviting you to participate in a research study that is aimed at exploring the perceptions of OSU students (faculty) regarding the usefulness of mobile learning management systems. Specifically, our survey will ask you to provide responses on which content presentation, communication, and assessment features of Desire 2 Learn you would like to see in the mobile version of this learning management system.

The primary benefits from this work are for the advancement of our understanding of the uses of of learning management systems that are employed to support online and traditional, face-to-face learning. If you are interested in the outcomes of this research, arrangements can be made with the Principal Investigator, Nilou Derakhshan, to acquire copies of the publications, as they become available.

Note that your response will be collected anonymously, but you will have the option to provide your OSU e-mail address, if you would like it to be entered in a drawing for 2 iPod Shuffles and 5 $20 Walmart gift cards. Thus, e-mail addresses will be collected separately from responses.

All information about you will be kept confidential and will not be released. The survey data will be collected using LimeSurvey, which is a secure, password-protected survey management tool. All research records will be stored securely in Excel files on the PI's office computer and only researchers and individuals responsible for research oversight will have access to the records. This information will be kept as long as it is scientifically useful; typically, such information is kept for three years after publication of the results. Results from this study may be presented at professional meetings or in publications. You will not be identified individually; we will be looking at the group as a whole.

There are no risks associated with this project, including stress, psychological, social, physical, or legal risk which are greater, considering probability and magnitude, than those ordinarily encountered in daily life. If, however, you begin to experience discomfort or stress in this project, you may end your participation at any time.

You may contact any of the researchers at the following addresses and phone numbers, should you desire to discuss your participation in the study and/or request information about the results of the study: Nilou Derakhshan, MS in Educational Technology student, Willard 220, Oklahoma State University, Stillwater, OK 74078, (405) 762-2671. If you have questions about your rights as a research volunteer, you may contact Dr. Shelia Kennison, IRB Chair, 219 Cordell North, Stillwater, OK 74078, 405-744-3377 or irb@okstate.edu

Your participation in this research is voluntary. There is no penalty for refusal to participate, and you are free to withdraw your consent and participation in this project at any time, without penalty.

Thank you for considering participating in this study. You will provide your consent to participate in this research by accessing the link to the online survey below.

VITA

Nilou Derakhshan

Candidate for the Degree of

Master of Science

Thesis: STUDENT AND FACULTY PERCEPTIONS OF THE FEATURES OF MOBILE LEARNING MANAGEMENT SYSTEMS IN THE CONTEXT OF HIGHER EDUCATION

Major Field: Educational Technology

Biographical:

Education:

Completed the requirements for the Master of Science in Educational Technology at Oklahoma State University, Stillwater, Oklahoma in May, 2012.

Completed the requirements for the Bachelor of Information Technology in Information Systems Engineering at The Information Technology Department of Multimedia University, Cyberjaya, Selangor, Malaysia in 2009

Experience:

Worked as an intern at Microsoft Innovation Center in 2008 in Malaysia and during 2009-2011 worked as a graduate assistant at Oklahoma State University.

Name: Nilou Derakhshan Date of Degree: May, 2012

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: STUDENT AND FACULTY PERCEPTIONS OF THE FEATURES OF MOBILE LEARNING MANAGEMENT SYSTEMS IN THE CONTEXT OF HIGHER EDUCATION

Pages in Study: 111 Candidate for the Degree of Master of Science

Major Field: Educational Technology

Scope and Method of Study: Despite the exponential growth in the use of learning management systems and mobile learning applications, little empirical research exists on student and teacher views on which mobile learning features and tools they find useful. This study was designed to explore the perceptions of university students and faculty regarding their patterns of use and usefulness of various mobile learning management system features. Data were collected using two online surveys that were distributed among 5,000 Oklahoma State University faculty, graduate, and undergraduate students at the Stillwater and Tulsa campuses. A total of 387 individuals responded. Data analysis included the use of descriptive and nonparametric statistics.

Findings and Conclusions: This study's results demonstrate that the patterns of using handheld devices and perceptions regarding mobile LMS's features were quite different among student and faculty participants. Students indicated higher levels of interest in using a mobile learning management system than faculty members. The most desired mobile learning management systems features were identified for each group of users. The thesis was concluded with a discussion of implications for the design and practical use of mobile learning management systems in higher education.

ADVISER'S APPROVAL: Dr. Pasha Antonenko