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PATTERNS OF EDUCATOR LEARNING MANAGEMENT SYSTEMS USE IN A  
SECONDARY SCHOOL: A DESCRIPTION OF USE AND COMPARISON  
BETWEEN EDUCATOR SUBGROUPS

by

Alexandra Bayne-Greenwood

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DISSERTATION APPROVAL PAGE

This is to certify that the thesis prepared by Alexandra Greenwood entitled Patterns of Educator Learning Management System Use in a Secondary School: A Description of Use and Comparison between Educator Subgroups has been approved by the thesis committee as satisfactorily completing the dissertation requirements for the degree Doctor of Education in Instructional Technology.

<u>David Wizer</u>	Dr. David Wizer	<u>3/28/17</u>
Chairperson, Dissertation Committee Signature		Date

<u>William Sadera</u>	Dr. William Sadera	<u>3/28/17</u>
Committee Member Signature		Date

<u>Scot McNary</u>	Dr. Scot McNary	<u>3/28/17</u>
Committee Member Signature		Date

<u>Todd Kenreich</u>	Dr. Todd Kenreich	<u>3/28/17</u>
Committee Member Signature		Date

<u>Janet V. DeLany</u>	Dr. Janet DeLany	<u>May 10, 2017</u>
Dean of Graduate Studies		Date

## **DEDICATION**

To my husband, your ability to both support and question me in all of my endeavors have made you a valuable teammate through this process and many others. You are at times an unwavering guide and at others a disciplined participant. I could do it without you, but not half as well.

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## **ABSTRACT**

As K-12 public school districts seek to expand their technology infrastructure, they have invested millions of dollars in Learning Management Systems. A Learning Management System (LMS) is a web-based tool that can be used for planning, implementing, and assessing course content. Tools such as LMS have become useful to school systems because of the capacity to collect and analyze assessment data. Despite the recent adoption of LMS in schools, guidelines have not been set to aid educators in the design and implementation process of LMS. A mixed methods sequential explanatory design was used to identify the current uses of LMS in secondary classrooms as well as the educators' perceptions of their use. LMS use of 35 middle school educators was observed for 22 weeks. Educators were categorized into subgroups by grade level, content area, years of experience, perception of LMS, frequency of use, and course ability levels. Correlational analyses were used to identify associations between educator subgroups and course homework submission and scores. One of the key findings of the study was that educator use was found to be associated with time spent in school, not away from it. Second, educators reported to have increased use of the LMS, but they do not feel use impacts the classroom. Therefore, results indicate there is limited interactive LMS use and there was no significant correlation between total educator use and course homework submissions. However, subgroups, such as mathematics educators and grade six educators, were found to use LMS more frequently than the other subgroups. Rogers Diffusion Theory provided a conceptual framework regarding educator use of LMS platforms. Personalized, small-group professional development led by educators is suggested to help educators to use data from LMS to improve the design and implementation of LMS in the secondary classroom.

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## **CHAPTER 1**

### **INTRODUCTION**

Technology use has become one of the main characteristics of 21<sup>st</sup> century classrooms. In fact, in the past ten years technology use has changed the daily operations of secondary schools (Alshammari, Ali, & Rosli, 2016; Papadakis, Dovros, Paschalis, & Rossiou, 2012). Today, the increased access to technology has provided opportunities for educator and student use at home and in school (Ertmer, Ottenbreit-Leftwich, Sadik, & Sendurur, 2012; Partnership for 21<sup>st</sup> Century Skills, 2012; Schrodt, Witt, & Turman, 2009).

Many secondary schools have taken advantage of these advances by introducing Learning Management Systems (LMS) (Al-Busaidi & Al-Shihi, 2011; Electronic Education Report, 2002; Hill, 2009). A LMS is a web-based tool that can be used for planning, implementing, and assessing course content (Al-Busaidi & Al-Shihi, 2011; Papadakis et al., 2012; Liu & Cavanaugh, 2011a). Using LMS educators have the opportunity to post assignments, report grades, hold discussions, and to video conference. This allows educators to communicate schedules, assignments, and grades with students and parents.

Educators use LMS to increase communication between teachers and students as well as between students and their classmates (Blau & Hameiri, 2010; Dang & Robertson, 2010; DeNeui & Dodge, 2006; Psycharis, Chalatzoglidis, & Kalogiannakis, 2013). LMS designed for secondary schools provide educators, parents, and students with an age-appropriate version of university online communities (Al-Busaidi & Al-Shihi, 2011). They also prepare secondary students for the growing use of technology in both

college and career environments (Papadakis et al., 2012; Partnership for 21<sup>st</sup> Century Skills, 2012). Even though LMS use in secondary schools has increased throughout the country, limited research exists on educator patterns of use and the impact of that use on secondary students (Al-Busaidi & Al-Shihi, 2011; Basal, 2015; Blau & Hameiri, 2010; Liu & Cavanaugh, 2011a).

## **Background**

In the early 1900s technological devices were developed for teaching and learning. Notably the University of Alberta developed a machine called the “problem cylinder”. The device presented problems for students to answer and tracked the success of the student (Bush, 1989). In the 1950s and 60s the first strides were made in higher education toward true distance education. This began with televised college courses and systems such as Programmed Logic for Automated Teaching Operations (PLATO) (Gentile, 1967), where students could study for lessons by communicating with teachers and accessing notes electronically. By the 1980s educational technology was placed in K-12 student remediation courses with applications such as Successmaker that focused on spelling and grammar (Flynn, 1998). In 1997 both CourseInfo LLC and Blackboard LLC were developed as distance learning software for higher education. The two groups merged to form Blackboard Incorporated. By 2006 over half of the colleges and universities in the United States were using Blackboard and they were able to acquire their largest competitor WebCT (Sleator, 2010). Most recently, Blackboard merged with Edline, the most widely used K-12 LMS, and was renamed Blackboard Engage. From its early days, LMS have ranged in use from business training to educational record keeping. Most recently however, LMS have been used to deliver instruction entirely



online or to augment courses taught in face-to-face classrooms (Bradford, Porciello, Balkon, & Backus, 2007).

Higher education settings have used LMS as a part of distance learning for two decades, but secondary educators lack experience with integrating these online communities (DeNeui & Dodge, 2006). There is limited understanding of LMS usage patterns in secondary schools or evidence that supports relationships between use and student success (DeNeui & Dodge, 2006; Liu & Cavanaugh, 2011a; Schrodtt et al., 2009). Educators seek to provide online learning experiences for 21<sup>st</sup> century students; however, due to the lack of research in this area, best practices for LMS use have not yet been established.

Currently, privatized LMS platforms have been developed for educational use in secondary schools, who monetarily subscribe on an annual basis. Among the most popular privatized secondary school LMS platforms are Edline and Edmodo (Al-Busaidi & Al-Shihi, 2011). While privatized systems were developed for entire school systems, free open-source LMS were designed for individualized educator use. These promote flexibility in learning environments. The most common open source LMS are Moodles (Modular Object-Oriented Dynamic Learning Environments), which encourage customizable classrooms (Norris & Soloway, 2012; Trotter, 2008). Regardless of the school or type of LMS, educators develop habits in the way they use technology. Over time these habits create a pattern of posting. A LMS usage pattern or pattern of use, describes how, when, and to what extent educators access a school's LMS to post information. Unfortunately, while LMS use has become common and even expected in secondary schools; programs lack consistence, educators lack training, and platforms go

underutilized (Al-Busaidi & Al-Shihi, 2011; Papadakis et al., 2012; Sehring, Duhaney, Anderson, & Gottschalk, 2007).

### **Statement of the Problem**

Past LMS research (Schrodt et al., 2009; Lochner, Conrad, & Grahman, 2015) has studied a variety of individual aspects of LMS. For example, stakeholders (i.e., administration, educators, students, parents, and community members) have been studied in order to identify their perspectives and involvement in LMS integration. Research (Blau & Hameiri, 2010) has also observed classroom aspects fostered by LMS such as motivation, communication, and collaboration. There has been limited research that goes beyond individual aspects of a LMS. The connection between patterns of use and student learning outcomes has limited research support, especially across content areas and grade levels (Al-Busaidi & Al-Shihi, 2011; Basal, 2015). This lack of information has made it difficult for educators to justify LMS use in their curriculums, especially because LMS use is often not required and guidelines for use have not been established. LMS do have many uses in secondary classrooms, the platform however, has been largely underutilized, preventing learning benefits from reaching students (Blau & Hameiri, 2010; Psycharis et al. 2013). Abram (2012) expressed the need for pilot studies to examine the continued worth of integrating LMS into secondary classrooms. This study seeks to identify patterns of educator LMS use associated with student homework submission and scores. Educators need to see the value in a tool before they adopt it into their classroom use (Rogers, 2003). It would not be prudent for an educator to devote time to digitally designing a collaborative online classroom, if they see no value in their use. Educators need to see the value in using an LMS (Lochner et al., 2015).

## **Purpose**

The purpose of this study is to observe and describe educator LMS use and analyze their relationship to student homework submission and scores. Secondary students' technology use has been evaluated to identify levels of motivation, perceptions, collaboration, and communication (Al-Busaidi & Al-Shihi, 2011; Alshammari et al., 2016). As more technology is integrated into secondary schools, research must develop beyond individual aspects of LMS (Basal, 2015; Lui & Cavanaugh, 2011b). Studying how LMS are used authentically will help to predict how future technology will be used in secondary schools. Analyzing the impact of LMS use with respect to student learning outcomes will help to develop best practices. Identifying impacts on students will also provide validation for continued educator commitment and advocate use.

Varied individual elements of LMS have been researched, however how often or to what extent LMS are used within the entire school and between subgroups is still unknown (Al-Busaidi & Al-Shihi, 2011; Blau & Hameiri, 2010; Psycharis et al., 2013). Analyzing these relationships between different subgroups within a middle school is the basis for building consistent practices that influence educator's instructional design (see Table 1). In order to establish useful technology integration in secondary schools it is necessary to close the gaps in understanding LMS use.

As secondary schools continue to implement new technology, research is necessary to look for evidence of an impact (Blau & Hameiri, 2010; Psycharis et al., 2013). This study examines LMS use within a middle school. In this school, the LMS was adopted to supplement the content curriculum, but lacks a framework to guide educator use. This study observes, analyzes, and describes LMS patterns of use in the

core content classes of a middle school (grades 6-8). Exploring educator and student relationships within a LMS is an important step in continued implementation.

### **Research Design and Questions**

The research design for this study was a Mixed-Methods Sequential explanatory design. This is a two-phase design method that begins with collection and analysis of quantitative data and is followed by collection and analysis of qualitative data (Creswell & Plano Clark, 2007). During data collection, quantitative data of educator LMS use was collected over a period of time and then supplemented by qualitative data relating to the same time period of LMS use. This study was designed to first describe patterns of LMS use by conducting digital observations of LMS classrooms. Then to explain and interpret the observed findings by surveying the participants on their perceptions of personal and school based LMS use.

To better understand the use of LMS within secondary schools the following questions were posed to guide both descriptive and interpretive data collection:

- 1) What are educator patterns of Learning Management System use in grades 6-8?
  - a. What are the most used aspects of LMS by educators?
  - b. In which weeks did the LMS accrue the most access?
  - c. Which content areas and grade levels use the LMS and to what extent?
  - d. Are years of experience teaching associated with the frequency of LMS use?
  - e. Are educator perceptions of LMS usefulness associated with the frequency of use?
- 2) Is there an association between the patterns of educator LMS use and the frequency of course homework submission?

- 3) Is there an association between the frequency of educators' LMS use and mean homework scores throughout 22 weeks?

### **Sample**

This study included 35 educator participants from core content area classes including foreign language, language arts, mathematics, science, and social studies. Digital patterns of LMS use were observed over a 22-week period. These educators also completed three separate surveys spaced at least ten weeks apart (week 1, week 12, week 22) to explain and interpret the quantitative data collected on educator posting. Ten students were randomly sampled from each of the 35 educator's classrooms. A total of 350 students in first period courses were sampled from the 874 total school population to determine aggregates of course homework submission and mean course homework scores for each content area course. The current school is located in central Maryland in a region with a high-socioeconomic status. Over 95% of students have internet access at their homes which allows for the possibility of regular access to information posted on the school's LMS.

### **Limitations**

Although this research was carefully prepared, there were some limitations that should be noted. The limitations in this study include confounding variables (multiple outside influences), setting (researcher presence), and data collection (one sided data collection).

This study has limited by generalizability. Due to the nature of LMS, there are a wide variety of variables that influence the practices of the educators in this specific middle school setting. First, the style of teaching that the educator uses in their physical

classroom will spill over into their digital classroom is influenced by the culture of the school. Second, homework submission and scores can be greatly impacted by how the educator structures their face-to-face classroom and the policies and expectations of administration within a school. Finally, parental involvement plays a huge roll in the success of students. This school has a large amount of parental involvement, which is not true of all of the schools within the district. While this small group of educators in a specific middle school may not be generalizable to the population as a whole, it may be generalizable to other middle school in high-socioeconomic regions.

The setting may have served as a limitation in that the researcher was an educator at the school during the study, but the researchers LMS use was excluded from data collection. In order to have the necessary access to educator LMS use and course homework scores, an existing relationship between the researcher and the school was necessary to ensure student privacy. Educators and parents consented to the collection of archival LMS data. This may have caused a brief increase in LMS use at the beginning of the study, data collection over a long period of time helped to dissipate any increases in use overtime. To combat any false increases in use, the consent forms were signed and submitted at the beginning of Quarter One. This provided time for a ten-week pilot study that would dissipate the impacts of a false increase in use. The study then went on to collect data during Quarters Two and Three, a 22-week period in the middle of the school year. During this research, the data collection was limited to one middle school. While research may not be generalizable for the entire district, this research relates to schools with similar demographic qualities.

Finally, the data collected for this research study did not collect student or parent LMS use data. Due to restrictions from the proprietary LMS provider, student and parent usage information was not made available for analysis. This study is comprehensive in terms of collecting a variety of information from educators including perceptions, posting data, and grade book access. These data however are one-sided. Student log-in information may have helped to identify if a specific pattern of educator use encouraged patterns of student use. Without this detailed description we can only theorize about the association between LMS use and student learning outcomes. This opens the door for future research that both describes and interprets parental and student roles in LMS use.

### **Rationale**

Analyzing patterns of use in a LMS adds to the research on technology use in secondary schools (Sehring et al., 2007). Usage patterns of educators fall into many subgroups, such as the experience level of the educator or the content area they teach. LMS use differs depending on subgroup comparisons, such as the time of year, grade level (6-8), or class ability level. For example, at the beginning of a school year students may use LMS less frequently. As students increase use throughout the school year, educators may use the LMS to offset inclement weather days and student absences or to increase rigor and provide enrichment. A content subgroup such as language arts may have one pattern of LMS use and mathematics another. Gaps in LMS research still exist in secondary schools, specifically in middle schools (Psycharis et al., 2013). Educators cannot be sure that their technology choices are positively impacting students without a description and analysis of secondary LMS use (Papadakis et al., 2012). Defining differences in use will be important to identifying strengths and weakness of

implementation in LMS integration and will help the school to identify areas of focus for current improvement or to help understand other classroom technology use in the future, before the school's culture develops an incomplete understanding of the tool (Blau and Hameiri, 2010).

### **Definition of Terms**

**21<sup>st</sup> Century Classroom** – A classroom in which certain core competencies such as collaboration, digital literacy, critical thinking, and problem-solving are taught to help students thrive in today's world.

**Ability Level** – Students ability level groups are established by state testing scores on the mathematics portion of the assessment. The four levels include below average, average, above average, advanced. Heterogeneously grouped classes include a mixture of the four ability levels.

**Aspect of LMS**- These are areas of LMS research that have been the focus of previous studies. Some aspects are different features within the digital classroom, while some are behaviors displayed by LMS users. Individual aspects of LMS that have been studied include student motivation, collaboration, communication, educator perception, student perceptions, LMS quality, and achievement (Blau & Hameiri, 2010; Lui and Cavanaugh, 2011a).

**Authentic Use** – Authentic use explains how educators use technology in the classroom with no intervention. Authentic use is observed as educators, students, and technology interact naturally in the classroom.

**Class Content** – Class content is a type of LMS posts, which include assessments, assignments, attachments, and discussion boards.



**Assessments** – A type of LMS post that includes any testing that takes place on or through the LMS.

**Assignments** – A type of LMS post that includes specific homework information which needs to be completed by students in the course.

**Attachment** – A type of LMS post that includes any document uploaded to the LMS to assist students in understanding course content or completing an assignment.

**Discussion Boards** – A type of LMS post which includes any time students have synchronous or asynchronous communication within the LMS.

**Culture of Use** – The way in which the LMS is perceived and promoted by administrators and educators within a school.

**Edline** – Edline is the most popular K-12 LMS. It was recently acquired by Blackboard Engage.

**General Information** – General Information is a types of LMS posts, which presents information including; news, web links, and calendar items (Papadakis et al., 2012).

**Calendar Items** – A type of LMS post that accounts for information loaded to the classes' calendar.

**Class Information** – A type of LMS post that includes details an educator posted on the LMS as notes for class. This could be copies of notes, work sheets, or outlines of information covered during class. This category also includes general class updates, such as, “Bring glue sticks tomorrow”, “Reading logs are due Friday”, or “Bring a bagged lunch to the field trip tomorrow”.

**Web Links** – A type of LMS post that includes an item posted to the LMS which navigates to an outside source. Many of these are placed under the “Links” tool bar. Others are woven throughout as needed for homework or class work assignments.

**Learning Management System (LMS)** – A web-based application used for delivering, administrating, tracking, and reporting online learning, also referred to as Learning Community, Management System (LCMS) or Content Management System (CMS) (Haugsbakk, 2009).

Table 1

*LMS Variables Included in the Current Research*

Usage Variables	Homework Variables	Survey Variables
Grade Level	Number of	Age
Content	Assignments	Experience
Time of Year	Number of Points	Perception of LMS Use
Usage Level	Class Ability	Perception of LMS
High Use	Homework Submission	Platform
Moderate Use	Mean Homework	Perception of LMS
Low Use	Scores	Impacts
Types of Posts		
Class Information		
Calendar Items		
Web Links		
Grade Updates		
Study Information		
Assignments		
Attachments		
Discussion Boards		
Assessments		

**Patterns of LMS Use** – The frequency at which educators access the school-based LMS to post information adding to the courses content. Educator LMS use includes posts which are tracked by the type of information, the dates at which the educator posted

information to a LMS course, and the variety of documents and tools used to enhance the digital classroom. As per school policy, educator homework posts are heavily suggested. The content included on the LMS beyond homework assignment notification are categorized as other types of LMS posts including, but not limited to attachments, assessments, and calendar posts.

**Specific Information** – Specific information is a types of LMS posts, listed in that are individualized for each student; including grade updates and study information.

**Grade Updates** – A type of LMS post that includes specific scoring information for each student within the course. Grade Updates are the only educator LMS requirements of the school. Grades were expected to be posted every two weeks. Grade posts provided calculated course score as well as scores for each assignment submitted up to that point.

**Study Information** – A type of LMS post that explains when an assessment is scheduled and what should be utilized by students to be successful on the assessment.

**Tools** – Online educational platforms used by educators for enrichment or remediation. Online tools are typically made available to students through a LMS.

**Types of Posts** – The kind of information educators posted to the LMS. Weekly data collected in the general information, specific information, and course content categories.

**Quarter**- A measure of time. Secondary classrooms are in operation from late August through mid-June and are divided into four quarters which are typically 8-10 weeks in length. Also referred to as educational quarters.

**Usage Level** – An educator's mean posts per week throughout one quarter of the school year.

**High Use** - Educators with a mean usage score of 4.5 posts per week or higher were grouped as High Users.

**Low Use** - Educators with a mean usage score of less than 2.5 posts per week were grouped as Low Users.

**Moderate Use** - Educators with a mean usage score of 2.5 - 4.49 posts per week were grouped as Mid Users.

## **CHAPTER 2**

### **REVIEW OF LITERATURE**

This review of literature addresses the educational uses of Learning Management Systems (LMS). The review begins by identifying the educational theories that guide LMS integration and the current state of use in K-12 education. Next, the review explores literature that has reported the impacts of LMS communication on the school environment. Finally, the benefits and drawbacks of LMS use for educators and students are explored.

#### **Thematic Review**

The first theme in this review includes information on current LMS use. Within this theme, the current uses of LMS in secondary education are described and the extent of LMS guidelines are explored. Limitations in the scope of LMS patterns of use in this area helped to frame the descriptive nature of research question one. The literature goes on to describe the perceived uses for LMS within secondary schools and how that use is impacting secondary education.

The second theme includes different aspects of LMS use within secondary education. Within this section, LMS will be discussed in terms of educator communication with students as well as educator perception of online classrooms. The use of a LMS as a tool for communication is perhaps its most defining characteristic, and is therefore crucial to describing its uses. Much of the LMS literature describes the platform as a source for homework communication between educators and students. Research question two seeks to identify the impact of LMS homework communication on student homework submission. In secondary schools, educators are the facilitators of this

communication and therefore use the LMS most often to provide information for student use.

The final research theme includes the student learning outcomes connected with LMS. Within this section, LMS use will be discussed in terms of student achievement. The use of LMS for assigning homework will also be examined, due to the regularity of LMS homework communication tools. Research question three will describe the relationship of LMS homework communication with student homework achievement. Each of the three themes in this literature review help to determine how LMS use has impacted students in secondary schools.

### **Literature Collection Process**

The LMS literature search process included seven databases in the disciplines of education, business, library and information sciences, psychological and behavioral sciences, and communication and mass media. In November 2014, an initial search for LMS yielded 3,644 results. The search was then refined to include LMS, K-12, and technology integration, which yielded 33 results. Studies selected for review met specific inclusion criteria. The article needed to focus on LMS, K-12 education, and technology integration. After reviewing the titles and abstracts of these sources, those that were not written in English, those that were duplicates, and those that were not relevant to this review were eliminated.

During January and February 2015, following this primary elimination, an examination of references and key terms in each of the remaining 33 articles was conducted. Fifty-six additional articles were present that contained the elements necessary for a complete evaluation of LMS usage patterns. From November 2015

through January 2017, updated literature searches were conducted monthly. This helped to identify newly published articles in the study's content areas. The final review closely examines 25 articles that describe LMS use in K-12 education.

While conducting a review of literature, a number of important themes were identified, including: the current uses of LMS, the impacts of LMS communication on the K-12 classroom, the perception of educators on LMS integration, and the impacts of LMS on student achievement. The following review describes each of these themes and identifies gaps in the research for further review.

### **Theoretical Framework**

For the last two decades, LMS have been integrated into secondary schools. Most research (Psycharis et al., 2013) claims that current LMS are underutilized in the secondary classroom. The middle school of the current study has subscribed to use of a LMS for fourteen years, but the level at which the LMS has been adopted by the community of educators is unknown. As more and more technological innovations are introduced into the secondary school setting it is useful to investigate how previous technology adoptions have occurred. This will help us to both address any weaknesses with current technology use and prepare for future innovations to enter the school system.

**Diffusion of innovation theory.** The field of education has used Rogers' Diffusion Theory (Rogers, 2003) as a model to understand how teachers adopt and implement innovations. Diffusion research examines how an idea spreads within a group of people. Examining the integration of a new technology into a school has made a seamless connection with the field of instructional technology. Rogers' (2003) enables an investigation of three crucial aspects of technology innovations which include where the

innovation will take place, what the source of the innovation is, and who will be enacting the innovation. The current school has used a LMS for fourteen years, which provides hindsight, giving an opportunity to update current procedures and to better prepare for future innovations.

One way in which educational communities can evaluate the possible success of an innovation is through the environmental qualities that encourage an innovation to spread (Rogers, 2003). These qualities are systematic and often embedded into the cultural procedures of the school. When the initial adoption process takes place, the compatibility of the innovation with the existing values and practices of the school is important for the innovation to take hold. In other research, Ertmer (et al., 2012) found that there are great barriers that prevent the adoption of technology. First order barriers include items like hardware, software, and training. Second order barriers include items like technology confidence, beliefs on the value of technology, and beliefs concerning how students learn. Rogers (2003) would argue that the adoption of technological innovations rely heavily on how successfully an organization could overcome first order barriers, such as training, and how meaningfully an organization could imbed the innovations into the school's culture.

As time goes by, more and more of the first order barriers are disappearing (Ertmer et al., 2012); most secondary schools are beyond the initial adoption process with LMS. This will be important to consider moving forward into more advanced digital classrooms. Rogers (2003) also acknowledges the length of time needed for the successful adoption of an innovation. Throughout that time an open communication channel that helps to provide comfort will give educators the chance to implement the



innovation. Within a school, opportunities for personal groups of educators to employ an innovation helps them to determine ease of use and identify the relative advantages of use (Roger, 2003).

Rogers (2003) identifies another critical piece to the adoption process is the source of the innovation. Authority innovations have taken place in the case of many LMS, meaning individuals in positions of power (administration) have implemented them to an entire system. Authority innovations lack some of the freedoms of optional (individual change) or collective innovations (group change), but the required use provides educators with a chance to implement the innovation in authentic conditions. The adoptions process in many secondary schools has authority figures as a source, which is why professional development is crucial to full adoption by educators. Fraser , Kennedy, Reid, and McKinney's (2007) research suggests that professional development should be designed by educators, be personal and social, target specific groups, and allow for classroom implementation. Rogers' (2003) reliance on peer-peer networks, heavily influence opinion leaders, are reinforced by the findings of Fraser (et al., 2007).

Finally, Rogers (2003) identifies who will be enacting the change in the adoption process. He acknowledges the importance of understanding different segments of users in order to personally and specifically address the needs of the group. Educational research has examined the rate at which educators adopt a new idea within a school to facilitate both short term and long-term change goals. In the case of LMS in secondary schools, educator adopters would be placed in categories based on their willingness to and speed of adoption. Rogers (2003) has grouped different levels of adoption in categories called innovators, early adopters, early majority, late majority, and laggards. Using Rogers ideas

of adoption, Dori, Tal, and Peled (2002) characterized the way middle school science teachers incorporated web-based learning. They found that four types of science teachers had beliefs about web-based learning: the initiator, the follower, the avoider, and the antagonist (2002). Much like Rogers' (2003) Diffusion of Innovation Theory, the different levels of web-based use had different behaviors that were used to classify their placement. Dori (et al., 2002) described the initiator as a pathfinder who is seeking new ways to incorporate web-based learning. The follower was described as a conformist who will apply the web-based tool when it is convenient for them. The avoider was described as someone who will use the web-based tool only when required. The antagonist was described as someone who will not use the tool at all regardless of requirements. In the current study, educators existed in each of these classifications. Both Rogers (2003) and Dori (et al., 2002) would argue that, when it comes to technology integration, a school's environment is a large indicator of educator use, or change in use. Both Rogers (2003) and Ertmer (et al., 2012) would agree that before educators decide to adopt an innovation, it is important that they see evidence of learning outcomes. This study collected student learning outcomes and educator perceptions in order to describe authentic LMS adoption in secondary schools to better integrate current LMS tools or to prepare the school for future technology adoption.

In central Maryland, where this study took place, many school systems have initiated a Bring Your Own Technology (BYOT) program or a One-to-One Technology program. Technology has been placed in the hands of students, so for many educators, resources are no longer a barrier. This does not however, acknowledge educator technology knowledge, attitudes, or beliefs. Students can continue to have access to

technology, but without addressing cultural barriers, little will be accomplished (Ertmer et al., 2012). The second order barriers described by Ertmer (et al., 2012) stand in the way of adoption by the late majority and laggards described by Rogers, 2003. The current study plans to describe educator LMS use in a secondary school, and their perceptions of its usefulness. Looking at both what educators do and what they think they should do will help to develop training programs that address specific educator needs for LMS use and technology integration as a whole.

### **The Current Practices in Secondary Education LMS**

**LMS role in education.** In 2007, Electronic Education Report disclosed that 95% of school district's educators are using online sources to communicate assignments and 88% of districts subscribe to a district-wide LMS (Electronic Education Report, 2007). In 2011, Electronic Education Report estimated that of the 130,000 schools in the United States, 100,000 are using a LMS as a solution to classroom procedural needs, such as disseminating information, communicating with parents, and billing. This educational report also criticized the use of LMS, saying that existing educational technology needs to take into account that students should be generators of information, and not just consumers (Electronic Education Report, 2011).

Hill (2009) explained some of the main benefits of LMS. These benefits include the ability of students to become independent, competent, creative, communicative problem-solvers, while requiring educators to become the facilitators of the knowledge (Hill, 2009). The facilitator role is a difficult position for many educators who struggle with technology integration and student-centered classrooms (Papadakis et al., 2012). Describing current educator usage patterns may help identify where educators have

strengths and weaknesses in their practices. Using this data, better frameworks could be created to provide more intentional LMS use. Ninety-five percent of secondary school systems have used a LMS, however they are often used for only one-to-one communication while collaborative tools often go underutilized (Al-Busaidi & Al-Shihi, 2012). The current study intends to describe LMS use and identify the relationship of use to student achievement. Findings from this study may identify areas in which the adoption of a LMS has been successful and unsuccessful within this school. Successful use could provide educators with a more concrete purpose for use and a help design a framework for digital classroom implementation (Al-Busaidi & Al-Shihi, 2012; Papadakis et al., 2012).

**Applying frameworks to LMS instruction.** The popularity of LMS is evident through the growing adoption in higher education, vocational schools, corporate businesses, and K-12 environments (Electronic Education Report, 2011; Hill, 2009; Papadakis et al., 2012). LMS use in K-12 environments is relatively new compared to higher education, and therefore guidelines for integration are not readily available. In 2012, Papadakis and colleagues implemented a series of tutorials to aid secondary educators in the preparation, organization, and implementation of a LMS. They attempted to change the conceptual understanding and attitudes that students had toward LMS use in the classroom. The goal of their research was to observe if student attitudes and usage patterns would change when educators conduct LMS use in a more structured format. Papadakis (et al., 2012) explained that a LMS can be a useful pedagogical tool, but findings indicated that current classroom instruction does not fit with online instruction. A large portion of the current study seeks to describe what current LMS instruction looks

like, to help identify areas of need for educator LMS users. Papadakis (et al., 2012) claimed that past pedagogical approaches and theoretical frameworks are shifting from teacher-center to student-centered due to the introduction of new technologies. Quality guidelines that go beyond basic content delivery are needed for LMS use. Therefore, in order to produce research-based LMS instruction, LMS use should continue to be analyzed (Basal, 2015). Further findings may support the development of best practices to guide educator design and integration.

Online learning environments were built for classrooms, and are therefore designed for ease of use by educators. Rogers (2003) identified ease of use as an important element in the adoption of an innovation in any social organization. He also explained that wide spread computer use through the means of an electronic social network should lead to better diffusion of an innovation. Badge, Cann and Scott (2005) found that a lack of formal LMS training has led to limited classroom use and underdeveloped instructional design. What resulted was an underuse of the tools available within a LMS, leaving this advanced learning tool to act as a repository of electronic documents (Al-Busaidi & Al-Shihi, 2011; Badge et al., 2005). The research conducted by Papadakis (et al., 2012) showed that when implementing a LMS, a wide range of pedagogies might be used. A research-based framework would be helpful to guide educator and student use of collaborative LMS tools (Al-Busaidi & Al-Shihi, 2011; Papadakis et al., 2012; Psycharis et al., 2013). The use of LMS for one-way communication represents a more teacher-centered, behaviorist approach to pedagogy rather than a student-centered, constructivist approach in a collaborative online environment. A lack of understanding of the processes used to conduct online classrooms

has left best practices unclear. While some argue that the use of a LMS help educators by making better use of classroom time, there are no easily accessible guidelines for educator use (Al-Busaidi & Al-Shihi, 2011). Therefore, online classrooms often go underutilized, making LMS an addition educator responsibility with little evidence of learning benefits for students (Ertmer, 2012; Liu & Cavanaugh, 2011b).

**Perceived benefits of LMS in secondary education.** Proponents of LMS expect them to increase student motivation and infuse student-centered activities simply due to their collaborative nature (Blau & Hameiri, 2010). A LMS platform houses a set of tools that can close the gap between traditional classroom instruction with technology literacy in 21<sup>st</sup> century classrooms (Partnership for 21<sup>st</sup> Century Skills, 2012; Papadakis et al., 2012). Online classrooms are expected to play an important role in reaching a wide range of students, including different ability levels, cultural backgrounds, and ethnic populations (Hill, 2009). While LMS have been given an important role in the classroom, few studies have researched how LMS are used to meet these expectations.

The LMS was designed to provide educational stakeholders with different benefits. Hill who described the Baltimore City Public School System's use of LMS in 2009, stated that 27,000 classrooms were using LMS to organize instruction for 83,000 students. Hill's (2009) description of LMS use is similar to that of the school described in the current study. He explained that administrators who support LMS use are enticed by the thousands of dollars they can save in paper and mailing expenses when communicating with parents. The administrative uses of LMS include communication through newsletters, links, surveys, and announcements (Hill, 2009). Educator LMS use is expected to be closely linked to student LMS use (Hill, 2009). Hill (2009) claimed that

these collaborative learning environments afforded secondary schools with an opportunity for students to use technology for homework collaboration.

**LMS use in secondary education.** Despite the perceived benefits of LMS use, there are many who question the value of the platform. Current reports describe LMS as underused, leaving online classrooms that simply hold information (Abik, Ajhoun, Ensias, & Morocco, 2012). The current study seeks to observe educators' online posting, in order to describe educator use and compare it to student learning outcomes. If educator LMS use and homework submission rates are high in the same courses, the two could be associated. Rogers (2003) described the importance of value in the adoption process. Providing educators with achievement data may provide them with the information necessary to more informed decisions regarding the use of LMS with their students. The story that has not been told in more than a decade of LMS use within secondary schools is the relationship between educators posting patterns and student homework success within a school.

Despite Hill's (2009) description above, LMS use varies so much between schools that it is difficult to observe its benefits. Some educators create and maintain their own LMS, while some districts mandate specific use of their LMS (Electronic Education Report, 2011). These usage differences have been studied individually, but not as a whole, which has created a lack of consistency in findings (Psycharis et al., 2013). Because there are not uniform findings, educator guidelines have not been developed. This leaves educators to make usage decisions based on personal choice rather than research, which has weakened the quality of LMS use over time (Abik et al., 2012). This study would demonstrate a method to observe and analyze technology use in an entire

school. This method could be used in schools or individual classrooms that lack mandates to guide their decision-making.

### **Aspects of LMS Classrooms in Secondary Education**

**Communication and LMS.** In the early 2000s, LMS were used strictly to manage courses in secondary schools (Sehring et al., 2007); however, in recent years, they have expanded to become an online communication system, which includes a spectrum of possibilities (Blau & Hameiri, 2010; Sehring et al., 2007). Blau and Hameiri (2010) studied the impacts of LMS use on the quality and quantity of communication between educators, students, and parents. For three years, the researchers recorded the number of educator logins, online grade books, and the messages sent between educators. They believed that LMS should be used to organize courses and communicate, so their research observed two schools, one with communication between educators and students and one with communication only between educators. Blau and Hameiri (2010) also identified Dori (et al., 2002) study of educator technology users as crucial to the success of a LMS. They explained that the success of LMS implementation is determined by the level at which the initiator, the follower, the avoider, and the antagonist adapt to the tool. The same is true in Rogers (2003) Diffusion of Innovations, communication is essential in the decision of an educator to adopt or reject a technological innovation. Blau and Hameiri (2010)'s study showed significant communication and data entry on the part of the educators who were communicating with students which increased over the three years. This was not true of the school where educators were only interacting amongst themselves. Blau and Hameiri (2010) felt that the most important aspect of LMS was open communication that could pass frequently between parents, educators, and students.



Blau and Hameiri (2010) found that one key benefit of LMS is that the platform opens a number of communication pipelines that can be useful. When educators interacted more frequently with students, the students logged on more regularly than the students of educators who used LMS for only colleague interactions.

The LMS provides communication tools that help parents, students, and educators interact with one another through the use of a variety of media applications (Caron, Beudoin, LeBlanc, & Grant, 2007). Understanding what LMS tools are used most commonly and to what extent they are used, could help paint a picture of LMS in secondary education environments. Caron (et al., 2007) explained a model for LMS usage patterns called The Lifelong Online Learning Environment (LOLE) model. This model (Caron et al., 2007) demonstrated that communication can be asynchronous or synchronous, and can be conducted between content and learner, learner and collaborator, learner and peer, or parent/community member and collaborator. An individual learner may interact with content on his or her own, but when he or she becomes a collaborator, they are working with tools that should enable students to work on the same topic at the same time (Caron et al., 2007). The success of synchronous communication through LMS in secondary schools has provided an opportunity for relationship building among groups of users (Blau & Hameiri, 2010). In fact, Blau and Hameiri (2010) found that opening the lines of communication in a LMS increased the amount of system logins, data reporting, and message sending. This supported their argument that the main purpose of a LMS is to support communication, and that this communication has led to favorable attitudes and positive evaluation of courses. Even though a variety of collaborative tools exist (i.e., wikis, blogs, or discussion boards) many secondary LMS are not employing

these resources (Al-Busaidi & Al-Shihi, 2011). Using educator posts to measure asynchronous communication in the secondary school environment could help to build a framework for LMS use.

Communication has been shown as a major benefit of LMS in several studies. Blau and Hameiri (2010) found that communication increased student use, but Schrodt (et al., 2009) explain why that is the case. Schrodt (et al., 2009) found that student learning outcomes were based on the communication behaviors between educators and students. In their findings, educator confirmation and clarifying remarks in online communication improved students' beliefs about the educator's credibility. The students felt that the educator's responses showed interest in their learning, and therefore, they continued to express their learning through online communication. In the same way that Rogers (2003) encouraged a social system that builds over time with the fostering of communication, Schrodt (et al., 2009) found that students need a continuous and specific communication line open with their teacher. These findings allow for more focused discussion on the ability of a LMS to develop connections. LMS have provided a platform where learning can take place outside of the school building. But as seen above, these learning experiences could vary without a framework to guide educator LMS use (Abik et al., 2012). Describing use within a secondary school, instead of higher education, could help to clarify the connection between LMS and the impacts that online communication has on student learning outcomes.

In classrooms that have initiated connections that focus on communication, LMS have been found to provide online enrichment related to daily face-to-face learning (Sehring et al., 2007). Sehring (et al., 2007) developed a Conceptual Content

Management System which modeled appropriate e-learning tasks. In promotion of this conceptual model, the researchers argued that in order to truly be an environment that provides individualized learning, open communication must be the main focus (Sehring et al., 2007). Allowing learners to produce, collaborate, and present to a larger group, is possible in a system with a mixture of communication tools, multimedia content, and pedagogical models. When studying online communication, Sehring et al. (2007) found that the quality of online environments played a role in the collaboration of stakeholders within online classrooms. LMS platforms create connections between stakeholders and content. The quality and variety of communication types that emerged in online learning environments were important to their overall success for the school, by drawing students to more regularly participate in active learning (Sehring et al., 2007). Therefore, Caron (et al., 2007) would agree that a greater purpose for LMS is to manage and foster communication, not simply hold the content within a course.

**Educator perception and LMS.** When integrating any technology into an educational community, the endorsement of the administration, confirmation of the community, assent of the educators, and validation of the students are just as important as the technology itself (Al-Busaidi & Al-Shihi, 2011; Dang & Robertson, 2010). Al-Busaidi & Al-Shihi (2011) wanted to examine the key factors influencing educator satisfaction of LMS. They developed a questionnaire that asked about the educators' technology experience, the quality of the LMS system they were using, and the organizational support they receive within their school. In the United States, 90% of institutions have adopted LMS, but many educators discontinue use because of their lack of design knowledge or fear of integrating technology. Al-Busaidi and Al-Shihi (2011)

explained that LMS provide an opportunity for educators to develop and implement online learning environments, but there are a variety of factors that influence their decision to integrate LMS into a classroom setting. In particular, Al-Busaidi and Al-Shihi (2011) found that educator satisfaction in the areas of technology comfort, system quality, technological support, and policy were significant indicators of their perceptions. Limited research has been conducted to connect the perceptions of educators to LMS use, despite the fact that satisfaction of online learning environments is needed for continued success (Al-Busaidi & Al-Shihi, 2011). Basal (2015) examined the perceptions of pre-service educators on the use of LMS. A total of 122 preservice English educators completed questionnaires and semi-structured interviews. These preservice educators had overwhelmingly positive perceptions toward the use of LMS as an integral part of face-to-face courses, but felt there were limited instructions for integration (Basal, 2015). While examining the patterns of secondary LMS use, understanding the perception of educators is necessary to decode the patterns of use. Findings about perception could help to determine whether first or second order barriers (Ertmer et al, 2012) are the biggest struggle in the secondary classroom. Knowing the educator's barriers will allow for more effective professional planning.

In order to resolve the technological concerns of educators, they first need to be informed of the benefits and drawbacks of LMS use. Information provides educators with justification to promote LMS integration (Ertmer et al., 2012; Lochner, et al., 2015). If educator LMS concerns are not addressed early on, integration may not become a part of the school's culture. Research is needed in order to identify how educators perceive LMS integration. Lochner et al. (2015) examined secondary educators' concerns about LMS

use. They found that, most often, an active educator in a face-to-face classroom was typically an active educator in a LMS classroom. However, as Ertmer (et al., 2012) explained, student-centered classroom design does not always translate to educator LMS use. Even though digital classroom use is increasing, K-12 classrooms are slow to adopt them; largely due to the attitudes of educators who seek value in the instructional choices they make (Lochner et al., 2015). Lochner (et al., 2015) found that educators largest concern about use was the increased demand LMS use put on their instruction and one of the smallest concerns was the impact LMS use has on students. The idea of connecting value to LMS use is critical in LMS research (Ertmer et al., 2012, Dori et al., 2002; and Lochner et al., 2015). The current research in the field has collected perception data, use data, and achievement data, but has not drawn lines between these variables to highlight the impacts of LMS use. Research questions two and three are aimed to target some of the possible impacts of LMS on secondary classrooms.

In 2012, Papadakis and colleagues examined the increasing adoption of LMS in secondary education, especially the perceptions of the educators who use LMS within their schools. Papadakis (et al., 2012) found that educators were satisfied with LMS use after receiving an instructional tutorial. The development of a framework that is simple and addresses educators' course needs lead to positive attitudes towards LMS use (Papadakis et al., 2012). Educators in the study felt that they could innovate on their own, save time, and reduce their workload. Simple instruction, policy, and a clear framework that provided educators with support is crucial to integration (Papadakis et al., 2012; Al-Busaidi & Al-Shihi, 2011).

While professional development for educators is not the focus of the current study, it is clearly important to effective adoption of LMS use. This study is aiming to find the areas of use and non-use at a secondary school in order to better develop a framework for practical use within the school. Fraser (et al., 2007) analyzed three professional development frameworks to compile streamlined examples of teacher education. The rapid changes in technology has made educator innovation occur more regularly. Fraser (et al., 2007) explained that this means more professional development should be designed by educators and less should come from school administration and state policy. Their findings explained that educators need professional development that has formal planned opportunities that are personal and social. In addition, professional development should include targeted groupings to provide educators with greater ownership of their learning, which could influence future opportunities for classroom implementation (Fraser et al., 2007). More recent research agreed that a focused small-group approach to professional development ensures sustainable applications (Kruger, Van Rensburg, & De Witt, 2016). By using descriptive LMS data, collected in research question one, to describe use amongst educator subgroups personalized professional development could be made more possible.

### **Student Learning Outcomes and LMS**

**Achievement and LMS.** Due to the vast ability to collect data, online learning has shown benefits for educators, researchers, program leaders, course developers, and policy-makers. However, there are limited factors that have been found to predict the use or success of secondary students within LMS (Liu & Cavanaugh, 2011a; 2012; Psycharis et al., 2013). Student homework submission and mean homework scores are quantifiable

measures for student success, especially with the current reliance on LMS as a tool for homework communication (Sehring et al., 2007; Schrodts et al. 2009). For the current study, research question three contains a set of data that describes homework scores in comparison to educator posts to the LMS.

Before discussing LMS and student achievement, it should be noted that there have been many studies that have found benefits for student sub-groups. Specifically, students with language-based disabilities and students who speak English as a second language (ESL) have been afforded extended processing and response time with the use of LMS (Dang & Robertson, 2012). The vast amount of research in this area is not included in this literature review, because this study's focus is on educator LMS use and not tracking benefits to student use based on specific learning needs.

The focus of this section of the literature review is to identify research that compared LMS use and student achievement in secondary schools. Psycharis (et al., 2013) as well as Liu and Cavanaugh (2011a; 2012) found improvements in student achievement in secondary science and mathematics classes through the use of a LMS. Psycharis (et al., 2013) evaluated students' perception of online science courses in a high school. They felt that students now grow up in a digitally connected society, and today's approach to education cannot meet those demands (Psycharis et al., 2013). Students today are considered connected knowers, and 21<sup>st</sup> century skills should be taken into account when looking at student learning outcomes. Characteristics of connected knowers include students who learn cooperatively, build on peer ideas, and demonstrate a more argumentative, critical way of learning (Psycharis et al., 2013). DeNeui and Dodge (2006) also observed LMS communication and found a significant relationship between

students' overall LMS use and their exam scores. Although the current study is focused on secondary education students, DeNeui and Dodge's (2006) research in higher education described an important connection between communication and student learning outcomes.

Liu and Cavanaugh (2011a, 2011b, & 2012) conducted three studies over a two-year period that focused on achievement in LMS-based high school math and science courses. The main focus in each of the three studies was to identify factors that contributed to LMS success in secondary classrooms. The factors they chose to include were, time students spent in the LMS, frequency of logins, free and reduced lunch students, educator comments within LMS, and student academic ability, age, and race. Furthermore, Lui and Cavanaugh (2011a) also looked at the characteristics of a specific school to determine if there is a learning culture that influences student achievement. Each of their studies followed one algebra or biology course throughout an entire school year. The data collected consisted of student usage patterns and final state testing scores in the course being observed.

In all three studies, Liu and Cavanaugh (2011a; 2011b; & 2012) found similar results. Students in lower grade levels were found to perform statistically significantly lower in online classrooms than upper-classman. They argued that this was due to the experience with online learning and the maturity it takes to be a responsible independent learner (Liu and Cavanaugh, 2011a; 2011b; & 2012). They also found that time spent by individual students on the LMS greatly increased face-to-face classroom interaction and that the number of logins was a good predictor of future academic success. Another significant finding was that students enrolled in a full-time online course scored higher



than students in part-time online courses. Overall students who received more educator comments scored higher than peers who received fewer comments from their educator. All of these findings pointed to successful use of LMS, where students who access the system more regularly scored higher on their assessments (Liu and Cavanaugh, 2011a; 2011b; & 2012).

While most of Liu and Cavanaugh's (2011a; 2011b; & 2012) research identified positive relationships between LMS use and achievement, there were two factors that impacted scores negatively. Students on free and reduced lunch programs had lower achievement when enrolled in LMS courses. Earlier findings indicated that students perform better if they spend more time on the LMS, however free and reduced lunch students do not always have the same accessibility to technology. This is a first order barrier (Ertmer et al., 2012) that could prevent some educators from promoting LMS use within their classroom.

Well-designed LMS classrooms were another predictor of success, because they helped to motivate students and increase their satisfaction in the course. Liu and Cavanaugh (2011a, 2011b, 2012) identified that well-designed frameworks typically include instructors that engage their students online through guiding questions and feedback (2011a; 2011b; 2012). LMS that lacked design produced different results in student outcomes. High enrollment in online courses tended to decrease facilitator interaction with students, and therefore had a statistically significant negative influence on student achievement (2011b).

The goal of most instructional technology is to increase the value of the learning experiences provided to students (Ertmer, 2012; Sehring et al, 2007). It is, however,

crucial to evaluate these learning environments in order to continuously adjust the instructional design used to develop the course. Rogers (2003) argues that when adopters saw evidence of an innovation impacting their environment in a positive way they are more likely to fully adopt the innovation. Liu and Cavanaugh (2011a) urged for continued research to provide evidence of impacts, especially with secondary learners, because it is a growing field that is transforming education rapidly (2011a).

**Homework and LMS.** One way to evaluate the acquisition of skills and knowledge from LMS is through the examination of student homework submission and mean homework scores. There is not complete agreement on the benefits of homework on student learning outcomes, but for schools that do subscribe to using homework as a part of their culture, Lucio, Hunt, and Bornovalova (2012) have identified homework submission as an indicator of success or failure within the school. LMS are meant to draw groups of students together digitally to make homework more collaborative, increase complex thinking skills, improve problem-solving capabilities, and more closely resemble the real world (Partnership for 21<sup>st</sup> Century Skills, 2012).

Due to the extensive variance on the purpose, amount, and value of homework, there are many homework topics that will not be covered in this review of literature. Within the current study homework submission and scores will be collected to compare with LMS use. Lucio (et al., 2012) conducted research that identified the point when students become at risk for academic failure. Homework completion was one of these points. This is one reason the current study selected homework as a data set to represent achievement. If homework submission is an indicator of success or failure, it could be used to analyze the relative achievement of students. This study is not a debate regarding

the value of homework in secondary schools, rather homework serves as a concrete example of a learning outcomes possible from increased LMS use.

As previously discussed, the most popular aspect of a LMS is the one-way communication between the school and home environments. However, LMS can also be organized layouts that benefits educator and student course goals (Blau & Hameiri, 2010). In 2011, Xu conducted research on homework in two secondary schools. First, Xu (2011a) surveyed students in grade eight and grade eleven to see how they perceived their homework completion. Xu (2011a) concluded that modeling homework management strategies throughout the school is the most effective way to increase homework completion. LMS can be used to model student responsibility and scheduling while providing groups for critical-thinking during peer communication. Identifying the different patterns of educator LMS use in a secondary school could describe which usage patterns are associated with the most student homework submission.

In Xu's (2011b) second study, students were surveyed about what they believed were the purposes of their homework assignments. Xu (2011b) reported that the purpose of each homework assignment was important to students. If there was a purpose that students deemed as important, they were more likely to complete the assignment. Two indicators that determined whether students found purpose in their homework were parent educational background and educator feedback (Xu, 2011b). If parents and educators saw purpose in homework, students did as well. This relates to Liu and Cavanaugh's (2011a) earlier findings that reported students are more likely to act when they see real-life applications of assignments. This relates to the P21 Framework (2012) which explained that technology use helps prepare students for their future in higher

education and the workplace, because students need to be ready for experiences they will encounter in real-life.

Homework assignments that are posted to a LMS are similar to those written during class in a student planner. One major difference is that homework posted online is accessible from many locations, while homework written in a plan book can only be in that one place. Wilkinson and Echternacht (1998) conducted a study comparing Internet homework activities with traditional homework activities. Their purpose was to compare student learning, time spent on homework, and student attitude differences between the two environments. The results identified that students using the Internet for homework spent more time online completing homework and had a better attitude about homework, but there were no significant differences between final scores or student homework completion. Yet still, Salend, Duhaney, Anderson, & Gottschalk's (2004) argue that the Internet has offered direct and effective methods to plan and incorporate homework for the convenience of its users, however the extent of this impact is unclear.

While LMS have been researched from many angles, gaps still remain in a complete understanding of the patterns of LMS use within secondary schools. This is especially true of indicators that translate to the traditional classroom, such as homework submission. Liu and Cavanaugh (2011a; 2011b; 2012) clearly identified factors that influence achievement, while Xu (2012) acknowledged the influence of technology on student homework communication. Educator feedback has been shown to positively impact students (Xu, 2012), but educator LMS usage patterns have not been observed in comparison.

## **Gaps in Previous Literature**

LMS classrooms have been presented as everything from an answer to educational woes to an overrated tool that will leave little lasting impact on the educational environment (Salend et al., 2004). It would be unfair to make the assertion that the use of a LMS for distance education is an altogether new development. However, there are evolving trends in LMS that are having significant impacts on 21<sup>st</sup> century learning. For example, LMS allow for personalized education and connection to educational resources anywhere at any time (DiBlasi, 2013). Due to the rapid changes in technology and relatively recent adoption of LMS into secondary schools, the research associated with LMS use is scattered amongst a variety of categories. This has left only limited studies that have either depth or breadth in their findings (Al-Busaidi & Al-Shihi, 2012; Alshammari et al., 2016). This points to a need for a description of educator LMS use and an evaluation of the impacts to determine the frameworks that benefits students.

Overall, the research describing how LMS impacts students in secondary schools is positive. Students have shown improvements in the areas of motivation, communication skills, collaboration, and even perception of educational technology (Liu & Cavanaugh, 2011a; Liu & Cavanaugh, 2011b; Liu & Cavanaugh, 2012; Psycharis et al., 2013). However, a more focused approach is needed in examining student-learning outcomes related to LMS use (Liu & Cavanaugh, 2011a). Individually, the disciplines of math and science have been evaluated, but these evaluations alone have left shortcomings in LMS research in other areas. Conducting a study of educator LMS use, in conjunction with student homework submission, would greatly increase our understanding of secondary school operations within a LMS.

This lack of focus in research has left a gap in how secondary educators use LMS. While 90% of secondary schools are now using LMS (Al-Busaidi & Al-Shihi, 2012), a clear picture of how and to what extent educators are using them is not available. For example, what does a quality environment look like? How effective is communication between instructor and learner in a secondary LMS? These questions, and many more, have yet to be answered. In order to build a community dedicated to continued technology use, an understanding of current patterns of LMS use is pertinent. Research indicates that there is a lack of findings in this area (Al-Busaidi & Al-Shihi, 2012), nor is there an abundance of successfully pioneered frameworks for use. Most research described the need of LMS to be tied to an educational framework to be used as a tool for communication (Blau & Hameiri, 2010), but failed to identify best practices for its uses.

### **Summary**

Twenty-first century learning has made communication, collaboration, and networking play a larger role in secondary schools. Schools across the country, and most of the globe, have begun to transform their traditional classrooms by taking advantage of the constant presence and frequent use of technology (Cook, 2012). LMS have been largely adopted in secondary education because of the push towards authentic technology use (Partnership for 21<sup>st</sup> Century Skills, 2012; Xu, 2011a). A description of educator LMS use, and its impacts on the relationships between students and achievement, is needed to build a framework for best practices. There is a large population of learners that participate in various forms of e-learning (Liu & Cavannaugh, 2012). Student outcomes are often recorded in terms of communication, collaboration, or motivation, but a focus on student outcomes connected to educator use is the next step.

In the future, the field needs to move toward identifying a clear framework for educators by conducting research on the impact of LMS on student learning (Lucio, Hunt, & Bornovalova, 2012). Student achievement indicators are the most important factors to analyze because they demonstrate learning changes within the classroom (Psycharis et al., 2013). Research should begin to look beyond the perceptions educators have about LMS and, instead, analyze the use of LMS in the secondary educational setting. Exploratory research on the impact of LMS was strongly recommended for secondary education (Liu & Cavanaugh, 2011a). An in-depth analysis of the authentic use of LMS by students and educators within a secondary school is required in order to inform the educational community about the roles educators and students play in both the online and face-to-face classrooms.

## CHAPTER 3

### METHODOLOGY

#### **Introduction**

The purpose of the current study is to examine the patterns of educator LMS use in a secondary school. This research described educator use within different subgroups such as content area, grade level, years of experience, and course ability level. Educators were observed through recording the frequency and type of posts to a LMS. In addition, educators were surveyed to determine their perceptions of the LMS use. Finally, educator patterns of use were compared by determining course homework submission rates and mean homework scores within those courses.

**Overview of research.** The current study provided detailed descriptions of LMS usage patterns for educators in grades six through eight by quantifying and comparing weekly data collection of LMS posts. Researching educator LMS use provides insight into some of the online classroom formats used in today's secondary schools (Partnership for 21<sup>st</sup> Century Skills, 2012). In order to better understand secondary school LMS use, research question one focused on observing LMS use in terms of frequency of use, grade level use, content area use, function and tool use, and patterns of use over 22 weeks. In order to better understand the impact of secondary LMS use research questions two and three focused on describing and comparing educator LMS posts with course homework submission and mean homework scores. The descriptions of these aspects and comparisons between them aimed to describe the operations of a LMS in a middle school. The findings of this study were intended to highlight LMS patterns of use that



were associated with homework scores. This research tracked educator LMS posts for 22 weeks and compared the frequency and type of posts, homework submission rates, and mean homework scores. Limited research connects educator LMS use to benefits in student learning outcomes (Al-Busaidi & Al-Shihi, 2011; Basal, 2015), especially in educator subgroups such as content area and language arts. Rogers (2003) specifically states the importance of targeted peer-peer conversations that revolve around visible results in order for full adoption to occur. Using the research questions below to describe and compare use within a school could not only produce more informed use of the current LMS, but also guide the use of future technological innovations in the school.

### **Research Questions**

- 4) What are educator patterns of Learning Management System use in grades 6-8?
  - a. What are the most used aspects of LMS by educators?
  - b. In which weeks did the LMS accrue the most access?
  - c. Which content areas and grade levels use the LMS and to what extent?
  - d. Are years of experience teaching associated with the frequency of LMS use?
  - e. Are educator perceptions of LMS usefulness associated with the frequency of use?
2. Is there an association between the patterns of educator LMS use and the frequency of course homework submission?
3. Is there an association between the frequency of educators' LMS use and mean homework scores throughout 22 weeks?

## Research Design

This research study used a Mixed-Methods Sequential Explanatory Design. In this study quantitative data is the focus of data collection, but additional data is needed to fully understand and interpret educator LMS use. In Sequential Explanatory Design research quantitative data is collected first and is the primary data collection. In this case, educators' frequency of LMS use was observed, recorded, and analyzed (Creswell & Plano Clack, 2007). After an initial analysis of the quantitative data, qualitative data is collected and analyzed. In this research, surveys regarding LMS design decisions, and homework and grading policies were collected. Explanatory design research requires a lengthy amount of time to collect data because of the multiple phases of data collection and analysis. Creswell (2010) suggested that classrooms are perfect environments for explanatory design because they start with quantitative data collection, which is common in the classroom, and follow-up by in-depth qualitative data collection to further explain the existing quantitative results.

Descriptive research was used to identify the current patterns of LMS use in a secondary school. Educators were categorized into subgroups by grade level, content area, years of experience, perception of LMS, frequency of use, and course ability levels. These groups were formed naturally within the school, but qualitative data helps the researcher to explain why differences do or do not exist between groups (Creswell, 2010). To identify if significant differences exist in LMS use, correlational analyses were used to identify associations between educator subgroups. Specifically, Pearson's  $r$  correlational analyses were conducted to find the strength of the linear relationship between two variables (Salkind, 2014). For example, in this research, associations

between educator patterns of LMS use and courses' homework submission or mean homework scores were analyzed.

Three surveys were included in the data set. The Initial LMS Use Survey was distributed before week one of data collection and was analyzed using descriptive statistics on an ordinal Likert scale. The remaining two surveys used the follow-up explanations model (Creswell & Plano Clark, 2007), because the quantitative data collected during this study needed additional explanation due to differences between educator subgroups. The Quarter Two survey (week 12) and Quarter 3 survey (week 22) consisted of mostly open-ended questions which allowed educators to more clearly describe quantitative findings from earlier in the study. For this reason, each of the three surveys were given about ten weeks apart, allowing for quantitative analysis of results before survey distribution. The educator survey responses were used to develop a more rich understanding of the descriptive LMS data collected within the school. More detailed survey descriptions can be found in the instruments section.

## **Setting**

The current study took place in grades six through eight in a public school in Central Maryland with a population of 874 current students. The middle school has two full and three partial elementary feeder schools within the district. The middle and high school are located on the same campus in two different buildings with minimal facility sharing between programs. The elementary feeder schools do use the LMS, however primary grades one through five use the LMS only as a resource for communication with parents, such as registration and inclement weather alerts. Secondary application differs depending on grade level. Grades six through eight primarily use the LMS as a digital

classroom communication resource, but also for classroom activities, formal and informal grade notifications, specific classroom projects, school clubs and activities, homework notification, and classwork discussion opportunities. There is not one specific LMS policy within the district; usage requirements are left to the administrator to determine policy. In the current school, faculty of grades six through eight are required to use the schools LMS, but required use consists of bimonthly posting of course grades and suggested homework assignment postings.

The rationale for selecting this particular middle school was threefold. The current school was selected as the county pilot school for the “bring your own technology” program in the spring of 2015, and 88.6% of students brought a personal technological device to school from March through June of 2015. During the 2015-2016 school year, the BYOT policy was continued, and 92.4% of students brought personal technological devices to school each day. Student access to technology within the school provides greater opportunity to utilize the LMS. BYOT devices allow student to connect to the school based Wi-Fi for educational web-based activities, but does not provide them with county or school software available on school based desktops, laptops, or tablets. When students did not have personal technology to use in class, educators supplemented with classroom desktops or school tablets. Second, the socioeconomic status of the community determines that technology access within the home is high. School entrance surveys indicated that 96.1% of students have Internet access at home and computing devices are assumed of students enrolled in the school. In previous studies, educators have used the lack of technology as a reason to not utilize the tools provided to them (Ertmer et al. 2012); this is not the case in this school. For student that do not have internet access

available at home, classroom and media center desktops are available for student personal use during homeroom, lunch, or the school's 45 minute advisory period. Finally, the principal researchers is employed at the school where the study occurred. Selecting this school is partially a convenience sample, however being a member of this school's staff gave me access to a variety of LMS data.

### **Sample**

The current school has an enrollment of 874 students. Two hundred and eighty-two students are enrolled in grade six, 281 are enrolled in grade seven, and 311 are enrolled in grade eight. The campus employs a total of 68 faculty members as general educators, special educators, classroom support staff, and administrators. Ninety-one percent of the educators in this school hold an Advanced Professional Certificate.

The following student demographic data were collected: gender, age, race/ethnicity, and known learning disabilities. Student ethnicity for the middle school during the current study included 88.5% Caucasian students, 2% Asian students, 3% African America students, 2% Hispanic students, 2% mixed race students, and 3% are not listed by the Maryland State Department of Education. Sixteen percent of the students enrolled have Free and Reduced Meal plans, totaling 140 students. The school is made up of 51.2% boys and 48.8% girls. The school employs six special educators and seven support staff that service 76 IEP students. After comparisons of the three surrounding public middle schools using MDSE (Maryland State Department of Education), the population was found to be representative of both student demographics and teacher characteristics (MSDE, 2014). These regional similarities provide possibilities for generalizable findings in the immediately surrounding area.

The current school regularly scores among the highest middle schools in the district on federally required standardized testing. Of grade six students, 86.4% scored proficient or advanced in mathematics, and 94.3% scored proficient or advanced in reading. Of grade seven students, 94.1% scored proficient or advanced in mathematics, and greater than 95% scored proficient or advanced in reading. Of grade eight students, 79.7% scored proficient or advanced in mathematics, 90.5% scored proficient or advanced in reading, and 87.5% scored proficient or advanced in science. These are important statistics for this school because student class placement is based on their state mathematics scores. At this school, class ability level placement is connected with mathematics ability more than any other content area, which elevates the importance of the mathematics curriculum in the community.

**Educator participants.** Of the 68 faculty and para-educators at the current school, 35 of 36 general educators participated in the study. A purposeful sampling was taken of the total educator population in that the sample included 97.2% of the general educators in the core content area sources at this school. These content areas include: science, social studies, mathematics, language arts, and foreign language. Due to the small size of the sample, it was important to include all core content area educators within the current school, because they have specific LMS exposure and use that would address the research questions posed in the current study. The pilot study made it obvious that some educators did not meet the criteria for the research. Para-educators were excluded from the sample because they serve as an educator providing services to IEP students within a preexisting class and therefore do not conduct their own LMS classroom.

Table 2

*Participating Student and Educator Subgroup Demographics*

Subgroup	Demographics	n	%
Educator Experience	> 1 year	0	0
	1-2 years	2	5.7
	3-5 years	1	2.8
	6-10 years	5	14.3
	11-15 years	10	28.6
	16-20 years	8	22.9
	21-25 years	4	11.4
	26-30 years	4	11.4
	30 or more years	1	2.8
Educator Content	Mathematics	9	25.7
	Language Arts	9	25.7
	Science	8	22.8
	Social Studies	7	20.0
	Foreign Language	2	5.7
Educator Grade Level	6th grade	11	31.4
	7th grade	12	34.3
	8th grade	12	34.3
Total Educators (N = 35)			
Students Grade Level	6th grade	110	31.4
	7th grade	120	34.3
	8th grade	120	34.3
Students Ability Level	Below Average	80	22.8
	Average	80	22.8
	Above Average	80	22.8
	Advanced	70	20.0
	Heterogeneous	40	11.4
Student Content Area	Mathematics	90	25.7
	Language Arts	90	25.7
	Science	80	22.8
	Social Studies	70	20.0
	Foreign Language	20	5.7
Total Students (N = 350)			

Unified Arts (UA) and Physical Education (PE) educators were excluded from the sample because they did not instruct the same group of students for the 22-week data collection period. UA and PE courses are scheduled in trimesters instead of quarters. Students rotate in and out of their courses instead of keeping a steady schedule all throughout the year. All 35 core content educators from the school acted as participants in the study, with the exception of the principal researcher's LMS use data. This data would have been recorded under grade six, social studies, but was excluded from data collection. Educators included nine mathematics educators, nine language arts educators, eight science educators, seven social studies educators, and two foreign language educators. Data was collected from all 35 participants for each of the three research questions. Table 2 contains data for specific educator subgroups.

**Student participants.** Ten students were randomly sampled using purposeful sampling with maximum variation. Ten students from each educator's first period course were selected based on their student identification number. Due to the schedule at the current school, all 874 students in the school are registered in a first period core content course at the same time. By randomly selecting only ten students from each course, it was ensured that a variety of contents, grade levels, and ability levels were included in the student sample. Student identification numbers for each course were entered in sets into a number randomizer used for random sampling. Thirty-five sets of ten values were randomized. Every student in the school had an equal opportunity to be selected as a part of the sample. Class sizes range from 18-32, therefore, selecting ten students from each class ensured that at least 31.5% of each class was included in the sample. Selecting from only first period classes ensured that no student was overlooked, and no student was



included in the study more than once. A total sample of 350 students was included in the study in order to evaluate 40% of the school's total population. Table 2 contains data for specific student subgroups.

The participating students consisted of a range of five ability levels grouped in both homogenous and heterogeneous classes. The school places students into class groups according to the following guidelines. Students who tested below grade level in mathematics state testing and students with IEPs were grouped in the below average ability level. Students who tested on grade level in mathematics state testing were grouped in the average ability level. Students who tested slightly above grade level in mathematics state testing were grouped in the above average ability level. Students who tested one or more grade levels above their current grade level placement in mathematics state testing were grouped in the advanced ability level. In grade eight there are four heterogeneously grouped courses, all four were included in this study. Including student participants from each educational ability groups provided a representative sample of the school population. The study included participants proportional to the ratio of ability level students as are in the school population.

Student and educator school attendance within the face-to-face classroom is important in determining the association between LMS use and student learning outcomes. Irregular school attendance leads to inconsistent analysis because it does not allow for regular data collection (Liu & Cavanaugh, 2011a). The Maryland state standard for satisfactory attendance is 94% or more school days attended. The current school has maintained over 95% attendance since 1993 (MSDE, 2014). Less than five percent of the students at the current school have been absent for twenty or more days in a given school

year. Any student or educator participant absent for five or more days in one quarter was excluded from the quarterly analysis data. Three students were excluded due to these criteria. At that point another student was randomly sampled from the remaining students within that same class. Students transferring from other schools or classes not active throughout an entire quarter were also eliminated from participation. This data was extracted and analyzed by the principal investigator and then stored using pseudonyms and identification numbers to protect the identity of educators and students respectively.

### **Data Collection Procedures**

The current study extracted data from a LMS used in grades six through eight in an environment where preexisting use had already been established. The research did not introduce any new technology use to educators or students; rather, the study observed and described current use within the school. Data was collected weekly for 22 consecutive weeks. Between Friday and Saturday evenings, the principal investigator visited online classrooms designed by each of the 35 participating educators. During these visits data was recorded within an excel spreadsheet identifying the number of updates made to the LMS classroom during that week. Updates were recorded for general information, specific information, and content information. Descriptions of information collected for each category is listed in the Types of Posts – Operational Definitions for Data Collected for Research Question One. For 22 weeks, grade updates were used to identify course homework submission rates and mean homework scores for the 350 student participants. Grade data was examined at the end of each quarter when educators posted final grades. The principal investigator visited each of the 35 online classrooms to record the grades

that were posted for student participants in first period courses for all 35 participating educators.

### **Instrumentation**

The study included four data collection tools. The first instrument was the Educator LMS Use Spreadsheet, an observation spreadsheet used by the principal investigator to tally educator LMS use. The second, third, and fourth instruments were surveys disseminated at the beginning, middle, and end of the data collection period. The Initial LMS Use Survey was adapted from a previous study and analyzed quantitatively. The Individualized Quarter Two LMS Use Survey and Individualized Quarter Three LMS Use Survey were developed by the principal investigator and used to collect anecdotal information throughout the data collection period. These data tools are described in more detail below.

**Educator LMS use spreadsheet.** The educator LMS usage data was collected to address Research Question One that asked about patterns of LMS use within educator subgroups at a local middle school. This instrument was used by the principal investigator and was not seen by any of the participants in the study. The data was collected once weekly by tallying educator LMS use on a 14-column spreadsheet (see Appendix D). The first six columns of the spreadsheet contained educator information including, name, pseudonym, content area, grade level, class period, and ability level. The remaining eight columns were categorized by the type of LMS posts including; web links, class information, calendar, grade update, study information, assignments, attachments, assessments, and discussion boards. A pilot study was conducted during Quarter One within the same school. After the pilot data collection, appropriate changes

were made to the Educator LMS Use Spreadsheet. One column was eliminated due to non-use, and two columns, class information and calendar, were split to provide a more detailed data collection. Each data collection week contained the five school days and two weekend days prior to the data collection. The post was also categorized in the column corresponding with the type of post that was made by the educator. To ensure inter-rater reliability, four evaluators independently sorted 4 weeks of pilot study posts into the spreadsheet categories listed above. There was at least 90% agreement on the sorting of LMS posts.

**Initial LMS use survey.** The Initial LMS Use Survey (see Appendix A) was distributed electronically at the beginning of the 22-week study. The information collected from the survey included educator demographics (age, experience, content area), perception of purpose and benefits of LMS use, classroom homework procedures, current uses of LMS, and perceptions of LMS success in the classroom for educational purposes. The survey consisted of 28 items adapted from Harrington, Gordon, and Schibik's (2004) research on content management systems. The first six items on the Initial LMS Use Survey asked educators about their demographics and teaching experiences. The demographics section consisted of one open-ended question and five multiple-choice questions. Survey items seven through ten asked educators about their perceived use of the LMS. The perceived use section consisted of two yes or no questions, one multiple-choice question, and one Likert scale question. Survey items 11 through 28 asked educators about their perception of LMS impacts on the school. This section consisted of 13 Likert scale questions, four multiple-choice questions, and one open-ended question. Some of the multiple choice questions asked educators to select one

response, while others asked educators to select all that apply. The survey was distributed to the participating educators through their school-based e-mail. This school requires daily e-mail use, which ensured that they would receive and complete the survey. Weekly reminders were sent about survey completion. It took three weeks to receive all of the surveys.

**Initial LMS use survey validity.** The Initial LMS Use Survey was modeled after a survey designed and field-tested by Harrington (et al., 2004), the authors of, *Course Management System Use and Implications for Practice: A National Survey of Department Chairpersons*. The survey items were used to record information regarding the perceptions and patterns of use of educators within a LMS. Harrington (et al., 2004) did not provide detail on the process by which the survey was field-tested, therefore, the derived version of the Initial LMS Use Survey was further field tested by six secondary educators in two different Maryland school districts as well as six graduate students in the Instructional Technology field. The field testers were asked to complete the online survey in the same way the participants would. Each of the field testers either had been or was currently a classroom educator, each with differing levels of experience with LMS. Each tester reported back on readability, ease of understanding, and importance of the survey items. Two survey items were removed due to lack of connection to the research topic. The field testers reported a struggle with two specific items, because they were asking multiple questions in one survey item. These items were originally written by Harrington (et al., 2004) and were split into two questions each in order to cover more specific LMS information in regards to a secondary school. For example, survey item 17 asked about educator time spent planning and survey item 18 asked about educator time spent in

parent communication (see Appendix A). On the original survey these were one item, but during field testing the experts felt that these questions were asking two different things, so they were split into two separate items.

**Individual quarter two and quarter three LMS use surveys.** The Individualized Quarter Two (see Appendix B) and Quarter Three LMS Use Surveys (see Appendix C) were distributed at weeks 12 and 22, respectively. These follow-up surveys allowed educators to review their personal LMS data, and comment anecdotally on their LMS use patterns. The Individualized Quarter Two LMS Use Surveys consisted of two graphs and eight open-ended survey items. The two graphs included an individual educator's LMS use graph for Quarter Two and a total population educator LMS use graph for Quarter Two. The eight survey items asked educators to justify their individual use by explaining their instructional choices. This survey provided an opportunity for educators to contribute detailed information regarding their personal patterns of LMS use. Educator answers on these surveys helped clarify classroom activities supporting the LMS and to describe peaks and troughs in usage patterns. These surveys were distributed in a paper-based format. This format was selected because each educator received different graphics based on their individual usage where they were able to annotate the graphs. The data from this survey was used to interpret the quantitative data collected during digital observations. A deductive approach was used to analyze the open-ended survey questions. Using the three research questions as categories, survey answers were grouped if they were addressing the same general topic, such as content area or grade level. Similarities and differences were then identified within each category to look for

trends that represent the LMS use of individuals or shared-attitudes about LMS use within the school.

The Individualized Quarter Three LMS Use Survey consisted of 16 items. This survey was disseminated on week 22, when data collection was complete. Of the items on the survey 13 were multiple choice questions and three were open-ended questions. The survey items asked educators to further explain their patterns of assigning, posting, and grading homework. Educator comments on these surveys helped to clarify homework submission rates and mean homework scores within patterns of course LMS use. This survey was disseminated via the school-wide email at the end of data collection. Annotation was not necessary on this survey, because no individualized graphs were included. Educators were again given weekly reminders to complete the survey.

The Individualized Quarter Two LMS Use Survey and Individualized Quarter Three LMS Use Survey were both field tested by the same experts who field tested the Initial LMS Use survey, including six secondary educators in two different Maryland school districts as well as six graduate students in the field of Instructional Technology. The field testers were asked to complete both surveys in the same way the participants would. Each of the field testers either had been or was currently a classroom educator, each with differing levels of experience with LMS. Each tester reported back on the quality of the instructions, wording, detail, question relevance, length, and convenience. The Quarter Two Survey originally included graphs that displayed educator types of posts but these were removed to ensure that it was collecting relevant data. The Quarter Three Survey items were rearranged to an order that would make the survey flow more understandable and convenient for the participants

## **Data Collection**

Participating educators began the 2015-2016 school year as planned. No significant adjustments were made to educator LMS training, nor were adjustments made to students use policies related to the LMS. The first three days of school in August 2015 were professional development days. During a faculty meeting on Friday, August 28, 2015, the entire school faculty, including the 35 participating educators, were informed about the research. They were also provided with a cover letter describing the purpose of the study (see Appendix E) and informed consent (see Appendix F). The educators were given an option to sign and return the forms to the school's office within one week of dissemination. While the principle investigator was employed at the school, the LMS from that sixth grade social studies class were not recorded.

In September 2015, once the school year had begun, student participants were selected. Student identification numbers were extracted from copies of digital schedules in the school's office. One class at a time 18-32 student identification numbers were entered into a random number generator. Ten participants were selected from each first period course. A cover letter and informed parental consent form was disseminated Wednesday, October 7, 2015. The random number generator process was repeated for any courses where parental content was not received for one or more students. By October 28, 2015, there were a total of 350 completed consent forms: 10 per participating educator.

The pilot study data collection began in September of 2015 and was completed by the end of Quarter One in early November. On November 2, 2015, Quarter Two began, marking the beginning of the LMS classroom observation and data collection. The weekly



data collection window went from Friday evening at seven o'clock through Saturday evening at seven o'clock. Each data collection observed an entire week of educator use. For example, the first data collection took place on Friday, November 8, 2015 at seven o'clock. During this collection any educator post between Friday, October 30, 2015 at 7:01 PM and Friday, November 8, 2015 at seven o'clock was tallied on the data collection spreadsheet. Weekly data was extracted to avoid the loss of raw data. Some educators have different organizational strategies for their LMS. Many reorganize their LMS each unit, monthly, or quarterly by deleting files that are no longer in use. Collecting data weekly ensured that no posts would be overlooked as it became an achieved file.

On Monday, November 2, 2015 the Initial LMS Use Survey was disseminated via the school-based email system. Reminders (see Appendix G) were sent to the participants who had not completed the survey via email on Monday, November 9<sup>th</sup>, 16<sup>th</sup>, and 23<sup>rd</sup>. By Monday, November 30, 2016, 100% of the participants' surveys were completed which eliminated the need for further reminder emails.

Quarter Two ended on Friday, January 20, 2016. On this Friday the normal LMS classroom observations were conducted, however in addition the grade books of participating educators were exported to spreadsheets for data storage. Each educator spreadsheet contained ten students labeled with their identification numbers. Educators' digital grade books displayed homework submission and scores which were compiled and saved for later analysis.

Between Monday, January 23, 2016 and Friday, January 27<sup>th</sup>, Quarter One LMS classroom observations were analyzed to find patterns and compare subgroups. During this week educator usage graphs were added to the Individualized Quarter Two LMS Use

Survey to prepare them for dissemination. The paper based survey along with a cover letter explaining the follow-up survey was distributed to educator mailboxes on Monday, January 30, 2016. Educators were asked to provide anecdotal comments regarding the peaks and troughs in LMS use throughout Quarter Two. Educators were reminded weekly via email, to return the survey to the office. By Monday, February 27, 2016, 100% of the participants' surveys were completed which eliminated the need for further reminder emails.

Between Monday, January 23, 2016 and Friday, April 7, 2016 Quarter Three weekly data was again gathered and sorted according to the same guidelines from Quarter Two. On Friday, April 7, 2016 educators posted their final Quarter Three grades. Educator grade books were again exported into spreadsheets, and the same 350 students scores were analyzed for homework submission and mean homework scores.

On Monday, April 10, 2016 the Individualized Quarter Three LMS Use Survey was disseminated to the educators. The survey was distributed via the school-based email along with a message explaining the final follow-up survey. Educators provided additional information that explained personal patterns of homework assigning, grading, and posting. Educators were reminded weekly via email, to return the survey to the office. By Monday, May 1, 2016, 30 out of 35 (85.7%) of the participant surveys were completed.

From Monday, May 1, 2016 through Friday, June 16, 2016 data sets were analyzed to allow for description of the data sets and comparisons between them. These data sets included 1) Initial LMS Use Survey, 2) Quarter Two classroom observation spreadsheet, 3) Individualized Quarter Two LMS Use Survey, 4) Quarter Two Educator

grade posts, 5) Quarter Three classroom observation spreadsheet, 6) Individualized Quarter Three LMS Use Survey, and 7) Quarter Three educator grade posts.

**Data to address research questions.** Research Question One addressed the largely unknown patterns of LMS use for secondary education. Research Questions Two and Three address the association of educator LMS use with course homework submission rates and mean homework scores. Question Two examined associations between educator LMS use and course homework submission rates. Research Question Three examined the association between educator LMS use and mean course homework scores.

The first data set collected was individualized educator LMS usage patterns. A pattern of use identifies when (the time period) educators are posting to the LMS and what (the types of material) they are posting. The second data set collected was educator perceptions of LMS use. The Initial LMS Use Survey (see Appendix A) was administered to identify personal demographics of educators, how often they believe they are using the LMS, and how they perceive the usefulness of the LMS in their teaching. Two follow-up surveys, the Individualized Quarter Two Usage Survey (see Appendix B) and the Individualized Quarter Three Usage Survey (see Appendix C), were administered to collect anecdotal educator descriptions of their own and the school's LMS use. The third data set collected included mean values from educators' digital course grade books. Course homework submission rate and mean homework scores for ten randomly selected students were analyzed. Ten students from each of the 35 content area courses comprise at least 31.5% of the students in each course. Every student in the school is enrolled in a

content area course for first period, therefore 350 students is a random sample of 40% of the school's total population of 874.

**Types of posts – operational definitions.** Educators had the opportunity to post a variety of materials to their LMS. For the purposes of identification throughout the study, educator posting categories were established, based on types of postings identified in previous literature (Liu & Cavanaugh, 2011a; Papadakis et al., 2012). The first category of posts was general information, which included information presented to students and parents. This included news, web links, and calendar items. These posts allowed the students enrolled in the class to view course information. General information may require educator action, but requires no return action from the student. The student may read and record the information, but they are not required to submit anything to the educator. It is one-way communication from educators to students (Papadakis et al., 2012). There are three types of general information posts: web links, class information, and calendar items. First, web links included items posted to the LMS that navigate to an outside source. Second, class information included information in class posted to the LMS. This included copies of notes, work sheets, and outlines. Class information also included reminders such as, “bring glue sticks tomorrow” or “bring a bagged lunch to the field trip.” Third, calendar items included any information that has been posted to the classes' calendar. These posts tell students when an assignment was given, how long they have to work on it, and when it is due.

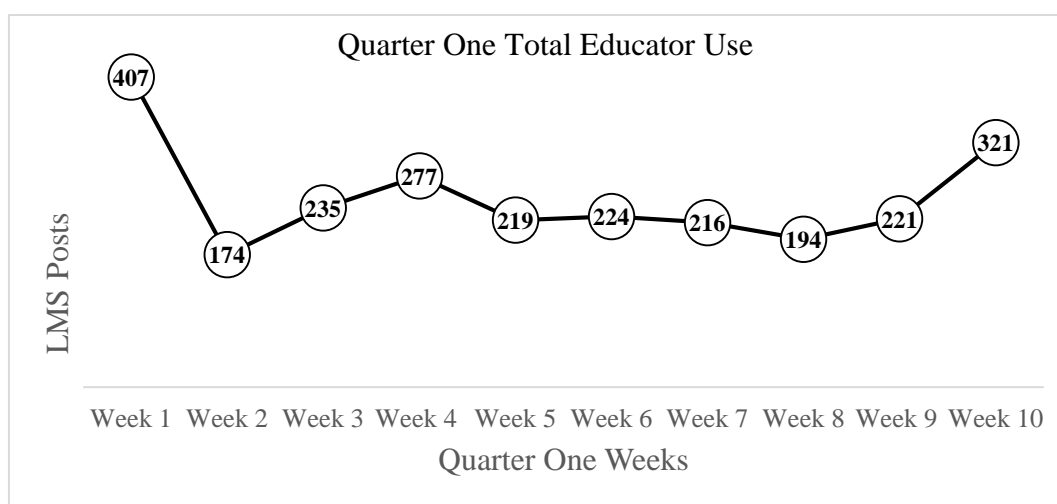
The second category of posts included Specific Information. This is information that is individualized for each student, such as grade updates and study information. These posts allowed those enrolled in the class to view the information and may have

required action on the part of the student, such as the completion and submission of a missing assignment. Specific information gave students a purpose for action. For example, a student could see a missing assignment on their grade post and be able to make up the work. There are two types of specific information posts. First, grade updates were posts that included specific scoring information for each student within the course. The posts provided the score a student has in that course, as well as scores for each individual assignment submitted. Second, study information included specific details that explained both when an assessment was scheduled and what should be studied in order to be successful on the assessment.

The final category of posts included Class Content such as: assignments, attachments, assessments, and discussion boards. These posts required action on the part of the student to complete a task. Class content posts required students to submit a product to the educator in either electronic or paper form. These posts can be interactive and require student electronic communication. There are four types of class content posts. First, assignments included specific homework information that needed to be accounted for by students in the course, for example, “read pages 34-46”, “complete numbers 1-10”, or “finish the geology worksheet”. Second, attachments included any document that was uploaded to the LMS to assist students in their class needs. This may be a printable homework handout, a PowerPoint with class notes, or a pdf of a textbook page. Third, assessments include any testing, formative or summative, that was administered on or through the LMS. Finally, discussion boards included any post where the entire class was asked to use the LMS to discuss content peer to peer.

**Types of educator use - operational descriptions.** Weekly data was collected in the general information, specific information, and course content categories to develop an understanding of educator use within the current secondary school. This data was used to sort educators into subgroups based on their frequency of use.

Based on data from a ten-week pilot study, educators with a usage score of three or fewer posts per week accrued less than one post per school day and were grouped as Low Users. Educators with a use score of four through ten posts per week accrued about one post per school day and were classified as Moderate Users. Educators who posted eleven times or more were grouped as High Users. These groups were established during the ten-week pilot study by collecting the frequency of educator posts and splitting the educators into groups by thirds, to help identify patterns of use within the school. This created two groups of twelve and one group of eleven. The goal of these groups was to observe users who post less than half of the days during a five-day school week, users who post daily during a five-day school week, and users who post multiple times a day during a five-day school week.



*Figure 1. Quarter one total educator use.*

## **Data Analysis**

**Frequency of Use Analysis.** Descriptive statistics were calculated to determine patterns of use for many educator subgroups. Educator means and standard deviations were calculated based on the data extracted from the LMS. Calculations were done directly in the excel spreadsheet used for data collection. Group totals, means, and standard deviations were calculated within Excel. Analyzing both total and mean educator LMS posts helped to identify patterns of LMS use during a given time period. For example, Figure 3.1 shows the total weekly educator LMS use during the Quarter One pilot study.

**Associations between data subgroups.** Educator LMS use was compared across grade level, time period, content area, type of post, years of experience, course ability level, homework submission, and homework scores. Educator data were further analyzed by exploring the association between patterns of educator use and course homework scores, as well as between patterns of educator use and homework submission rates. Homework submissions were recorded by viewing educator's final grade updates. Three hundred and fifty student mean homework updates were tracked for two quarters.

Homework submission data were analyzed based on the total number of homework assignments graded in each educator's grade book, as well as the total number of assignments submitted for that course. For example, if an educator graded 11 assignments during a quarter, then 110 assignment submissions are possible (11 assignments for each of the 10 students randomly selected from that course). Each assignment turned in increased the educator's submission rate. Therefore, if 90

homework assignments out of the 110 possible homework assignments were turned in, the course would have a submission rate of 81%.

Mean homework score data was analyzed when participating educators' posted the scores to digital grade books. Within each course, the mean homework scores were calculated for the 10 participating students. The mean homework calculation included student scores on each of the homework assignments that were graded by the educator. Homework assignments that were not submitted by students were weighted into the assignment grade as a 0%. The pilot study showed that 95% of students submitted 20% or more of their homework. This study planned to exclude data of student outliers who have completed five percent or less of the assigned homework required for the course, however this was not observed during the data collection.

Of the data sets collected for the three Research Questions, associations between data included 1) educator perception and frequency of use, 2) educator perception and course homework submission, 3) educator perception and mean homework scores, 4) frequency of use and homework submission, 5) frequency of use and mean homework scores, and 6) homework submission and mean homework scores. Pearson's  $r$  was computed using Excel.

**Survey analysis.** Surveys were collected three separate times throughout the study. Through the Initial LMS Use Survey, each answer was assigned a corresponding value to allow for statistical interpretation. Each answer option that implied a positive response or an increase in the quality of teaching and learning was assigned a high number, while each answer option that implied a decrease in the quality of teaching and learning was assigned a low number. There responses were assigned numbers 1 – 4, 1 –



5, or 1 – 7, respectively. The higher the number, the more positive view the educator had of the LMS. A composite score was calculated by summing individual items. The lowest possible score for the Initial LMS Use Survey was 24, which would occur if an educator answered each item with the most negative possible response. The highest possible score for the Initial LMS Use Survey was 140, and would occur if an educator answered each item with the most positive possible response. Similar ordinal analysis and descriptive statistics were conducted on the original survey that served as a basis for the surveys in this study (Harrington et al., 2004).

### **Summary**

The purpose of the current study was to explore the authentic patterns of LMS use within a secondary school. Data was collected over a 22-week period to describe educator LMS use in a secondary school and the possible association it may have on course homework submission and scores. Associations were investigated through an analysis of educator LMS posts, educator surveys, course homework submission, and mean course homework scores. These investigations were used to help determine what patterns of LMS use are associated with course homework submission and scores.

## **CHAPTER 4**

### **RESULTS**

#### **Introduction**

This chapter provides analysis of the data related to this study's three research questions and a discussion of the results. The results include descriptive data from educator surveys, observations of LMS use, records of course learning outcomes, and associations between data sets. The first data set is the Initial LMS Use Survey, which asked questions about educator demographics, perceived LMS use, and perceived LMS usefulness. The second data set is the observations of online educator LMS use. The third data set is records of course homework submission and mean homework scores.

#### **Research Question One - Description of LMS Use**

The charts and graphs within this section display data that was collected to answer the three research questions described in Chapter 3.

- 1) What are educator patterns of Learning Management System use in grades 6-8?
  - a. In which weeks did the Learning Management System accrue the most access?
  - b. What are most used aspects of Learning Management System by educators?
  - c. Which content areas and grade levels use the Learning Management System and to what extent?
  - d. Are years of experience teaching associated with the frequency of LMS utilization?

- e. Are educator perceptions of LMS usefulness associated with the frequency of utilization?

### **Educator Reported Posting Patterns**

The Initial LMS Use Survey provided an answer to the first research question by asking educators to report how they perceive their LMS use within the middle school.

When educators were asked if they used the school-based LMS, 91% (n = 32) responded yes, while 9% (n = 3) responded no. Throughout Chapter 4, there is an analysis of posts for all 35 participating educators. So although three educators claimed that they do not use the school-based LMS, they are at least meeting the posting requirements set by administration, as described in Chapter 3. One participant is lost in later analysis because there was no homework assigned within that course. Therefore, no homework submission or score data could be analyzed.

**Highest educator reported posting patterns.** Participants were asked how frequently they use different LMS elements in their teaching. Educators were given 11 LMS posting actions and seven Likert-type response options ranging from 5-7 days per week through never (see Table 3). The four highest categories of reported use were: posting homework, project reminders, assessment reminders, and posting attachments. In these categories, more than 50% of educators reported that they use the elements at least once per week.

The highest use educators reported was use of the LMS to post homework as communication to parents and students. On the Initial LMS Use Survey, educator responses regarding the frequency of homework posting included 5-7 days a week 45.4%

(n = 15), 2-4 days per week 24.2% (n = 8), 1 day per week 15.1% (n = 5), or 2-3 times per month or fewer 15.2% (n = 5).

The second highest LMS use educators reported was to post reminders for long-term projects. The frequency of this type of post was more differentiated than homework posting. Educator responses were 5-7 days per week 25% (n = 8), 2-4 days per week 12.5% (n = 4), 1 day per week 18.7% (n = 6), 2-3 times per month 18.7% (n = 6), about once per month 15.6% (n = 5), or rarely and never 9.3% (n = 3). The percentage of responses, as seen above, for posting homework as communication and long-term project reminders show that about 50% of educators within this sample believe they post to the LMS somewhere between 2 and 7 days per week.

The third highest use educators reported was how often educators post student grades to the LMS. Educator responses were 5-7 days per week 6.0% (n = 2), 2-4 days per week 6.0% (n = 2), 1 day per week 56.5% (n = 18), or 2-3 times per month 33.3% (n = 11). No educators responded about once a month, rarely, or never. This is noteworthy because the school calendar only requires two grade posts a month on days designated by the administration. If you combine all the educators who reported they are posting 1 day per week, 2-4 days per week, or 5-7 days per week it includes 68.5% of educators. In terms of posting grades to the LMS a majority of educators say they are posting at least once per week, which goes beyond the administrations expectation for twice a month grade posting.

**Lowest educator reported posting patterns.** Educators also identified the aspects of the LMS they do not use as frequently. There were four aspects of the LMS that a large group of educators say they never use. They were assessment administration,

digital homework submissions, interactive student-teacher discussions, and links for BYOT activities. In the literature, these four uses for LMS are listed as benefits of LMS use in 21<sup>st</sup> century classrooms (Papadakis et al., 2012; Liu & Cavanaugh, 2011a). However, large groups of participants in this study report that they do not use the LMS for its interactive tools.

Educators reported the least frequency of use to administer assessments on the LMS. Educator responses were never 66.7% (n = 22), rarely 12.1% (n = 4), about once per month 9.0% (n = 3), and 2-3 times per month 3.0% (n = 1), 1 day per week 6.0% (n = 2), or 5-7 days per week 3.0% (n = 1). No educators responded that they administered assessments 2-4 days per week.

The second lowest LMS use educators reported was digital homework submission. Educator responses were never 66.7% (n = 22), rarely 9.0% (n = 3), about once per month 3.0% (n = 1), 2-3 times per month 6.0% (n = 2), 1 day per month 3.0% (n = 1), 2-4 days per week 12.1% (n = 4), and there were no responses for 5-7 days per week.

The third lowest LMS use educators reported was student-teacher discussions. Educator responses were never 45.4% (n = 15), rarely 24.2% (n = 8), about once a month 12.1% (n = 4), and 2-3 times a month 6.0% (n = 2), 2-4 days per week 6.0% (n = 2), or 5-7 days per week 6.0% (n = 2). No educators responded that they facilitate student-teacher discussions 1 day per week.

The fourth lowest LMS use educators replied were links posted for BYOT activities. Educators reported that they post links for BYOT activities never 36.3% (n = 12), rarely 21.2% (n = 7), about once a month 6.0% (n = 2), 2-3 times per month 9.0% (n = 3), and 4-5 times per month 3.0% (n = 1). No educators responded that they post links for BYOT activities 6-7 times per month or 1 day per week.

= 3), 1 day per week 12.1% (n = 4), 2-4 days per week 6.0% (n = 2), or 5-7 days per week 9.0% (n = 3).

The above Initial LMS Use Survey data displayed patterns of LMS use. About half of the participants post homework as communication to parents and students every day. This posting shows LMS use as a digital calendar or planner for the students. Also, more than half of the participants reported that they rarely or never use the LMS as an interactive tool for discussion, homework assignment submission, assessment, or BYOT. These findings reinforce previous studies, which describe LMS as a tool with a variety of functions which are often underutilized (Psycharis et al., 2013).

Table 3

*Self-Reported Frequency of LMS Use by Educator*

Educator Posts	Mean (SD)	5-7 days / week	2-4 days / week	1 day / week	2-3 times / month	once / month	Rarely	Never
Homework communication	5.6 (1.7)	45.4	24.2	15.1	0.0	3.0	9.0	3.0
Project reminders	4.8 (1.7)	25.0	25.0	18.8	18.8	15.6	6.2	3.0
Posting grades	4.8 (0.7)	6.0	6.0	54.5	33.3	0.0	0.0	0.0
BYOT activities	2.9 (2.0)	9.0	6.0	12.1	9.0	6.0	21.2	36.3
Discussion interaction	2.3 (1.8)	6.0	6.0	0.0	6.0	12.1	24.2	45.4
Homework submission	2.0 (1.8)	0.0	12.1	3.0	6.0	3.0	9.0	66.6
Assessment	1.8 (1.4)	3.0	0.0	6.0	3.0	9.0	12.1	66.6

## Observed Educator Posting Patterns

Question One-A asked in which weeks the LMS accrued the most access.

Educator posting patterns were tracked through 22 weeks (see Figure 2). As described in Chapter 3, educators were divided into groups of high, moderate, and low users based on their mean weekly posts. Figure 2 displays the total posts from all 35 participants from November 2, 2015 through April 7, 2016. This school's pattern of LMS use shows peaks and troughs throughout Quarters Two and Three. Week 4, week 8, and week 9 had multiple scheduled days off school due to holidays.

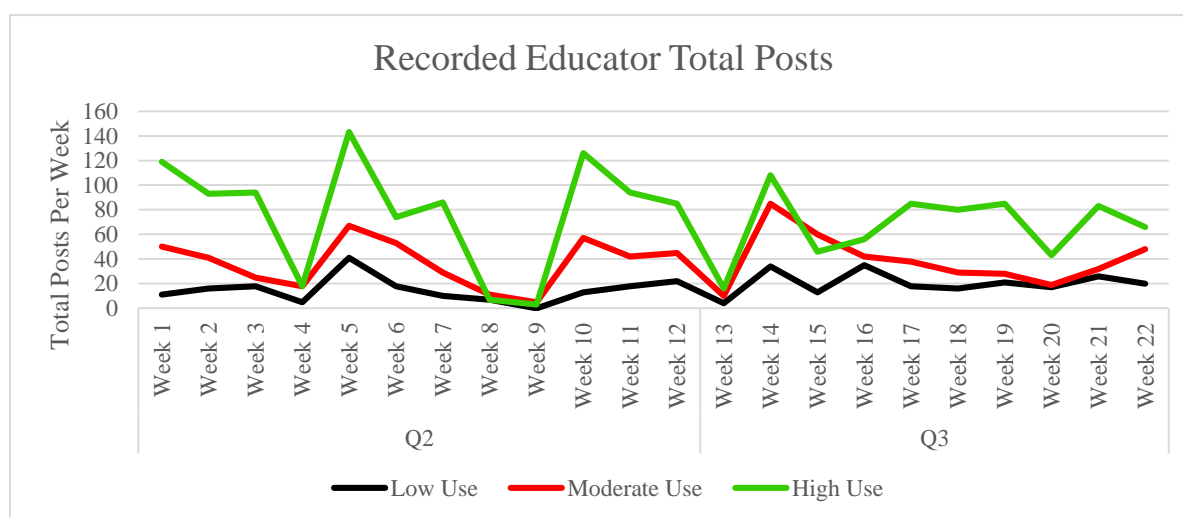


Figure 2. Total recorded posting patterns per week.

Educators in this school are restricted from assigning homework over holiday breaks. This leads to notable observable decreases in LMS use during weeks that contain holidays and observable increases during weeks after holidays. Limited use is still recorded during holiday breaks because, despite the administrative restrictions to assigning homework over holidays, educators are able to post grades or future homework assignments during these weeks. For all participants, the mean total of all LMS posts for 22 weeks was 42.5 posts per educator, with a standard deviation of 35.1. Across 22 weeks of data collection, high users were recorded to have a total mean of 73.1 posts per

high user with a standard deviation of 40.0. Moderate users were recorded to have a total mean of 37.7 posts per moderate user with a standard deviation of 16.9. Low users were reported to have a total mean of 17.4 posts per low user with a standard deviation of 38.1.

**Highest educator observed posting patterns.** High, moderate, and low users all display a peak in use directly after a holiday break (weeks 5 and 10), however high users displayed a large peak in use during weeks prior to a holiday break (weeks 3 and 7). Week 5 displayed a post-holiday peak of 251 posts; high users made 143 of these total posts. Week 10 also displayed a post-holiday peak with 196 total posts across all three groups. Of these posts, 126 of them were made by high users. During week 3, before the Thanksgiving Holiday, the high users made 94 posts. During week 7, before winter break, high users made 86 posts. The pattern of LMS use within this school follows the school's calendar for holiday breaks, high users have an enhance pattern surrounding these same breaks.

The highest use in Quarter Three occurred during week 14. The total number of posts for high, moderate, and low was 227. High users posted 108 total posts, moderate users posted 58 total posts, and low users posted 34 total posts. Week 14 occurred directly after the school had five days off for inclement weather. Much like having days off for holidays, educator posts peaked after days off of school. The longest continuous time period with steady posting occurred during week 17 through week 19. High user posts for weeks 17, 18, and 19 fluctuated between a total of 80 to 85 LMS posts. Moderate user posts decreased from a total of 38 posts during week 17 to a total of 29 posts during week 18 and finally a total of 28 posts during week 19. Low user posts for weeks 17, 18, and 19 fluctuated between a total of 16 to 21 LMS posts.



**Lowest educator observed posting patterns.** In Quarter Two, the three lowest points of use occurred during weeks 4, 8, and 9. Total educator posts were week 4 with 41 posts, week 8 with 25 posts, and week 9 with 8 posts. Due to Thanksgiving and Winter Breaks, weeks 4 and 8 were partial weeks of school. Week 9, when students and educators did not attend school at all is the week that the least amount of LMS use was recorded. This pattern of low-use held for high, moderate, and low users. These findings suggest that specific patterns of use within the school are associated with holidays or time spent away from the physical school building.

In Quarter Three similar posting patterns were made based on physical distance from the school building. There was a period of use during week 13 with 30 total posts. During week 13, high users had a total of 16 posts, moderate users had a total of 10 posts, and low users had total of 4 posts. During this week, the school district declared five inclement weather days due to record snowfall in the region. This is noteworthy because, although educators are restricted from assigning homework during holiday breaks, inclement weather homework assignments are permitted.

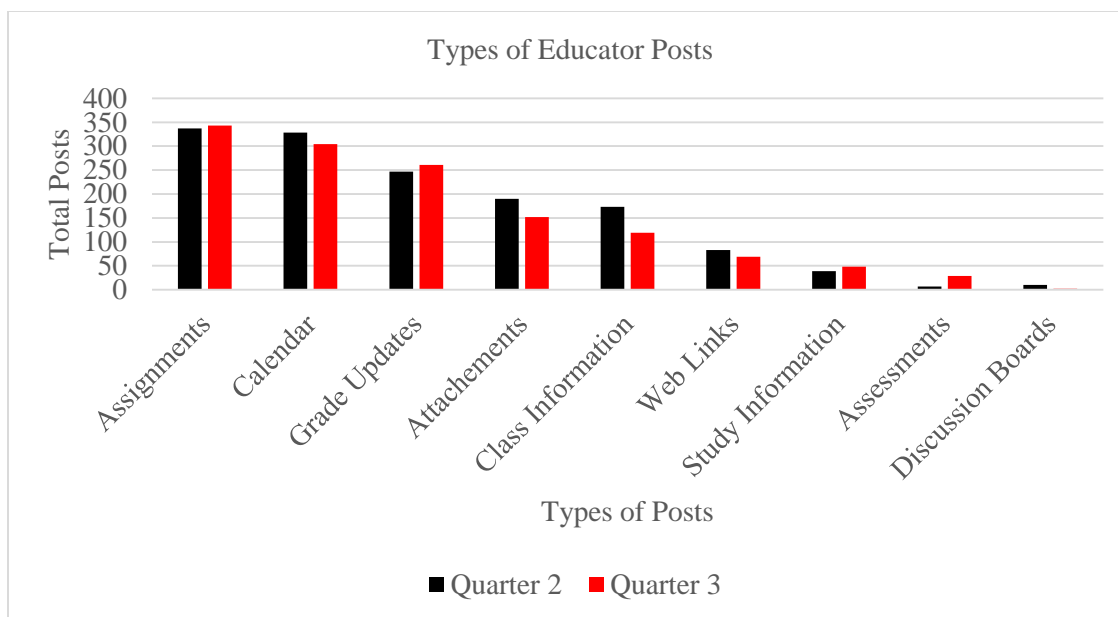
Weeks 15 and 16 were also impacted by inclement weather. The school was closed two days during week 15 and one day during week 16. During week 15, high and low users displayed a steep decline in LMS posts. High user posts decreased from 108 total posts in week 14 to 46 total posts in week 15. Low user posts decreased from 34 total posts in week 14 to 13 total posts in week 15. Moderate users displayed a more gradual decline in use, decreasing from 85 total posts in week 14 to 60 total posts in week 15. During week 16, high and low users produced an increase in posting. High users increased from 46 total posts in to 56 total posts in week 16. Low users increased from 13

total posts in week 15 to 35 total posts in week 16. Moderate users continued their decline from 60 total posts in week 15 to 42 total posts in week 16. High and low users have different patterns of total posts, but generally follow the same pattern peaks and troughs in LMS use, while moderate users post on a different trajectory.

**Educator survey data.** A common pattern between both quarters is the fluctuation that occurred at the beginning, middle, and end of each. Anecdotal information was collected in two informal follow-up surveys in order to better describe educator patterns of use. The Individualized Quarter Two LMS Use Survey was administered at week 12 and the Individualized Quarter Three LMS Use Survey was administered at week 22. On these surveys 60% ( $n = 21$ ) of participating educators commented that posting at the beginning of the quarter represented educators presenting a new topic or unit, posting in the middle of the quarter represented a progress report, and posting at the end of the quarter represented final course scores. Compared to Quarter Two, Quarter Three displayed a more prolonged pattern of steady use during weeks 17, 18, and 19. Anecdotally, 48.5% ( $n = 17$ ) of educators reported that this was because the third quarter traditionally contains the hardest content, and it requires more guiding for mastery. More consistent educator LMS use in Quarter Three, than in Quarter Two could be due to steady schooling on back-to-back weeks with no days off.

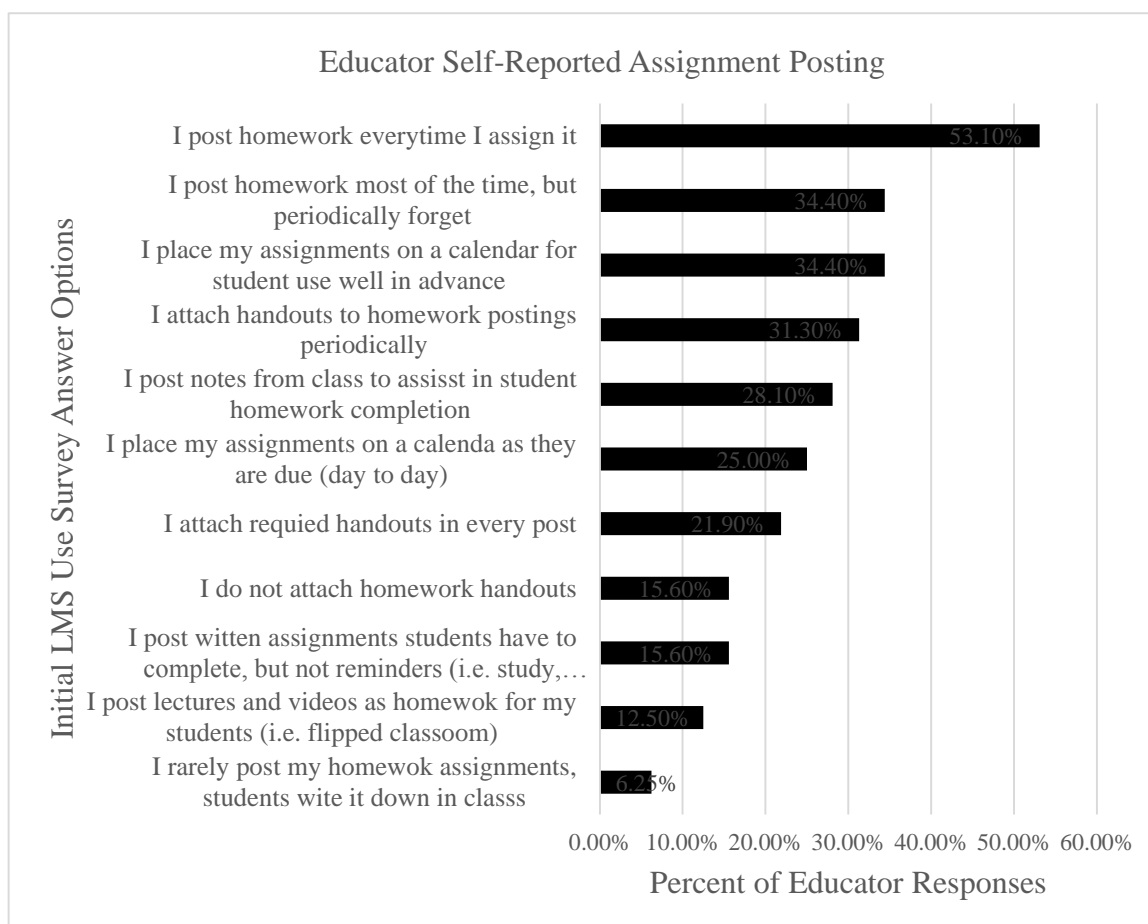
### **Types of Posts**

Question One – B asked about the most used aspects of the LMS by educators. This data was helpful in showing the extent of interaction this LMS supports at the current school.



*Figure 3. Recorded posting patterns categorized by type.*

**Highest educator reported types of posts.** The four most common uses for the LMS, where at least 50% of educators post weekly were homework assignments, calendar updates, grade updates, and attached documents. Quarter Two contained higher posting than Quarter Three in six categories. Throughout Quarter Two, there were 54 more class information posts, 38 more total attachments, 34 more total homework assignments, 24 more total calendar posts, 14 more total web link posts, and 8 more total discussion board posts. During Quarter Two the types of posts show the pattern that educators most frequently posted assignments. The only types of posts where Quarter Three had higher use than Quarter Two were grade updates, study information, and assessments. The highest recorded types of posts during Quarter Two and Quarter Three were homework assignments with 720 total posts, calendar updates with 632 total posts, grade updates with 508 total posts, and attached documents with 342 total posts.



*Figure 4. Self-reported homework assignment posting.*

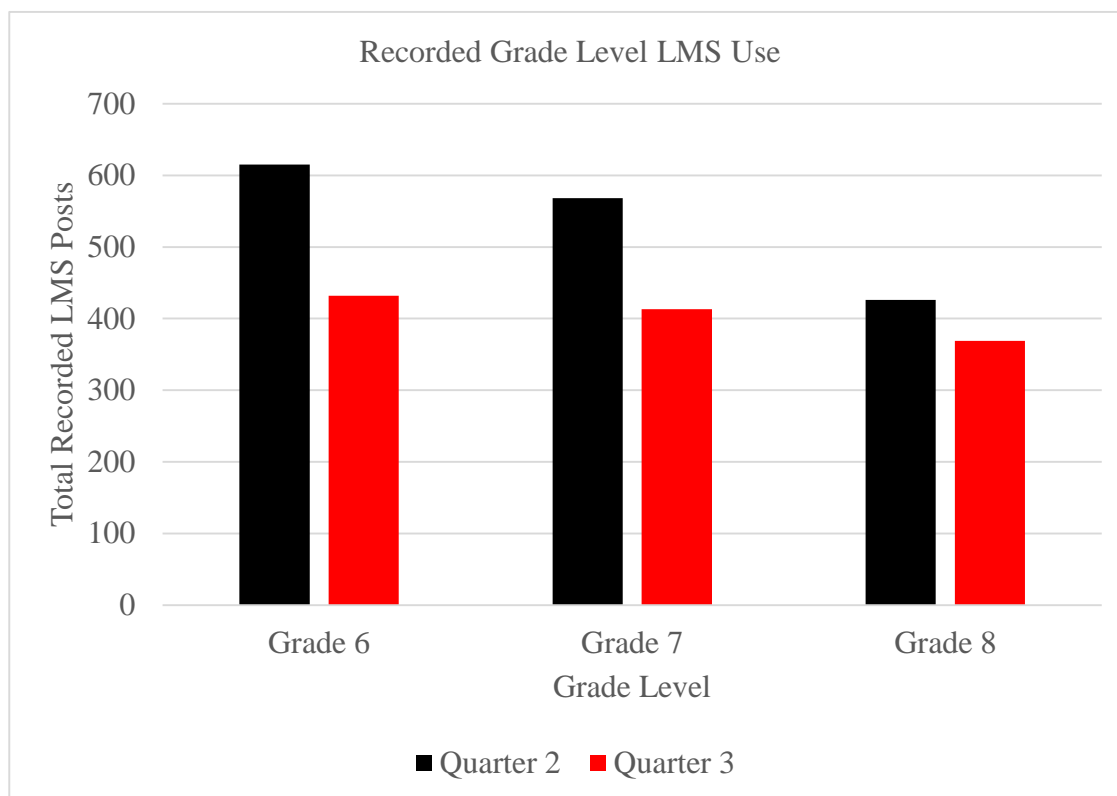
**Lowest educator reported types of posts.** The four types of LMS posts made with the least frequency were assessment administration, discussion boards, BYOT activities, and digital homework submission. On the Initial LMS Use Survey at least 50% of educators say they rarely or never make these types of posts. The self-reported data in Figure 4 mirrors the total recorded posting patterns, which are displayed in Figure 3 above. In Quarters Two and Three the lowest recorded types of posts by educators were web links, assessments, and discussion boards. Educators posted a total of 83 web links during Quarter Two and 69 web links during Quarter Three. Educators posted a total of 7 assessments during Quarter Two and 29 assessments during Quarter Three. Educators posted a total of 10 discussion boards during Quarter Two and 2 discussion boards during

Quarter Three. Recorded educator posts that were observed for 22 weeks mirror the educators post responses that were reported on the Initial LMS Use Survey, with high amounts of one-way communication and limited interaction between users. The types of posts by educators gives an idea of what the school expects of students during certain points in the school year. For example, Quarter Three posts show very achievement driven uses, such as assessments and grade posts.

### **Highest and Lowest Observed Grade Level Posting Patterns**

Question One – C asked about the extent to which different content areas and grade levels use the LMS. In Quarter Two, total educator grade level posting results were from grade six educators with a total of 615 posts, grade seven educators with a total of 568 posts, and grade eight educators with a total of 426 posts. Figure 5 displays that, more frequent LMS use was more common amongst lower grade levels. Grade six educators posted 189 more posts than grade eight educators in Quarter Two.

When comparing the two quarters, Quarter Three resulted in 346 fewer total posts than Quarter Two, as shown on Table 4. During Quarter Two more assignment-oriented posts were made, while in Quarter Three more assessment-oriented posts were made. Because homework assignments were posted more regularly than assessments, this explains the elevated posts in Quarter Two. In Quarter Three, the total number of educator grade level posts were grade six with 432 posts, grade seven with 320 posts, and grade eight with 413 posts. Total grade level LMS posts for Quarter Three had a mean of 369 posts per grade level with a standard deviation of 77.5. Grade six educators posted more than the grade eight educators in both quarters.



*Figure 5. Total mean recorded grade level post per educator.*

**Educator survey data.** Educators were presented Quarter Two posting data at the end of the first 12 weeks, and were asked to comment on an informal Individualized Quarter Two LMS Use Survey. When questioned about grade level use, 74.2% ( $n = 26$ ) of educators explained that they believe grade six educators use the LMS more because the students need more guidance with the transition to middle school. While 51.4 % ( $n = 18$ ) of educators explained that grade eight uses the tool the least in order to prepare students for the independent learning that they will experience in high school. The observed posting patterns mirror this response. Grade six educators not only post the most overall, but their posts represent reminders such as homework assignments, calendar posts, and study information. Total grade level LMS use for Quarter Two had a mean of 536.3 post per grade level with a standard deviation of 98.3.

Table 4

*Grade Level Recorded Posts by Quarter*

	Grade 6	Grade 7	Grade 8
Total Recorded Posts	1047	981	795
Quarter 2 Total Posts	615	568	426
Quarter 3 Total Posts	432	413	369
Total Mean Posts/ educator	95.1	93.6	61.1
Quarter 2 Mean Posts/ educator	55.9	51.6	32.7
Quarter 3 Mean Posts/ educator	39.2	42	28.3

**Highest and Lowest Observed Content Area Posting Patterns**

In Quarter Two mathematics educators posted most frequently with 561 total posts ( $M = 62.3$ ), language arts with 426 total posts ( $M = 35.5$ ), science with 291 total posts ( $M = 22.8$ ), social studies with total 279 posts ( $M = 23.1$ ), and foreign language with 52 total posts ( $M = 26.7$ ). When combining the number of posts from all five content areas, there was a mean of 321.8 posts per content area with a standard deviation of 189.5. Figure 6 shows mathematics and language arts educators as the highest users, and foreign language educators as the lowest users.

In Quarter Three language arts educators posted most frequently with 392 total posts ( $M = 43.5$ ), mathematics educators with 377 posts ( $M = 41.8$ ), social studies with 254 posts ( $M = 36.3$ ), science with 215 posts ( $M = 26.8$ ), and foreign language with 48 posts ( $M = 24$ ). The total number of posts for Quarter Three was 1263 with a mean of 252.6 posts per content area and a standard deviation of 140.2. Mathematics and language arts content educators were again the highest users, however in Quarter Three mathematics educators posted less than language arts educators. Table 5 shows data of content area posting for foreign language, science, and social studies educators. Social studies educators decreased by 48 total posts between quarters, while foreign language

recorded only a four post difference. Science educators showed a large decrease in use with 76 fewer total posts in Quarter Three than in Quarter Two.

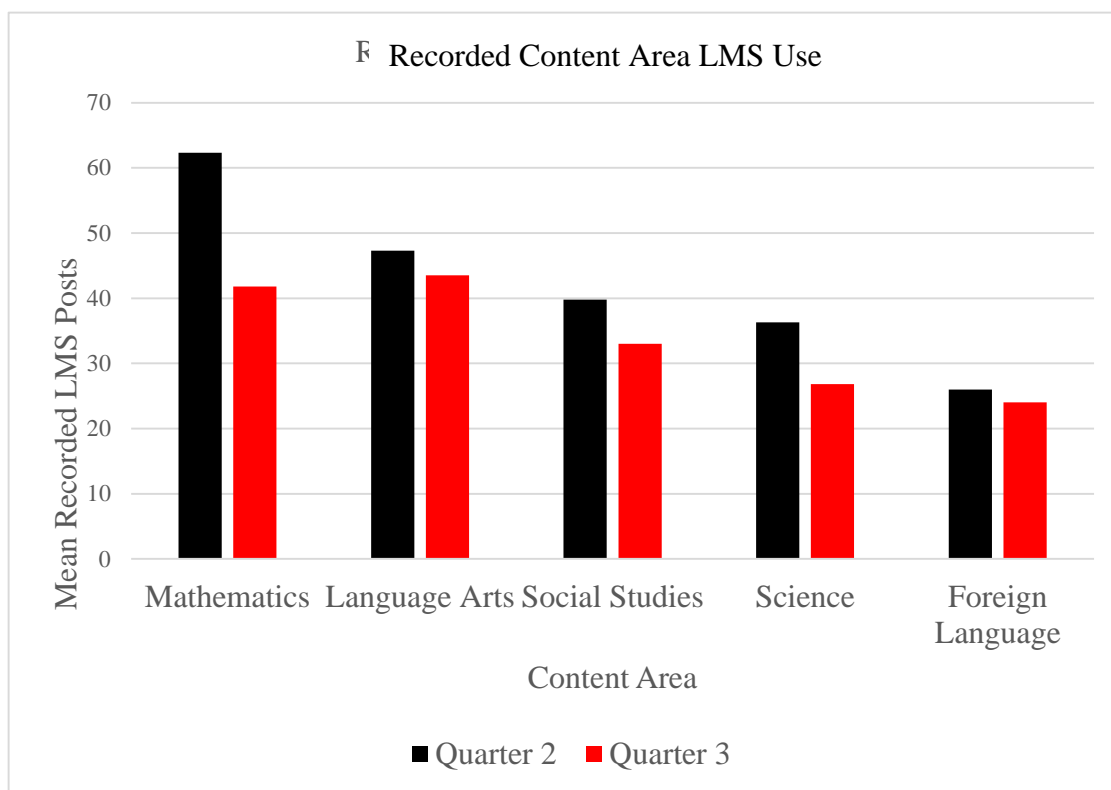


Figure 6. Mean recorded content area posts.

One educator's responses to the Week 12 Individualized LMS Use Survey explained why the mathematics educators went from posting most frequently in Quarter Two to second most frequently in Quarter Three. The daughter of a mathematics educator, one of the highest users, was diagnosed with Leukemia toward the end of Quarter Two. This educator's posts dropped dramatically and remained low during Quarter Three while she transported her daughter to and from treatments. This accounted for the large variance in mathematics posting between Quarter Two and Three. While there were two other mathematics educators whose posting decreased more than 40 posts between Quarter Two and Three, this particular educator posting pattern decreased from 67 total posts in Quarter Two to 11 total posts in Quarter Three. This decrease is



the difference between being in the high use category and the low use category, which was not the case for the other mathematics educators whose posting decreased.

**Educator survey data.** When educators were presented personalized LMS data at the end of the first 12 weeks, they were asked to comment using the follow-up Individualized Quarter Two LMS Use Survey. When questioned for their opinions about content area use, 62.8% ( $n = 22$ ) of educators explained that mathematics educators use the LMS more because it is the most important subject, requires the most homework, and evokes parental concern due to the current school's mathematics placement procedures.

Table 5

*Content Level Recorded Posts by Quarter*

	Mathematics	Language Arts	Social Studies	Science	Foreign Language
Total Recorded Posts	938	818	510	506	100
Quarter 2 Total Posts	561	426	279	291	52
Quarter 3 Total Posts	377	392	231	215	48
Total Mean Posts*	104.2	90.8	72.8	63.2	50
Quarter 2 Mean Posts*	62.3	47.3	39.8	36.3	26
Quarter 3 Mean Posts*	41.8	43.5	33	26.8	24

*Note.* \* Indicates mean posts/ educator.

### **Highest and Lowest LMS Use and Educator Experience**

Question One – D asked if educators' years of experience teaching was associated with the frequency of LMS use. The sample of educators is shown on Table 2 in Chapter 3. This group contained three social studies educators, one science educator, and one mathematics educator. The mathematics educator within this group was also the highest LMS user in the school. Total posts and mean posts were calculated across both Quarter Two and Quarter Three. The results in Figure 7 displayed that, educators with 1-5 years of experience made 78 total posts ( $M = 39$ ), educators with 6-10 years of experience made 785 total posts ( $M = 130.8$ ), educators with 11-15 years of experience made 675

total posts ( $M = 67.5$ ), educators with 16-20 years of experience made 377 total posts ( $M = 62.8$ ), educators with 21-25 years of experience made 583 total posts ( $M = 83.2$ ), educators with 26-30 years of experience made 463 total posts ( $M = 92.6$ ), and educators with 30 or more years of experience made 76 total posts ( $M = 38.35$ ). In order to calculate a correlation, years of experience were each assigned a corresponding value ranging from 1 to 7, with fewer years of experience being assigned a lower number. The total frequency of the educator posts above had a mean of 88 posts per educator with and standard deviation of 64.5. On the 1-7 rating scale, educator years of experience had a mean of 3.9 with a standard deviation of 1.5. Total posts had a weak negative association with educator's years of experience,  $r(33) = -.29$ .

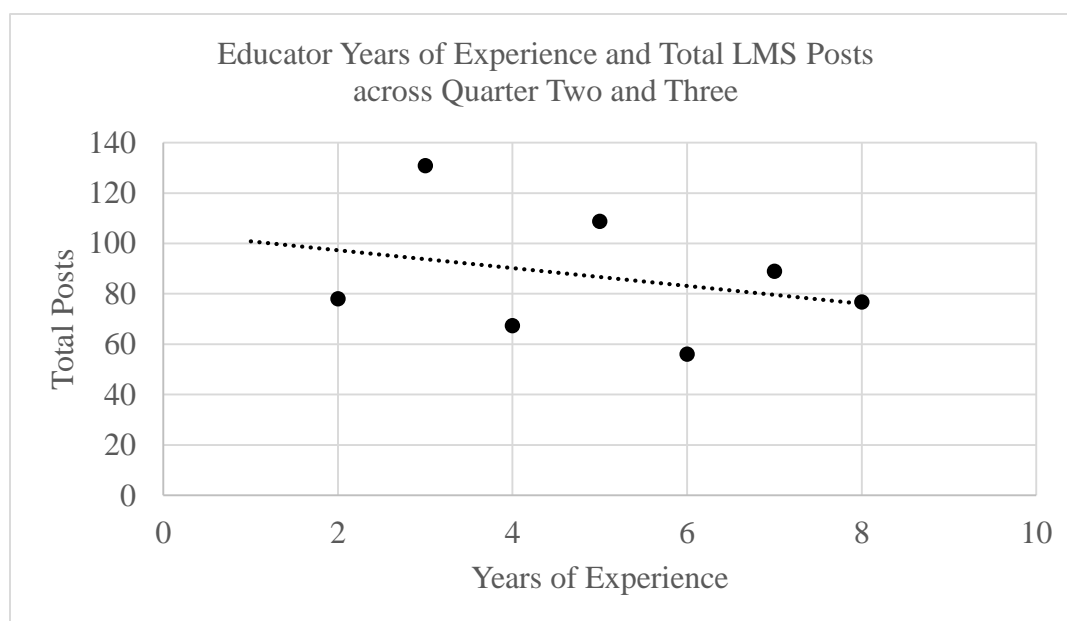


Figure 7. Educator years of experience and total LMS posts across Quarter Two and Three.

### **Educator Reported LMS Perceived Usefulness and Observed Educator Posting Patterns**

Question One – E asked if an educator's perception of LMS usefulness was associated with their frequency of use. On the Initial LMS Use Survey educators were

asked 13 questions that assessed their beliefs concerning the usefulness of LMS in their classrooms.

**Highest perceived LMS usefulness.** On three specific survey items, more than 50% of the participants clustered on one response choice. This implies that there was some agreement between the educator perceptions in those areas. Educators were asked how the use of the LMS affected their time spent planning. Educator responses were, has significantly increased time commitment 18.7% (n = 6), has increased time commitment 50.0% (n = 16), has not changed time commitment 21.8% (n = 7), has decreased time commitment 6.2% (n = 2), and has significantly decreased time commitment 3.1% (n = 1). These responses indicate that 68.8% of educators perceive the LMS to be a tool that requires them to increase their time commitment to educational course planning.

Educators were also asked how they would describe the enthusiasm of their school for using a LMS. Responses were, extreme enthusiasm 12.5% (n = 4), high enthusiasm 31.2% (n = 10), moderate enthusiasm 50.0% (n = 16), low enthusiasm 6.2% (n = 2), and no enthusiasm 0%. These responses indicate that 96.8% of educators believe that the school has at least moderate enthusiasm for LMS use.

Educators were also asked how the school's BYOT initiative would impact LMS use. This question had the highest amount of agreement amongst educators. Seventy-five percent of educators believe the BYOT initiative will increase LMS use. However, in both the recorded LMS observation data and the self-reported survey data, links posted for BYOT was a type of LMS post that occurred with low frequency.

Table 6

<i>Educator Perception of LMS Usefulness</i>						
Perception of LMS Usefulness:	Mean (SD)	Has become essential	Has significantly increased	Has slightly increased	Has not changed	
Changes in reliance on a LMS	2.3 (0.9)	18.8	31.3	28.1	21.9	
Changes in quality of grading practices	2.2 (0.9)	9.3	31.3	34.4	25.0	
Perception of LMS Usefulness:	Mean (SD)	Significant Increases	Increases	Unchanged	Decreases	Significant Decreases
Effect of BYOT on LMS	3.9 (0.6)	15.6	59.4	5.0	0.0	0.0
Changes in time spent planning	3.7 (0.9)	18.8	50.0	21.9	6.4	3.1
Enthusiasm for using a LMS	3.5 (0.8)	15.5	31.3	50.0	6.2	0.0
Effects on final course scores	3.1 (1.0)	15.6	21.9	28.1	34.4	0.0

**Lowest perceived LMS usefulness.** On three specific survey items, there was no cluster of answers on any one response choice, which implies that there is little agreement between the educator perceptions in those areas. Educators were asked how their reliance on LMS has changed. This question had the lowest amount of agreement amongst educators, with approximately a quarter of participants responding to each option. Educator responses were that LMS has become essential to teaching 18.7% (n = 5), has significantly increased 31.2% (n = 10), has slightly increased 28.1% (n = 9), and has stayed about the same 21.8% (n = 7). Educators were also asked how the quality of

grading practices has been impacted by the use of a LMS. Nine percent of educators said the LMS has become essential to grading practices ( $n = 3$ ), has significantly increased the quality of grading 31.2% ( $n = 10$ ), has slightly increased the quality of grading practices 34.3% ( $n = 11$ ), and has not increased the quality of grading 25.0% ( $n = 8$ ).

Finally, educators were asked what they perceived as the impact of LMS to overall course scores. Educators said that LMS has significantly increased course grades 15.6% ( $n = 5$ ), has changed course grades some each year 21.8% ( $n = 7$ ), has somewhat changed course scores 28.1% ( $n = 9$ ), has not changed course grades 34.3% ( $n = 11$ ), and has decreased course scores 0.0%. These survey items indicated that educator responses are less consistent when it comes to the association of LMS with grading.

**Perception of LMS usefulness and total recorded posts.** The Likert scale responses displayed on Table 6 were each assigned a numerical value. The survey had six items with four response options, and seven items with five response options. For each of the participants, responses were summed across all 13 items. The responses were assigned numbers 1-4 and 1-5, respectively. The higher the number, the more positive view the educator had of the usefulness of the LMS. The lowest possible score for these survey items was 13, which would occur if an educator answered each item with the most negative possible response. The highest possible score for these survey items was 59, which would occur if an educator answered each item with the most positive possible response.

Total educator perception of usefulness scores for the 35 participating educators had a mean of 36.2 with a standard deviation of 7.5. As displayed on Figure 8, educator perception compared to total recorded posts did not have a strong relationship,  $r$  (30)

=.11. This finding showed that educators who perceive the LMS as a useful tool do not necessarily post more frequently.

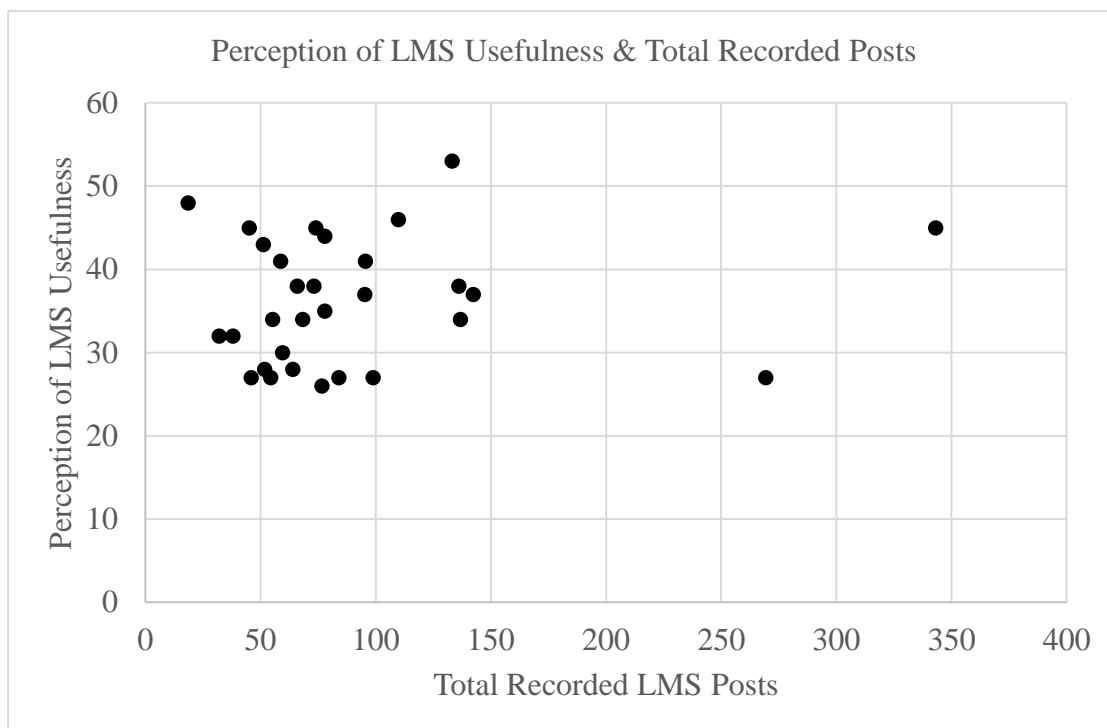


Figure 8. Educator perception of LMS usefulness and total recorded LMS posts.

### Research Question Two – Course Homework Submission

- 2) Is there an association between the patterns of educator LMS use and the frequency of course homework submission?

Question two asked if there was a relationship between the patterns of educator LMS use and the frequency of course homework submission. Of the 35 participating educators in the study, 34 educators had recordable homework posting and submission rates. Educator data was removed from correlation calculations if they did not meet the requirements described in the Chapter 3, in this case the educator did not assign or grade any homework during Quarter Two or Three.

### Educator recorded homework posting patterns and course homework

**submission.** Research Question Two focuses on associations between educator LMS use and course homework submission. Over Quarter Two and Three there was a total of 2,902 posts. Of these posts, 720 (25.1%) of them were homework assignments. The mean number of total homework posts for each quarter was 10.6 posts per educator for Quarter Two and 8.8 posts per educator for Quarter Three. Across all educators there was a mean of 89.3% course homework submission with a standard deviation of 6.8%.

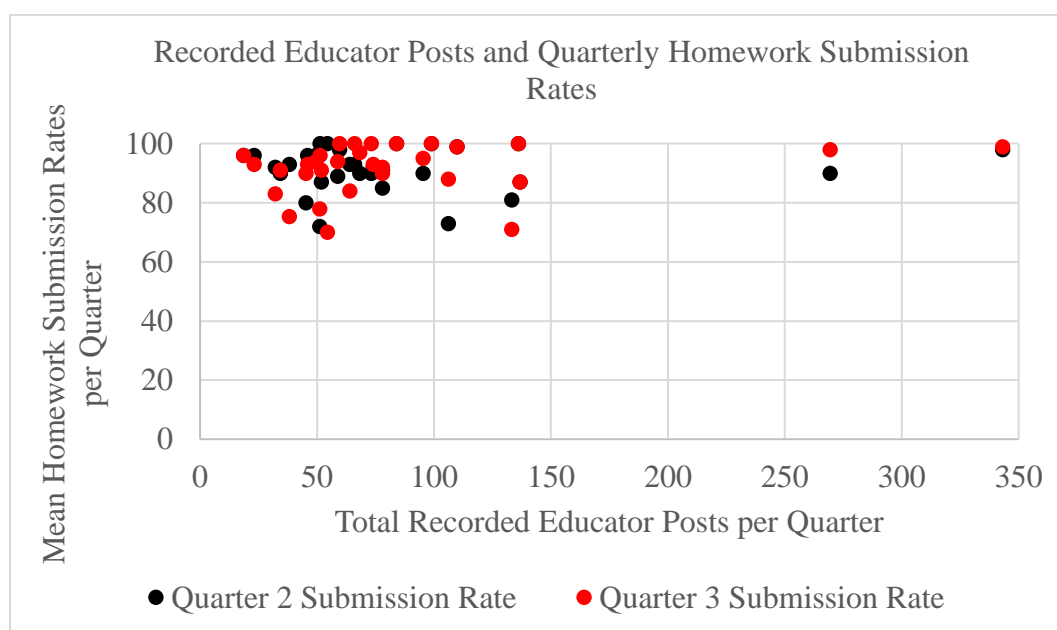
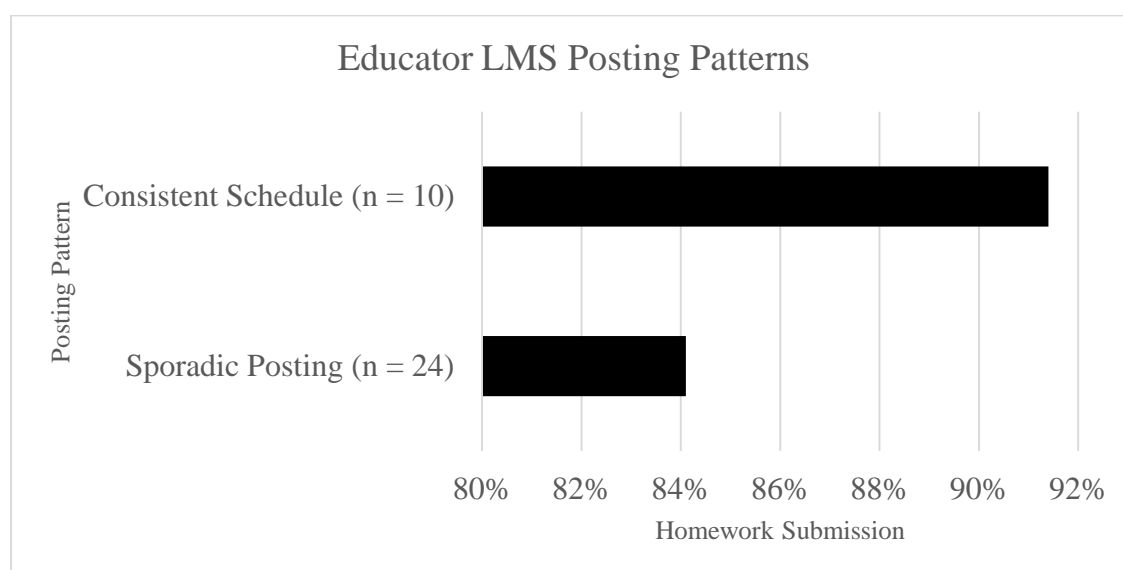


Figure 9. Total recorded educator posts and mean homework submission rates per educator.

To answer Research Question Two, a comparison was made between the observed amount of homework submitted by course and the observed posting patterns of the educators. It is important to note that only homework that was graded and posted through the online gradebook was included in this analysis. There are other homework assignments, such as reading and studying, which could not be tracked using the LMS. The sample size for this correlation was 34 participants. Educator LMS use and course homework submission had a weak correlation,  $r(32) = .06$ . Figure 9 displays in both

Quarter Two and Quarter Three posts from educators who use with more regularly do not necessarily have higher homework submission within their courses, which may be explained by different posting patterns in grade level and content area posting described below.

**Educator survey data consistent posting patterns.** Before discussing educator grade level and content area use, there was one pattern of LMS use that was strongly associated with homework submission. Recorded on the weekly observation data, there were ten educators who posted in very specific patterns. These educators posted on the same days each week and formatted their posts in the same way. Of these ten educators, three teach mathematics, two teach language arts, two teach foreign language, two teach social studies, and one teaches science. Together these educators had a mean homework submission rate of 91.4%. The remaining 24 educators, who posted on a non-regular basis had a mean homework submission rate of 84.1%. This finding may be an indicator that a regular pattern of posting increases course homework submission.



*Figure 10. Educator LMS posting pattern and homework submission.*



### **Grade level recorded LMS posting and homework submission patterns.**

Although LMS posting and homework submission overall have no relationship, observations of homework submission rates by grade level do have a noteworthy pattern. The 11 Grade Six educators assigned a mean of 48.7 homework assignments per educator, and received a 90.7% homework submission. The 12 Grade Seven educators assigned a mean of 28.1 homework assignments per educator, and received a mean of 91.2% homework submission. The 11 Grade Eight educators assigned a mean of 35.7 homework assignments per educator, and received a mean of 92.4% homework submission. Although grade eight educators post a mean of 13 fewer assignments per educator, their students are submitting 1.7% more assignments. Table 7 shows us that grade eight educators put a total of 124 of their posted homework assignments in the grade book and students submitted 114 assignments. In grade six educators put a total of 77 of their posted homework assignments in the grade book and students submitted only 69 assignments.

Table 7

#### *Homework Submission Rates and LMS Educators Posts*

	Grade 6	Grade 7	Grade 8	Mean
Number of Educators	11	12	12	11.6
Number of Students	110	120	120	116.6
Total Homework Assignment Graded	77	107	124	102.6
Mean Homework Assignments Graded	7	8.9	10.3	8.7
Homework Submission Rate	90.7%	91.2%	92.4	91.4%
Total LMS Posts	1047	981	795	941
Total LMS Homework Posts	536	458	429	474
Mean LMS Homework Posts/ Educator	48.7	38.1	35.7	40.8

When comparing homework submission rates to graded assignments, grade eight had the highest homework submission rate, and submission descended to grade six with the lowest homework submission rate. Grade six educators posted a total of 1047 LMS posts and 536 of these were homework posts, grade seven educator posted a total of 981 LMS posts and 458 of these were homework posts, and grade eight educators posted a total of 795 LMS posts and 429 of these were homework posts. Although grade six educators are posting more homework to the LMS, they are not grading as many homework assignments as grade seven or grade eight educators. On Table 7 there is one homework posting pattern that is highest for eighth grade educators. Grade eight educators grade more homework assignments. were graded by grade six educators. While the homework submission rates between grade levels is not a drastic difference it does show that educators from higher grades are using fewer posts to accomplish similar homework submission, which is made more clear by content area homework submission data.

#### **Content area recorded LMS posting and homework submission patterns.**

Grade Level is not the only way to investigate educator LMS pattern of use. The content of the course taught is another subgroup that has varying patterns of use. Table 8 displays total homework assignments that were recorded in the online gradebook for Quarter Two and Three. Mathematics educators graded a total of 121 homework assignments ( $M=14.7$  / educator), language arts graded a total of 78 homework assignment ( $M=9.3$  / educator), science graded a total of 43 homework assignments ( $M=5.9$  / educator), social studies graded a total of 38 homework assignments ( $M = 6.5$  / educator), and foreign language graded a total of 28 homework assignments ( $M=14.5$  / educator). Total graded homework

assignments had a mean of 61.6 per content area with a standard deviation of 38.1. The standard deviation in this case indicates that there are certain content areas, such as mathematics and foreign language, that grade assignments at a much higher frequency than other content areas.

Table 8

*Homework Submission Rates and LMS Educators Posts*

	Mathematics	Language Arts	Science	Social Studies	Foreign Language	Mean
Number of Educators	9	9	8	7	2	7
Number of Students	90	90	80	70	20	70
Total Homework Assignments Graded	121	78	43	38	28	61.6
Mean Homework Assignments Graded	14.7	9.3	5.9	6.5	14.5	10.8
Homework Submission Rate*	94.7	89.8	91	89.7	92.7	91.5
Total LMS Posts (Mean)	938 (104.2)	818 (90.8)	506 (63.2)	510 (72.8)	100 (50)	574.4
Total LMS Homework Posts	584	342	211	210	76	284.6
Mean LMS Homework Posts*	64.8	38	26.3	30.0	38	30.4

*Note.* \* Indicates mean posts/ educator.

Students submitted the most homework in mathematics classes. Table 8 depicts the homework submission patterns of different content areas; mathematics 94.7%, foreign language 92.5%, science 91%, language arts 89.8%, and social studies 89.7%. Across content areas the mean submission rate was 91.5% with a standard deviation of .02%.

Just as the grade level data may have provided information to understand the

responsibilities and expectations of differently aged students the content area data reveals some of the differences in expectations of content areas educators in this sample. Total homework submission varied by content area. The number of homework assignments educators posted to the LMS had a mean of 284.6 per content area with a standard deviation of 191.9. These content areas observed had a mean of 91.5% submission per content area with a standard deviation of 2.08.

The number of graded homework assignments was again related to submission. Mathematics posted the most overall ( $M = 104.2$ ) and received the highest homework submissions (94.7%). Foreign language however posted the least overall ( $M = 50$ ), but had the second highest homework submission (92.7%). The similarity between the two content areas is the total number of graded homework assignments. Mathematics educators graded a mean of 14.7 homework assignments and foreign language graded a mean of 14.5 homework assignments. Similar to grade level posting patterns, courses that posted the highest amount of graded homework assignments, also received the highest amount of homework submission regardless of high or low overall posting patterns.

### **Research Question Three – Mean Homework Scores**

- 3) Is there an association between the frequency of educators' LMS use and mean homework scores throughout 22 weeks?

**Educator recorded posting patterns and mean homework scores.** Research question three asked if there is a relationship between the frequency of LMS use and the mean homework scores within a course. As previously discussed, LMS have been promoted as an educational tool that can connect the physical classroom from the school day to an online resource in the evening. The assumption made by most research is that

use of a LMS will help students by providing remediation, repetition, and enrichment to course content (Papadakis et al., 2012). With this in mind, the expectation is LMS use should increase student achievement within content courses, especially since research has shown homework as an indicator of student success or failure in the classroom (Lucio et al., 2012). For Research Question Three, correlations were calculated between homework scores and educator LMS use. Course homework scores for Quarter Two and Three had a mean of 85.8% per educator with a standard deviation of 10.41. Educator LMS use had a mean of 82.0 LMS posts per educator with a standard deviation of 61.8.

Educator homework assignment posts have a mean of 22 posts per educator with a standard deviation of 23.8. Mean homework scores had a mean of 85.8 per educator with a standard deviation of 10.4. The correlation coefficient between homework assignment posts and homework scores indicated no strong relationship,  $r(32) = .18$ .

**Educator survey data.** Five educators commented on their Individualized Quarter Three LMS Use Surveys that they grade homework based on completion exclusively or a mixture of completion and accuracy, while the others 30 graded for accuracy. In the case of one language arts educator, each of the 10 students observed submitted their homework and received full credit as a completion grade, which gave this educator a 100% mean homework score. In Question Two mathematics and foreign language had the highest homework submission rates. On the Individualized Quarter Three LMS Use Survey, seven of the nine mathematics educators and two of the two foreign language educators reported that they grade based on completion. In other words, different educator grading practices impacts homework scores. Homework assignments graded for accuracy have the possibility to lose points when answers are incorrect and

therefore have systematically lower average homework scores. This is not true of homework assignments graded for completion only. For both accuracy and completion homework, assignments not submitted were calculated into homework performance as a 0%, just as they are in the school's grade book. Therefore, educators who had low homework submission often had lower homework scores.

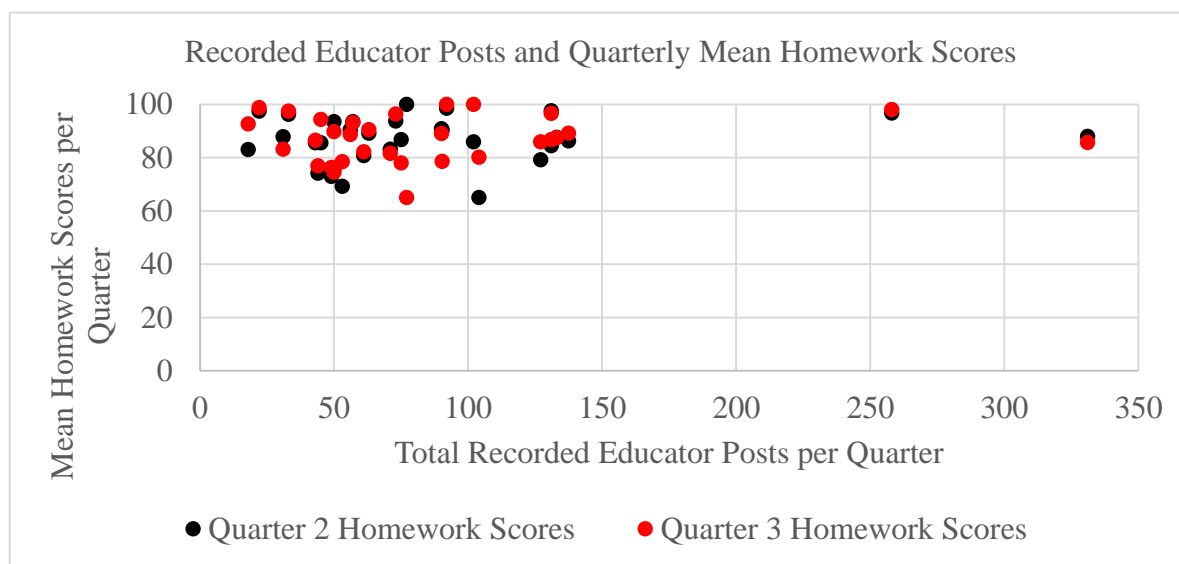


Figure 11. Recorded mean homework scores and total educator posts.

In order to adjust the data to accommodate for these grading practices, the data was analyzed removing educators who grade based on completion alone. Seven educators were removed for grading based on completion and three educators were removed for incomplete data. The mean of the remaining 24 educators' total was 96 posts per educator with a standard deviation of 53. The mean of the remaining 24 homework scores was 88.4% per educator with a standard deviation of .9. There was a slight relationship between these variables  $r(22) = .21$ .

### **Grade level recorded LMS posting and mean homework score patterns.**

Although there is no strong relationship between total LMS posting and mean homework scores, a noteworthy pattern emerges. The 11 Grade Six educators posted 1047 total

times and the mean student homework scores within their courses was 85.9%. The 12 Grade Seven Educators posted 981 total times and the mean student homework scores within their courses was 86.3%. The 12 Grade Eight educators posted 795 total times and the mean student homework scores within their courses was 88.6%. Although grade eight educators posted 252 fewer total posts over all the students were scored 2.7% higher. As discussed during the homework submission section of Chapter 4, grade six educators may post the most overall and the most homework assignments, however they grade the fewest number of assignments. The opposite is true of grade eight educators. Grading more homework, as in grade eight, may provide students with more incentive to submit the homework and provide them with more opportunity to improve scores when all assignments are calculated together.

#### **Content area recorded LMS posting and mean homework score patterns.**

Content area LMS posting and scores is also important to understand the culture of LMS use with the school in the current study. As previously stated in Chapter 4, mathematics has the highest total LMS posts, while foreign language has the lowest total LMS posts. However, both mathematics and foreign language courses had the highest mean homework submission rates and the highest mean graded homework assignments. The same is true of mathematics and foreign language for mean homework scores. Foreign language courses had the highest mean homework scores, recording a mean of 91.6%. Mathematics courses had the second highest mean homework scores, recording a means of 90.2. Due to the nature of their contents, both mathematics and foreign language courses combined assigned 96.4% drill and practice homework. This homework required students to practice the same skill repeatedly. Mathematics and foreign language also

grade more regularly and grade for completion rather than accuracy. These items lead to similar results in homework scores despite the differences in posting patterns. The recorded mean homework scores for the other content areas include science 87.3%, language arts 84.2%, and social studies 84%.

### **Analysis Beyond Research Questions**

Throughout the research process both homework submission rates and mean homework scores were analyzed without taking student ability level into account. At the current school, students are sorted into ability level groups based on their scores on state mathematics assessments. Each student is placed in an ability level grouping that has students with similar mathematic ability. Those students stay together as a group in all of their core content classes throughout the day. Different ability level courses were associated with differing patterns of LMS use. These patterns revealed expected results for homogenous ability groupings. The advanced students and above average students submitted the highest amount of homework, while the average and below average students submitted lower amounts of homework and had lower mean homework scores. During Quarter Two, below average students submitted a higher rate of homework submission than their mean homework scores. In fact, during Quarter Two below average student submitted the second highest amount of homework, only lower than advanced students by .5%, however their homework score was a mean of 88.3%, while advanced students had a mean homework score of 96.7%.

### **Summary**

Chapter Four presented descriptive and correlational analysis for three research questions that examined the use of LMS by secondary educators and the associations of



that use with student learning outcomes. In addition, the research questions searched for associations between sets of data to help develop a complete description of LMS usage patterns for the participants in the study.

Research Question One was multifaceted; with a purpose of guiding an investigation that helps describe the use of a school-based LMS. Five sub-questions were addressed within research Question One in order to analyze a variety of patterns in LMS use. There were four noteworthy findings from Research Question One.

First, in Question One –A there was a pattern of educator LMS use that varied greatly throughout the 22 weeks of data collection. In Quarter Two and Three, the weeks with the lowest LMS use were the weeks with breaks from school due to holidays or weather. The LMS was still used during these weeks, but use was very limited. Time that students and educators spent away from the school building was found to be associated with less frequent educator LMS use. Although LMS are distance learning platforms high, moderate and low users all displayed peaks when the school was in session.

Second, findings for Question One – C showed that patterns of educator LMS use exist for both content area and grade level educators. Grade Six had the highest grade level use for Quarter Two, with over 200 more posts than grade eight educators. In Quarter Three, the mean total of grade eight educators had fewest posts to the LMS. LMS are often viewed as a tool to increase student responsibility for learning and independence. The association of use found in this study recorded higher grade levels to have with lower mean LMS use, which was inverse to what was expected.

Third, content area educators showed some very distinct patterns of use. During Quarter Two mathematics had the highest total mean educator LMS posts. Mathematics

educators posted a mean of 21 more posts per educator than language arts educators (the next highest content area). The mathematics content area was found to have five of the highest LMS posters in the school. Implications of mathematic LMS use along with differing patterns from other content areas is discussed in Chapter Five.

Finally, for Research Question One, on the Initial LMS Use Survey educators agreed that they had significantly increased their use of the LMS, but educators reported that they believe LMS have had little impact on the students in their classroom. The survey responses may help shed light on why the literature and the recorded posts from this study have observed underutilization of LMS in secondary schools. Research Question One-B highlights this underutilization in the collaborative LMS use facilitated by educators, showing on 12 total discussion board posts over 22 weeks observed.

Research Question Two was used to compare course homework submission with educator LMS use. These two variables were not found to have an association, most likely due to the differing results in grade level and content area posting patterns. However, Research Question Two had four noteworthy findings. First, when looking at grade level educator posts and course homework submission, grade six educators were found to post the most homework assignments however, they did not grade all of the homework assignments they posted. Grade seven and grade eight educators post less frequently, but grade more of their submitted homework assignments. The grade eight educators posted the fewest total posts and the fewest homework posts, but their courses had the highest number of graded homework assignments and the highest submission rate at 92.4%.

Second, content area courses were also found to have differences in their posting patterns and homework submission. Mathematics educators posted the most total posts to the LMS, the most total homework assignments, and also had the highest submission rate of 94.7%. Content areas that displayed posting patterns with fewer total posts and fewer homework posts had fewer homework submission. Throughout the data high mathematics posting, submission, and scores was a theme.

Third, different types of homework assignments were posted to the LMS. Three points were important in students submitting their homework by content areas: style, regularity, and grading practices. The style of homework assigned was associated with the amount submitted. Foreign Language and Mathematics had a higher number of submissions. Observations of online homework posting showed that these assignments were most often “drill and practice.” In drill and practice homework students use what they learned in class and repeat the skill in a variety of ways to increase familiarity with the content. Within different content areas, homework that required reading, inference, or interpretation was submitted less frequently.

The regularity of homework assignments posted had an association with submission. Educators who posted the same homework assignments on the same days each week had higher submissions. For example, an educator who posted homework assignments on Monday, Wednesday, and Friday each week (see Figure 10) had a higher submission rate ( $M = 91.4\%$ ) than educators who rarely assigned homework or posted more sporadically ( $M = 84.1\%$ ). Finally, educators who graded for completion rather than accuracy had higher homework submission rates.

The findings for Research Question Three focus on the association between the frequency of educator posts and mean homework scores. There were three noteworthy findings for this research question. First, there was no relationship found between homework scores and educator LMS use. When comparing only educator homework assignment posts to mean homework scores the correlation coefficient was stronger. The association between homework scores and educator posts, was again made stronger when only homework scored based on accuracy was taken into account.

Second, in Research Question Two, grade eight educators were found to have the highest total homework submission. When viewed by quarter, a pattern of submission and homework scores was found. Between Quarters Two and Three grade seven courses' homework submission decreased and their homework scores did as well. In grade six and eight homework submissions and mean homework scores increased.

Finally, homework submission and scores were divided into ability level subgroups. The two highest performing subgroups, advanced and above average, showed minimal difference in submission or homework scores between Quarters Two and Three. Below average students however showed a noteworthy pattern of homework submission and score. Between Quarter Two and Quarter Three below average students decreased in homework submission, and they scored lower on their homework assignments.

The findings for Research Questions One, Two, and Three provide a more complete description of LMS use than has appeared in previous literature. These findings open the door to LMS research studies in the future that identify further association between LMS use and students. Interpretations of the results, implications of the findings, and suggestions for future research can be found in Chapter 5.

## **CHAPTER 5**

### **CONCLUSIONS AND RECOMMENDATIONS**

This chapter provides a summary of the current study, interpretation of the findings, and implications drawn from the findings in Chapter 4. The research questions in this study guided the observation of educator LMS use in a middle school and comparison of LMS use to course homework submission and mean homework scores. This chapter also includes recommendations for future research and suggestions for integrated uses for LMS in 21<sup>st</sup> century secondary classrooms.

#### **Overview of the Study**

The purpose of this research study was twofold; first to describe patterns of LMS use and then to compare LMS use with homework learning outcomes. Analysis of this data helps identify strengths and weaknesses in LMS use, which will allow the development of an improvement strategy. A review of literature revealed a variety of LMS uses, which have had positive impacts on student motivation and achievement including collaboration, quality integration, and communication (DeNeui & Dodge, 2006; Nasser, Cherif, & Romanowski, 2011; & Psycharis et al., 2013). LMS research has explored a breadth of topics, however most research focused on individual aspects of LMS and did not provide descriptions of when and how LMS were being used to support secondary classrooms (Elias, 2010; & Psycharis et al., 2013).

Little research has been conducted that describes school-wide uses for LMS (Al-Busaidi & Al-Shihi, 2011). Conducting descriptive school-wide research is becoming more critical, because of the rapid growth of technology integration in secondary schools (Al-Busaidi & Al-Shihi, 2011; Basal, 2015; & Boote & Beile, 2005). Studies that describe and compare previous innovations will provide a greater understanding of

technology adoption among educators in secondary schools. Describing the successes and failures of previous adoptions of technological innovations will add needed insight to future technology diffusion within this school.

The growing changes in technology innovations will result in increased use of digital platforms. Today's secondary educators are required to master a combination of digital media and instructional design, but are given little guidance to support 21<sup>st</sup> century tasks, while adhering to standardized assessments, curricular goals, and content understandings (Sehring et al., 2007; Papadakis et al., 2012 & Picciano & Seaman, 2007). Without a framework to navigate their use (Al-Busaidi & Al-Shihi, 2011), educators often integrate digital learning environments of secondary classrooms.

Rogers (2003) explained that organizations face a complex adoption process, because they consist of individuals within a social network already enacting cultural procedures. The current study aims to define LMS use within a local middle school and compare educator subgroups, because current use of LMS can be sporadic and undefined. Assigning value to particular patterns of use may create peer conversations, which leads to a greater chance for trialability and observable results (Rogers, 2003). Using the LMS, which the educators are comfortable with, established routines that may lead to greater successes in the future when new innovations reach the school.

### **Findings and Interpretations**

LMS are digital platforms that are instrumental in connecting educators and students inside and outside of the school building. This study resulted in findings that describe educator LMS use throughout a middle school and examined the use of individual subgroups. The data collected to define school-wide patterns of use identified

the frequency of posts, the types of posts, the time period of posts, the content area posts, the grade level posts, the years of experience of the posters, the perceptions of the posters, course homework submission, and mean homework scores. Based on the review of literature, LMS use is poorly defined in secondary schools (Al-Busaidi & Al-Shihi, 2011; Papadakis et al., 2012; Psycharis et al., 2013). There were a variety of individual aspects of LMS use that had been investigated, but broad definitions and comparisons are limited.

The results of observation within this middle school displayed specific cultural norms within this organization. First, the LMS was most often used when educators and students were in traditional routines that mirrored the school's schedule for communicating curricular goals, assessments, and grade reports. The LMS was not used as a proactive tool to engage students across time and space, which is the typical expectation of technology designed for distance education (Sehring et al., 2007). While most research insisted that collaborative communication was the biggest promise of LMS (Psycharis et al., 2013), this school displayed basic adoption of the LMS as a communication tool. Much of the literature identified that LMS are underused, leaving digital classrooms that hold information, but are not interactive (Abik et al., 2012; Haugsbakk, 2009; Norris & Soloway, 2012; & Sehring et al., 2007).

Comparisons between educator LMS posting patterns, course homework submission, and mean homework scores revealed further associations between educator LMS use in grade levels and content areas. Results indicate while LMS posts were highest in grade six, course homework submission and mean homework scores were the lowest and grade eight course homework submission and mean homework scores were

the highest. In content area, mathematics posted to the LMS most frequently and language arts posted the least frequently, but these two contents had the highest course homework submission and mean homework scores. The similarity between grade eighth educators, mathematics educators, and language arts educators is the amount of graded homework assignments. The more frequently educators graded homework assignments, the higher course homework submission and mean homework scores a course had, regardless of LMS posts. Without seeing the relative advantage of the innovation at hand the chance of adoption are much less likely (Rogers, 2003).

### **Discussion of Results**

**Communication.** Both the review of literature and the current research pointed to the importance of communication in the implementation of LMS (Psycharis et al., 2013; Sehring et al., 2007). The data from this study helped identify an example of what current LMS communication looks like, by recording patterns in 35 classrooms within a middle school. The question that this leads to is; what should LMS communication look like? LMS use for communication has become typical in secondary schools (Electronic Education Report, 2011). The promise of LMS use was that technological communication would help create students who are connected knowers (Psycharis et al, 2013), who would use the LMS as a community of critical thinkers to create and publish (Sehring et al., 2007). Previous literature identified that students who spend more time in LMS communication recorded increased scores (Liu & Cavanaugh, 2011a) and that students who receive personalized communication from educators also recorded increased scores (Xu, 2011a).



However, both the literature and the current research showed that LMS are widely underutilized as communication tools (Al-Busaidi & Al-Shihi, 2011; Papadakis et al., 2012; Sehring et al., 2007). This study found that one-way communication, where the LMS was used like a billboard or class calendar, was the primary use. While this has its benefits, it falls short of many of the original intentions of the LMS. Higher-level communication is not only recommended, but shows up in state-wide and national technology standards. ISTE standards indicate that students need to be creative communicators who can clearly express themselves using a variety of platforms (ISTE, 2017). NETS-S describe technology communication as a tool used to collaborate, publish, and interact with a variety of users in a variety of formats (Williams, 2004). Maryland Technology Literacy Standards echo the others, using communication as a way for students to express ideas using various media formats (MSDE, 2014). Rogers (2003) further explains the importance of communication channels that maximize the spread of information. The same should be true of the way educators expect students to adopt technological communication in a formal education settings. However, after more than ten years of advancing technology use, most educators have adopted only base line use of this tool. Our students are expected to create, collaborate, evaluate and use technological information with greater autonomy (P21 Framework, 2012), but educators must first initiate a communication design that fosters these skills. The question is how do educators do that? Rogers (2003) tells us how influential technological networks can be in spreading an innovation, but in this case the technology communication itself is the innovation.

**LMS Changes.** Culture within a school building was identified by the literature as important for implementation of any technology (Al-Busaidi & Al-Shihi, 2011; Lui & Cavannaugh, 2011b; Schrodt et al., 2009). Rogers (2003) also discusses the importance of the cultural climate where the adoption of an innovation is attempted. Change is difficult and uncomfortable in any organization, but secondary schools have the added disadvantage of housing a variety of stakeholders with different goals. The benefits to conducting research within a secondary school is that one could observe things that need to change, discover how they got that way, and attempt to make improvements. In short, analysis of previous technology trends in schools allows for future innovations to be conducted with more purpose, by knowing some barriers that have stood in the way in the past. Rogers (2003) would suggest allowing time to pass, ease of use, ease of transfer, opinion leaders, continuous support, time for trial and error, and applications for direct implementation. Fraser (et al., 2007) would say that a new innovation should be accompanied by professional developments that is designed by educators as a personal and social experience within a target group, and be ready for classroom implementation. Common interdisciplinary planning in middle schools could be used in part for open discussions about technology use, primarily use that involves communication with the students and parents. This discussion should include which LMS the educators are using, how often they post assignments, whether students were expected to submit homework or complete discussion boards online, and the frequency of online assessment administration and grade posting. Small groups of educators that have common students can build on the knowledge that students have of the LMS from other courses and assist each other in digital growth in the classroom.

The question that remains is; how can schools get to this point? Some argue that because LMS lend themselves to big data analytics, educators have the opportunity to refine their practice. Big data refers to extremely large data sets that may be analyzed to reveal patterns and associations (Marz & Warren, 2015). Analytics is a system of computer analysis of data or statistics (Siemens & Long, 2011). These data help to form insights with which educators could make smarter decisions regarding classroom technology innovations. Data can provide evidence of student learning (Marz & Warren, 2015), which Rogers (2003) says is an important part of adding value to an innovation. Big data analytics can help districts or schools to develop planned implementation of innovations to improve student results, but on a smaller scale technological data analysis can improve learning experiences in the real time. Small data is manageable enough for human analysis and comparisons (Steyerberg, Eijkemans, Harrell, & Habbema, 2001). Educator analysis of small data can guide educational design on a more individualized basis. Both Rogers (2003) and Fraser (et al., 2007) suggest individualized methods for implementing innovations, especially when the adoption process is taking place in a large community with varying stakeholders. Educators in small grade level group or interdisciplinary teams can collect data on their students through observations and assessments to make improvements. Middle schools are the perfect environment for cross content discussion because of the common use of interdisciplinary teaming. Interdisciplinary team planning is used for a variety of classroom preparations and could be used as a time for different content areas to plan technology integration together. This would benefit a teams' joint students, but also provide more LMS planning time for educators in all content areas. A small data analysis strategy already in place in many

central Maryland schools is the CFIP strategy (MSDE, 2014). This includes six steps implemented by educators to improve student achievement. During CFIP educators identify patterns of strengths and weakness in student test responses, plan improvement strategies, and implement those strategies in future instruction. Improvement strategies like CFIP enhance the role of educators' judgment. This same process can be applied to the use of technology, which often allows educators to quickly collect data on their students.

### **Recommendations for Further Study**

The current study did not investigate student or parent use of the LMS. Because this proprietary LMS did not consent to collection student log-on data, this research could not capture how educator LMS use was associated with student LMS use or parent LMS use. Future research should extend on the current findings by identifying if associations exist between educators with high LMS use and students in their courses. Rogers' (2003) Diffusion Theory explains how innovations are adopted after they have diffused across individual members. Educators are not alone in their use of the LMS, they are one group within a community of LMS users. Therefore, further research should be conducted on other stakeholders such as students and parents. Students who access the LMS more regularly or for a longer period of time may have higher achievement. This would provide a clear description of student LMS use and its association to educator LMS use and course achievement. An investigation of the frequency of parent log-ins may also provide further understanding of their relationship to the school community and student achievement. Further research could also be conducted on the educators themselves. Communication was found to be the most accessed use of the LMS within this school.

Through either altering how communication tools are used or Measuring the effects of different types of communication could help us understand identify beneficial communication strategies to use in classroom digital design.

For the purposes of this study, student homework submission and mean homework scores were selected as the indicator of student success within a course. Finding value in homework is crucial for students (Xu, 2011a), and finding value in LMS use is crucial for educators. A variety of previous LMS and homework research helped guide this selection. Lucio (et al., 2012) identified homework as one of the components that indicated whether a student would be successful in a course. Wilkinson and Echternacht (1998) include homework as a measure for achievement because of the common use of LMS for homework communication. However, future research look at other measures of student learning outcomes, such as time spent using the LMS or the content posted within discussion boards. These could directly relate to LMS posting patterns of educators.

### **Recommendations for Practices**

**Recommendations for schools.** The results of the current study suggest that the LMS is a tool used by educators for primarily one-way communication. As a classroom tool, LMS are meant to extend education past the physical constraints of a school building. They are however, used with more frequency when educators and students are in school, rather than digitally when they are away from school. Developing school-based standards for communications and use could help to create structures for how and when to use the LMS. At this point, many secondary schools are not equipped to conduct completely online courses that would substitute for a full day of school, but it does allow

for a continual flow of access to information. Increased use from students and educators during extended periods of time away from school, would benefit the school community by creating possibilities for individual students who have absences due to illness or vacation. Long-term changes could include predesigned coursework that is made available to students in the event of an extended absence.

**Recommendations for educators.** The results of the current study indicate that educator consistency was important to both course homework submission and mean homework scores. Educators who posted with regularity had students within their courses with higher homework submission. In order to achieve high homework submission and mean homework scores, educators at this school could implement the LMS patterns from educators who post regularly to guide their posting. At that point, using small data analysis could help educators identify strengths and weaknesses in use, develop a regular plan of action, and implement classroom changes (MSDE, 2014). Professional development is traditionally planned by administration, but educators share in the responsibility of establishing worthwhile professional learning. The study supports the research of Fraser (et al., 2007) who suggests that the most beneficial professional development is led by educator and held in small groups. This allows members to personalize professional growth in order to design and implement LMS in the secondary classroom. For example, if one educator on an interdisciplinary team routinely conducts online discussions, other members of the team can use similar assignments and grading structures. Educators who share digital practices, will be able to support one another teaching because student expectations may already be set, allowing educators to maximize their planning time and simplify their digital design.

**Recommendations for administration.** A description of the current school showed that there were no strict guidelines for how educators were supposed to implement the LMS. According to Rogers (2003), a focused and guided diffusion strategy is needed for adoption to take place. Secondary schools have such a variety of LMS users that an Authority Innovation-Decision is needed. This means that the decision to implement a new innovation is made for an entire community by individuals in a position of power. Administrators within a school can set up structured checkpoints for individualized professional development, wherein educators are expected to share updates made to LMS in certain departments. Depending on the needs of the school, these could take place in interdisciplinary teams or content area departments. Fraser (et al., 2007) explained that relationships between small groups of educators need to be nurtured through support of administration. This could also help these groups to share ideas and practice use of an innovation (Rogers, 2003). Many of the previous problems with the success of professional development comes from the conceptual vagueness of the expectations for educators (Fraser et al., 2007). Dori (et al., 2002) explain that an educator's career starts with a daily struggle to implement curriculum in its most basic format and slowly builds into a career where educators develop a continuous, stable approach. This could lead to indifference toward innovations and reluctance to break away from some hard fought routines.

### **Summary**

This chapter includes recommendations for continued LMS use within secondary schools to help increase the culture of use by developing ideas for school-based diffusion practices. Overall, this research suggests that the communication offered by LMS has

been beneficial, but it is not sufficient to guide educators into instructional design that promotes independent digital literacy for students. Digital literacy can include participation in a variety of media tools to evaluate information, share knowledge, and collaborate with peers (P21 Framework, 2012). The challenge is advocating for educators to enact technology charged classrooms that instruct students on appropriate digital citizenship.

The study's focus was to define current LMS use in a middle school and investigate if relationships exist between educator use and course homework submission and mean homework scores. Educator use was described across a middle school and within subgroups. The categories that were analyzed include, frequency of use, grade level, content area, time period, years of experience, and ability levels of the courses taught. In addition, data from educator surveys was collected to describe educator demographics and perception of LMS usefulness.

The four most prominent results of the current study provide a description of LMS use in a secondary school. First, the LMS at the current middle school is not used as an interactive platform for learning. Posting homework assignments as one-way communication (like a planner) is the number one use for the school's LMS. Over half of these educators also reported that they rarely or never use any of the interactive applications, such as discussion boards, digital assessments, and project collaboration.

Second, posting patterns were found to be distinct between grade levels and content areas. Grade six was found to post the most to prepare students for middle school. The educators' posts decreased as the students got older. Mathematics posted most often.



Educators identified that they believed this was due to the importance that the mathematics content holds in placing the students into their ability groups.

Third, on the Initial LMS Use Survey educators agreed that they have significantly increased their use of the LMS in the past five years, but that they believed it had little to no impact on students in the classroom. These survey responses help to explain why educators may not use the LMS to their full potential.

Fourth, increased posts to the LMS does not associate with increased homework submission or increased mean homework scores. In fact, there were varying submission rates associated with educator posts to the LMS. Grade six educators posted the most total posts, but had the lowest homework submission. Grade eight educators posted the least total posts and had the highest homework submission. Mathematics however posted the most total posts and received the most homework submission. This corresponds with the detail provided earlier about the importance of mathematics in this school, their grading practices, and the style of homework they assign.

In conclusion, the overall results began by defining LMS patterns of use, which varied depending on educator subgroups. The most distinct differences in LMS subgroups were found in content area use. The content area of a course was the driving force behind how educators designed their classrooms. Using the data from school-wide patterns of use can provide administrators with the information needed to develop guidelines LMS use. It is recommended that educators can implement classroom changes using data based decision-making.

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## APPENDIX A

### Initial LMS Use Survey

1. Name:

2. Grade Level (s) (2015-2016)

- ☐ 6
- ☐ 7
- ☐ 8

3. Subject (s) (2015-2016)

- ☐ Foreign Language
- ☐ Health
- ☐ Language Arts
- ☐ Mathematics
- ☐ Science
- ☐ Social Studies

4. Years of Experience

- ☐ > 1 year
- ☐ 1-2 years
- ☐ 3-5 years
- ☐ 6-10 years
- ☐ 11-15 years
- ☐ 16-20 years
- ☐ 21-25 years
- ☐ 26-30 years
- ☐ 30 or more years
- ☐ Other (please specify)

5. Education Type (highest level completed)

- ☐ Bachelors
- ☐ Some Graduate School
- ☐ Masters
- ☐ Graduate work beyond Masters
- ☐ Master's plus 30 credits
- ☐ Doctorate

6. Age

- ☐ 20-29
- ☐ 30-39
- ☐ 40-49
- ☐ 50-59
- ☐ 60-69
- ☐ 70-Retirement

7. Are you currently using a web-based learning management system (i.e. Edline, Moodle, OneNote) in one or more of your courses?

☐ Yes

☐ No

8. Is the school based web-based system the only Learning Management System you and your students have ever worked with?

☐ Yes

☐ No

If no, what other system have/do you utilize (blog, wiki, Moodle, another school's system)?

9. How frequently do you utilize the following web-based learning management elements in your teaching?

	5-7 days per week	2-4 days per week	1 day per week	2-3 times per month	about once per month	Rarely	Never
Assessment notification	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assessment administration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Posting homework as communication to parents and students	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Posting homework as attachments for possible printing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Digital homework submission from students	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Communication to parents via email	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Long term project reminders and scheduling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Posting grades	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Posting instructional resources (notes, assistive technology, readings, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Student – teacher discussion / interaction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Posting links for BYOT activities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

10. How many years have you used a web-based learning management system for your academic course(s)?

☐ Less than 1 year

☐ 1-2 years

☐ 3-5 years

☐ 6-10 years

☐ 11-15 years

☐ 16-20 years

☐ 21 or more years

11. In the past 5 years, to what degree has your utilization of the web-based Learning Management System changed?  
*My utilization of the web-based Learning Management System...*

Has led to regular implementation within the classroom	Has significantly increased	Has increased slightly	Has stayed the same
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12. How do you perceive your use of a web-based learning management system has affected student learning in the classes you teach?  
*Their utilization of the web-based Learning Management System...*

Has become essential to student learning	Has led to significant increases in student learning	Has slightly improved student learning	Has led to no change in student learning
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

13. In the past 5 years, how has your reliance on a web-based learning management system in teaching changed?  
*My reliance on a web-based learning management systems...*

Has become essential to teaching	Has significantly increased	Has slightly increased	Has stayed about the same
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

14. What do you perceive the effects of the web-based learning management system are to homework submission?  
*The web-based Learning Management System...*

Has led to essential use for homework submission increases	Has significantly increased homework submission	Has slightly increased homework submission	Has not increased homework submission
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15. In the past 5 years, to what degree do you believe the quality of teaching in your classroom been affected by the utilization of a web-based learning management tool?  
*The web-based Learning Management System...*

Has become essential to the quality of teaching and learning	Has significantly increased the quality of teaching and learning each year	Has slightly increased the quality of teaching and learning	Has not increased the quality of teaching and learning
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

16. In the past 5 years, to what degree do you believe the quality of grading practices been affected by the utilization of a web-based course management tool?  
*The web-based Learning Management System...*

Has become essential to grading practices	Has significantly increased the quality of grading	Has slightly increased the quality of grading practices	Has not increased the quality of grading
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

17. How has your use of a web-based learning management system affected your time spent during planning? (e.g. To what extent has posting to a LMS affect your time commitment as a teacher?)

Utilization of the web-based Learning Management System...

Has significantly increased time commitment	Has increased time commitment	Has not changed time commitment	Has decreased time commitment	Has significantly decreased time commitment
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

18. How has your use of a web-based learning management system to post grades, affected your time spent in parent teacher contact? (e.g. To what extent has posting grades affected your time spent discussing grades with parents?)

Utilization of the web-based Learning Management System...

Has significantly increased time commitment	Has increased time commitment	Has not changed time commitment	Has decreased time commitment	Has significantly decreased time commitment
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

19. How do you perceive your use of a web-based learning management system in relation to student responsibility for learning in the courses in your department?

Their utilization of the web-based Learning Management System...

Has led to significant increases in student responsibility for learning	Has led to increases in student responsibility for learning	Has led to no change in student responsibility for learning	Has led to decreases in student responsibility for learning	Has led to significant decreases in student responsibility for learning
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20. What do you perceive the effects of the web-based learning management system are to overall final course scores?

The web-based Learning Management System...

Has significantly increased course grades	Has changed course grades some each year	Has somewhat changed course grades	Has not changed course grades	Has decreased course scores
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

21. To what degree have technical difficulties (system down, access issues, system modifications) with the web-based Learning Management Systems been a disruption to your teaching?

Technical difficulties...

Have not been a major disruption to our course	Have not been a minor disruption to our course	Have not affected disruptive to our course	Have been a minor disruption to our course	Have been a major disruption to our course
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

22. How would you describe your school's enthusiasm for utilizing a Learning Management Systems?

The educators' attitudes toward utilization of the web-based learning management system show...

Extreme enthusiasm	High enthusiasm	Moderate enthusiasm	Low enthusiasm	No enthusiasm
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

23. What effect do you believe BYOT will have on teacher/student utilization of the web-based Learning Management System?

Due to BYOT the utilization of the web-based learning management system...

Will significantly increase	Will increase	Will stay the same	Will decrease	Will significantly decrease
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

24. Are there courses for which you developed web-based sites as a requirement for your school, but do not regularly utilize them in your teaching? (e.g. you only use them for required administrative tasks such as posting grades)

- ☐ Yes, I created the course, but discontinue use as the year goes by.
- ☐ No, I use the school-based Edline for my courses
- ☐ Yes, but I use other web-based tools for digital classroom management

If Yes, but I use other web-based tools, What do you use?

25. Which of the following best describes your homework posting habits? (Check all that apply)

- ☐ I post homework every time I assign it.
- ☐ I post homework most of the time, but periodically forget.
- ☐ I post written assignments students have to complete, but not reminders (i.e. study, bring books back)
- ☐ I rarely post my homework assignments, students write it down in class.
- ☐ I attach required handouts in every posting.
- ☐ I attach handouts to homework postings periodically.
- ☐ I do not attach homework handouts.
- ☐ I post notes from class to assist in student homework completion.
- ☐ I post lectures and videos as homework for my students (i.e. flipped classroom)
- ☐ I place my assignments on a calendar for student use well in advance.
- ☐ I place my assignments on a calendar as they are due (day to day)
- ☐ Other homework posting actions:

26. For what size classes do you find a web-based Learning Management System most useful?

- ☐ <10
- ☐ 10-20
- ☐ >20

26. For what size classes do you find a web-based Learning Management System most useful?

- ☐ <10
- ☐ 10-20
- ☐ >20

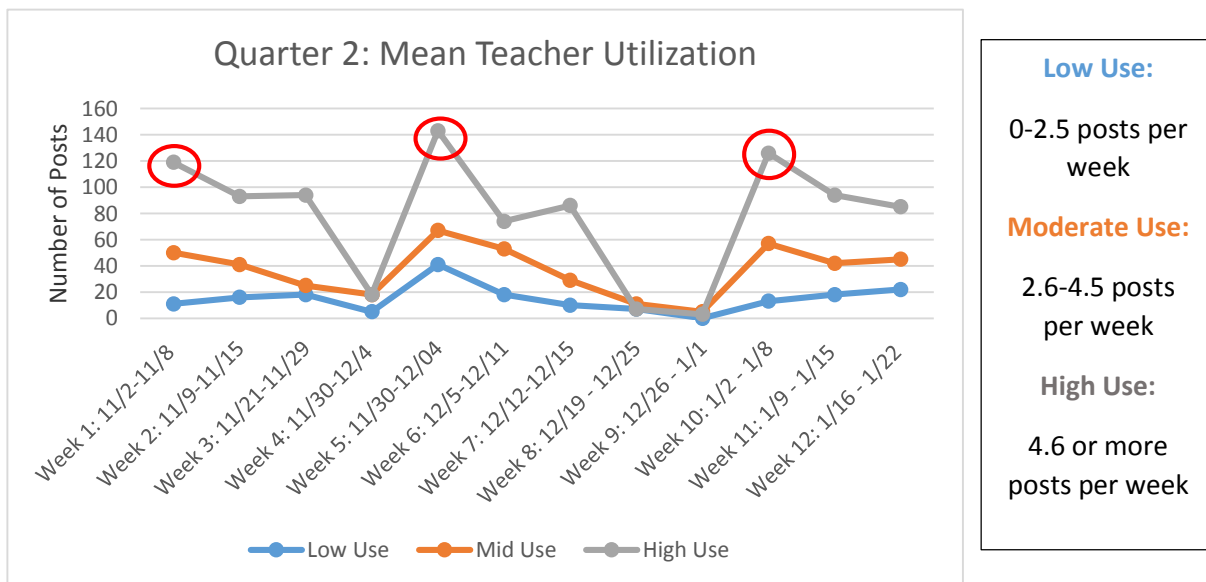
27. For what type(s) of course do you believe a web-based Learning Management System would be most useful?

- ☐ Foreign Language
- ☐ Health
- ☐ Language Arts
- ☐ Mathematics
- ☐ Science
- ☐ Social Studies

28. Please provide any additional comments about your use or perceptions of web-based Learning Management Systems.

## APPENDIX B

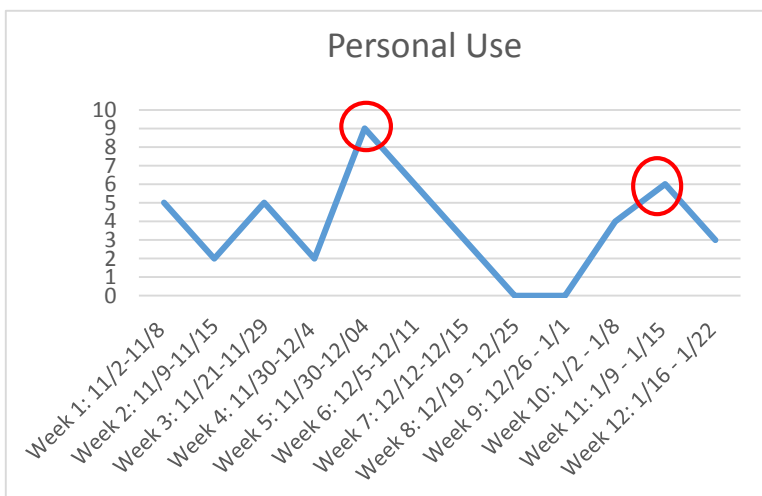
### Individualized Quarter Two Usage Survey



*(Weeks 4, 8, and 9 represent Thanksgiving and Winter Break.)*

- 1) Do you believe there is any school-wide reason for upward trends during weeks 1, 5, and 10? If so what do you believe were the causes of these peaks?

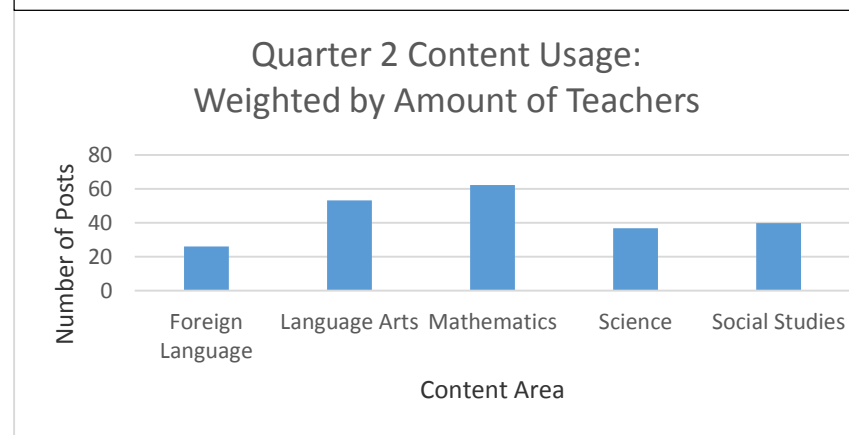
- 2) In what way do “grade update days”, “progress reports”, and “report cards” affect your posting?



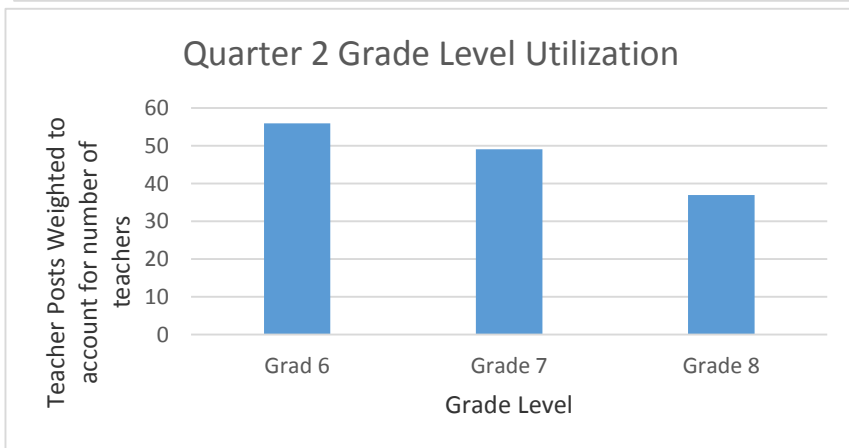
**3) Does your Edline utilization data look like what you thought your actions were during the quarter?**

**4) What was happening in your class or in the school during weeks 6 and 11 that created such peaks in use?**

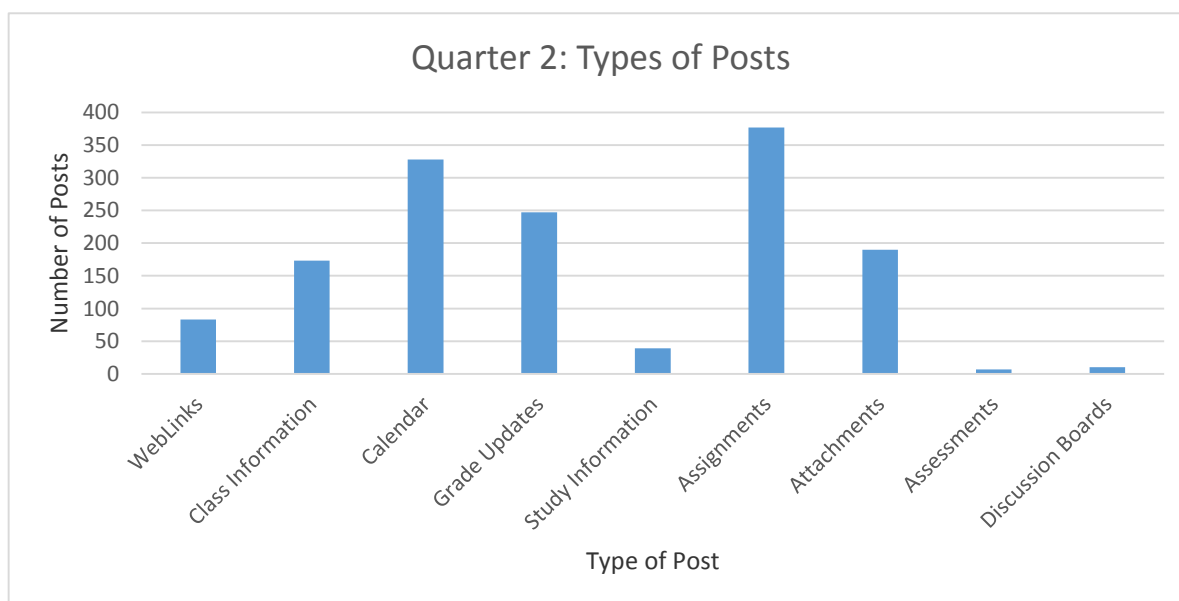
**5) Are there other trends in your data that you would like to note in greater detail?**



**6) Why do you think mathematics utilizes Edline most regularly?**



**7) Why do you think sixth grade utilizes Edline most regularly?**



**8) Have you done anything new on Edline this year that you have not done in years past? If so what new strategy have you adopted (for example: posting all homework on Monday, posting class notes each Friday etc.)?**

**9) Are you using any LMS besides Edline to post homework, give assessments, or conduct discussion boards? If so, what are you using and how often are you using it?**

**10) What are the common types of (homework) assignments you post online?**

**11) Do you feel you have used Edline more or less than you did during quarter 1?**



## APPENDIX C

### Individualized Quarter Three Usage Survey

1. Name:

2. Age

- ☐ 20-29
- ☐ 30-35
- ☐ 36-40
- ☐ 41-50
- ☐ 51-60
- ☐ 61-69
- ☐ 70-retirement

3. How often do you post homework assignments to Edline?

- ☐ Daily
- ☐ 2-4 days per week
- ☐ 1 day per week
- ☐ 2-3 times per month
- ☐ About once a month
- ☐ Rarely
- ☐ Never

4. On Average, how many homework assignments (that are turned in for a grade) do you assign each quarter?

- ☐ I do not grade homework
- ☐ less than 5
- ☐ 6-10
- ☐ 11-15
- ☐ 16-20
- ☐ 21-25
- ☐ 26 or more

5. Rate how strongly you agree with the following statement: Edline helps to increase homework submission.

- ☐ Strongly Agree  
☐ Agree  
☐ Neutral  
☐ Disagree  
☐ Strongly Disagree

6. Do you encourage your students to rely more on their planner or Edline?

- ☐ Planner  
☐ Edline

Explanation (if necessary)

7. What types of graded homework do you assign (check all that apply)?

- ☐ I do not assign graded homework  
☐ Reading Logs  
☐ Vocabulary  
☐ Curricular Handouts  
☐ Written Responses  
☐ Research  
☐ Workbook Pages  
☐ Discussion Boards  
☐ Online Activities

Other (please specify)

8. How would you rate the difficulty level of your typical homework assignments?

- ☐ Extremely Challenging  
☐ Challenging  
☐ Neutral  
☐ Not Challenging (mostly review)

9. Do you assign different homework assignments to different ability level classes?

- ☐ Yes
- ☐ No
- ☐ No, but I provide accommodations to students in need

10. Do you assign any repetitive homework assignments (the same thing each week, due on the same day)? Examples include defining vocabulary terms, geography assignments, and reading logs.

11. When grading your assignments, which do you grade for?

- ☐ Completion
- ☐ Accuracy
- ☐ Both at times

12. Do you weight your grades?

- ☐ Yes
- ☐ No

If "Yes" what is the weight?

13. Do you provide multiple chance for students to turn in missing homework assignments?

- ☐ Yes, for full credit
- ☐ Yes, For partial credit
- ☐ No, I do not accept late work

14. Do you provide students with reminders to turn in missed assignments?

- ☐ No, I collect homework once
- ☐ Yes, but only one or two times
- ☐ Yes, I remind students until they turn in the assignments?

15. Do your students have homework assignments that are required, but not graded (check all that apply)?

- ☐ Reading
- ☐ Watching Videos
- ☐ Visiting Links
- ☐ Studying
- ☐ Bringing in supplies

Other (please specify)

16. Please provide any details about your Edline or Homework procedures that you feel are important or unique.



## APPENDIX E

### Informed Consent Cover Letter



May 2015

Dear Participant,

My name is Alexandra L. Greenwood and I am a graduate student in the College of Education at Towson University. As part of the research for my doctoral dissertation, I will be conducting digital observations of Fallston Middle School's online Learning Management System (Moodle) and distributing surveys to determine educator utilization of virtual learning in the K-12 environment. Participation in this study is voluntary. If you choose to participate in my project, you will be asked to complete a short survey at the beginning, in the middle, and at the end of the 2015-2016 school year. It is not necessary to answer every question, and you may discontinue your participation in the project at any time. Your decision whether or not to participate in the project or to withdraw from the project at any time will in no way affect your employment status. Mr. Mascari has given me permission to conduct my study at your workplace; he will not know whether or not you have participated, or, if you did, how you responded.

If you do choose to participate in the study, your information will be kept confidential. Data reports will not record any identifying information, no one reading the compiled results of the survey or digital observation data will not be able to identify you.

If you have any questions about the project, you may contact me at (410) 409-8029, my faculty advisor, Dr. David Wizer at (410) 704-6258, or the Chairperson of Towson University's Institutional Review Board for the Protection of Human Participants, Dr. Debi Gartland, at (410) 704-2236. A copy of the results of the survey, reported in aggregate form, will be available to you upon completion of my project, if you would like to see it. Copies will be forwarded to Fallston's office, where you may pick them up.

Thank you for your time.

Sincerely,

Alexandra L. Greenwood

Graduate Student

## APPENDIX F

### Informed Consent Form

PRINCIPAL INVESTIGATOR: Alexandra Greenwood      PHONE: (410) 409-8029

Purpose of the Study:

The purpose of this study is to examine the structure of activity and usage of a digital Learning Management System (Moodle) over time throughout an educational organization throughout the 2015-2016 school year. The study intends to determine patterns of LMS use by both teachers and students. These patterns are to be observed through analyzing the logins and posts of students and teachers to the school based Moodle.

Procedures:

Participants will be given a survey three times through the course of the 2015-2016 school year. The survey can be completed digitally and will take no longer than 20 minutes to complete. The survey contains items on Moodle usage, perception of Moodle use, and Benefits or drawbacks to classroom interactions. Usage data from each educators' Moodle classroom will be provided to them on the second and third survey.

Benefits:

There are no benefits participation for the participant. This research is meant only to explore teacher and student interactions within a 21<sup>st</sup> century learning environment in order to track patterns in digital learning structure that could provide insight into classroom formats in which digital literacy could be developed in primary and secondary schools.

Alternatives to Participation:

Participation in this study is voluntary. You are free to withdraw or discontinue participation at any time. Refusal to participate in this study will in no way affect digital observations made throughout the course of the study.

Confidentiality:

All information collected during the study period will be kept strictly confidential. You will be identified through identification numbers. No publications or reports from this project will include identifying information on any participant. If you agree to join this study, please sign your name below.

\_\_\_\_\_ I have read and understood the information on this form.

\_\_\_\_\_ I have had the information on this form explained to me.

\_\_\_\_\_  
Subject's Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Principal Investigator

\_\_\_\_\_  
Date

If you have any questions regarding this study please contact Dr. David Wizer at (410) 794-6268 or the Institutional Review Board Chairperson, Dr. Elizabeth Katz, Office of University Research Services, 8000 York Road, Towson University, Towson, Maryland 21252; phone (410) 704-2236.

## **APENDIX G**

### **Educator Survey Reminder Email**

Faculty,

If you have not yet completed the survey of Edline utilization, here is the link again. I have about half of the teachers I asked. This is just a friendly reminder.

Please complete it by this Friday, December 11th so that I can have an update for my professors by the end of the semester. The survey is 28 questions and should take less than a half an hour. I will send a reminder about once a week, so if you do not have time this week, you will receive the link again next week.

Best,

Alex Greenwood

Survey Link:

<https://www.surveymonkey.com/r/Z7LZMF7>

## APPENDIX H

### Edline Home Page

[Home](#)


---

[My Classes & Shortcuts](#)


---


[My Content](#)


---

[My Account](#)


---

[Tools](#)



Now to order your yearbook for the 2016-2017 school year.

*Principal*

*Assistant Principals*

Please direct Edline questions to

*The ... learning community is committed to excellence by providing rigorous, high quality instruction in a safe learning environment that fosters and encourages life-long learners.*

**News**

Games and Noble for PAMS and PAMS Jazz Band

Is your child considering a private school next year?  
Please turn in paperwork soon to ensure the school has time to complete the paperwork.

Yearbook Information

PTA Fundraiser continues  
Please fill in form.

REFLECTIONS -- REFLECTIONS -- REFLECTIONS  
Participation Rules for Participation

Show Name...

**Contents**

- [Accelerated Reader Program Brochure](#)
- [Classes](#)
- [Clubs & Activities](#)
- [Conversation Scheme for Students](#)
- [Cup Chat](#)
- [Cruiser Time - Questions and Answers II](#)
- [Health Suite](#)
- [Media Center](#)
- [Master Page](#)
- [Parent Connections](#)
- [School Counseling Office](#)
- [Staff email list 2016-2017](#)
- [Student Connections](#)
- [Student Recognition](#)
- [Teacher Connections](#)

**Links**

- [Concussion and Sudden Cardiac Arrest Awareness](#)
- [Download Adobe Acrobat Reader](#)
- [EdLine FAQs](#)
- [FMS PTA](#)
- [Hartford County Public Schools](#)
- [HCP's Food & Nutrition/Cafeteria Menu](#)
- [HCP's Nondiscrimination Statement](#)
- [LifeTouch Photography](#)
- [Meal Benefit Form](#)
- [PARCC Assessments](#)



## APPENDIX I

### Institutional Review Board (IRB) Approval



Date: Tuesday, July 28, 2015

#### NOTICE OF APPROVAL

**TO:** Alexandra Greenwood **DEPT:** COE

**PROJECT TITLE:** *The Structure and Organizational Patterns of Learning Management Systems*

**SPONSORING AGENCY:** None

**APPROVAL NUMBER:** 16-A008

The Institutional Review Board for the Protection of Human Participants has approved the project described above. Approval was based on the descriptive material and procedures you submitted for review. Should any changes be made in your procedures, or if you should encounter any new risks, reactions, injuries, or deaths of persons as participants, you must notify the Board.

A consent form: ☒ is ☐ is not required of each participant

Assent: ☒ is ☐ is not required of each participant

This protocol was first approved on: 28-Jul-2015

This research will be reviewed every year from the date of first approval.

  
Debi Gartland, Chair  
Towson University Institutional Review Board



**APPROVAL NUMBER: 16-A008**

**To:** Alexandra Greenwood  
3123 Chesley Ave  
Baltimore MD 21252

**From:** Institutional Review Board for the Protection of Human Subjects Debi Gartland, Chair

**Date:** Tuesday, July 28, 2015

**RE:** Application for Approval of Research Involving the Use of Human Participants

Office of Sponsored Programs  
& Research

Towson University  
8000 York Road  
Towson, MD 21252-0001

t. 410 704-2236  
f. 410 704-4494  
[www.towson.edu/ospr](http://www.towson.edu/ospr)

Thank you for submitting an Application for Approval of Research Involving the Use of Human Participants to the Institutional Review Board for the Protection of Human Participants (IRB) at Towson University. The IRB hereby approves your proposal titled:

*The Structure and Organizational Patterns of Learning Management Systems*

If you should encounter any new risks, reactions, or injuries while conducting your research, please notify the IRB. Should your research extend beyond one year in duration, or should there be substantive changes in your research protocol, you will need to submit another application for approval at that time.

We wish you every success in your research project. If you have any questions, please call me at (410) 704-2236.

**CC:** David Wizer  
File

## APPENDIX J

## HCPS School District Research Approval



Barbara P. Canavan, Superintendent of Schools  
102 S. Hickory Avenue, Bel Air, Maryland 21014  
Office: 410-838-7300 • [www/hcps.org](http://www/hcps.org) • fax: 410-893-2478

January 7, 2016

Mrs. Alexandra Greenwood  
Fallston Middle School  
2303 Carrs Mill Road  
Fallston, MD 21047

Dear Mrs. Greenwood:

Please accept this letter of approval for your research study. Your approval is contingent upon approval from your school principal and securing permission from parents and guardians of the involved students.

Please ensure that you adhere to the guidelines listed in the Harford County Public Schools Research Application to protect student data. Should you have any questions, please do not hesitate to contact me.

Sincerely,

Phillip E. Snyder  
Supervisor of Accountability

cc: Mr. Joseph Mascari, Principal

## APPENDIX K

### Institutional Review Board (IRB) Annual Review Notice

Towson University Institutional Review Board  
Annual Review Notice

Principal Investigator: Alexandra Greenwood Protocol #: 1606001252

Protocol Title: The Structure and organizational patterns of learning Management Systems

Last Approval Date: 7/28/2015 Expiration Date: 7/27/2016

Principal Investigators are required to assure the confidentiality of all data and any breach of confidentiality must be reported to the IRB.

Project Status (Check all items that apply):

a. **INACTIVE** – no further contact with human participants or records are required:

- ☐ Original data and/or research material have been destroyed  
☒ The linkages between existing data and original source of information have been destroyed. No individuals can be identified from existing data.  
☐ The data with identifiers will be retained – submit a separate memorandum indicating why such data will be retained, where and for how long. Annual reports will be required.

**ACTIVE** – contact with human participants is still required

- ☐ subject interviews are still required  
☐ data are still being collected from records or other sources  
☒ data are still being analyzed  
☒ original procedures for protecting human subjects are still in effect. Attach the current informed consent.

same, no new additions  
to the study.  
archival  
data  
not  
in  
contact  
w/ participants

Yes	No	Attach additional information for all items marked "Yes"
	<input checked="" type="checkbox"/>	Evidence from your experience to date or from recent literature indicates the existence of risks different from those previously described
	<input checked="" type="checkbox"/>	Has the study has been active for three years?
	<input checked="" type="checkbox"/>	Have there been any withdrawal of participants from the research?
	<input checked="" type="checkbox"/>	Have there been any complaints about the research?
385		What is the number of subjects accrued this year?
385		What is the number of subjects accrued since the study began?

Investigator Signature: [Signature] Date: 10/14/16

## CURRICULUM VITAE

Instructional Technology  
 Doctorate of Education, May 2017

### Education

Doctoral Candidate | 2012-present | Towson University  
 Instructional Technology  
 Dissertation Topic: “The Impact of Educator LMS Use on Student Achievement”

Master’s Degree | 2011 | Towson University  
 Secondary Education  
 Master’s Thesis: “The Influence of Current Events as Social Studies Enrichment on Student Achievement”

Bachelors of Science | 2007 | Towson University  
 History / Secondary Education  
 Magna Cum Laude

### Work Experience

General Educator | Harford County Public Schools | 2007 - present  
 Sixth Grade Social Studies Teacher: Daily classroom instruction, lesson design, classroom management, and student relations

National Board of Certified Teachers | 2014 - present  
 Components 1-3 completed for exceptional social studies education: Evaluate, assess, improve, and reflect on personal teaching practices

School Board President | 2014 - present  
 Chair of St. Peter’s School Board: Make employment and salary decisions, write school policies and contracts, and assist with general operations

Pre-Service Teacher Mentor | 2011 – present  
 Mentor pre-service social studies teachers with instructional methods, internship requirements, and course work

### Professional Presentations

“The Immigration Conversation” MSCSS Conference 2017  
 Discussing social justice in the secondary classroom

“BYOT Integration” 2015

Successfully integrating student devices into interactive classrooms

“Tablet Training” 2014

Tablet classroom integration

“Technology Resource Pack” 2013

Developing technological resources to pair with social studies instruction

“Active Inspire in Social Studies” 2012

Using interactive whiteboard in the social studies classroom

“Excel Database Project” 2011

Using Excel to catalog information within social studies

“Introduction to Interactive Whiteboards” 2010

Beginner instruction on the Active Inspire Software

“Learning Through Watching” 2008

Successfully embedding videos into education

### **Professional Awards**

Graduate Fellowship 2016

Fellowship Scholarship

Middle State Council for Social Studies 2016

Teacher-to-Teacher Networking Award

Alumni Association 2013 and 2014

Fellowship Scholarship

Phi Alpha Theta 2004-2007

National History Honors Society

### **Certifications / Expertise**

Advanced Professional Certificate (APC): Maryland State Teacher Certification

Completed Components 1-3 of National Board of Certified Teachers (component 4 in progress)

Possess “Master’s Plus 30 Credits” Awarded

Experience evaluating impacts of k-12 Student Learning Objectives and technology integration

