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The Challenges, Barriers, and Resources in the Integration of Technology in a Department of Transportation Training Program

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Maurice Elliott Jr.

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2019

Abstract

The Challenges, Barriers, and Resources in the Integration of Technology in a

Department of Transportation Training Program

by

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MBA, Texas A&M Commerce, 2012

BS, University of Phoenix, 2011

Project Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Education

Walden University

May 2019

Abstract

A learning management system (LMS) is a software application used in documentation, administration, tracking, reporting, and the delivery of training programs to support acquiring knowledge through practical problem-solving. There is a lack of widespread use of LMS technology in the training of program analysts. The purpose of this qualitative case study was to examine the challenges or barriers and the necessary resources in the use of technology for this training within a Texas Department of Transportation (DOT) and the best practices in the implementation of the LMS technology in the training of program analysts. The usage of Papert's technology constructionism theory with combination with the technology acceptance model as the framework. The research questions concerned the perceived challenges or barriers in using LMS technology in the training of DOT program analysts and the necessary resources integrating LMS technology at the DOT. The implementation of qualitative methodology with a case study research design that involved semi structured interviews of program analysts and educators from a DOT office in Texas. Yin's 5-phased analysis was used for the case study to analyze interview data. Findings indicated insights toward the enhancement effectiveness of the DOT training. Participants spoke about budgetary issues, lack of well-trained experts, and lag in technology. They discussed both physical, human, and informational resources and best practices for the LMS implementation. They believed support staff should have continuous access to information. This study may aid in the development of a suitable training curriculum in DOT for program analysts.

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Section 1: The Local Problem

The Local Problem

Researchers have recognized the integration of technology in the training of employees of transportation agencies as an essential strategy in the development of these agencies. Mitchell, Bausman, Islam, and Chowdhury (2016) posited that those in transportation agencies must have effective and efficient training. However, there is a lack of learning management system (LMS) technology use in the training of program analysts, leading to a lack of widespread use of LMS technology. Leadership within a Department of Transportation (DOT) in Texas used LMS to provide personnel with training material (e.g., Zender et al., 2014). According to a Texas DOT director, the integration of LMS technology in the training of program analysts was not widely implemented, despite the availability of this technology in the department. Leadership at the DOT did not use the LMS technology in the training of program analysts at DOT because of lack of resources and best practices.

Based on monthly data, only 23% of the staff of the Austin Division of the DOT uses the LMS system. Leaders of the Texas site under study were responsible for training divisions in all of Texas. As posted on the DOT website, they provided training for all their employees to improve laterally, vertically, and geographically (Texas DOT, 2018). Compared to other sites, those in Washington, DC had better access to centralized training and resources; those in other sites, such as Missouri, depended on western states, such as California and Washington State, for resources. However, the problem was that Washington DC received all the resources first, and only the excess was passed down to

other states, which resulted in different training protocol, different missions, as well as different outcomes after training. Leadership in Washington, DC received the highest standard of training compared to other states, resulting in employees having different priorities due to a lack of centralized training, which added to the problem of lack of widespread use of LMS technology (e.g., Zender et al., 2014).

Most employees of the Texas DOT relied on <http://www.GoToMeeting.com> for web-conference training development. The Texas DOT director reported that this reliance had a negative impact on the training of staff because staff had to use a system on which they had not received training. The division administrator of DOT also noted that employees often refused to use the LMS system because they believed it unintuitive; they expressed the lack of specific training available, and they believed the system unreliable, expressing they could not access the system for several weeks at a time. Similarly, A. A. Kim, Sadatsafavi, Anderson, and Bishop (2016) reported that leaders and employees across several industries viewed the integration of a technology-based system unfavorably because of a lack of hands-on training.

Leadership may find an LMS as a helpful tool to use in training employees across several industries. According to A. A. Kim et al. (2016), leadership needed to provide effective training for the long-term success of transportation agencies. Researchers have studied leadership using an LMS as a training tool in schools and universities (De Smet, Valcke, Schellens, De Wever & Vaderlinde, 2016). However, the benefits and barriers of LMS' use in the local DOT were unknown. Researchers have suggested that the integration of an LMS in training can lead to positive outcomes, such as improved

problem-solving and more productive learning (Azlim, Husain, Hussin, & Maksom, 2014; Emelyanova & Voronina, 2014; Ingle & Kuprevich, 2016). Moreover, researchers have recognized the integration of technology in the training of employees of transportation agencies as an important strategy in the development of these agencies (S. Islam, Chowdhury, Bausman, Khan, & Mitchell, 2016). DOT employees had to use this technology to complete job requirements, but leadership did not widely use LMS technology in their training because of constant server failure. Employees reported the DOT servers as having slow Internet connectivity when on the network or the LMS. Consequently, the DOT director stated that employees tried to avoid using the LMS to allow faster connectivity to other systems on the network.

Rationale

The training of employees is an essential aspect of the development of transportation agencies in the United States. The findings of this study could inform the practice regarding the benefits, barriers, needed resources and challenges of LMS use in the local DOT, and possibly transportation companies in the United States. González-Gallego, Molina-Castillo, Soto-Acosta, Varajao, and Trigo (2014) stated that the leaders of government agencies should consider the significance of integrating technology in meeting the demands of modern society. According to Christie and Hicks (2017), leaders of the DOT have explored different strategies to enhance standards of the agency regarding the integration of technology in their abilities to provide services to the public. However, even though leadership of the DOT has attempted to implement technology-based practices, employees have often shown resistance. The local DOT director stated

that they might resist due to the lack of technology integration in the current training program in the state DOT. Leadership who offer adequate training in an LMS for DOT employees through professional development might increase the use of such a system.

Although researchers have defined LMS implementation as challenging, they have identified several benefits associated with its successful completion. For example, Azlim et al. (2014) and Emelyanova and Voronina (2014) found the leaders who used the LMS encouraged active learning and supported the acquisition of knowledge through effective problem solving. The findings of this study might provide a framework for the successful integration and execution of an LMS that could enhance training and efficiency in transportation companies. By exploring barriers and challenges experienced by Texas DOT employees through a qualitative inquiry, the findings of this study might indicate solutions for this problem in all U.S. DOTs. The purpose of this qualitative case study was to examine the challenges or barriers and the necessary resources in the use of technology for this training within a Texas DOT and the best practices in the implementation of the LMS technology in the training of program analysts. I sought to address the local problem identified by a DOT director concerning the lack of widespread use of LMS technology in the training of program analysts due to lack of resources and best practices.

Definition of Terms

Department of Transportation (DOT). Congress founded the DOT through an act on October 15, 1966, and the DOT's first operations occurred on April 1, 1967. The U.S. DOT (2015) defined the mission as leaders must "serve the United States by

ensuring a fast, safe, efficient, accessible and convenient transportation system that meets our vital national interests and enhances the quality of life of the American people, today and into the future” (para. 1).

Educators. Janes, Silvey, and Dubrowski (2016) defined an educator to be an individual with a multidimensional role to play, who can also be named an administrator or teacher, with the main goal of educating others. For this study, educators refer to professionals employed in training centers who train program analysts to build their DOT technical knowledge by sharing best-practices and strengthening the fulfillment of the agency’s safety mission.

Learning management system (LMS): An LMS refers to a software application or web-based technology users can utilize for to document, administer, track, report, and deliver training programs or educational courses; educators can include integrated components of e-learning (Ariffin, Alias, Rahman, & Sardi, 2014; Sharma & Vatta, 2013).

Program analysts. According to Jasper (2017), program analysts construct relevant, accurate, timely, and actionable analytical outcomes in the form of analysis, alert, and indicator bulletins. Program analysts follow recommended best practices. For this study, program analysts referred to professionals responsible for making improvements to operations and procedures on rules and regulations. They prepare reports to communicate recommendations by using analytical and problem-solving skills for the DOT.

Significance of the Study

Despite the emergence of technological advancements and the integration of technology by the DOT, researchers have conducted a limited amount of research examining the integration of technology in DOT training of professionals. Budgetary constraints require the DOT to utilize technology to increase the efficiency of training and minimize costs (S. Islam et al., 2016; Mitchell et al., 2016). Therefore, I examined the challenges, barriers, necessary resources, and best practices in the integration of the LMS technology in the training of program analysts in DOT (e.g., Hart, 2014).

The findings of this study might be instrumental in the effectiveness of DOT training because I addressed the challenges associated with lack of resources and best practices. Furthermore, this study might aid in the development of a better training curriculum in DOT for program analysts. Leaders should aim to ensure public safety of DOT leaders; hence, improved training opportunities would positively influence social wellbeing by keeping Americans safe on the roads (e.g., Scriba & Jette, 2017).

Research Questions

There was a lack of widespread use of LMS technology in the training of program analysts in the local DOT due to lack of resources and best practices. Therefore, the purpose of this qualitative case study was to explore the challenges, barriers, necessary resources, and the best practices in the implementation of the LMS technology in the training of program analysts in DOT. I used the following research questions to examine the barriers or challenges experienced in the implementation of the LMS technology in the DOT:

Research Question 1 (RQ1): What are the perceived barriers or challenges to the integration of LMS technology into the training of program analysts?

Research Question 2 (RQ2): What resources do program analysts and educators need to use the LMS technology in their jobs at the DOT?

Review of the Literature

Overview

A. A. Kim et al. (2016) defined effective training of employees as an integral factor in the continuing success of transportation agencies. Moreover, researchers have found leaders should integrate technology into their training programs to aid employees (S. Islam et al., 2016; Mitchell et al., 2016). Although researchers have shown leaders using LMS have achieved positive outcomes in the educational context, information regarding the challenges and barriers of the implementation of LMS in transportation agencies is scarce (e.g., Azlim et al., 2014; Emelyanova & Voronina, 2014; Ingle & Kuprevich, 2016; Mtebe, 2015; Muhametjanova & Cagiltay, 2016).

The purpose of this qualitative case study was to examine the challenges or barriers and the necessary resources in the use of technology for this training within a Texas DOT and the best practices in the implementation of the LMS technology in the training of program analysts. The results of the study might help the DOT in evaluating the current effectiveness of LMS in training their program analysts and help to identify areas that require improvement.

In this literature review, I examine recent research studies regarding the implementation of LMS. The chapter includes the following: I include the conceptual

framework of Papert's (1993) constructionism theory and Davis's (1993) technology acceptance model (TAM) in the first section of this literature review. In the second section, I include background information on LMS. In the third section, I address LMS in the workplace, along with current trends in the organizational setting. Because research regarding LMS and transportation agencies is scarce, I include a background on barriers of the integration of LMS into the organizational setting in the fourth and fifth sections. I also provide an explanation of known resources and practices for successful implementation of an LMS. The chapter concludes with a summary of the literature review.

I used the following online databases for this literature review: Google Scholar, JSTOR: Journal Storage, EBSCOhost, Online Research Databases, Emerald Insight, and Wiley Online Library. I used the following key search terms to find relevant references: *learning management system, e-learning systems, technology in learning, professional development programs, online professional development, technology acceptance, learning management system implementation, and transportation agency training.*

I reviewed most literature (80 of 98 sources) in this review published between 2013 and 2017; therefore, I sourced the information from recent publications. However, because recent research on LMS was limited, I used some older resources with pertinent findings (18 of 98 sources) in the literature review. I also used older studies in the conceptual framework of the study because of the relevance to the implementation of LMS.

Conceptual Framework

I based this study on Papert's (1993) technology constructionism theory and Davis's (1993) TAM. Papert's (1993) technology constructionism theory is classically constructivist, an extension and combination of Piaget's (1980) initial development of constructivism (Fosnot, 2005). According to Piaget's (1980) self-learning theory, educators learn through constructing logical steps based on what they already know and have recently learned. Papert (1993) defined constructionism as “built on the assumption that children will do best by finding (‘fishing’) for themselves the specific knowledge they need” (p. 139). Papert (1993, 1999) stated that learners more effectively gained understanding through using tools to construct knowledge, rather than through conveyance and knowledge acquisition. Papert (1993, 1999) defined constructionism as a process of building knowledge using tools. Leaders can use the process to engage learners, thus resulting in a meaningful and transformational application of learning (Berland, Baker, & Blikstein, 2014).

Leaders based widespread usage of computers in the constructivist-learning environment on Papert's (1999) work. Although addressing the involvement of technology in learning, constructionists did not discount the importance of traditional methods of teaching. However, they maintained that leaders could use educational innovation to develop better methods of teaching (e.g., Papert, 1971a, 1971b). Thus, leadership could use technology as a learning tool to support improvements in teaching, learning, and thinking.

Kafai and Resnick (1996) stated researchers had used Papert's (1993) constructionism theory to explain the integration of technology in education. In the constructionist context, leadership offering increased learning opportunities could promote the use of technology in learning. For example, Wilensky and Reisman (2006) demonstrated that leadership using simulations could enhance learning science, while Buechley and Eisenberg (2008) found that leaders using e-textiles resulted in increased engagement among female students in the field of robotics. Meanwhile, Blikstein (2013, 2014) found that success in training in programming, engineering, and electronics was significantly increased by using technology in the form of constructionist digital fabrication. Blikstein (2013, 2014), Buechley and Eisenberg (2008), and Wilensky and Reisman (2006) defined technology as a medium through which learners could interact and construct their meanings from the information they accessed. Through technology, learners could learn complex content in more connected and meaningful ways.

Davis (1993) developed and tested the TAM from 1985 until 1993. Davis created the TAM model to provide a framework to understand individuals' resistance when using innovative technology. Davis explained that individuals' tendencies to use information technology were significantly influenced by the technology's perceived ease of use and perceived usefulness (Davis & Venkatesh, 1996). Depending on the technology, perceived benefits from use can vary; in the organizational context, Venkatesh and Davis (2000) identified benefits as increased productivity, job performance, and job effectiveness. I used Davis's (1993) theory to show that employees resisting technology could negatively influence the success of organizations, and I used the TAM to

understand the resistance, why the resistance occurred, and the effect of specific technology features.

Researchers have used the TAM to study the behavioral patterns of e-learning system users. These researchers documented the barriers and drivers of the adoption of e-learning in the educational (e.g., Al-Adwan & Smedley, 2013; Alharbi & Drew, 2014; Cheung & Vogel, 2013) and organizational (e.g., Lee, Hsien, & Chen, 2013; Wong & Huang, 2015) contexts. From these studies, findings indicated that if employees perceived e-learning systems as easy to use and beneficial, then they would more likely use such systems (Mitchell et al., 2016).

The instructional principles of constructionism involve generating one's conclusions based on creative experimentation and the creation of social objects (Papert, 1993). Constructionist instructors facilitate learning by serving as mediators during the problem-solving of students. Constructionists emphasize the role of instructors in assisting their students in solving problems and achieving their own learning goals (Papert, 1993). I included educators and program analysts as participants; therefore, I used the constructionism theory to provide an understanding of educators' perspectives, while I used the TAM model to provide a deeper understanding of program analysts' experiences. Leaders could use problem-based learning for students to face situations that would allow the construction of solutions through active exploration, yet there might exist a barrier for program analysts being educated because of new technology.

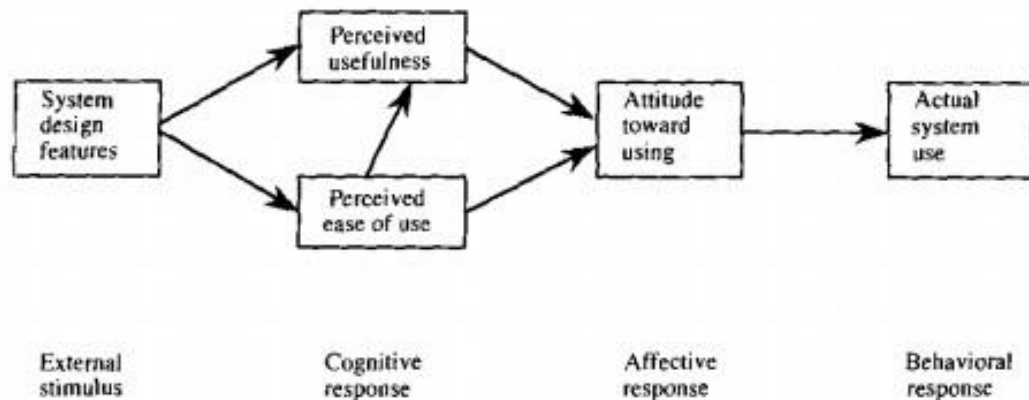


Figure 1. The technology acceptance model. Adapted from “User acceptance of information technology: System characteristics, user perceptions and behavioral impacts,” by F. D. Davis, 1993, *International Journal of Man-Machine Studies*, 38, p. 476. Copyright 1993 by Academic Press.

Papert (1999) integrated constructionism and technology to enhance and facilitate learning. Papert (1999) pioneered technology constructionism through the Logo Learning program, which leaders intended for the instruction of mathematics with the aid of technology. Grounded in Papert’s (1993) technology constructionism theory, leaders can integrate technology to provide learning by trying, exploring, inquiring, and experiencing subjects. I chose Papert’s (1993) technology constructionism theory in combination with Davis’s (1993) TAM as an appropriate framework. I integrated the LMS in the work of program analysts in DOT so these professionals could enhance their work skills and competencies, even though they might also face barriers.

I used Papert's (1993) constructionism theory in conjunction with the TAM (Davis, 1993) to provide an added application of both theories, thereby expanding validity of the theories for future use in educational research. Researchers have used Papert’s (1993) constructionism theory in educational research as a learning theory,

specifically pertaining to mathematics; moreover, researchers have applied the theory as a design theory. Researchers have also applied this theory in technological digital fields (Kynigos, 2015); therefore, I used Papert's (1993) constructionism theory to assist researchers in the future application of the theory.

Researchers have used Davis's (1993) TAM to study implementation of new technology (Park & Kim, 2014). Researchers have shown the TAM as reliable in identifying barriers and benefits for new technology, as well as the process of acceptance for employees (Park & Kim, 2014). I provided an application of these theories in this study.

Learning Management Systems

Reduction in employee productivity, inconstant training delivery, irrepressible training costs increases, and not allowing users to access training anywhere on campus or home are issues when individuals lack technological skills and company leadership does not integrate LMS into their PD training. Leaders use LMSs to enable individuals to learn and connect with society better. Therefore, researchers have taken interest in studying the importance of modern IT applications in education (Delfosse, Jérôme, Detroz, & Verpoorten, 2014; Finger, 2014). They have found that through progressive technological developments in computer software, web applications, and data network bandwidth, electronically based LMS have positively impacted the educational abilities of schools, universities, and corporate training systems (Delfosse et al., 2014; Finger, 2014).

Dahlstrom, Brooks, and Bichsel (2014) defined LMS—also referred to as course management systems, e-learning systems, or virtual learning environments—as “web-based software that is used for the delivery, tracking and managing of education and training online” (p. 20). Popular examples of Internet-based LMS include Moodle, Blackboard, WebCT, and Desire2Learn, which leaders can use to support teaching-learning process in distance, face-to-face, and hybrid/blended forms of instruction (Dahlstrom et al., 2014). Leaders can use these Internet-based applications to distribute educational and professional courses over the Internet, as well as online collaboration among fellow users, which university leaders have widely adopted (A. N. Islam, 2014). Leaders can use LMS to provide educational and instructional services in both synchronous and asynchronous modes, which are accessible anytime and anywhere.

According to Mahmood and Hafeez (2013), web technology, such as LMS, is becoming a popular medium for teaching and learning (T&L) today. Although learners typically learn by themselves, faculties and trainers control courses and programs available on LMS. Creators commonly design LMS for formal instructional purposes; teachers and instructors can create and upload content, communicate with the students, assess their performances, and complete other administrative tasks (Hermans, Kalz, & Koper, 2013). Analysis on LMS has also shown that most of those existing today allow for integration to social media tools, such as wikis and blogs.

Leaders use LMS to provide course management tools for students to use in their learning journeys. Online group chats and discussions, as well as course content, are available in the forms of documents and power point presentations. Sometimes, trainers

may create videos-on-demand, wherein they give short lecture presentations on various subtopics. First, educators can give e-assignments as tasks after every lecture. Like traditional education, instructors set a deadline for such small projects; however, the students must turn in their assignments as an attachment to a message sent online (Mahmood & Hafeez, 2013). Secondly, at the end of each section of the training program, students usually answer tests on the online platform, after which they receive scores through programming recorded on the instructor's system. Lastly, a main part of LMS involves the e-evaluation and feedback. At the end of the training program, summative and formative evaluation forms are automated, and educators ask course participants to give their feedback about the program. Educators note these comments in the administration's system for reference in improving the program for future participants (Mahmood & Hafeez, 2013). Leaders have evolved and improved LMS their use over time in terms of educational content, technological resources, and interaction features; Freire, Arezes, and Campos (2012) maintained that a point of concern for administrations involved the maintenance and continuous improvement of the quality of the interface and the ease with which users employed the system.

Learning Management System in the Workplace

Hong, Tai, Hwang, Kuo, and Chen (2017) noted the growing frequency of LMS in various education programs, including commercial and industrial training programs. Thus, leaders of many organizations have invested a lot of financial and human resources to integrate LMS into their existing infrastructure. Liyanage, Strachan, Penlington, and Casselden (2013) found that many employers from various sectors expressed the

importance of training their employees, which required additional time and effort from organization management. Despite findings that employees and professionals continuously needed professional development, Liyanage et al. (2013) found that employees faced often little or no opportunities in their existing employment. In such situations, leaders could use LMS to create learning opportunities for people in the workplace. Delfosse et al. (2014) and Finger (2014) defined LMS as an innovation in teaching and learning that leaders could use to accommodate every individual's social, financial, and time constraints. Leaders could use e-learning to provide education and professional developmental opportunities for the staff at the workplace.

As markets become increasingly competitive, leaders must employ and maintain competent employees with updated knowledge in their respective fields. Consequently, many organization leaders consider investing in employees' continuous improvement as an advantageous strategy for success (Cheng, Wang, Mørch, Chen, & Spector, 2014). Researchers have examined the effects of LMS in various organizations and found that leaders have used LMS for employees to access information anytime from anywhere (A. K. M. Islam, 2013; Pena-Ayala, Sossa, & Mendez, 2014).

Participants could use LMS to collect resources available to them for self-learning. These resources could include fundamental course materials and supplementary resources; with access, learners can use such resources to gain additional insights into the subject matter (Klotz & Wright, 2017). Developers and users should continually find new ways to use these features and enhance available opportunities to use such technologies (Beetham & Sharpe, 2013).

Researchers have implemented electronic LMS to aid in the professional development of individuals in various industries, such as physicians (Shaw et al., 2014); nurses (Lahti, Hätönen, & Välimäki, 2014); teachers (Gartmeier et al., 2015); and employees from the manufacturing (Hattinger, Eriksson, Malmsköld, & Svensson, 2014; Marjanovic, Delić, & Lalic, 2016), analytics (Dubey & Gunasekaran, 2015), and accounting sectors (Mohammadyari & Singh, 2015). However, despite the advantages from leaders using LMS in the organizational setting, researchers have noted that leaders have yet to realize the full potential of LMS (Mohammadyari & Singh, 2015).

Jaschik and Lederman (2013) studied LMS and found that employees did not use all functions of LMS. Fathema and Sutton (2013) found that faculty members and training instructors only used document uploading, grade posting, and uploading assignment announcements in the LMS. When interviewed about their utilization of LMS, they said that they encountered system problems and design flaws that influenced their decisions to reduce their overall utilization of LMS.

Barriers to Learning Management System Integration

Technical difficulties. In some cases, participants have reported technical difficulties from an LMS having low technical quality. For example, Kooi and Ping (2012) interviewed users of a LMS and concluded that creators should refine and systemize aspects of the system, such as the organization of features and structure of resources. Participants said that outdated content also negatively influenced their intentions to continue using the LMS (Kooi & Ping, 2012).

Researchers have examined the relationship between the implementation of LMS and learning outcomes. K. Kim, Trimi, Park, and Rhee (2012) and Saba (2013) concluded that users reported system quality, information quality, and computer self-efficacy as strongly influencing their system use, satisfaction, and self-managed learning behaviors. These findings indicated similarities with recent studies' findings where participants reported several system issues, such as the suitability of design in screen and system, ease of course procedure, interoperability of system, ease of instruction management and appropriateness of multimedia use, flexibility of interaction and test, learner control, variety of communication and test types, and user accessibility. For example, Li, Duan, Fu, and Alford (2012) suggested that to influence users' intentions to use and maintain LMS, developers should ensure and improve the service and course quality of these systems, as these indirectly influence perceived ease of use and usefulness. Alsabawy, Cater-Steel, and Soar (2013) found comparable evidence showing users facing the absence of IT infrastructure services reported the issue as detrimental to e-learning service success; users had negative reactions in perceived usefulness, user satisfaction, customer value, and organizational value. Similarly, Fathema et al. (2015) found users reported the quality of these features as directly or indirectly influencing their attitudes toward LMS.

In other cases, researchers have demonstrated that technical difficulties might not derive from low technological quality; employees face a lack of clarity and preparation from trainer instructors toward the functionality and usage of LMS. For example, Dabbagh and Kitsantas (2012) found that organization leaders experienced difficulties in

implementing LMS into their existing infrastructures because users lacked the required management skills to use the service effectively. Dabbagh and Kitsantas argued leaders must offer instruction and training in the early stages of implementation. The findings of this study were aligned with those of Mouakket and Bettayeb (2015), who found that the availability of technical support and user training positively influenced users' perceptions of the usefulness of LMS, as well as their satisfaction and intentions to continue using the LMS.

Negative perceptions of staff. Researchers have defined staffs' attitudes about their confidence and skills toward using an LMS as a major factor influencing user adoption of LMS. Li et al. (2012) noted researchers should examine the experiences, perceptions, and initial usage intentions among users of the system prior to implementation. Leaders should consider mentality on LMS as an important indicator of the system's success (Li et al., 2012).

Researchers have defined perceived usefulness as a significant aspect of users' perceptions of LMS that significantly influences how—and to what extent—they use the LMS. Calisir, Altin-Gumussoy, Bayraktaroglu, and Karaali (2014) studied LMS among blue-collar employees. Calisir et al. found that these employees seemed more willing to use a learning management system if they believed it would improve their job performances. Calisir et al. Perceived found usefulness and perceived ease of use by users were influenced by the quality of the LMS itself. Fathema et al. (2015) found that instructors emphasized the system's functions, content, navigation speed, and interaction capability when explaining their attitudes toward the LMS.

Fryer and Bovee (2016) studied 560 instructors and found perceived self-efficacy as a significant factor in determining the integration of LMS into an organization's processes. Participants confident in operating the basic features and functions of LMS perceived these as useful to use. Moreover, they did not experience difficulties using those functions. This finding indicated that confident users were more likely to accept and use LMS than the less confident ones (Fathema et al., 2015).

Studies have shown that users' confidence in their abilities to cope with online tools and resources might change based on opportunities to develop their skills. King and Boyatt (2014) showed that students and teachers needed support to develop skills to effectively use LMS to realize their full potential. This might be indicative of an advantage for individuals who are technologically proficient, as they offer a starting point for better implementing technology into their learning practices. King and Boyatt's findings supported those of Chen, Yang, Tang, Huang, and Yu (2008). Chen et al. compared nurses' and blue-collar workers' attitudes on LMS. Blue-collar workers regularly faced technology and had to use computers in most of their work tasks. Chen et al. found workers had higher levels of self-efficacy and more positive perceptions of LMS compared to nurses, who must learn to operate a computer or the Internet voluntarily and through their efforts.

Lack of needs analysis. A frequent problem among organizations is leaders rarely tailor strategies to implement LMS to the teaching and learning needs of the specific organization employees. Leaders often create strategies to focus on technology and develop these without consultation with the instructional staff and employees (King

& Boyatt, 2014). As opposed to an organization-driven approach, this technology-driven approach is a common barrier to proper implementation of LMS. King and Boyatt (2014) found this lack of pedagogic consideration as a concern to staff, who might adopt autonomous approaches to feel like they operated outside of or in opposition to the institution's core strategy.

J. Kim, Lee, and Ryu (2013) showed that leaders should evaluate staff personality characteristics and learning preferences for organization teachers to improve the primary learning experience of employees directly, as well as to directly address the limitation of information. Moreover, Poulouva and Simonova (2014) found that learners had higher levels of satisfaction when leadership of the LMS employed an instruction method that best reflected employees' preferences and needs. Although leaders of every organization might not have the capabilities of enacting this process, Wang (2014) showed that leaders who created personalized and dynamic lesson and assessment systems for everyone could strengthen learners' learning achievements and reduce their misconceptions about LMS.

Overall, researchers have agreed that ongoing consultation and collaboration with staff can ensure a more coherent and effective training approach to meet organizational needs better. Leaders could obtain a more precise idea about employees' needs; leaders can develop more appropriate strategies, especially tailored to the specific organization (King & Boyatt, 2014).

Necessary Resources for Learning Management System Integration

Technological resources. The system must provide the learner with, at least, the necessary tools for self-managed learning, such as tools for planning activities;

collecting, organizing, and sharing resources; knowledge creation and sharing; reflection; and evaluation (Hermans et al., 2013). Creators of systems must allow learners to foster social interactions between one another. Hermans et al. (2013) identified this feature as enabling learners to identify their instructors and other learners to connect and converse.

Financial resources. Another important aspect of planning for LMS is the cost planning. Organization leaders must consider the integration of LMS among their list of expenses. Researchers have found that a distinct factor that delineated continued initiatives from terminated ones has concerned the availability of financial support to sustain initiatives (McGill, Klobas, & Renzi, 2014). Leaders have found that LMS has often required ongoing financial support. Therefore, those enacting e-learning initiatives require ongoing financial support. Thus, management should review financial factors and adjust other plans accordingly (McGill et al., 2014). Leaders should appropriately compensate trainers and developers for their added contribution to the ongoing maintenance of LMS (McGill et al., 2014).

Human resources. The users of the newly implemented LMS must also receive tools and resources for successfully operating the system. Hermans et al. (2013) suggested training programs for both learners and instructors. Hermans et al. defined human resource as the department of the agency responsible for instructing employees to become users of the LMS.

Adequate user training. Leeds (2014) showed that leadership who used technology could change culture in LMS. First-time e-learners commonly experienced culture shock regarding time, autonomy, and flexibility. Leaders should address these

issues for employees to become better accustomed to new learning arrangements. Moreover, employees usually resist using new technologies and new policies. For example, Ali, Zhou, Miller, and Ieromonachou (2016) stated that leaders could reduce the risk of resistance to LMS by involving employees in initial training on the operation of LMS and ensuring they have made progress learning how to use features, such as interactive learning.

Researchers have also found adequate training as relieving anxiety from first-time usage of a new learning technology, such as an LMS. For instance, Calisir et al. (2014) found that users who lacked enough knowledge in operating computers or the Internet could benefit from such training. Mahmood and Hafeez (2013) established similar findings in which participants with the most successful learnability from LMS were highest when they better understood the various functions of LMS and when they could operate these with little administration problems.

Tay and Low (2017) stated that developers and suppliers usually provided LMS training support in the form of assistance in familiarizing future users with unique features of the system. Sawang, Newton, and Jamieson (2013) found leaders used these initial training opportunities to compensate for employees' low technological self-efficacy, thereby enabling them to adopt the e-learning system more openly and positively influence their intentions of retaining its use.

Instructor training. Baran, Correia, and Thompson's study (2013) identified seven exemplary practices that successful teachers in web-based learning systems should follow: (a) knowing and creating the course content, (b) designing and structuring the

online course, (c) knowing the students, (d) enhancing teacher-student relationships, (e) guiding student learning, (f) evaluating online courses, and (g) maintaining teacher presence. Just effective tutors in face-to-face learning must remain available to enhance learner achievement, effective instructors online must also remain available and present. These educators can check their students' progress, motivate students, and aid students in overcoming difficulties in the lesson. Thus, Chang (2016) found that training instructors using the LMS would significantly strengthen the advantages and minimize the disadvantages of adopting such systems into an organization. Leaders should ensuring that instructors could provide enough consultation and feedback; leaders who offer sufficient instructor training can help learners stay focused, understand the requirements and relevance of their work, and improve their progress and level of competency (Chang, 2016).

Although not a universal concern, researchers who have studied the perceptions of LMS participants have found that several have concerns over the responsiveness of their trainers online (Kooi & Ping, 2012). Researchers have shown that when creators failed to add interactive features in the LMS, many participants' enthusiasm to engage with interactive media lowered. Moreover, they expressed that instructors should post more interesting, relevant, and thought-provoking discussions related to the course objectives. instead of materials indirectly related to the course content to increase the participation rate of the learners (Kooi & Ping, 2012).

Fryer and Bovee (2016) identified that when teachers did not believe in the relevance of the coursework or training they taught, their students might also not find

relevance in the lessons. Fryer and Bovee suggested two ways in which teachers could address this issue. First, teachers should feel involved in the curriculum decision-making process. Second, leaders of the curriculum content should convince teachers of the value and relevancy of current curriculum content. After these steps, instructors could convince the students of the relevancy of their self-study online classes.

Various courses and training programs exist for future e-learning instructors available for organizations to use to ensure that training supervisors and managers of LMS can operate alongside the system in improving employees' professional skills (Lei et al. 2016). Furthermore, instructors must stay significantly recognized and incentivized for this training. Marshall (2013) found that supervisors who trained employees on LMS experienced high workloads but low recognition for their additional work. Therefore, instructors were more likely to perform better and learn more from their instructor training when there was a good training program, when they received sufficient time to devote to this added task, and when it was recognized as an additional part of the job. Leaders can enhance e-learning policies within organizations to help in setting the protocol for these circumstances (Marshall, 2013).

Implications

To gain a deeper understanding of the limited integration of LMS technology, I provided important information to help in the successful integration of an LMS in the training of program analysts in a Texas DOT. The results of the study showed the questions of benefits, barriers, needed resources, and challenges. In the LMS and through

professional development of those who train program analysts, adequate training might increase the use of such a system.

Based on the conclusions, leadership and educators of LMS could develop decisions about the use of an LMS for training and possible technology integration in the instruction of program analysts at a Texas DOT. I designed recommendations for an administrative-supported technology specialist program based on the experiences and perceptions of instructors and program analysts in a Texas DOT. By examining the benefits, barriers, necessary resources, and challenges in the successful integration of LMS in training for program analysts in DOT, I developed a better understanding of the instructional needs of both educators and program specialists.

Summary

In summary, I focused the literature review on the integration of LMS in the organizational setting. A growing body of evidence has shown the benefits of leaders using LMS in organizations, primarily regarding ease of access, flexibility, and cost; leaders of some organizations have difficulties in effectively integrating trainings into their organizational infrastructures. They face barriers to progress due to a lack of planning and preparation, both at the organizational and employee level.

Consistent with the conceptual framework, the lack of planning and preparation may affect employees' perceptions of LMS and become barriers to the successful implementation of LMS. From the literature review, I found that that to implement LMS successfully in an organization, researchers must make a thorough analysis to identify the needs of the employees, and researchers should monitor and maintain progress. All

stakeholders must put in time and effort throughout, and those using the new LMS should have proper training and receive appropriate compensation to encourage adoption of the new technology.

A large body of literature showed the integration process of LMS in organizations; however, there was a gap in practice regarding the integration process, including the factors that facilitated it the process, in the training of program analysts in the Texas DOT. Thus, I aimed to develop a project to address the gap in practice in the local setting of a Texas DOT. By understanding the challenges and barriers, as well as the necessary resources and practices of LMS integration in the DOT, this study's findings might indicate valuable information to human resource directors and executive managers for them to take the necessary procedures to implement LMS in the Texas DOT successfully.

The purpose of this qualitative case study was to examine the challenges or barriers and the necessary resources in the use of technology for this training within a Texas DOT and the best practices in the implementation of the LMS technology in the training of program analysts. I contributed to the existing literature concerning the barriers, needed resources, and challenges of LMS use in a DOT, and possibly transportation companies in the United States. I yielded insights, instrumental to the enhanced effectiveness of DOT training and the development of a better training curriculum in a Texas DOT for program analysts.

I used Papert's (1993) technology constructionism theory in combination with the Davis's (1993) TAM as the framework. I provided valuable information to help in the

successful integration of an LMS in the training of program analysts in a Texas DOT.

Section 2 includes the methodology, research design, participants, data collection, and data analysis in detail.

Section 2: The Methodology

Introduction

There was a lack of widespread use of LMS technology in the training of program analysts in a Texas DOT due to lack of resources and best practices. The purpose of this qualitative case study was to examine the challenges or barriers and the necessary resources in the use of technology for this training within a Texas DOT and the best practices in the implementation of the LMS technology in the training of program analysts. I chose a qualitative method because it allows for the exploration of the subjective experiences or perceptions of individuals from a specific social group without using deductive strategies and tools such as standardized survey questionnaires and statistical techniques (Lewis, 2015; Smith, 2015). Due to using qualitative methodology, finding did not generalize to other populations. However, I found this methodology effective because I wanted to perform in-depth analysis of a phenomenon based on experiences, perceptions, and behavior of participants (Lewis, 2015; Silverman, 2016). I used this methodology to gain an in-depth understanding of the phenomenon. The contents of this section include (a) qualitative research design and approach appropriateness, (b) participants and recruitment procedures, (c) data collection procedures, (d) data analysis technique, (e) limitations of the study, and (f) data analysis results.

Research Design and Approach

A researcher commonly uses a qualitative study he or she deems it suitable to explore a specific phenomenon based on the perceptions of individuals from a

homogeneous group of individuals (Yin, 2017). I collected data through one-on-one interviews about the perceptions of educators and program analysts who used LMS technology. I focused on the implementation of LMS technology in the training of program analysts in DOT. Therefore, I found the qualitative approach appropriate for this research.

The research questions of the study were the following:

RQ1: What are the perceived barriers or challenges to the use of LMS technology in the training of DOT program analysts?

RQ2: What resources do program analysts and educators need to use the LMS technology in their jobs at the DOT?

Based on these research questions, I believed Yin's (2017) description of the appropriate use of a qualitative study applied to this study. I conducted a qualitative research interview (Appendix B) to describe and identify the meanings of central themes of the subjects. The primary task of interviewing is to understand the meaning of what the interviewees say (Yin, 2017). Therefore, I guided my research interviews based on what the respondent said and because I worked directly with the respondent. Therefore, I could ask follow-up questions to determine experience, perception, and perspective of the interviewee, as suggested by Yin (2017).

When using a qualitative design, three types of interview categories may be applicable: informal, open-ended, and closed/fixed-response (Yin, 2017). An informal interviewer seeks general information from each interviewee. The interviewer can use this approach to provide more focus than the conversational approach, while achieving

some degree of freedom and adaptability in getting the information from the interviewee (Yin, 2017). In an open-ended interview, the interviewer asks questions to all interviewees. The interviewer can conduct quick interview sessions that he or she can easily analyze and compare (Yin, 2017). Yin (2017) defined the closed interview approach as the interviewer presenting all interviewees with the same questions and asking participants to choose answers from a set of alternatives; furthermore, Yin defined the approach as useful for novices.

For this qualitative research study, I deemed the open-ended interview approach as the most suitable for data collection and analysis. I asked interviewees the same questions regarding their opinions about the implementation of the LMS technology in the training of program analysts in a Texas DOT. I used follow-up questions to clarify the answers. I asked educators and program analysts from the target group to share their perceptions about the challenges, barriers, and necessary resources concerning the integration of LMS technology in Texas DOT training.

I decided to use a case study design for this study because I focused on interview data from a DOT in Texas. I used a grounded theory to create an abstract method of a process, action, or interaction in the views of participants with multiple stages of data collection and refinement. I created a theory for purposes of understanding phenomena, as based on Creswell's (2013) definition. For time purposes, I did not use grounded theory because of the length required to complete grounded theory research. Furthermore, I was uninterested in creating a theory. Phenomenological researchers find the essence of human experiences and understand lived experiences phenomenon as a

philosophy, as well as a method (see Creswell, 2013). I did not identify LMS as a philosophy through prolonged engagement to develop patterns and relationships. Narrative researchers investigate the lives of individuals and provide stories about their lives (Creswell, 2013). I decided that using this research approach did not fit this study because I did not collect data from participants' experiences. Ethnography researchers study cultural groups in a natural setting over a prolonged period to collect data by observation and interviews (Creswell, 2013). I decided this approach was inappropriate for this research because I did not collect data from a cultural group.

I used a generic qualitative approach to make the study theoretically explicit. I chose a single established methodology but deviated from its intent, rules, or guidelines to benefit the study, as based on suggestions made by Kahlke (2014). A generic qualitative researcher may follow more than one established design to seek discovery, understand a phenomenon, study a process, or identify the perspectives and worldviews of the people involved (Kahlke, 2014).

Target Population

The target population for this study included people with direct knowledge about the implementation of LMS technology in Texas DOT training. Specifically, the target group included educators and program analysts in the division of DOT located in Texas. Although educators train employees on government systems and regulatory items, program analysts implement the systems. Both groups of participants were involved in the implementation of LMS technology. I chose these individuals as the because of their relevant experience and expertise in the implementation of the LMS technology and

training of program analysts in a Texas DOT. They had valuable information to answer the research questions of the study. By considering these individuals as the target population for this study, I gained an in-depth understanding of their perceptions about challenges or barriers, necessary resources, and best practices in the integration of the LMS technology in Texas DOT training.

I included program analysts and educators in this study. I obtained a sample of 10 participants from a population pool of 15 educators and 41 program analysts. I chose an equal number of educators and program analysts. I recruited the sample based on a set of eligibility criteria. According to Merriam and Tisdell (2015), researchers first need to determine the criteria to select his or her participants successfully. Therefore, I selected participants with knowledge in the field explored; therefore, I invited participants to participate in this doctoral study who (a) possessed relevant experience related to LMS technology in Texas, (b) possessed knowledge about the DOT requirements in Texas related to the use of technology, and (c) participated actively in the DOT initiatives of implementing LMS technology. I used the inclusion criteria to identify a homogenous group of participants.

Recruitment of Participants

I recruited participants using purposive sampling. Barratt, Ferris, and Lenton (2015) and Etikan, Musa, and Alkassim (2016) defined this sampling technique as involving a researcher selecting targeted individuals; therefore, I only considered the people who satisfied the requirements of the study. Barratt et al. (2015) stated researchers used purposive sampling in different qualitative studies, especially case studies. Barratt et

al. posited that participants selected through purposive sampling want to provide detailed information about the topic of study because of their familiarity with the topic or phenomena. By using this technique, I targeted and selected participants with the relevant knowledge and experiences about implementing LMS technology in the DOT in Texas.

To begin recruitment, I contacted the DOT Texas division administrator to seek permission to interview the educators and program analysts in the division of DOT in Texas. Upon obtaining permission from the DOT, I asked for a list of names and contact information of educators and program analysts with experiences and qualifications related to LMS technology implementation. From the list, I sent an invitation email to all the educators and 20 program analysts to obtain a positive response from about 10 participants of the target group. I asked those willing to participate to read and sign the informed consent form attached to the invitation email. Those who signed the form sent an email reply to me containing the signed copy. After receiving the signed informed consent, I called the participant by phone to schedule for interviews. I asked for their preferred time and date for the interview.

Ethical Issues and Data Integrity

As a requirement for conducting studies with human participants, the researcher must address ethical concerns as one of his or her main responsibilities (Lacey, Howden, Cvitanovic, & Dowd, 2015). Researchers must ensure that they minimize risks to the participants, and they address issues related to ethics. As the main process for ethical consideration, I presented an informed consent to potential participants. In the informed consent form, the participants learned about the coverage or scope of their participation. I

informed the participants of the potential risks involved upon deciding to participate in the study; however, risks for this study were minimal because the topic did not involve a sensitive issue or a disadvantaged population. The informed consent also included information about procedures for confidentiality and data security, recording of interviews for transcription purposes, the concept of participants as volunteers, and my personal contact information. I only considered those who signed the form and returned the copy to me for interview scheduling.

As part of protecting the participant and before conducting any recruitment of participants and collection of data, I submitted the proposal to the institutional review board (IRB) to seek approval for including human subjects in the research. Merriam and Tisdell (2015) highlighted the importance of obtaining approval from an IRB and protecting participants' identities. Therefore, I did not identify participants in the study. I used pseudonyms instead of participants' real names during data collection, analysis, and result reporting.

I am the only one who knows about the real identity of the participants; I have kept the information confidential. Moreover, I will keep all data and information used for this study safe. I will keep all nonelectronic documents in a locked cabinet inside a home office. All the electronic data are stored on a password-protected flash drive. The flash drive is inside the locked cabinet together with the nonelectronic documents. All electronic and nonelectronic files about the study will be preserved for 5 years after the end of the study. After 5 years, I will burn all the nonelectronic documents, while I will deleted all the stored files permanently from the flash drive containing all electronic data.

Role of the Researcher

My role as the researcher during data collection involved recruiting participants, conducting interviews, and transcribing interviews. To minimize any potential personal bias, I acknowledged that experiences, beliefs, and perceptions with any relation to the topic of the study must be written and disclosed. In this manner, I remained aware and cautious of the possible sources of bias when collecting data and developing interpretations of the study. To minimize conflict of interest, I did not include any family members, relatives, coworkers, or peers as participants.

I conducted face-to-face interviews with participants at a DOT in Texas. I stayed objective. Therefore, I collected data from departments where I had no fulfilled role as a supervisor or manager. At the time of this study, I worked as a program manager who oversaw safety data information from commercial enterprises that used American highways to transport goods and services. Prior to the study, I did not establish relationships with the participants. A researcher must avoid bias in his or her research because to ensure validity and reliability of the study's discoveries (Creswell, 2013). I formed a working relationship with the division administrator, assistant division administrator, and federal program specialist who permitted me to access the site.

As a witness to the death of a family member caused by a commercial motor vehicle because leaders did not redesign roads to accommodate large vehicles, I could recognize when a government agency does not have the training or resources to prevent crashes effectively. I witnessed the effects of gaps in training that could have reduced accidents on the highway. Therefore, I might have bias because of personal and

professional experiences. Consequently, Creswell (2013) suggested that during the data collection process, researchers should use member checking and peer debriefing to eliminate any prejudice or bias from the research project. Therefore, I used member checking and peer debriefing. Furthermore, to avoid opportunities for coercion to participate, I recruited respondents through the office of the administrator; I used the list supplied by the administrator to recruit participants.

Instrumentation

I used semistructured interviews as the main data collection technique for this study (Appendix B). According to Jamshed (2014), researchers commonly use semistructured interviews to solicit data collection in qualitative studies; therefore, I used this process to enable my research participants to narrate their experiences freely regarding technology integration. Because I conducted semistructured interviews, I acted flexibly regarding exploring the topic of the study by asking follow-up interviews. Researchers have conducted different case studies using semistructured interviews to collect data from the participants (Jefferies, Brewer, & Gajendran, 2014; Trompette, Kivits, Minary, Cambon, & Alla, 2014). In this manner, I facilitated in-depth data collection. I needed such in-depth data collection to address the research questions of this study comprehensively.

Data Collection

I used a guide to conduct semistructured interviews (Appendix B). I also used interview questions designed to answer the research questions. I based the interview questions on literature to fulfill the purpose of the study (e.g., Kallio, Pietilä, Johnson, &

Kangasniemi, 2016). I designed each research question to have at least three corresponding items in the interview guide to ensure the instrument was enough in addressing the research questions of the study. Through the interview guide, I kept the structure and alignment of the topic of the questions to the topic of the study, as suggested by Kallio et al. (2016). However, because I conducted semistructured interviews, I asked follow-up questions related to the topic. Through the follow-up questions, I could seek clarification of every answer.

I conducted the data collection interviews based on an interview guide. I conducted interviews inside a small conference room at the workplace of the participants. Each interview lasted for 30 to 45 minutes. I recorded all interviews electronically with the participant's permission through the informed consent. I began the interview by discussing an overview of the topic and the flow of the interview. I then asked open-ended questions based on the interview guide. For each answer of the participant to the main question, I asked a maximum of three follow-up questions to obtain comprehensive information about the phenomenon. Once I finished, I allowed the participant to ask any question about the interview or give relevant comments.

Data Analysis

I used Yin's (2017) following five-phased cycle for coding study data: (a) compiling, (b) disassembling, (c) reassembling, (d) interpreting, and (e) concluding. During compiling, I organized the interview data. I analyzed data using the NVivo software as a tool to perform coding for the voluminous data collected for this study. In the first phase of analysis, I checked if all data were complete and valid before including

these as a valid response to the study. I loaded all transcripts, in Microsoft Word format, to the software to facilitate analysis. Additionally included in the first phase, I read the transcripts at least two times to become familiar with the data.

After familiarization, I performed disassembling. I broke down data into smaller codable units, such as relevant words, phrases, sentences. I determined the relevance based on the direct relationship that the codable unit had with the research question of the study. I assigned new labels or codes to each of the relevant words, phrases, and sentences.

In the third phase, I clustered similar codes into distinct groups to develop relevant themes, as based on Yin (2017). I labeled each theme. I also had at least three iterations of theme development; I determined the major themes based on the most frequent or persistent theme from data. In the fourth phase, I used thermalized data to develop a narrative or report to discuss the overall interpretation of data. In the fifth phase, I developed conclusions and presented recommendations based on the findings based on Yin's (2017) stages.

Accuracy and Credibility

Findings from qualitative studies must be accurate and credible. For instance, data should indicate the true feelings of the respondents (Creswell, 2013). Therefore, I ensured data remained accurate, credible, and sensical. I recruited a sample of 10 educators and analysts from the target population of 15 educators and 41 program analysts.

In qualitative studies, researchers base the minimum sample size requirement on the point of data saturation (Fusch & Ness, 2015; Tran, Porched, Tran, & Raved, 2016).

Tran et al. (2016) defined the point of data saturation as achieved when any additional data set to an existing pool of coded data that did not generate significantly different information. According to Creswell (2013), collecting at least six participants with the correct characteristics is enough to reach the data saturation point. Therefore, I determined data saturation point for the participants by coding the first six interview data for the group. I noted the number of codes generated and the number of occurrences or frequencies of each code. I coded data from one more interview until the addition of one interview failed to change the number of codes and frequency of code occurrence significantly. I then computed the check for the number of codes and frequency of code occurrence. I only stopped after the changes in the number of codes and frequency of code occurrence resulted in less than 5%. At that point, I reached data saturation. Therefore, I deemed 10 participants as enough to reach data saturation.

Limitations

Limitations refer to weaknesses of the study that a researcher cannot control (Yin, 2017). However, I addressed these limitations to minimize the unwanted effect these could have on the findings of the study. The major limitation of the study was the focus on educators and program analysts in Texas, thus minimizing the generalizability of the findings. To address the lack of generalizable findings, I improved transferability. I provided a comprehensive discussion of the different procedures implemented for this study. I followed this process so future researchers can replicate the study. Moreover, I provided an overall and complete discussion of the findings in a report to allow readers

and future researchers to determine the transferability of procedures and methods implemented in the study.

Another limitation of the study was that the honesty of the participants with their answers could not be fully ascertained. The main source of data for this study involved participants' answers to the interview questions. Therefore, I always reminded participants to answer questions truthfully and completely.

Data Analysis Results

I aimed to investigate the barriers, needed resources, and challenges related to the implementation of LMS technology in the training of program analysts in a Texas DOT. I analyzed qualitative data using Yin's (2017) five-phased cycle approach. More specifically, I used semistructured interviews to collect data from 10 educators and program analysts in a division of DOT in Texas to address the main research questions:

RQ1: What are the perceived barriers or challenges to the use of LMS technology in the training of DOT program analysts?

RQ2: What resources do program analysts and educators need to use the LMS technology in their jobs at the DOT?

In the following sections, I detail the themes and subthemes from this analysis.

Demographic Characteristics

Ten individuals currently working with DOT participated in the study. Five identified as educators, and five identified as program analysts. Most had at least some experience with LMS technology. Participants worked at DOT between 2 and 15 years (see Table 1).

Table 1

Demographic Characteristics

Participant	Position	Education	Prior Experience	Years of experience
Aaron	Educator	BA in Adult Education	Continual education at Austin Community College	11 years
Andromeda	Program Analyst	BA in Psychology; graduate certificate in Financial Crimes and Compliance Operations	Online webinars for training purposes during annual training	4 years
Christy	Educator	MA in Human Resource Development & Management and Leadership	Administrator and User	4 years and 3 months
Daniel	Educator	MA in Nursing	Online webinars for training purposes during annual training	5 years
Erin	Program Analyst	BA of Art	None	2 years
Ester	Educator	BA of Business Administration-Accounting; Certification in Administrative Management	Online webinars for training purposes during annual training	6 years
Jacinda	Program Analyst	BA	None	3 years
Sandra	Program Analyst	None	Online webinars for training purposes during annual training	15 years
Thomas	Program Analyst	MA in Accounting	Online classes at University of Florida.	9 years
Tressica	Educator	BA, Associate Degree	Online classes at University of Florida.	15 years

Major Themes and Subthemes

Three major themes emerged from the analysis of the semistructured interviews: barriers, needed resources, and challenges. The theme of barriers indicated the participants' perceptions of the major problems in the implementation of the LMS technology. Participants identified the lack of budget, experts, and skills among the intended users; a lag in technology; poor content of online instructional materials; and the lack of a systematic approach as major challenges for the LMS implementation.

The theme of needed resources indicated participants' beliefs about what resources were needed for successful implementation of LMS technologies. They particularly spoke about the need for updated technology, well assembled and well-coordinated teams of educators and technical support staff, and continuous access to broad informational resources.

Finally, the theme of challenges indicated participants' perceptions of the most effective practices in implementation of the LMS technologies. Participants acknowledged a careful content design, selection of more user-friendly technologies, and employment of a systematic approach as the most effective implementation strategies.

Figure 1 depicts these themes and subthemes.

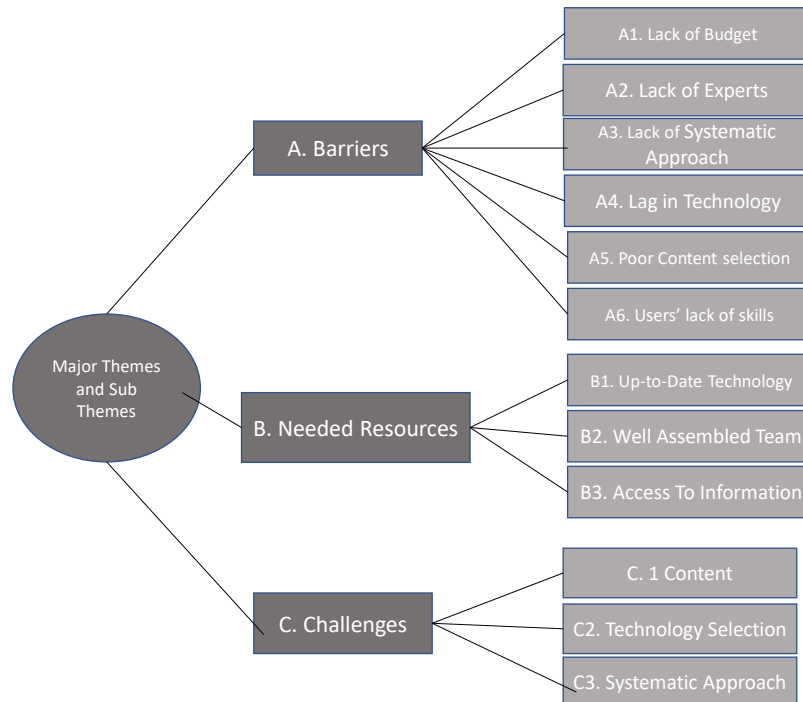


Figure 2. Major themes and subthemes.

Major Theme A: Barriers. The theme of barriers indicated typical problems that study participants believed they had encountered during the LMS implementation. Participants identified the lack of budget and the lack of experts as major challenges for the LMS implementation. They also believed that leaders of the DOT did not have the up-to-date technology, and the content of online instructions and materials was poorly selected, thereby making it harder for individual users to navigate their way through LMS modules. Participants also pointed out that leaders implemented different components of LMS in a disconnected manner. Participants believed that such nonsystematic approaches generated unnecessary difficulties for both support staff and intended users. Finally, participants commented that the lack of skills among the intended users obstructed the LMS implementation (see Table 2).

Table 2

Major Theme A, Barriers

Subthemes	Participants	References
Lack of Budget	5	6
Lack of Experts	5	7
Lack of Systematic Approach	6	8
Lag in Technology	9	16
Poor Content Selection	5	11
Users' lack of Skills	3	3

The first subtheme to emerge from the data was the lack of budget, which indicated that participants believed that the lack of funds a major barrier in LMS implementation. Five participants specifically used the word “budget” when responding to the question about major barriers. They recognized that the LMS implementation involved a substantial investment in technological time and human resources, which were likely to be costly, and thus not necessarily financially feasible. For instance, Daniel explained that the “cost of development and integration of the LMS technology might be a barrier during the initial process of set up.” Participants also recognized that budgetary constraints were likely to influence effectiveness of the LMS program after the initial setup. For example, Tressica noted, “The agency budget issues limit the capabilities of more effective training systems.”

From the data analysis, the second subtheme was the lack of experts. Five participants expressed the belief that the DOT did not employ enough technical support employees with the expertise necessary for LMS technology implementation. For instance, Aaron commented, “We, at the DOT, have no real subject matter experts or no

Prior instructional design knowledge has been the biggest challenge and barrier to receive quality training and integration with innovative technology.”

Due to the lack of appropriately trained technical support, Esther replied that they often perceived the LMS implementation as “unrealistic” and hard “to integrate [...] for training staff.” Participants also did not think leaders could train the technical support staff with available resources. Daniel observed, “With limited staff and boring annual training, the LMS is just not fun to do and more of a headache to use.”

The third subtheme that emerged from responses of six participants was the lack of systematic approach. This subtheme indicated participants believed the leaders of the DOT did not plan the implementation of the LMS technology in a systematic manner, which was important for such an ambitious undertaking. Participants believed that the DOT effort tended to be fractured, inconsistent, and limited in scope. For instance, Esther believed, “All online training is half-baked so limited to no resources will be in our online category.” Because of the apparent lack of an overall vision, educators of the LMS training courses did not address diverse needs of different departments of DOT. For example, Sandra thought that because “Department of Transportation has about 22 or 24 different agencies [...], it will be impossible to provide agency related specific training;” therefore available trainings were very general and of limited efficacy.

Jacinda posited that another consequence of DOT’s lack of systematic approach was leadership has not thoughtfully designed the LMS training to fit into existing operations. She shared,

What I find undesirable isn't any time allotted for self-paced training. We have a deadline to complete a certain training but are not given time to block out for the training, at least that is the case in my division.

Therefore, Andromeda said that "workload and training schedule deadlines" became difficult to balance. She also noted, "Completion of course not accurately reflected in the software." Furthermore, leadership had not updated available technical support in line with the needs of the LMS implementation. For instance, Esther said, "We do not have a direct training department that only manage an online learning context." These comments indicated participants' beliefs that leadership at DOT did not approach the LMS implementation in a systematic and coordinated manner.

The fourth subtheme that emerged from comments of nine participants was the lag in available technology. This subtheme indicated participants' opinions about how technological challenges influenced the LMS implementation. For instance, Tressica identified "computer use, Internet and training opportunities" among the most important technological problems that influenced the LMS implementation. Other participants identified these difficulties as well. Daniel commented on the "lack of computer availability" and difficulties with software design: "The software crashes a lot without any save feature." Erin admitted frustration that users' computers often could not reach content because of the ineffective network. For instance, she said, "It can be difficult to log into the system (it can be down). At other times, [she] may start a training, come back to it, and it has difficulty opening back up to finish." Jacinda admitted to sharing Erin's frustration: "The network is not very reliable. The system is very unstable and [...] has no

save points.” Esther raised another technological concern. She noted, “Some systems are not compatible with MAC computers or not supporting other applications.”

Thomas produced a list of common technological problems that effectively summarized concerns of other study participants. He spoke about “weak connectivity,” “limited number of computers,” “the user’s interface [being] old, like 1990’s old,” and outdated software interface: “Plus, you have click the keyboard for all your answers and not point and click like everything else these days.” He also added the following:

The main technical challenge I foresee is that the agency is getting larger and with more employees, there are more individuals need to be connected to the training program. We are a small agency so I can see the system crashes because the servers run both the LMS and other online programs we used to do our job at work.

The fifth subtheme from the data analysis indicated yet another barrier for the LMS implementation. The subtheme indicated opinions of five study participants that the content of online materials was poorly selected. For instance, Andromeda thought that the “training content [...] is very limited and the items that are presented are lackluster.” Christy thought that courses could be too long, and these might require “too many steps to complete a task.” At the same time, they did not find the training “relevant,” as Sandra stated, “The system is very limited and course that are available do not adhere to my job duties.” She further explained, “Most of the training we receive are subjects such as Active Shooter training or How to use government computer safety to avoid hackers but nothing on regulations or job improvement courses.” Thomas also argued that “more job

specific training or education is needed to utilize the LMS technology” and that the existing “system is very difficult to use and not user friendly.”

The next subtheme, users’ lack of skills, indicated the opinions of three participants that many intended users of the LMS technology often lacked the skills and knowledge base necessary for LMS use. Daniel stated, “One barrier that comes to mind is the level of computer savviness for the trainees. Trainees with limited computer ability might have some difficulty using the technology during the training.”

Some participants specifically commented on how heterogeneous these skills were across generational groups. For instance, Tressica thought that “the age gap between younger and older employees” could contribute to the barriers in the LMS implementation. She explained, “Younger employees are more willing to adopt while old folks like me kick and screen not to adopt.” Consequently, the LMS adoption could become individual based rather than institution based, which was likely to influence its overall effectiveness.

Overall, participants recognized that the LMS implementation was a challenging task and noted a broad range of potential barriers from system wide factors (e.g. budgetary considerations, lack of appropriate human and technological resources) to individual factors (e.g. individualized content of training courses and individual skills and knowledge). They further discussed necessary resources and best practices to address these issues, as reflected in the subsequent two major themes.

Major Theme B: Needed resources. The second theme, needed resources, showed opinions of eight participants about resources critical for successful LMS

implementation. Within the first subtheme, up-to-date technology, participants described technological resources that could make it easier to adopt the LMS (see Table 3).

Table 3

Major Theme B, Needed Resources

Subthemes	Participants	References
Up-to-date Technology	8	12
Well Assembled Teams	9	16
Access to Information	7	16

Eight out of 10 participants thought that moving from desktop-based sources to tablets and iPad-based courses could make it easier for employees to use them. As Aaron said, “Table[t]s and iPad are simpler to use than desktops or laptops.”

Daniel thought that better and more “appropriate infrastructure and software is needed to utilize the LMS technology.” Tressica agreed that better “computer use and Internet capabilities” were important for the LMS implementation. Thomas similarly noted, “Technical challenges would include having a well-built technology infrastructure for the LMS technology, but we don’t.” He thought that if the available system was not updated, that it “crashes often or is down for updates or it just do not connect to the servers.” In his and seven other participants opinions, leadership should have current and well-functioning technology.

The second subtheme, well-assembled team, showed the opinions of nine participants. They believed in the importance of having a thoughtfully selected, trained, and coordinated team of experts and technical support staff who could facilitate LMS adoption. The participants thought that face-face-to-face, continuous interaction with a

support team was critical for the LMS implementation. For instance, Aaron explained the following:

If we can hire an expert with a great personality and a strong work ethic barriers and challenge can be solved today and we can build on that success. With instructional design knowledge, we can all provide online resources that can allow use to brush up on the basics and provide quality LMS.

Andromeda similarly thought that the most important starting point was to assemble the core team, “which includes a team lead, project manager, eLearning technology specialist, training administrator and IT and establish an implementation timeframe.” Cristy agreed, “The best practice [...] is to set up a team that dedicated to integrating LMS. An ideal team would comprise of both the stakeholders and the IT team to make the transition smoothly.” She explained that such team could keep “the process aligned with the outlined problems and find solutions to better integrate LMS technology.” Daniel added that employees needed to have continuous access “to support and additional explanation/details as needed.”

Esther thought that it would be practical to have a department dedicated to the LMS adoption. She suggested “having a department that focuses on online training of program analysts.” Sandra added, “Educators must be subject matter experts.” Tressica agreed, “Educators and IT professionals need to work hand in hand with the IT systems when it comes to systems integration.”

The third subtheme, access to information, showed opinions of seven participants that both technical support and targeted users needed to have easy access to information

about the technology that they had to use as a part of the LMS implementation, including detailed manuals and information about the updates. For instance, Aaron commented that “staying up-to-date with modern tech by allowing every year to bring new tech tools, gadgets, and software that we can use for our eLearning course design” was critically important for the implementation process. He thought that both users and tech support staff needed to

attend tech conferences, eLearning events, and trade shows. The agency needs to give us access to articles so we can read up on apprenticeships and watch video reviews of the latest and greatest technologies. This will give us the opportunity to stay up-to-date with modern tech for eLearning and enhance our learning library.

Similarly, Cristy argued for “continued education and updates on advancements in the field of training technology.” Daniel explained, “Regulations and updates on policies change quickly so it would be wonderful if training can keep up with the changes.” Esther agreed with Daniel that “updates on policies, regulations, and new industry issues that effects agency. It will better prepare program analysts to interact with companies, drivers, and customers.” Jacinda added, “Training for program analyst should be at least twice a year as a group to allow group discussion and hands-on training.”

Overall, these comments indicated that up-to-date technology, well assembled and available transition and support team, and continuous access to information on use and development of the LMS technology were critical for the LMS adoption resources.

Major Theme C: Challenges. Within this final major theme, challenges, participants discussed how LMS technology should be implemented in the most effective

way. Within this theme, participants spoke about a content selection for the online materials, about technology selection, and about adopting a systematic approach to the LMS implementation (see Table 4).

Table 4

Major Theme C, Challenges

Subthemes	Participants	References
Content Selection		
Accessibility	7	10
Engagement	4	13
Interactivity	7	18
Personalization	7	12
Technology Selection	5	7
Systematic Approach	3	4

The first subtheme within the challenges theme was a content selection; this subtheme indicated participants' beliefs about how to select the content for the online training and support materials. They particularly commented on the following four factors: accessibility, engagement, interactivity, and personalization.

The subtheme, accessibility, showed the opinions of seven participants that the content had to be presented in a simple and concise manner. Tressica noted, "The system is very cumbersome and sometimes the search menu is pretty much useless sometimes." Aaron, Daniel, and Erin agreed with Tressica that the system must be made more user-friendly. Aaron said, "Just make it simple and create content that employees will enjoy by creating greater experience." Daniel agreed that about the importance of simplifying "LMS while making it more user friendly and informational." Erin thought that making courses short and concise was critical: "Training can be improved if the courses were

shortened in order to increase the probability of remaining focused and allowing the individual being trained to maintain the information.” She also thought that accessibility could be improved through “additional support.”

The subtheme of engagement showed thoughts of four participants on how online course materials could be made more interesting and engaging. Aaron discussed this point in detail:

I can affect the training program if I can keep them actively engaging in the eLearning experience. I provide them with an interactive and immersive eLearning course that includes their interests and aligns with their goals because the perceptions are that LMS courses are throw away courses that are mandatory.

Andromeda agreed that it was important to “present content in a way that keeps the attention of the audience in which the training is intended.” She also added that “content, presentation and job specific training with a quiz at the end to ensure the information learned is being reinforced.” Esther thought that eLearning should target individuals with different learning styles: “I tend to learn visually. I am more engaged when illustration is being presented and it fits my needs.” She also suggested using “computer base training modules, presentations, video, and feature demos.” Overall, the comments indicated participants’ opinion that the learning should be made a more enjoyable experience for the user by shortening time to task, increasing efficiency, and reducing redundancy.

The next subtheme, interactivity, referred to the opinions shared by seven participants that users must actively interact with the online materials and technical

support staff. Jacinda noted that in its current form, “LMS is not interactive enough and I lose interest.” Aaron posited, “If we can develop branching scenarios, simulations, and serious games that include the key takeaways, our learners might actually find the eLearning experience enjoyable.” He shared that he tried “to give each course value which will allow them to actively participate.”

Daniel agreed that “training can be more interactive and intuitive to help information retention.” Erin added, “Having access to a live individual, or at least another source to provide additional, clearer information if needed.” Ester suggested, “On-going training would be helpful, this would include dummy accounts to allow the user to become familiar and comfortable.” Tressica also advocated for “on training opportunities and interactive video.” These comments indicated the shared opinions of the study participants that the online teaching material needed to be interactive.

Finally, subtheme personalization indicated the opinions of seven study participants that leaders should create online teaching materials to target the individual needs of targeted users. For instance, Aaron contrasted the needs of users of different age groups: “One challenge we have is trying to create content with two or three different generation, from Baby Boomers to Generation Z.” He explained it in more detail:

It has been extremely difficult to overcome because older generation rather do traditional classroom training while younger generations welcomes more online and distance classroom training. We find ourselves trying to create a learner personas so that all employees are able to customize the eLearning content based

on their experience level and tech-savviness but our outdated LMS keeps us from overcoming this challenge.

Tressica agreed that different versions of the program should target different age groups: “Provide Training Videos for step by step procedures would be grateful, especially for people my age who are not as computer savvy as the younger employees or Millennials Generation.” She also thought that leaders should let the users proceed at their own pace: “It may enhance training/learning opportunity and learning availability to have self-paced training program available.”

Ester posited, “Personalization of an LMS would allow me to feel more comfortable.” Sandra thought that personalization should also target needs of people from different position. Sandra stated, “The real challenge is actually making the training related to what program analysts actually do day to day.”

Subtheme technology selection showed the opinions of five participants on the importance of selecting the right technology for the LMS adoption. Daniel stated that, generally, “technology and infrastructure must be up to date.” Other participants were more specific in their recommendations. For instance, Aaron said, “Try to create courses on tablets and iPad because people are more comfortable using those than computers. Tablets and iPad or simpler to use than desktops or laptops.” Christy also advocated for “training to be used on iPad since most people believe that the user interface is more intuitive.” In addition, Esther suggested that “cloud base could be useful in allowing the user to access content from anywhere in the world.”

Subtheme systematic approach showed the participants' opinions that the elements of the LMS adoption could not be implemented in a disconnected manner. Three participants supported a broader systematic approach to this task. Andromeda explained, "The implementation phase should consist of planning, LMS configuration, systems integration, course and data migration, user acceptance testing and system rollout." Tressica agreed, "The problem is we have so much wonderful ideas but are poorly integrated because IT was not involved in the beginning. This help keeps projects realistic and goals obtainable."

These comments were in line with opinions of other study participants who discussed the importance of using an integrated approach. Esther commented on some essential components of this integrative process: "Support is very necessary. Resources that will lay the foundation for the LMS system would include a budget, a team of computer programmers that would continually monitor, analyze and improve it for the user." Fractured implementation of different components of the LMS system would likely make it less effective and lead to unexpected and unnecessary problems for the users. According to participants, system-wide integrative implementation of the LMS might lead to more initial investment in terms of time and effort; in the long term, it would definitely have benefits to the employees.

Overall, participants emphasized that for the successful LMS adoption, leadership should carefully design the content. Leadership should make content more accessible, interactive, engaging, and individualized. They should remain mindful of the newest and

most user-user-friendly technology, and they should invest in the beginning by using a step-by-step, integrative, system-wide implementation plan.

Summary

I aimed to investigate the fits, barriers, needed resources, and challenges related to the implementation of the LMS technology in the training of program analysts in a Texas DOT. I conducted a qualitative analysis of 10 semistructured interviews of educators and program analysts in the division of a Texas DOT to address two research questions of the study:

RQ1: What are the perceived barriers or challenges to the use of LMS technology in the training of DOT program analysts?

RQ2: What resources do program analysts and educators need to use the LMS technology in their jobs at the DOT?

Regarding RQ1, participants listed several factors as significantly hindering the LMS technology adoption. They spoke about budgetary issues, lack of well-trained experts, and lag in technology. They expressed concern about the lack of systematic and integrative approaches to the LMS implementation, and they discussed problems related to poor content selection and users' lack of skills and knowledge.

Regarding RQ2, participants discussed both physical, human, and informational resources and best practices for LMS implementation. Participants believed leadership should use up-to-date technologies, carefully assembled technical and educational support teams, and systems that provide continuous access to information. They also emphasized that leaders should carefully design the content of the courses to ensure the

content was accessible, engaging, interactive, and personalized. They further discussed how to select the best technology for the online courses, and they argued for the initial investments of money, time, and efforts for careful design of the systematic implementation plan.

Section 3: The Project

Introduction

In this section, I describe barriers and challenges experienced by Texas DOT employees through a qualitative inquiry. I discuss the goals and rationale for the qualitative case study and a literature review. I based this project deliverable (an evaluation report) on a qualitative case study (see Appendix A: The Project). I relied on one-on-one interviews about the perceptions of educators and program analysts who used LMS technology. I included program analysts and educators in Texas as participants. I analyzed barriers, needed resources, and challenges related to the implementation of the LMS technology in the training of program analysts in a Texas DOT.

I present recommendations for improving better training curriculum in DOT for program analysts. I include perspectives from program analysts, trainers/instructors, learners, and management to show the unique roles of each group (see Appendix A). Additionally, I present recommendations to provide necessary resources in the implementation of LMS systems for trainers and program analysts to use LMS technology in their jobs in the DOT.

Description and Goals

In this subsection, I provide the project's purpose, criteria, and major outcomes. I introduced the program analysts in DOT to the DOT educators to train the program analysts. I provided contact information, instructional manuals regarding LMS systems specific to their jobs, a training session on LMS technology, content delivery training, hands-on training, and some time to use the LMS system. DOT educators and program

analysts recognized the need for additional training support to increase the effectiveness of using LMS technology in DOT initiatives. Participants outlined perceived barriers or challenges to using LMS technology in the training of DOT program analysts. I asked participants about resources needed by program analysts and educators to use LMS technology effectively in their jobs at the DOT.

I used data analysis to inform the training evaluation results and suggestions for improvement. I based The Evaluation Report (see Appendix A: The Project) on findings derived from participant responses and relevant research on barriers or challenges of LMS technology training programs. The report derived from interviews of participants containing the results of perceived barriers or challenges to using LMS technology in the Texas DOT training programs for program analysts. I used the feedback from program analysts and educators and relevant literature about the development of LMS technology to guide the recommendations within The Evaluation Report. The report included a recommendation for components to improve the training program for LMS technology and the implementation of the LMS technology in the training of program analysts in the DOT.

Project Goals

Leaders using LMS technology could yield lowered costs, increased flexibility of learning in terms of place and time, convenience of centralized learning, and the encouragement of self-management. However, results from the interviews indicated several barriers and challenges. These included budgetary issues, the lack of well-trained experts, and the lag in technology. In addition to these findings, participants

acknowledged a lack of systematic and integrative approach to the LMS implementation; they demonstrated problems related to the poor content selection and the users' lack of skills and knowledge.

I aimed to minimize present barriers and challenges but maximize the opportunities in training programs of DOT program analysts by providing feedback on challenges or barriers, necessary resources, and best practices in integrating LMS technology in DOT training to enhance using LMS technology in their jobs at the DOT. I anticipated administration could use the report at the Texas DOT in assessing administrative competencies and being more knowledgeable about training support for DOT program analysts to enhance using LMS technology in DOT. Finally, DOT administrators and trainers could use the suggestions and findings in the report to develop, implement, and assess training program components to minimize present challenges and barriers in LMS technology, while maximizing potential opportunities and benefits of LMS technology. DOT administrators and trainers could use the perceptions of the challenges and barriers in LMS technology data to identify training program opportunities. DOT administrators and trainers could use data to address the need to increase and enhance using LMS technology in DOT. They could create learner-centered learning and personalization for employees and learners. Leaders could provide DOT program analysts with support outside of the administrative team by training mentors and coaches in that support. Leaders could increase trainers' capacities to notice, analyze, and respond to program analysts' thoughts (including their perceptions in LMS challenges and barriers) through observations in the course of the training, pre and postplanning

sessions, feedback provision, and intentional coaching by trained facilitators and mentors. Leaders could give program analysts varied instructional strategies training for development in using LMS technology.

Rationale for the Project

Researchers demonstrated the benefits of leaders implementing and integrating LMS in the organizational setting (Fryer & Bovee, 2016; S. Islam et al., 2016; Kooi & Ping, 2012), yet a gap existed regarding implementing LMS technology in the training of program analysts in the local DOT of Texas. According to literature, the rationale for this issue was due to lack of resources and best practices; moreover, researchers found lack of planning, preparation, and training at the organizational and employee level as issues (Chang, 2016; Hart, 2014; Lei et al., 2016; Marshall, 2013). According to findings and literature, leaders who did not provide proper planning, preparation, and training for LMS technology in organizations influenced employees' perceptions of LMS; hence, they became barriers and challenges to the successful implementation of LMS. Previous researchers who have explored and investigated the lack of planning, preparation, and training for LMS technology (Chang, 2016; Lei et al., 2016; Marshall, 2013); however, perceptions of LMS participants included having concerns over the responsiveness of their trainers online (Kooi & Ping, 2012).

At the study site, the local DOT director acknowledged a lack of implementation and integration of LMS technology in the training of program analysts, despite its readily being available in the department. The director reported that only 23% of the staff of the Texas division of the DOT used the LMS system. Additionally, I found that leadership at

the DOT in Texas did not have a centralized and formal training for the users of LMS technology. The exact reasons for the lack of resources and best practices at the DOT of Texas were not formalized into empirical information; reasons might include lack of planning for integration, financial constraints, and lack of formalized training (e.g., Zender et al., 2014). I provided similar findings. I found financial constraints, lack of formalized training, and lack of prioritization regarding planning and preparation as some barriers/challenges to implementing LMS technology.

Review of the Literature

Researchers have cited the implementation and maintenance of LMS as a challenging task (Lal, 2015; Wentworth, 2014). Leadership requires additional costs to hire new program analysts, create new courses, pay for administrative costs, and provide 24/7 service support (Lal, 2015; Romiszowski, 2004; Ruth, 2010). Researchers have identified a lack of technology integration in the current training program in the Texas DOT (Lal, 2015; Romiszowski, 2004; Ruth, 2010). However, evidence has indicated that educators of training programs help in successfully integrating LMS technology in organizational systems through such components as professional development, mentorship, supervisor support, and observations for DOT employees (e.g., Azlim et al., 2014; Emelyanova & Voronina, 2014).

Online Databases

I used the following online databases in the literature review: Educational Resource Information Center (ERIC), JSTOR: Journal Storage, EBSCOhost Online Research Databases, and Google Scholar. I used the following key search terms to find

relevant references: *learning management system, e-learning systems, technology in learning, professional development programs, online professional development, technology acceptance, learning management system implementation, and transportation agency training.*

I reviewed literature in this review published between 2013 and 2017, ensuring that I sourced information from the most recent findings. I use this review to expand the study background by focusing on strategies useful for implementation of LMS. I discuss literature about improving the use and implementation of LMS technology through effective training programs.

Conceptual Framework

I used the following theories as the conceptual framework: Papert's (1993) constructionism theory and Davis's (1993) TAM. Papert (1993) developed the constructionism theory as an extension and combination of Piaget's (1980) initial development of constructivism (Fosnot, 2005). Researchers can use this theory to understand the widespread usage of computers in the constructivist-learning environment (Papert, 1999). According to Papert (1971a, 1971b), incorporating technology in learning while retaining traditional methods of teaching aids in the process of developing better methods of teaching. In the constructionist context, leaders who use technology can increase learning opportunities in education using technology as a learning tool. However, Blikstein (2013, 2014) indicated leaders using technology might face barriers to learning for students or learners unfamiliar or uneasy with using technology. According to the findings of this study, participants revealed that they faced barriers and

challenges in using LMS technology in their jobs in the Texas DOT. Leeds (2014) highlighted that users of technology changed culture in LMS, wherein first-time e-learners experienced culture shock regarding time, autonomy, and flexibility when delving into new learning environments. Leeds's finding applied to the present study, as many participants reported this issue as a barrier and challenge.

Learners can use technology as a powerful medium to interact and construct their meanings from the information they access; therefore, researchers should address barriers and challenges faced by new learners in this context. Without paying attention to such key struggles and providing plausible solutions, the learning environment of new learners deteriorates and is ineffective (Blikstein, 2013, 2014). My findings were similar to others who indicated that the value of training of new learners to new technology often resulted in increased engagement, higher learning skills, self-reliance, and a strong sense of independence (e.g., Blikstein, 2013, 2014; Buechley & Eisenberg, 2008; Wilensky & Reisman, 2006).

In this current study, participants expressed that they did not have a direct training department with leaders who only managed an online learning context. The participants also revealed that they did not believe that employees used computers or Internet enough; they cited a lack of training opportunities as the most important technological problem that affected the LMS implementation. Researchers have used Papert's (1993) constructionism theory to show the multitude of factors that influence the successful integration of technology in education (Kafai & Resnick, 1996). I used Papert's (1993)

constructionism theory to explore my findings and identify barriers and challenges faced by trainers and program analysts.

According to Davis and Venkatesh (1996), individuals tend to use information technology based on the technology's perceived ease of use and perceived usefulness. Hence, perceived benefits from use can vary; specifically, in the organizational context, Venkatesh and Davis (2000) identified benefits as increased productivity, job performance, and job effectiveness. According to my findings, participants identified a lack of user training and support programs provided by leadership of the Texas DOT, which might indicate these factors contributed to the low usage and implementation of LMS in DOT Texas. In this study, the barriers and challenges by program analysts and educators were related to user training, financial planning, and preparation and support in the integration, which resulted in user resistance in the LMS technology implementation.

I used Davis's (1993) TAM to understand user resistance of the LMS technology, as well as why the resistance occurred, and the effect of specific technology features and the individuals requested to implement the technology. The findings of this research indicated barriers and challenges with time-management that included difficulty in learning new systems and balancing regular tasks in the workplace. Thus, I used Davis's (1993) TAM to provide a deeper understanding regarding program analysts' experiences. I used Davis's (1993) theory to provide a more in-depth understanding of the origin of barriers and challenges that program analysts and educators/trainers could face.

Project Description

Researchers demonstrated the benefits of leaders implementing and integrating LMS in the organizational setting (Fryer & Bovee, 2016; S. Islam et al., 2016; Kooi & Ping, 2012), yet a gap existed regarding implementing LMS technology in the training of program analysts in the local DOT of Texas. Thus, I aimed to add to the limited body of knowledge on LMS in the DOT. By understanding the benefits and barriers, as well as the necessary resources and practices of LMS integration in the DOT, I provided valuable insight to human resource directors and executive management to undertake the necessary procedures to implement LMS in the DOT successfully.

I provided the project deliverable as a report about LMS technology that the DOT used with focus on the challenges/barriers faced in the implementation of the LMS system, as well as a framework for the successful integration and implementation of a LMS that could enhance training efficiency. Hence, I analyzed the perceived barriers and challenges by DOT employees to determine effective elements of the implementation of the LMS technology. I used semistructured, one-on-one interviews to gather data. I used results of the analysis to recommend improvements to the implementation of the LMS technology, as well as the training program for LMS users or DOT employees. I discussed necessary resources, challenges and/or barriers, and best practices in the implementation of the LMS technology in the training of program analysts in DOT specified in the analysis report.

Potential Resources and Existing Supports

The DOT administration and employees voiced interests in the study results and requested a copy of the analysis report containing the framework for the successful integration and implementation of LMS. The district of study was a potential resource for the presentation of the findings of the study. Evers, Brouwers, and Tomic (2002) stated that researchers who could work within an administration's organization to support a study obtained an invaluable resource; hence, the DOT environment where I conducted the study was no exception. Leadership at the Texas DOT faced difficulties implementing LMS technology; therefore, the DOT administration and employees welcomed the opportunity for a qualitative study. Thus, I assessed the perceived barriers and challenges of LMS technology in DOT and the culminating analysis report. The DOT administration asked for the report based on the research and allowed for the framework presentation at the culmination of the research.

Potential Barriers and Solutions

I identified lack of funding for the suggested framework to improve LMS technology through training program analysts, indicating that further research for grants for rural areas would be necessary. Finally, I shared the report with DOT administration, management, program analysts, LMS developers, and trainers and facilitators. If they found recommendations practicable, then a planning and training committee would be needed for implementation. Leadership would require funding and upper-level permission to complete this process. I remained in communication with the district of study to provide a solvable solution to presentation permission at study completion.

Project Implementation and Timetable Proposal

I obtained permission from the DOT to conduct the study. I contacted the DOT Texas division administrator to seek permission to interview the educators and program analysts in the division of a DOT in Texas. Second, after obtaining permission from the DOT, I asked for a list of names and contact information of educators and program analysts with experiences and qualifications related to LMS technology implementation in a DOT in Texas. I then recruited educators and program analysts to participate in the study. In reference to the derived list from the DOT, I sent an invitation through email to all educators and 20 program analysts to obtain positive responses from about 10 participants of the target group.

I scheduled a one-on-one interview for each participant. I scheduled each interview with the participant through phone. I remained responsible for setting up the meetings and conveying details to participants' students, as well as explaining the purpose and rationale of the study. In the interviews, I aimed to explore the experiences of program analysts and educators in LMS systems, the current barriers/challenges that they face, and the resources needed to use LMS in their jobs successfully.

Roles and Responsibilities in the Project Implementation

The stakeholders involved in the analysis report and the development of the framework included LMS trainers and facilitators, program analysts, and the DOT administration. This tripartite relationship must continue for the analysis report. Because the DOT administrators were the decision-makers, I needed their approval to present the report, hire or reassign employees, and provide funds; otherwise, I could not provide the

analysis and recommended framework to LMS trainers and facilitators for the DOT program analysts. The DOT administration—who allowed program analysts and DOT employees within their building, and who supported or declined training implementation for their LMS trainers and program analysts—allowed LMS trainers to have access to the training contract. Leaders provided funding in their budget if the training program that was part of the project framework was approved at the DOT. Without their consent, leaders could not create the training program for LMS, obtain access to training contract and/or time for them to participate in the training program, and gather all funding from their budget. Leadership could withhold some funding. Therefore, the DOT administration should accept, support, and allocate trainers and fund the training program implementation recommended in the project’s framework recommendation and analysis report.

Project Evaluation Plan

I identified the perceived barriers and challenges to the integration of LMS technology into the training of program analysts. I guided research interviews based on what the respondent said. To identify the perceived barriers and challenges by DOT employees, educators, and program analysts, I considered the results in relation to literature related to LMS implementation and training programs. I probed deeper into participants’ understandings of LMS technology regarding its use and implementation. First, I created a semistructured set of interview questions, which I administered on the first day of participation. Secondly, mentors and teacher coaches and program analysts (if training program for programs analysts in DOT was funded) participated in one-on-one

interviews, as well as received support in professional development when providing professional training to teachers and program analysts. Finally, I asked DOT employees to indicate the resources needed by program analysts and educators to use the LMS technology in their jobs at the DOT.

I analyzed all gathered data on an ongoing basis with findings presented to DOT administrators and management. I used participant responses that differed to the recent literature on LMS technology implementation and LMS training programs and commonalities between responses of participants and recent literature to propose project validity. I found that participant responses that indicated nonconformity of perspectives of challenges and barriers about using LMS technology in the training of DOT program analysts required further consideration and assessment. Due to the confidential nature of participant responses, participants did not experience pressure to provide responses that did not accurately reflect their views of using LMS technology.

Key Stakeholders

The key stakeholders for this project included induction contract teachers, DOT administrators and management, educators, and program analysts who used LMS technology. Because I addressed using LMS technology in DOT, DOT administrators and management were the primary stakeholders; they could review the analysis and framework to inform further discussion on barriers or challenges to using LMS technology. The DOT administrators and management have managerial responsibility for DOT employees. Leaders must maintain the monetary feasibility necessary for the success of LMS technology and the successful training of DOT program analysts. When

program analysts and educators can use the technology in their jobs at the DOT, they can better maximize the benefits of LMS technology implementation in DOT, encourage independent learning, increase flexibility of learning in terms of place and time, and encourage self-management in the workplace. As evaluator, I created the guided interview questions, gained necessary permissions to commence the study, contacted the participants, gathered and analyzed data, constructed an evaluation report, and shared findings with the school district of study policymakers upon final approval.

Project Implications

Local Community

Leaders of LMS technology have faced challenging problems regarding implementation and usage, with only 23% of the staff of the Texas DOT (2018) using the LMS system. DOT employees and program analysts required to use such a system have not received training in its use. The DOT administration and program analysts were all affected when program analysts and trainers were unprepared or dissatisfied with the implementation of LMS technology. They could view LMS technology for the organization as unreliable.

I developed the project as an analysis on the perceived barriers and challenges of the LMS technology and an implementation framework. I supported DOT administration in increasing the LMS technology's implementation and usage to maximize the LMS technology's benefits and identify the training program for program analysts and trainers that would minimize using the technology's barriers and challenges. I found results to assist in furthering understanding of effective training for programs analysts in DOT for

the long-term success of transportation agencies. If organization leaders better understand how to develop training programs, then positive implications for DOT administrations can occur when implementing LMS technology. Regarding social change, DOT administrators of this initiative could stabilize their training programs with the effective use of LMS technology, thereby increasing usage of LMS system. I provided DOT administrators with relevant information to allow training for program analysts and provide context for informed conversations about challenges and barriers in using LMS.

Far-Reaching Implications

Leaders improving future training programs can increase the usage of LMS system. Therefore, leaders increasing capacity for the usability of LMS systems and technology will improve outcomes for the Texas DOT administration well. If DOT administrators spend more time to conduct centralized training for LMS technology for program analysts and trainers, there will be a resulting increase in LMS technology usage and minimized perceptions of its barriers and challenges. Additionally, DOT administrations can utilize funds to conduct the highest standards of training previously allocated for costs previously incurred due to manual tasks and labor. DOT administrators could use the project framework in other districts and geographic areas aside from Texas. Finally, another possible implication is that higher usage in LMS systems will increase flexibility of learning in terms of place and time, minimize long-term costs, and advocate self-management for DOT employees.

Summary

I discussed the project's description and rationale, as well as the objective of providing a program analysis report. I discussed perceptions of DOT employees on LMS technology's barriers and challenges for the improvement of LMS technology and its usage in DOT. I presented studies related to the project genre, semistructured interviews, data concerning the framework, and implications for social change.

In Section 4, I reflect on the study findings and present conclusions about program analysts' and educators' perceived barriers and challenges regarding using LMS technology. Section 4 includes a discussion on the project strengths and weaknesses. Additionally, I reflect on the overall process of conducting the analysis report and framework conceptualization, in addition to the value of the project and the implications for social change.

Section 4: Reflections and Conclusions

Project Strengths and Limitations

In Texas, the DOT administration faced the challenging task of implementing and integrating LMS technology into the DOT training of program analysts. With only 23% of the staff of the Texas DOT (2018) using the LMS system, low usage of LMS technology presented as a problem for DOT administration, DOT program analysts, and trainers in Texas. Leaders could use LMS technology to aid in the training of employees of transportation agencies; therefore, the administration recognized that LMS was an essential strategy to use for developing these agencies. However, LMS technology was not used in the training of program analysts at DOT because of lack of resources and best practices.

I developed this project based on this study's findings. One strength of this project was its focus on uncovering perceived barriers or challenges to the integration of LMS technology into the training of program analysts. Researchers cited the need to improve LMS technology and its usage in organizations (S. Islam et al., 2016; A. A. Kim et al., 2016).

As discussed in the Literature Review in Section 2, researchers cited effective trainers as a core component of successful training of program analysts (Ingle & Kuprevich, 2016; King & Boyatt, 2014). Another strength of the project was that I combined trainers and program analysts in the development of a more effective LMS technology integration implementation. By combining both trainers and program analysts even before the implementation of LMS systems, I enabled DOT employees to

understand and quickly implement the LMS technology themselves. At the time of this study, barriers and challenges perceived by both trainers and program analysts were not identified; thus, needed resources for implementing LMS systems might not be provided to DOT employees/users.

I used the methodology to create an analysis report that included a framework for the successful integration and execution of an LMS to enhance training and efficiency in transportation companies. I used the design to provide DOT administrators with information gained from a review of relevant literature and the analysis of data gained through a semistructured interviews of program analysts and trainers. I used the perceptions of participants to show the needed solutions for the LMS technology integration problem in all DOTs in the United States. The survey's results indicated weaknesses in the provision of resources that program analysts and educators needed to use the LMS technology properly in their jobs at the DOT.

Limitations

Researchers have noted the inadequate design of LMS training regarding existing operations and lack of training regarding lack of resources and best practices as major contributors to low usage of LMS technology in Texas's DOT (Zender et al., 2014). Though training programs may improve the development of transportation agencies in the United States, a time-bound training program may not fundamentally change the usage of LMS technology in DOT within the state of Texas. If trainers and program analysts do not feel supported or heard, leaders attempting to implement LMS systems in DOT may not achieve success. Furthermore, morale is influenced by far more than

training programs. The participants, trainers, and program analysts who did not have the opportunity to participate in training program also influenced the culture and morale (e.g., S. Islam et al., 2016).

Additionally, leaders who develop a training program of limited duration may not fill any extreme knowledge gaps that trainers and program analysts may have when utilizing and adapting to the LMS technology. If the trainers and program analysts believe they are unprepared to use the LMS system in their workplace, the problem may derive from an adequate series of hands-on training, which a training program may not adequately resolve.

This project's finding might not apply to larger geographic areas. The qualitative study's small sample group could not be generalized enough to apply to a wider set of populations. Most DOT administrations offered LMS technology in their department, but funding for pertinent training programs targeted to DOT employees regarding specifically the use of LMS technology was not allocated.

The current study was restricted to a sample group of trainers and program analysts in DOT of Texas; data on the participants' perceptions of the challenges and barriers of LMS technology could not be generalized to a wider set of population aside from trainers and program analysts. I could not provide successful LMS implementation and integration data in DOT administrations. Thus, I could not yield data to show whether training participation for LMS systems increased in successful LMS implementation and integration.

Recommendations for Alternative Approaches

I found lack of resources and best practices as the primary reasons why leadership did not use LMS technology in the training of program analysts at DOT; for example, half of the total participants specifically used the word “budget” when they responded to the question about major barriers. Additionally, other research studies indicated that adequate training had a positive impact on usage of innovative technology (Hermans et al., 2013; McGill et al., 2014). Therefore, an alternative solution to offering program analysts and trainers a training program for LMS systems is to formalize the budget allocated for a series of training programs. Leaders can include hands-on simulation and training of LMS technology. Instead of offering a time-bound course designed to cover some topics, leaders can offer program analysts and trainers a consecutive series of training programs to ensure sustainable and continuous learning. Leaders can conduct the trainings monthly for analysts to provide consistent observations, feedback, and collegiality regarding LMS technology.

In a series of training programs, leaders could assign program analysts and trainers to LMS experts, as well as DOT administrators, to whom they could turn with questions, concerns, and challenges. The LMS experts could review the program analysts and trainers’ performances and constructive feedback regarding barriers and challenges faced in the use of LMS. Experts could encourage continued learning and sharing of best practices. Although the time-bound, initial training program might immediately bolster program analysts and trainers with LMS technology and usage, a formalized, budget-

allocated, and longer-term training program might target the continued usage of LMS technology focusing on cultivating best practices.

I designed the framework for the successful integration and implementation of LMS to enhance training efficiency by providing program analysts and trainers with learning strategies, best practices, and positive support groups. However, if program analysts and trainers were unprepared for using LMS technology in their systems, then LMS experts and DOT administrators might not prevent the usage and integration of LMS in DOT. Alternative solutions to lack of preparedness to the use of LMS systems could be provided through the certification system in the form of increased and consistently provided training and practical hands-on experiences.

The alternative solutions suggested within this study required long-term financial obligations, including pertinent scheduling commitments. The DOT administrators and employees might not make such commitments. Further major financial and staffing changes required DOT administrative approval, which was within the scope of the director of the DOT.

Scholarship, Project Development, and Leadership and Change

If being scholarly involved me gaining knowledge through a recurrent exercise of research and reporting of findings, such as sharing learning to impact social change, then I became scholarly. I had determination and patience, and I experienced connections from this process. I gained a significant amount of experience regarding media platforms, especially social media, to discuss, reflect, and interact with peers around the country. I also gained the ability to conduct research independently and perform an analysis of

firsthand experiences and perspectives of outside participants. I learned to infer from, interject, and listen to my instructors, as well as participants pertinent to this project. As I compiled the findings of my research into an analysis report and resulting framework, I gained an understanding of the perceived challenges and barriers and DOT employees' (program analysts and trainers) needs. I utilized the gained knowledge to create a pool of resource information to be used in my own building of the framework.

I had to do multiple different literature reviews for my project to gain pertinent information for use at my university. I conducted the professional development review to and received knowledge of best practices regarding LMS systems in DOT and resources needed for integrating LMS systems. I connected with many communities and mentors who wanted to meet the needs of program analysts and trainers in DOT. I followed the process of interviewing to understand the importance of gaining firsthand perspectives of users; to build semistructured, guided questions; and to create a framework derived from the analysis of the data collected. I researched LMS technology to provide knowledge on the usage, development, and importance of LMS technology for training.

Each part of the review provided me with knowledge and understanding, which I used as I built my project. Hence, to develop the project, I had to break down the interview responses of the participants; compile those responses into an organized, concise report; and connect data with DOT and LMS experts to report my findings. Because of this process, I gained experience working with stakeholders and DOT administrators, thereby enhancing my collaboration skills and leadership abilities.

Reflection on the Importance of the Work

Overall, the development and implementation of this project was a challenging process. However, I gained many new research experiences that contributed to my research and project development skills. I learned a lot about the needs of multiple stakeholders in the DOT, including insights from program analysts and educators from the findings of this study. The findings of the project study indicated the lack of identification relating to the perceived barriers or challenges to using LMS technology in the training of DOT program analysts, which were major contributors to the low implementation of LMS technology in DOT Texas. I analyzed the barriers, needed resources, and best practices for the successful implementation of LMS technology in organizations. The result of the evaluation might influence multiple DOT administrations positively.

Implications, Applications, and Directions for Future Research

I explored challenges, barriers, necessary resources, and best practices in the implementation of the LMS technology in the training of program analysts in DOT. I explored perceived barriers and challenges to provide DOT administrators with a firsthand glimpse of the needed resources by program analysts and trainers in successfully adapting and integrating LMS technology in their jobs. Regarding essential components of this integrative process, one participant said, “Support is very necessary. Resources that will lay the foundation for the LMS system would include a budget, a team of computer programmers that would continually monitor, analyze and improve it for the user.”

Researchers have shown that program analysts and trainers can navigate the difficulties that occur daily in using LMS technology in their jobs when leadership provides needed resources in LMS systems. Li et al. (2012) found that to influence users' intentions to use and maintain LMS, developers must ensure and improve the service and course quality of these systems, as these indirectly influence perceived ease of use and usefulness. My participants attested that having resources, such as LMS experts to work with them on issues/barriers of LMS integration, would address an issue presented in the current LMS implementation model. I made recommendations within this analysis report to give the DOT administration opportunities to conceive of training strategies for strengthening the LMS implementation and methods for removing barriers/challenges. I showed that program analysts and trainers should receive nonevaluative, timely support.

The potential for positive social change is significant for DOT administration in Texas because they have low usage of LMS technology. Therefore, I believe these recommendations must be shared with all stakeholders, especially given that framework to the LMS implementation and integration can positively influence overall LMS usability and effectiveness in DOT administrations. I conducted this study at one DOT in Texas. However, the successful usage of LMS technology was prevalent, so this report's framework for implementation was applicable for all DOT administrations. Therefore, comparison of the effects of the LMS technology implementation and integration is warranted, and I recommend further research compare components of LMS usage, including its barriers and challenges throughout the United States.

Conclusion

The problem addressed in this study was the low usage of LMS in DOT in Texas, which adversely influenced financial, human, and organizational structures of DOT administrations. I implemented a qualitative case study utilizing semistructured interviews to determine perceived barriers and challenges faced by programs analysts and trainers of LMS technology in their jobs. I used data collected during the study to validate the low usage of LMS technology program and respective successful integration in its present form. I obtained data collected using interviews from 10 participants from a population pool of 15 educators and 41 program analysts. Participants provided information to conduct an analysis and revealed perspectives about the barriers and challenges in LMX technology in their jobs. I documented recommendations for continual technology integration analysis and a series of training programs for LMS technology in an analysis report, which I planned to share with respective DOT stakeholders in Texas.

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Appendix A: The Project

The Challenges, Barriers, and Resources in the Integration of Technology in a
Department of Transportation Training Program

Maurice Elliott Jr.

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Introduction

I prepared this executive summary for DOT administrators, educators, and program analysts of the local DOT in Texas, United States who were seeking ways to increase the successful integration and execution of an LMS that could enhance training and efficiency in transportation companies. Recommendations are listed based on the findings of the report on barriers and challenges that are faced by DOT employees, as well as a framework recommendation that may improve successful integration and execution of an LMS in DOT administrations. The framework recommendations are proposed to actualize an enhanced effectiveness of DOT training because it might address the challenges associated with lack of resources and best practices. The implications, roles and responsibilities, and strengths and weaknesses of the framework recommendations are detailed.

Purpose

The purpose of this qualitative case study was to examine the challenges or barriers and the necessary resources in the use of technology for this training within a Texas DOT and the best practices in the implementation of the LMS technology in the training of program analysts. Currently, only 23% of the staff of the Austin Division of the DOT uses the LMS system (Texas DOT, 2018). Also, it is shown that other DOT sites such as Washington, DC fares better in LMS technology implementation. This is because training and resources are all centralized in other sites (Zender et al., 2014). The problem was the lack of centralized training and employees having different priorities that contributed to the problem of lack of widespread use of LMS technology. After

analyzing the participant interview responses gathered, I gained an understanding of the challenges and barriers to the LMS implementation.

The participants of this qualitative case study approach were educators and program analysts in DOT who have relevant experience and expertise in the implementation of the LMS technology. I made certain that participants understood that I realized that there was no form of judgment attached for answering regarding the barriers and challenges in the integration of the LMS technology in DOT training college and that I simply wished to understand their perceptions regarding the barriers and challenges of LMS systems implementations. I identified these participants through the purposive sampling. Data were collected from 10 participants, obtained from a population pool of 15 educators and 41 program analysts, through semistructured individual interviews. The following research questions guided the study:

RQ1: What are the perceived barriers or challenges to the use of LMS technology in the training of DOT program analysts?

RQ2: What resources do program analysts and educators need to use the LMS technology in their jobs at the DOT?

The primary data collection method of interviews included audio-recorded interviews that of which I later transcribed. I also took notes during the interviews (which also assisted with member checking).

Papert's (1993) technology constructionism theory and the TAM (Davis, 1993) were applied as the conceptual frameworks when conducting this qualitative case study on the barriers and challenges faced by program analysts and educators in DOT. Papert

(1993) developed the technology constructionism theory to understand how learners more effectively gain understanding using tools to construct knowledge rather than through conveyance and knowledge acquisition. According to Papert (1993), constructionism is a process of building knowledge using tools. According to Berland et al. (2014), this process engages the learners thus resulting in a meaningful and transformational learning and application. The most important part of the model is the premise that educational innovation helps in developing better things to do and more powerful ways to think about what you are doing than in developing better methods of teaching (e.g., Papert, 1971a, 1971b). The conceptual framework based on Papert's (1993) technology constructionism theory and the TAM (Davis, 1993) framed the analyses of the data.

A five-phased cycle approach was used to analyze the transcribed data. The five-phased cycle approach involved five phases, including (a) compiling, (b) disassembling, (c) reassembling, (d) interpreting, and (e) concluding. Several barriers and challenges faced in the implementation of LMS technology in DOT were identified including lack of financial budget, lack of experts, lack of systematic approach, lag in technology, poor content selection, and users' lack of skills. The benefit of this study was that DOT administrators and other stakeholders could better understand why educators and program analysts are apprehensive about using LMS systems in their jobs, and with such understanding, could make data-informed decisions to make changes that may improve the usage of LMS systems in DOT Texas. The study findings formed the base for the framework recommendation to help educators and program analysts effectively use and implement LMS technology in their jobs in DOT.

Executive Summary

I outline specifically the results from the identified barriers, needed resources, best practices, and recommended framework for the implementation of LMS technology. I provide a summary of the barriers, needed resources, and challenges in the following subsections.

Barriers, Needed Resources, Challenges

Barriers. These include the lack of budget and the lack of experts defined as major challenges for the LMS implementation. Participants surveyed felt that DOT did not have the up-to-date technology and that the content of online instructions and materials was poorly selected. These factors made it harder for individual users to navigate their way through the LMS modules. Additionally, they also felt that the DOT did not employ a enough technical support employees that had an expertise necessary for the LMS technology implementation.

Needed resources. These primarily constituted the resources that were critical for the successful LMS implementation such as technological, up-to-date resources. Participants also suggested that face-to-face continuous interaction with a support team was critical for the LMS implementation, and is currently lacking in the DOT.

Challenges. A selection of best practices is needed in successfully adopting a systematic approach to the LMS implementation. Participants indicated that there should be a thorough content selection for the online materials about technology selection. That is, participants particularly noted on four essential factors: accessibility, engagement, interactivity, and personalization.

Recommendations

Based on the results of this analysis, I recommend developing an administrative-supported technology specialist program, which addresses the barriers and challenges faced in the implementation of the LMS technology in DOT. Based on the barriers and needed resources found in the current project, I also recommend implementing a resource assessment system to further evaluate gaps in the specific resources needed to better support program analysts and educators.

Data Overview and Implications

Ten individuals currently working with DOT participated in the study. Five of them were educators, and five of them were program analysts. Most of them had at least some experience with the LMS technology. Participants worked at DOT between two and fifteen years. Table A1 depicts demographic characteristics of the study participants.

Table A1

Demographic Characteristics

Participant	Position	Education	Prior Experience	Years of experience
Aaron	Educator	BA in Adult Education	Continual education at Austin Community College	11 years
Andromeda	Program Analyst	BA in Psychology; graduate certificate in Financial Crimes and Compliance Operations	Online webinars for training purposes during annual training	4 years
Christy	Educator	MA in Human Resource Development & Management and Leadership	Administrator and User	4 years and 3 months
Daniel	Educator	MA in Nursing	Online webinars for training purposes during annual training	5 years
Erin	Program Analyst	BA of Art	None	2 years
Ester	Educator	BA of Business Administration-Accounting; Certification in Administrative Management	Online webinars for training purposes during annual training	6 years
Jacinda	Program Analyst	BA	None	3 years
Sandra	Program Analyst	None	Online webinars for training purposes during annual training	15 years
Thomas	Program Analyst	MA in Accounting	Online classes at University of Florida.	9 years
Tressica	Educator	BA, Associate Degree	Online classes at University of Florida.	15 years

Barriers

Lack of budget. A lack of budget is one of major challenges for the LMS implementation. Having recognized that the LMS implementation involved a substantial investment in technological, the participants noted that time and human resources that was likely to be very costly and thus was not necessarily financially feasible. One of the participants stated that cost of development and integration of the LMS technology proves to be a barrier during the initial process of set up, further indicating that the agency budget issues limit the capabilities of more effective training systems. As such, ensuring the effectiveness of the LMS program after the initial setup will require funding. In addition, funds should be allocated to the continuous training of DOT employees regarding LMS technology to support the recommended framework included in this analysis and findings. The input of a funding source will ensure the recommended effectiveness of the LMS program has an increased chance in being successfully integrated.

Lack of experts. Another barrier challenges for the LMS implementation was the lack of experts. Participants reflected on the help received from experienced LMS experts. Participants noted that the DOT did not employ a enough technical support employees that had an expertise necessary for the LMS technology implementation. Building upon the need for experts in LMS systems is discussed in the recommendations of this project's analysts report. A goal of this project was also to identify components and resources needed for the successful implementation of the LMS program.

Lack of systematic approach. Participants also expressed a common barrier of the lack of systematic approach. The participants stated that the DOT did not plan the implementation of the LMS technology in a systematic manner, which was important for such an ambitious undertaking. Implementing a systematic approach in implementing LMS systems needs to be given that the apparent lack of an overall vision may result in the LMS training courses not addressing diverse needs of different departments of DOT. When participants were asked explicitly regarding the consequence of DOT's lack of systematic approach, participants indicated the LMS training was not thoughtfully designed to fit into existing operations. Participants responded that the completion of course not accurately reflected in the software, which is also a reflection of the lack of updated and available technical support that is in line with the needs of the LMS implementation.

Lag in technology. An additional barrier of the LMS implementation was technological challenges. It was identified that computer use, Internet and training opportunities were among the most important technological problems that affected the LMS implementation. The project study revealed that lag in technology and difficulties with software design resulted to users' computers not reaching the content itself. In turn, users found that the network is not very reliable and is very unstable, adversely affecting system usability of LMS technology.

Poor content selection. Another barrier for the LMS implementation is poor content selection wherein participants felt that the content of online materials was poorly selected and is very limited. Participants felt that there is a need for more job specific

training or education to utilize the LMS technology, further noting that the LMS system is very difficult to use and not user friendly.

Users' lack of skills. Participants noted that many intended users of the LMS technology often lack the skills and knowledge base necessary for the LMS use. The level of computer savviness for the trainees presents to be a barrier for LMS technology implementation. The participants also felt that the age gap between younger and older employees could contribute to the barriers in the LMS implementation, noting that younger employees are more willing to adopt in contrast to older employees. LMS implementation and thus individualized content of training courses and individual skills and knowledge should be given to the users through effective support in training and technological support,

Needed Resources

Up-to-date technology. To address the issues/barriers faced in LMS implementation, the participants outlined the necessary resources needed; one of the needed resources mentioned was up-to-date technology wherein 80% of the participants indicated that this was critical for the successful LMS implementation. Specifically, 80% of participants stated that moving from desktop-based sources to tablets and iPad-based courses could make it easier for employees to use them. Additionally, majority of participants stated that having up-to-date technology was critical to perform well-functioning tasks considering the LMS technology.

Well assembled team. The needed resources that was indicated next was having a thoughtfully selected, trained, and coordinated team of experts and technical support

staff that would be able to facilitate the LMS adoption—that is, having a well-assembled team. Participants complained about not having a face-to-face continuous interaction with a support team that could assist with the LMS implementation. An ideal team would comprise of both the stakeholders and the IT team to make the transition smoothly. Participants felt that this was very crucial to keep the process aligned with the outlined problems and find solutions to better integrate LMS technology.

Access to information. Participants indicated that access to information about the technology that they had to use is a vital part of the LMS implementation. This allows the participants or learners to stay up-to-date with modern tech with the new tech tools, gadgets, and software that can be used for the e-Learning course design for program analysts; additionally, this will enhance the learners' learning library. Allowing for easy and readily available access to information will better prepare program analysts to interact with companies, drivers, and customers, along with regular sessions that allows the exchange of information such as group discussion and hands-on training.

Best Practices

Content. Findings of the study indicate how LMS technology should be implemented in the most effective way with best practices; the most basic reference of these best practices is content. Participants commented on four factors: accessibility, engagement, interactivity, and personalization. They also replied that content had to be presented in a simple and concise manner while making the system more user-friendly. Further, participants noted that leaders of online courses should create interesting and engaging course materials, such as having content, presentation, and job specific training

with a quiz at the end to ensure reinforcement of the information learned. In conclusion, participants similarly expressed that leaders should make learning a more enjoyable experience for the user by shortening time to task, increasing efficiency, and reducing redundancy.

Technology selection. One of the best practices outlined by the participants included technology selection, highlighting the importance of selecting the right technology for the LMS adoption. Participants outlined specific recommendations such as creating courses on tablets and iPad because people are more comfortable using those than computers. Other users added that training to be used on iPad is more intuitive.

Systematic approach. One of the best practices outlined was the systematic approach, which related to the elements of the LMS adoption could not be implemented in a disconnected manner. Participants' recommendations included a broader systematic approach to this task. That is, the technology selection in the implementation should include and consist of planning, LMS configuration, systems integration, course and data migration, user acceptance testing and system rollout. This makes the system integrated better because IT is involved from the beginning of the process. Finally, the participants underlined the importance of support such that this lays the foundation for the LMS system; that of which includes a budget, a team of computer programmers that would continually monitor, analyze, and improve it for the user.

Recommendations

This analysis identified barriers and challenges in the LMS implementation in DOT, such as lack of budget and the lack of experts. The LMS implementation gave

program analysts and educators an opportunity to share their experiences and outline needed resources to perform LMS systems in their jobs well. Additionally, the LMS implementation program for analysts and providing adequate training in the LMS through professional development of those who train program analysts has the potential to increase the use of such a system, which results in benefits for DOT administration and employees. If the major barriers and challenges, such as lack of experts and user training, can be managed and addressed the DOT administration ought to implement an effective LMS implementation system based on the analysis and recommendations contained in this report.

Though providing adequate training in the LMS for program analysts and trainers has the potential to increase use of the LMS technology in DOT, the results of this analysis suggest that program analysts and trainers would benefit from longer term, more structured, support. In response to feedback about the time commitment required for regular monthly meetings, the recommended training program and hands-on training sessions were designed as an intensive regular sessions, which allows for the provision of technical support for the users as well. To address those concerns, as well as ensure program analysts and trainers have the skills necessary to succeed in the usage of LMS in their jobs, I recommend regular training programs and hands-on training sessions that of which also includes LMS experts to aid the users' knowledge and use of the system.

The program analysts and trainers cited a lack of support and technical knowledge as key barriers for the LMS technology implementation. The proposed framework on LMS implementation includes employing a enough technical support employees that had

an expertise necessary for the LMS technology implementation. Additionally, the proposed framework increases instructional design knowledge in addition to receiving quality training and integration with innovative technology for the users in DOT.

In assessing the current LMS systems, several participants stated that with limited staff and boring annual training, the LMS is just not fun to do and more of a headache to use. This experience demonstrates that program analysts and trainers may feel unsupported if technical support staff is not involved in their training. Therefore, it will be important to include technical support staff in regular trainings, as well as to make the training sessions livelier and more interactive.

While a large body of the literature is comprised of the integration process of LMS in organizations, there is a gap in the literature regarding the integration process, including the factors that facilitate it, in the training of program analysts in the DOT. Thus, the goal of this study is to add to the limited body of knowledge on LMS in the DOT. By understanding the benefits and barriers, as well as the necessary resources and practices of LMS integration in the DOT, this study's findings may provide valuable insight to human resource directors and executive management to undertake the necessary procedures to successfully implement LMS in the DOT.

Conclusion

Majority of participants felt that the implementation of LMS technology need to have several needed resources in place for it to be effective, and that challenges/barriers to the implementation should be thoughtfully planned and thoroughly addressed prior to the actual integration. Most of the participants added that the implementation of the LMS

technology should be in a systematic manner, which is vital important for such an ambitious undertaking. Most of the participants indicated that the LMS training courses should first address the diverse needs of different departments of DOT and should be targeted with respect to the learners/audience at hand. In this analysis report, barriers, needed resources, and challenges were outlined that of which could affect the LMS implementation in DOT. Finally, I made recommendations for the increase of LMS implementation in DOT. To this end, I will provide the framework recommendation report to the district DOT in Texas.

Appendix B: Interview Questions

Research Questions:

RQ1: What are the perceived challenges or barriers to the integration of LMS technology into the training of program analysts?

RQ2: What resources do program analysts and educators need to use the LMS technology in their jobs at the DOT?

Demographic questions:

Are you a program analyst or educator?

What certifications or degrees do you have?

What is your prior experience of working with the LMS technology outside DOT?

How many years have you worked for the DOT?

RQ#1: What are the perceived challenges or barriers to the integration of LMS technology into the training of program analysts?

Interview questions for program analysts:

What are the technical challenges for using the LMS technology at DOT?

What other challenges have you encountered in using the LMS?

What is unacceptable or undesirable with the LMS technology training program at DOT?

What are the technical challenges for “program analysts” of the LMS?

How does your own perception of using an LMS affect the training program at DOT?

In what ways can the training of program analysts be improved?

Interview questions for program educators?

What are the technical challenges for “educators” of the use of an LMS for teaching?

What other challenges have you encountered in using the LMS?

In what ways can the training of program analysts be improved?

What are the perceived technical challenges for “program analysts” of the LMS?

How do you think that your own perceptions of using an LMS in your teaching can affect the training program?

What can be done to help you feel more comfortable with using the LMS in your teaching?

RQ#2. What resources do program analysts and educators need to use the LMS technology in their jobs at the DOT?

Interview questions for program analysts:

What do you think could be done to make you more comfortable with the LMS?

What technological resources do you as a program analyst need to more effectively use the LMS?

What other resources such as support and compensation do you think you will need to more effectively use the LMS?

In what ways can the trainings for using the LMS be enhanced or improved?

What are the best practices for integrating LMS technology into the DOT training of program analysts?

Interview questions for program educators:

What technological resources do program educators need to more effectively use the LMS?

What do you think could be done to make you more comfortable with the LMS?

What other resources such as support and compensation do you think you will need to more effectively use the LMS?

In what ways can the trainings for using the LMS be enhanced or improved?

What are the best practices for integrating LMS technology into the DOT training of program analysts?

Appendix C: Screening Questions

Have you worked with LMS technology in Texas for at least five years?

Do you know the DOT requirements of the LMS technology?

Have you participated in the implementation of the LMS technology?

Are you available to participate in this study for next three months?

Appendix D: Email Invitation to Participate

Dear Program Analyst or Educator,

I am conducting interviews as part of a research study to provide a framework for the successful integration and implementation of a learning management system or LMS that could enhance training efficiency. This research seeks to explore the challenges, barriers, the necessary resources, and the best practices in the implementation of the LMS technology in the training of program analysts in DOT. As DOT employees, you are in an ideal position to provide valuable first-hand information from your own perspective.

The interview takes around 30 minutes to one hour and is very informal. We are simply trying to capture your thoughts and perspectives on the TMS system which is our agency's LMS. Your responses to the questions will be kept confidential. Each interview will be assigned a number code to help ensure that personal identifiers are not revealed during the analysis and write up of findings. There is no compensation for participating in this study. However, your participation will be a valuable addition to our research and findings could lead to greater public understanding of implementation of the LMS technology.

If you are willing to participate, please suggest a day and time, that suits you and I will do my best to be available. If you have any questions, please do not hesitate to ask.

Thanks!

Maurice Elliott Jr

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