ABSTRACT

Title of Dissertation: SCHOOL DISTRICT ADOPTION AND IMPLEMENTATION OF A LEARNING MANAGEMENT SYSTEM: A CASE STUDY USING RIVAL THEORETICAL LENSES

Laura Highstone Hyde, Doctor of Philosophy, 2019

Dissertation directed by: Professor Robert Croninger
Professor Betty Malen
Department of Education Policy Studies

This study explored school district adoption and implementation of a learning management system. A substantial body of literature exists on school district data systems. However, this literature is highly rational in its view of data system adoption, and contains limited studies on learning management systems. With these liabilities in mind, this study used rival theoretical lenses from organizational theory, the rational perspective and the institutional perspective, to investigate these central questions: 1) how does a school district adopt and implement a learning management system and 2) how, if at all, do rational theory and institutional theory explain contextual forces and organizational actions in this process? These questions were answered with a single, exploratory case study in a school district that had recently adopted and implemented a learning management system.

The multivocal literature that guided this study contains four strands: evaluative, status report, prescriptive, and specialized. Study findings revealed that the district

engaged in a three-stage process of adoption, planning, and implementation of a learning management system. Although the rational perspective explained findings that aligned with the multivocal literature in the adoption and planning stages, district actions in the implementation stage were more clearly understood from the institutional perspective. Organizational processes in formalization, coupling, alignment, adaptiveness, and accountability, and external, contextual forces in accountability, privatization, and diffusion of innovation, proved to be salient concepts. These findings suggest that rival, theoretical lenses have utility in an investigation of school district learning management system adoption and implementation.

SCHOOL DISTRICT ADOPTION AND IMPLEMENTATION OF A LEARNING MANAGEMENT SYSTEM: A CASE STUDY USING RIVAL THEORETICAL LENSES

by

Laura Highstone Hyde

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Advisory Committee:

Professor Robert Croninger, Co-Chair
Professor Betty Malen, Co-Chair
Professor Cara Jackson
Professor Margaret McLaughlin
Professor Phil Piety
Professor John O'Flavahan

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Chapter One: Introduction

This study explored school district adoption and implementation of a learning management system. A substantial body of literature exists on school district data systems. However, this literature is highly rational in its view of data system adoption, and contains limited studies on learning management systems. With these liabilities in mind, this study used rival theoretical lenses from organizational theory, the rational perspective and the institutional perspective, to investigate this topic.

Learning management systems originate in a broader class of technologies called information management systems (Breiter & Light, 2006; Wayman, 2005). In corporate settings, information management systems collect and manage data for business decisions (Breiter & Light, 2006). In educational settings, universities and school districts use information management systems, or "educational data systems," to collect education data and facilitate educational decision making (Means, Padilla & Gallagher, 2010, p. 42; Breiter & Light, 2006; Piccano, 2009).

A school district may have many types of educational data systems, each with a different purpose and target audience (Bernhardt, 2005; Means, Padilla & Gallagher, 2010). Depending on a school district's investment in data system technology, it may have a student information system that organizes individual student data in real-time for educators and administrators (Thorn, 2001); a summative or formative assessment system that delivers standardized tests and collects assessment data for educators (Burch, 2010); a course management system that manages and facilitates student instruction in a classroom (Simonson, 2007); and a data warehouse that stores and processes student data for analysis by administrators and school districts (Curtis, 2010).

Within this constellation of educational data systems, learning management systems are a new type of data system that integrates a student information system, a course management system, and a formative assessment system into a single, unified platform for educator and student use (Berking & Gallagher, 2014; Cho, 2011; Halverson & Shapiro, 2012). Software vendors originally developed learning management systems for universities to deliver online courses and "support faculty and student workflow" (Molinar, 2014a, p. S11). In the past five years, learning management systems slowly replaced course management systems, and school districts acquired these systems in order to facilitate instruction, assessment, and data analysis at the classroom level (Berking & Gallagher, 2014; Ferriman, 2015; Foreman, 2013b). Although the literature on district data systems contains studies on data warehouses, student information systems, course management systems, and assessment systems, as a new type of data system, only a limited number of studies exist on learning management systems.

In the past 40 years, federal and state policies promoted district adoption and implementation of educational data systems, such as learning management systems (Anagnostopoulous, Rutledge & Bali, 2013; Keleher, 2007; Means, Chen, De Barger & Padilla, 2011; Means, Gallagher & Padilla, 2007). In the 1960s and 1970s, federal policies focused on the potential of standardized assessments to prepare students, and minority students in particular, for a technology-rich world (National Center for Education Statistics, 1966). In the 1990s, renewal of the Elementary and Secondary Education Act (ESEA) in the Improving America Schools Act of 1994 and the Goals 2000: Educate America Act, amplified this call to states and school districts for standards-based education reform and standardized assessments that measure student

performance (Improving America's Schools Act [ISEA], 1994; Goals 2000: Educate America Act, 1994; National Academy of Education, 2009). This federal push for standardized assessments continued with No Child Left Behind Act of 2001 (NCLB, 2001), which demanded that school districts adopt summative assessments to measure individual student achievement, and that states report the annual yearly progress of schools (Baer, 2017; Cho, 2011; Halverson & Shapiro, 2012; NCLB, 2001).

To meet federal requirements in No Child Left Behind, school districts initiated annual, standardized testing and reported those data to their state for analysis (Anagnostopoulous, Rutledge & Bali, 2013; Chen, Heritage & Lee, 2005). These demands led many states and districts to adopt and implement summative assessment systems to deliver annual, standardized tests, and data warehouses to process those data (Baer, 2017; Keleher, 2007, Means, Gallagher & Padilla, 2010). More recently, renewal of ESEA in the Every Student Succeeds Act of 2015 (ESSA, 2015) continued this push for adoption of state and district summative assessment systems, as school districts strive to meet federal requirements to test students annually and report those data to the federal government for analysis (Behr, 2017; ESSA, 2015).

In order to report summative assessment data to a state or the federal government, a school district needs a student information system with unique identifiers for individual students (Anagnostopoulos, Rutledge & Bali, 2013; Chen, Heritage & Lee, 2005; Thorn, 2001). In the 1990s, the National Forum for Education Statistics created the standardized data elements that school districts needed to systematically collect student data for federal reports (Clements, 2000; National Forum on Education Statistics, 1997; Thorn, 2001). A student information system allows a state or district to connect summative, assessment

data to an individual student record, in order to create an "individual, longitudinal record for each student" with demographic and assessment information (Chen, Heritage & Lee, 2005, p. 313; Clements, 2000). With these data systems in place, a school district can collect, store and report student assessment data in electronic form (Clements, 2000).

In addition to federal reporting demands in No Child Left Behind, the U.S. Department of Education's Race to the Top (2009) incentive program encouraged states and districts to "build data systems that measure student success" (U.S. Department of Education, 2009, p. 2). Particularly states and districts that participated in Race to the Top, this emphasis on data systems for teaching and learning increased expectations for school districts to adopt additional data systems, such as a course management or a learning management system, in order to facilitate data analysis and "data-driven" decision making in the classroom (Cho, 2011, p. iv; Halverson & Shapiro, 2012; Levinson & Boser, 2014; Means, Padilla & Gallagher, 2010).

Study Purpose and Research Questions

The purpose of this study is to explore how a school district adopts and implements a learning management system, and to explain study findings through rival, theoretical lenses in rational theory and institutional theory. With this purpose in mind, this study asked two, central research questions: 1) how does a school district adopt and implement a learning management system and 2) how, if at all, do rational theory and institutional theory explain contextual forces and organizational actions in this process? These questions were answered with a single, exploratory case study in a school district, Oak Trail School District," which had recently adopted and implemented a learning management system.

Theoretical and Conceptual Frameworks

This study analyzes findings through competing perspectives within organizational theory known as the "rational" perspective and the "institutional" perspective (Ogawa, Sandholtz, Martinez & Scribner, 2003). In the theoretical literature on organizations, the rational perspective presumes that an organization exists to attain specific goals, and that bureaucratic actors seek efficiency and technical certainty for measurable outcomes (DiMaggio & Powell, 1983; Senge, 2006). Through this lens, rationality is the "construction of alternative means that are considered appropriate for reaching desired ends" (Simon, 1997, p. 73), and rational decision-making maximizes efficiency or "the attainment of maximum values with limited means" (Simon, 1997, p. 75).

In the context of schools as organizations, rational theory suggests that when a school district adopts an educational technology, it engages in a shared organizational vision for change, and chooses goals purposefully designed to "contribut[e] to organizational improvement" (Wayman, Jimerson & Cho, 2012, p. 170). A rational approach to technology adoption encourages "technical innovations…that have a direct impact on the technical work activity of the organization, such as teaching methods, curriculum, [and] materials" (Bamburger, 1995, p. 173). Theoretically, because bureaucratic actors seek technical certainty for measureable outcomes, they implement educational technologies that meet goals aimed at educational improvement (DiMaggio & Powell, 1983; Meyer, 1992; Senge, Cambron-McCabe, Lucas, Smith, Dutton, & Kleiner, 2000). Through this lens, district adoption and implementation of a learning management system represents rational goal attainment focused on improvements in

teaching and learning (Wayman, Jimerson & Cho, 2012; Wayman, Johnston & Cho, 2007).

In contrast to the rational perspective, institutional theory suggests that an organization enacts change without concern for organizational effectiveness or efficiency (DiMaggio & Powell, 1983; Meyer & Rowan, 1977). In this perspective, an organization adopts an innovation to enhance legitimacy and conformity (Meyer & Rowan, 1977). Organizational actors do not work towards measurable outcomes, but instead align with society's perceived norms and values "despite the immediate efficacy of the acquired practices and procedures" (Rowan & Miskel, 1999, p. 363).

In the context of schools as organizations, institutional theory offers the possibility that a school district may adopt an educational technology that is poorly understood, or has "abstract goals" that are misaligned with teaching and learning (Bamburger, 1995, p. 189; DiMaggio & Powell, 1983). If organizational misalignment occurs, an educational technology may "persist with little impact" on instruction (Meyer, Scott & Deal, 1992, p. 60), or become "infused with value beyond the technical requirements of the task at hand" (Selnick, 1957, p. 14; DiMaggio & Powell, 1983; Meyer & Rowan, 1977). Through this lens, district adoption and implementation of a learning management system may not serve a rational purpose, but instead may promote institutional legitimacy, conformity, and the long-term survival of an organization (DiMaggio & Powell, 1983; Selznick, 1957).

An initial conceptual framework generated from the multivocal literature and theoretical framework suggests that external, contextual forces influence a school district's decision to adopt a data system. A rational lens provides insight into district

actions, which include a two-stage process to adopt and implement a data system, and internal, organizational processes in formalization, coupling, alignment, adaptiveness, and accountability. Theoretically, data system implementation leads to educator data use for instruction.

Organization of Study

This study is organized into five chapters. This first chapter provided an overview of this study, its purpose, theoretical and conceptual frameworks, and research questions. Chapter Two offers a review of the relevant literature for this study, the literature search process, and the strengths and weaknesses of this literature. This chapter also elaborates on the theoretical and conceptual frameworks for this study. Chapter Three describes the study methods, which includes the research design, data sources, data analysis procedures, checks for bias and error, and ethical considerations. Chapter Four presents study findings analyzed through rival, theoretical lenses. Chapter Five discusses study findings in light of the literature and theory.

Chapter Two: Literature Review

As noted in Chapter 1, a substantial body of literature exists on school district data systems. However, this literature is highly rational in its view of data system adoption; does not thoroughly investigate district data system implementation; and has limited studies on learning management systems. With this purpose in mind, this study asked two, central research questions: 1) how does a school district adopt and implement a learning management system and 2) how, if at all, do rational theory and institutional theory explain organizational actions and contextual forces in this process?

This chapter presents the literature review for this study. The first section presents the literature search method. The next four sections review the policy and data systems context for this study; the multivocal literature on data system adoption and implementation; and concepts from rational theory and institutional theory. The final two sections address the strengths and weaknesses of this literature and a conceptual framework generated from this literature review.

Literature Search

The data systems literature contains limited, empirical studies on school district learning management systems. Vendors, trade publications, and industry blogs contain relevant information on how a school district might adopt a learning management system, but none of these sources are empirical. Thankfully, Ogawa and Malen (1991) offer insight on how a diverse set of sources may shape a literature review on a salient topic of interest, such as school district adoption and implementation of a learning management system. These authors note that sources on an emergent topic may be "multivocal," which means "comprised of all accessible writings on a common, often contemporary

topic" (Ogawa & Malen, 1991, p. 265). Although this literature may contain diverse sources written by "academics, practitioners, journalists, policy centers, state offices of education, local school districts, independent research and development firms, and others," Ogawa and Malen (1991) assert that a multivocal literature can illuminate a current topic of interest and provide a relevant literature base for an exploratory case study.

In order to conduct a rigorous, multivocal literature review, Ogawa and Malen (1991) suggest that researchers define the topic and terminology, clarify literature search procedures, and identify reviewer bias. Accordingly, this literature search followed these guidelines. This search focused on adoption and implementation of data systems in public school districts. This search included six education-related databases;[1] 21 education and technology journals;[2] plus periodicals, books, reports, and conference papers.[3] As these sources were read, repeated in-text citations were noted and relevant articles were prioritized. This process was repeated until sources became redundant, and a body of literature on school district data systems emerged.

Due to the limited literature on learning management systems, a second search was conducted for contemporary literature on this topic. Nexis Uni and Google Scholar

[1] Databases searched were: Academic Search Premier, Education Source, ERIC, JSTOR, MasterFile Premier, and ProQuest Dissertations and Theses Global.

[2] Journals searched were: American Educational Research Journal, American Journal of Education, Contemporary Educational Technology, Education Policy, Education Policy Analysis Archives, Educational Administrative Quarterly, Educational Leadership, Educational Technology & Society, Interactive Learning Environments, Journal of Cases in Educational Leadership, Journal of Computing in Teaching Education, Journal of Educational Computing Research, Journal of Educational Technology and Society, Journal of Educational Technology Systems, Journal of Education for Students Placed at Risk, Journal of Information Systems, Journal of School Leadership, Peabody Journal of Education, School Effectiveness and Improvement, TechTrends, and Teachers College Record.

[3] A dissertation by Cho (2011) on district computer data systems referenced a website authored by Jeff Wayman (www.waymandatause.org), which provided additional sources on this topic.

databases were searched for articles on learning management systems in public school districts. Then, a Google search for websites and blogs on the same topic was conducted. As sources were identified, the utility of the source was gauged based on its consonance with this topic and study. Eventually, these two searches yielded 40 years of multivocal literature on data and learning management systems in public school districts.[4]

According to Ogawa & Malen (1991), because sources in a multivocal literature can be limited by a lack of systematic investigations, a literature review of this nature requires "a deliberate analysis of the words of the people recorded in these diverse writings, as well as a deliberate analysis of the findings" (Ogawa & Malen, 1991, p. 265). In keeping with this suggestion, sources in this review were organized to develop a clear understanding of this topic in terms of authorship, audience, rigor, methodology, and timeliness. This careful process resulted in four strands of literature on data and learning management systems, which for the purposes of this study are identified as *evaluative, status report, prescriptive and specialized*.

The *evaluative* literature strand contains empirical literature on data systems, educator data use, and educational technology. The sources in this strand include book chapters, conference papers, dissertations, journal articles, and project evaluations. Education researchers author this strand, which is intended for an academic audience. Studies in this strand are empirical, which means that they employ a theoretical lens, a well-defined study methodology, and account for bias and error. For example, Cho &

[4] Limited information exists on learning management systems in private schools. Hill (2018) includes private schools in a 2017 survey of public schools with learning management systems. Additionally, some vendor websites advertise private schools that use a learning management system (Instructure by Canvas, Inc., 2018; Schoology, Inc., 2018).

Wayman (2015) employ rational theory and open systems theory in a case study that examines school district efforts to support data system use and data use.

The sources in the evaluative strand have utility for this study because they identify and clarify factors involved in district adoption and implementation of data systems, and explicate the organizational processes and contextual forces that may influence a district's process. These sources also illuminate potential theoretical lenses, as well as clarify and qualify how, if at all, these lenses explain district actions. Although some sources in this strand are outdated or are not peer-reviewed, this strand is the most rigorous of the four strands in this multivocal literature, and therefore provides the empirical foundation for a systematic investigation of this topic (see Appendix A for a table with evaluative strand sources).

The status report strand provides both the historical context and the policy context for data system adoption and implementation in the United States. The sources in this strand include reports, policy briefs, and a conference paper. Education researchers, the U.S. Department of Education, and independent research firms author these sources for an academic audience. For example, a U.S. Department of Education report by Means, Padilla & Gallagher (2010), uses survey method to examine school district data systems and their use.

The sources in this strand have utility for this study because they provide insight on the history of district data systems in the context of educational technology, as well as information on types of district data systems and their use. Sources in this strand also provide details on how federal and state policies influence district data system adoption, and the conditions that shape this process. Although some of the sources in this strand are

over 10 years old and do not consistently apply a clear research methodology, this strand is the second most rigorous in this multivocal literature (see Appendix B for a table with status report strand sources).

The prescriptive literature strand provides instructions and advice for school districts on how to adopt and implement a data system, types of data systems, and their potential use. Policy experts, education journalists, and government officials author the sources in this literature strand, which includes book chapters, periodical articles, reports, policy briefs, and technical briefs. For example, a report by Levinson & Boser (2014) offers an overview of the types of district data systems and their potential utility. Even though the sources in this strand are not always systematic or empirical, this strand has utility for this study because the audience for this information is school district administrators and educators interested in data system adoption, implementation, and use (see Appendix C for a table with prescriptive strand sources).

The specialized literature strand contains contemporary information on learning management systems. Vendors, journalists, educators, and industry professionals author the sources in this strand, which includes online and periodical articles, blogs, industry publications, and information from vendor websites. For example, McIntosh's (2016) publication provides in-depth information on learning management systems vendors, products, and technical requirements. Even though sources in this strand are not necessarily rigorous, they have utility for this study because they contain valuable and timely information on learning management system vendors, products, technical specifications, and factors that shape district adoption of these systems (see Appendix D for a table with specialized strand sources).

In addition to these four literature strands, this literature search included federal laws and policies, as well as literature on rational theory and institutional theory. Federal and laws and policies provide information on the policy context for district data system adoption and implementation. The theoretical literature includes book chapters and peer-reviewed articles that contain information on the history of these theories, main concepts, and interpretations of each theory as it relates to education policy, schools as organizations, and educational technology.

Data Systems Context

Learning management systems originate in a broader class of technologies called information management systems (Breiter & Light, 2006; Wayman, 2005). In corporate settings, information management systems collect and manage data for business decisions (Breiter & Light, 2006). In educational settings, universities and school districts use information management systems, or "educational data systems," to collect education data and facilitate educational decision making (Means, Padilla & Gallagher, 2010, p. 42; Breiter & Light, 2006; Piccano, 2009).

A school district usually has many types of educational data systems, each with a different purpose and target audience (Bernhardt, 2005; Means, Padilla & Gallagher, 2010). Depending on a school district's investment in data system technology, it may have a student information system that organizes student data in real-time for educators and administrators (Thorn, 2001); a summative or formative assessment system that delivers standardized assessments and collects assessment data for educators (Burch, 2010); a course management system that manages and facilitates student instruction in a classroom (Simonson, 2007); and a data warehouse that stores and processes student data

for analysis by administrators and school districts (Curtis, 2010). Within this constellation of data systems, learning management systems are a new type of data system that integrates student information, course management, and formative assessment systems into a single, unified platform for educator and student use (Berking & Gallagher, 2014; Cho, 2011; Halverson & Smith, 2009). This section explains the history of these data systems in the context of this study.

In the 1960s, Cooley and Glaser (1969) proposed that school districts could benefit from the use of information management systems as a way to "collect data, monitor student progress, provide information as a basis for prescribing a course of instruction, and diagnose student difficulties" (p. 576). However, before a school district can adopt a data system, it needs the digital infrastructure that these systems require, such as desktop computers, networks, and Internet access (Piccano, 2009). By the late 1980s, most school districts in the United States had the computer hardware needed to adopt and implement an educational data system (Curtis, 2010; Piccano, 2009; Rudner & Boston, 2003). For example, between 1980 and 1987, schools with one or more desktop computer increased from 18% to 95%, and school districts installed local area networks, or LANs, so that desktop computers could communicate with each other (Piccano, 2009; U.S. Congress, 1988).

In the 1990s, as the digital infrastructure of school districts improved, vendors or districts developed data systems for district and educator use, such as student information systems, assessment systems, and data warehouses. Initially, school districts focused on adoption of student information systems to store and process student data (Keleher, 2007; Thorn, 2001; Zavadsky, 2009). A student information system stores student data, such as

gender or courses taken, and organizes those data into a record with unique identifier (Thorn, 2001). Current student information systems, such as PowerSchool, store a wide variety of data, such as attendance, demographics, grades, enrollment, and course schedules, as well as family, disciplinary, transportation, and special education information (Anagnostopoulous, Rutledge & Bali, 2013; Means, Padilla & Gallagher, 2010; PowerSchool, Inc., 2018).

In the early 2000's, many states and districts adopted and implemented assessment systems (Burch, 2010; Wayman, Cho & Shaw, 2011; Webb, 2002). An assessment system delivers standardized tests and organizes student test scores (Burch, 2010; Wayman, Cho & Shaw, 2011; Webb, 2002). Currently, many school districts use two types of assessment systems, a summative assessment system that delivers annual standardized tests, either at the state or district level, and a formative assessment system that delivers quarterly benchmark exams to "help schools and districts identify achievement gaps before the summative exam at the end of the year" (Burch, 2010, p. 148; Baer, 2017; Means, Padilla & Gallagher, 2010; Webb, 2002).

Because early versions of assessment systems only delivered standardized tests, but did not analyze student achievement data, some school districts built an additional type of data system called a data warehouse (Curtis, 2010; Means, Padilla & Gallagher, 2010; Long, Rivas, Light & Mandinach, 2008; Mieles & Foley, 2005). In the 1990s, corporations used data warehouses to "increase sales, reduce costs and offer better products or services" (Hwang & Xu, 2008, p. 48). In a school district, a data warehouse stores and integrates data for analysis by educators (Curtis, 2010; Long et al., 2008; Zavadsky, 2009). In order to perform these functions, a data warehouse uses a computer

server with a high storage capacity, and database software that merges assessment data and student information into a single, comprehensive database (Long et al., 2008; Wayman & Stringfield, 2006; Zavadsky, 2009).

Prior to the development of data warehouses, school districts did not have the computing capacity to "link student data and perform analyses using multiple variables" (Wayman, 2007, p. 157; Rudner & Boston, 2003). Current data warehouses allow school districts to conduct longitudinal data analyses, follow cohorts, and analyze student, group, and teacher data (Bernhardt, 2004; Curtis, 2010; Zavadsky, 2009). School districts also use data warehouses for data mining student achievement trends and instructional decision making (Curtis, 2010; Streifer & Schumann, 2005; Wayman, 2005). With these capabilities, a data warehouse helps district administrators to "make informed decisions about instructional practices" (Curtis, 2010, p. 30) and "predict events [that] help guide district actions" (Rudner & Boston, 2003, p. 62; Curtis, 2010; Long et al., 2008).

In addition to student information systems, assessment systems, and data warehouses, by the late 2000s many school districts had adopted a course management system (Means, Padilla & Gallagher, 2010; Simonson, 2007; Wayman, Conoly, Gasko & Stringfield, 2008). Although the U.S. government and corporations used course management systems for training as early as the 1950s, in a school district, a course management system assists an educator to manage and deliver instruction in the classroom (Bush & Mott, 2009; Cooley & Glaser, 1969; Simonson, 2007; Szabo, 2002). For example, an educator may use a course management system to post a class assignment, which students view and turn in for a grade (Bush & Mott, 2009; Wayman & Conoly, 2006; Wayman et al., 2008). Although early versions of course management

systems worked primarily as an assignment and grading system, in the last five years, course management system vendors, such as Blackboard, have redesigned these systems with better features and functions, and reintroduced these products as learning management systems (Ferriman, 2012).

A nationwide survey by Means, Padilla & Gallagher (2010) found that nearly all school districts in the United States had "multiple, distinct data systems" (p. xi). Over 90 percent of districts had student information systems; 79 percent had a formative assessment system; and 64 percent had a course management system (Means, Padilla & Gallagher, 2010, p. x-xi). Many states with longitudinal data systems or data warehouses reported that these systems linked to district data systems (Means, Padilla & Gallagher, 2010, p. ix). Therefore, due to the long-term investment of states and school districts in data systems, it is likely that school districts continue to use and update these systems (Means, Padilla & Gallagher, 2010).

In the past 10 years, student demand for online courses pushed school districts to adopt learning management systems (Lochner, Conrad & Graham, 2015; McMurray, 2017). A learning management system combines the functions of a data warehouse, assessment system, student information system, and course management system into a comprehensive platform (Ash, 2013; Berking & Gallagher, 2014: Herold, 2014). Corporations use learning management systems to deliver online professional development, and universities use learning management systems to deliver online courses and instruction (Fenton, 2018; Hill, 2018). Depending on the user, school districts use learning management systems for a variety of purposes, such as online learning,

classroom instruction, professional development, and data analysis (McMurray, 2017; Schaffhauser, 2015; Smith, 2018).

In the United States, Instructure by Canvas, Google, Moodle, and Schoology are the predominant vendors of learning management systems for school districts (Hill, 2018).[5] Many vendors offer two versions of learning management system software: a free educator version, and a subscription version for school districts (Hill, 2018). School districts with a learning management system report that educators use these systems to deliver formative assessments, assign and collect homework, and analyze student progress (McMurray, 2017; Smith, 2018).

Learning management systems also support mobile devices, applications, single-sign on technology, and external applications such as Google Docs and YouTube (McMurray, 2017; Remis, 2015; Smith, 2018). In addition to educators, central office personnel and school administrators use a learning management system for professional development, communication, and data analysis (Beams, 2017; Remis, 2015; Stephens, 2015). Because learning management systems have a wide range of functions and features, school districts and educators may perceive these systems to be a "one-stop shop" to deliver instruction, assessments, and analyze student data (Berking & Gallagher, 2014, p. 28; McMurray, 2017; Smith, 2018).

Policy Context

School districts in the United States adopted and implemented data systems in response to 40 years of federal laws, policies, and incentives (Anagnostopoulous,

[5] According to McIntosh (2016), over two hundred learning management system vendors compete for contracts in the United States and Canada. Some vendors have K-12 products, others have university products, and some, like Instructure by Canvas, have both.

Rutledge & Bali, 2013; Keleher, 2007; Means, Gallagher & Padilla, 2007; Means, Padilla & Gallagher, 2010; Means et al., 2011). In the early 1960s, federal policies focused on the potential of standardized assessments to prepare students, and minority students in particular, for a technology-rich world (National Center for Education Statistics, 1966). Then, in 1966, the Equality of Educational Opportunity Report (also known as the Coleman Report), encouraged states and districts to use educational technology to assist minority students in their "full participation in an increasingly technical world" (National Center for Education Statistics, 1966, p. 20). As a result, states and school districts began to consider how annual, standardized tests might mitigate disadvantages between students, as well as measure "student potential" (National Center for Education Statistics, 1966, p. 228).

In the 1980s, the report *A Nation at Risk* (1983) addressed how standardized tests and standards-based accountability policies might improve student achievement (Cho & Wayman, 2012; National Commission of Equity and Excellence in Education, 1983). This report noted that employers wanted highly-skilled workers who could meet the demands of a technically sophisticated workplace (National Commission of Equity and Excellence in Education, 1983). To produce a skilled workforce, the commission recommended that school districts take advantage of educational technology to assess student progress (National Commission of Equity and Excellence in Education, 1983).

In 1986, the National Task Force on Educational Technology reinforced the idea from *A Nation at Risk* that standardized assessments could "reduce the risk to the nation" posed by schools that do not "effectively serve all students" (National Taskforce on

Educational Technology, 1986, p. 1). The report stated that training educators to use educational technology could help them become

> managers of a complex educational environment, designers of an individualized learning program for each student, [and] evaluators (and perhaps constructors) of some of the sophisticated tools offered (National Task Force on Educational Technology, 1986, p. 2).

To meet these goals, the federal government encouraged states and districts to develop knowledge-based "expert systems" to facilitate higher order thinking skills (National Taskforce on Educational Technology, 1986, p. 2). In that same year, a National Governors Association report discussed the importance of educational technology, and how school district investment in data systems could improve curriculum delivery, assessment, and student achievement (National Governors Association, 1986). This report indicated that educational technologies could "add to the quality and effectiveness of our educational revolution…not only at the state level but at the regional and district level as well" (National Governors Association, 1986, p. 33).

Following this call to action, the Hawkins-Stafford Elementary and Secondary School Improvement Act (1988) offered financial assistance to school districts to purchase information management systems (Hawkins-Stafford Elementary and Secondary School Improvement Act, 1988). This law also established the National Forum for Education Statistics, which is an organization in the U.S. Department of Education created to "develop a comprehensive core system of comparable local, state, and federal data useful to policymakers and educators at all levels of government" (National Forum on Education Statistics, 1997, p. iii). In the 1990s, this organization helped to create the standardized data elements that districts needed to collect individual

student data for student information systems (National Forum on Education Statistics, 1997; Clements, 2000).

Renewal of the Elementary and Secondary Education Act (ESEA) in 1994, and the Goals 2000: Educate America Act, amplified this call to states and school districts for standards-based education reform and standardized assessments to measure student performance (ESEA, 1994; Goals 2000; National Academy of Education, 2009). This federal push for standardized assessments continued with No Child Left Behind (NCLB) in 2001, which required school districts to use summative assessments to measure individual student achievement, and required states to report the annual yearly progress of schools (Cho, 2011; Halverson & Shapiro, 2012; NCLB, 2001). Subsequently, some school districts purchased data systems to "retool and systemize" data collection, reporting, and analysis to meet new federal accountability goals (Rudner & Boston, 2003, p. 62; Breiter & Light, 2006; Curtis, 2010; Kerr, Marsh, Ikemoto, Darilek & Barney, 2006; Wayman, Stringfield & Yakimowski, 2004).

The passage of NCLB represented an important milestone in the district adoption and implementation of data systems (Breiter & Light, 2006; Cho, 2011; Wayman, 2005). States and school districts felt pressured to purchase data systems for compliance and data analysis purposes, and to think about how "information systems may…inform instruction and decision-making aimed at raising student achievement" (Breiter & Light, 2006, p. 206). More importantly, NCLB assumed that educator access to data systems and the availability of student data would "inform and initiate changes in teaching practice" to improve instructional effectiveness (Wayman, 2005, p. 296). Subsequently, some states passed laws that mandated annual, summative student testing, and some

school districts adopted and implemented summative assessment systems and data warehouses to collect student achievement data for analysis (Anagnostopoulos, Rutledge & Bali; 2013; Condelli et al., 2012; Fox, Waters, Fletcher & Levin, 2012; Keleher, 2007).

In 2006, the federal government continued its push for state and district adoption of data systems with incentives for Statewide Longitudinal Data Systems (SLDS) (Anagnostopoulous, Rutledge & Bali, 2013). An SLDS stores student achievement data so that school districts and educators can "measure, monitor, and regulate student, teacher, and school performance" (Anagnostopoulous, Rutledge & Bali, 2013, p. 219; Condelli et al., 2012; Hamilton, 2002; National Center for Education Statistics, 2014). However, in order to participate in the statewide analysis of test scores, a school district must invest in the digital infrastructure and the technical personnel needed to manage and report student data (Anagnostopoulous, Rutledge & Bali, 2013; Condelli et al., 2012; Fox et al., 2012). To reinforce this request, Congress passed the America COMPETES Act of 2007, which requires school districts to collect data when "students exit, transfer in, transfer out, drop out, or complete P–16 education programs" and share these data with the state (America COMPETES Act, 2007, p. 102).

In 2009, the U.S. Department of Education's Race to the Top incentive program also encouraged states and districts to "build data systems that measure student success and inform teachers and principals how they can improve their practice" (U.S. Department of Education, 2009, p. 2). Participating states set aside "funds and plans to improve data collection" to "identify student needs, fill curriculum gaps, and target professional development…[and] foster a culture of continuous improvement" (Anagnostopoulous, Rutledge & Bali, 2013, p. 220; U.S. Department of Education,

2009). In states and districts that participated in Race to the Top, this emphasis on "high-quality data systems" for instruction increased expectations for school districts to adopt data systems that facilitated educator access to student data and "data-driven" decision making (Cho, 2011, p. iv; Halverson & Shapiro, 2012; Levinson & Boser, 2014; Means, Padilla & Gallagher, 2010).

In 2015, Congress passed the Every Student Succeeds Act (ESSA), which renewed federal mandates from NCLB for district data systems. This law requires states and districts to track student progress to "close achievement gaps, increase equity, improve the quality of instruction, and increase outcomes for all students" (ESSA, 2015, p. 1). As with NCLB, school districts must deliver annual standardized tests and report test scores to their state Department of Education for analysis and public review (ESSA, 2015). This push by the federal government to merge standardized testing, curriculum, instruction, and data analysis further encouraged school districts to consider adoption and implementation of a learning management system (Hill, 2018).

In addition to federal policies and incentives, federal law requires a school district to comply with data security, privacy and access laws. For example, a school district must comply with the Family Educational Rights and Privacy Act of 1974 (FERPA), which protects the privacy of student education records, and the Child Online Privacy and Protection Rule of 1998 (COPPA), which protects children under 13 from unregulated access to the Internet (FERPA, 1974; COPPA, 1998). Additionally, the Individuals with Disabilities Education Act of 1973 (IDEA) requires a school district to encrypt data to protect Personally Identifiable Information (PII), as well as ensure that students with disabilities have access to the Internet and data systems (IDEA, 1973).

Adoption and Implementation of District Data Systems

The multivocal literature suggests that a school district follows a two-stage process to adopt and implement a data system. In the adoption stage, a district focuses on the selection of a data system vendor and product. In the implementation stage, a district focuses on data system deployment. Accordingly, this section has two parts: the adoption stage and the implementation stage.

The adoption stage. The multivocal literature identifies data system adoption as a process in which a school district selects a data system vendor and product prior to implementation (Cho, 2011; Wayman, Cho & Johnston, 2007; Wayman, Stringfield & Yakimowski, 2004).[6] This literature cites district actions in this stage, but not necessarily their order. These actions are: form a selection committee; conduct a needs analysis; evaluate cost; select a vendor and product; consider future data use; and develop the system.

Form a selection committee. The purpose of a selection committee is to "recommend, design, [or] purchase" a data system as well as "determine the mission, goals, objectives, uses, and users of data" (Bernhardt, 2004, p. 230; McMurray, 2017). Selection committee members include building and central office administrators, teachers, community members, clerical assistants, instructional personnel, school board members, and outside contractors (Bernhardt, 2004, Cho, 2011; Foreman, 2013a; Hamilton, Halverson, Jackson, Mandinach, Supovitz & Wayman, 2009; McMurray,

[6] Wayman, Cho & Johnston (2007) suggest a process prior to data system adoption called "calibration," which the authors define as a "discussion prior searching for a data system to identify how data will be used" (p. 42). Calibration insures that a district "define(s) education and how data support education" (Wayman, Cho & Johnston, 2007, p. 41). The process includes four questions that help districts "focus on teaching and learning": 1) What do we mean by learning and achievement? 2) How will we conduct and support teaching and learning? 3) How will we know teaching and learning when we see it? 4) What action will we take based on our results? (Wayman, Cho & Johnston, 2007, p. 42).

2017). Information technology professionals on a selection committee help a district understand operational requirements and technical standards in a learning management system (Berking & Gallagher, 2014; Foreman, 2013a; McMurray, 2017).

Conduct a needs analysis. A needs analysis identifies the "functions that a learning management system must perform in order to meet learners' needs" (Aslan, Huh, Lee & Reigeluth, 2011, p. 96; Berking & Gallagher, 2014; McMurray, 2017). Some of the learning management system "needs" cited in the specialized literature align with data system "needs" in the evaluative, status report, and prescriptive literatures. These needs include: interoperability, accessibility, hosting, formatting, reusability, scalability, extensibility, and durability.

Interoperability. Data systems require interoperability with other data systems (Berking & Gallagher, 2014; Foreman, 2013b; Means, Padilla & Gallagher, 2010; Means, Padilla, DeBarger, & Bakia, 2009; Molinar, 2014a; Watson & Watson, 2007; Wayman, Cho & Johnston, 2007; Wayman, Snodgrass-Rangel, Jimerson & Cho, 2010b; Yildrim, Reigeluth, Kwon, Kageto, & Shaw, 2014). Berking and Gallagher (2014) define interoperability as the "ability to take instructional components developed in one system and use them in another system" (p. 39). Interoperability can involve data, content, technical standards, user profiles, user accounts, or single sign-on capability (Berking & Gallagher, 2014; Foreman, 2013a).

If a data system lacks interoperability, it can limit data access, analysis, and use (Means et al., 2009; Means, Padilla & Gallagher, 2010; Wayman, 2007; Wayman, Cho & Johnston, 2007; Wayman, Jimerson & Cho, 2012; Wayman et al., 2010). Technical interoperability involves compliance with various standards for data transfer (Fenton,

2018). For example, in the United States, the Schools Interoperability Framework (SIF) sets standards for the transfer and integration of data between educational data systems (Bush & Mott, 2009; Cho, 2011; SIF Association, 2015).[7] Another interoperability standard, Learning Tools Interoperability (LTI), helps to connect a learning management system to a student information system (Fenton, 2018). Most learning management systems also have interoperability through a public Application Programming Interface (API), which allows applications in a proprietary data system to communicate with each other (Fenton, 2018).

In this literature, interoperability also refers to digital infrastructure, which is the hardware and software that a school district needs for data system use (Berking & Gallagher, 2014; Means, Padilla & Gallagher, 2010, p. 9; Fox et al., 2012). In school district, infrastructure may include fiber optic cable or satellite connections for Internet service, servers, and hosting, as well as hardware, such as desktop computers, laptops, or other portable, digital devices (Berking & Gallagher, 2014; Fox et al., 2012; Piccano, 2009).

Accessibility. Accessibility is the ability of data system users to locate and retrieve instructional components from multiple locations (Berking & Gallagher, 2014; p. 39; Foreman, 2013a; Herold, 2014; Wayman, Cho & Johnston, 2007; Wayman & Stringfield, 2003). Educators are more likely to use a data system that is accessible from home or from "anywhere else they choose to work" (Wayman & Stringfield, 2003, p. 5; Wayman,

[7] The SIF Association defines data transfer standards as "common data formats, naming conventions, and rules of interaction between applications" (SIF Association, 2015). This organization promotes standards for data exchange among all educational software applications in K–12 settings (SIF Association, 2015). Because vendors range in terms of SIF compliance, the SIF Association advises that school districts work only with data system vendors that follow SIF specifications (Bush & Mott, 2009; SIF Association, 2015; Wayman, Stringfield & Yakimowski, 2004).

Cho & Johnston, 2007). Data systems that have "single sign-on" capability provide one username and password for multiple data systems, either through a learning management system or through a third-party, single sign-on provider (Smith, 2018, p. 1).

Hosting. Hosting is the location designated by the vendor or school district for data storage (Foreman, 2013a). On-site hosting means that a district has its own servers or a data warehouse; remote hosting means that a vendor has its own servers, or uses third-party servers (Berking & Gallagher, 2014; Davis, 2014; Molinar, 2014a). "Cloud-based" hosting means that data are housed off-site on servers determined by the vendor (Gutiérrez-Carreón, Daradoumis, & Jorba, 2015, p. 145; Fenton, 2018). Most learning management system vendors host district data remotely on a private or public server (Gutiérrez-Carreón, Daradoumis, & Jorba, 2015; Molinar, 2014a).[8]

Formatting. Formatting is the software code for data systems (Lang & Pirani, 2014). Depending on the vendor, learning management systems have a closed, proprietary format or an open source format (Herold, 2014; Lang & Pirani, 2014; Yildrim et al., 2014). A data system with an open source format contains code that is available to the public and, to a certain degree, can be altered or changed (Lang & Pirani, 2014). A data system with a closed, proprietary format contains code that is owned by the vendor and is not publically available (Lang & Pirani, 2014). For example, Moodle's learning management system has an open source format, whereas Blackboard's system has a proprietary, closed format (Blackboard, Inc., 2017; Moodle, Inc., 2018).

[8] Private remote hosting is when a vendor "maintains the system in a private, isolated environment with dedicated servers just for that institution" (Molinar, 2014a, p. S11). Public remote hosting is when a vendor contracts server space with a remote provider, such as Amazon or Rackspace (Molinar, 2014a).

Reusability. Reusability is when a learning management system has the ability to share instructional components in multiple applications, such as with learning objects (Berking & Gallagher, 2014, p. 39). Learning objects are the smallest form of content in a learning management system (Berking & Gallagher, 2014; Watson & Watson, 2007). Reusability of learning objects or instructional components assists a school district in the setup and delivery of online courses, and helps to connect state standards to local curriculum and content (Watson & Watson, 2007).

Scalability. Scalability is "whether or not a [learning management] system can meet potential volume demands" (Berking and Gallagher, 2014, p. 39; Foreman, 2013a; Molinar, 2014b; Watson & Watson, 2007). To determine scalability, a district counts the number of concurrent users and matches that number to the vendor's "architecture for potential users" (Berking & Gallagher, 2014, p. 39; Molinar, 2014b). If a vendor's product is not scalable, then some users may not have access to the system upon implementation (Berking & Gallagher, 2014; Molinar, 2014b).

Extensibility. Extensibility refers to whether or not components in a data system can be modified to meet user needs (Berking & Gallagher, 2014; Herold, 2014; McIntosh, 2016). For example, data systems have tools that allow educators to collect, organize, and analyze student data (Schauffhauser, 2015; Wayman et al., 2010a; Zavadsky, 2009). Efficient system tools allow a district to get "data out of the system [so that] time can be spent analyzing and interpreting data" (Wayman, Jimerson & Cho, 2012, p. 171; Wayman, Stringfield & Yakimowski, 2004; Zavadsky, 2009). In a learning management system, tools aimed at extensibility include digital libraries, groups, discussion boards, gradebooks, pre-populated curriculum, and curriculum standards

(Berking & Gallagher, 2014; Fisher & Frey, 2015). Extensibility in a learning management system also allows an educator or district to customize tools to enhance system functions, such as additional software, applications, languages, or mobile use (Fisher & Frey, 2015; McIntosh, 2016; Molinar, 2014b).

Durability. Durability is the ability of a learning management system to "withstand technology changes over time without costly redesign, reconfiguration or recoding" (Berking & Gallagher, 2014, p. 39). If a data system is durable, it should be viable over many years (Bush & Mott, 2009; Wayman, Stringfield & Yakimowski, 2004).

Develop the data system. Sources in the evaluative, status report, and prescriptive literatures do not clearly identify steps involved in data system development. However, the specialized literature on learning management systems does suggest how a district might work with a vendor to facilitate this process (Berking & Gallagher, 2014; Foreman, 2013a; Herold, 2014; McIntosh, 2016; Yildrim et al., 2014). Potential steps identified this literature include attention to data security, data migration, customization and configuration, and staging.

Data security. School districts must adhere to data security laws and policies to protect Personally Identifiable Information (PII) (Aslan et al., 2011; Berking & Gallagher, 2014; Foreman, 2013a; McIntosh, 2016). Ensuring data security involves attention to encryption, passwords, security features, single sign-on, digital signatures, unique identifiers, security certifications, permissions, and roles (Berking & Gallagher, 2014; Davis, 2014; Foreman, 2013a; Foreman, 2013b).

Data migration. Data migration is the transfer of educator content from a "legacy" (or previous) system into a new system (Berking & Gallagher, 2014, p. 48; Foreman, 2013b; Herold, 2014). Prior to learning management system use, a vendor may offer to migrate educator content into the new system (Berking & Gallagher, 2014; Foreman, 2013b). Cho (2011) notes that data migration can be expensive.

Configurations and customization. System configurations are "changes [to a learning management system] made by a system administrator without any programming" (Berking & Gallagher, 2014, p. 15; Foreman, 2013a; Foreman, 2013b; Herold, 2014; McIntosh, 2016; Molinar, 2014b; Yildrim et al., 2014). System customization is the manual programming of a learning management system by technical personnel to fit user needs (Berking & Gallagher, 2014). Due to the technical nature of system configurations and customization, usually a vendor or district personnel with an information technology or computer science background configure or customize a learning management system (Berking & Gallagher, 2014; Schaffhauser, 2015).

Staging. Staging is a test of the learning management system prior to implementation (Berking & Gallagher, 2014; Foreman, 2013b). During staging, a vendor performs "'what if' scenarios" to determine whether or not a system works as intended (Berking & Gallagher, 2014, p. 39). Staging can reveal data system glitches that a vendor or school district may need to fix prior to implementation (Berking & Gallagher, 2014; Foreman, 2013b). Therefore, depending on the complexity of the data system and its potential use, staging a new data system may take a considerable amount of time (Berking & Gallagher, 2014; Foreman, 2013b).

Evaluate cost. Data system costs include infrastructure, integration, personnel to clean data, and additional features and options (Brush, Armstrong, Barbrow & Ulnitz, 1999; Hamilton et al., 2009; Wayman, Stringfield & Yakimowski, 2004). Vendors may price data systems as a cost per student, or offer an annual licensing fee (Burch, 2010; Cho, 2011). If not accurately priced, districts can find that a data system exceeds their budget (Levinson & Boser, 2014; Mieles & Foley, 2005). Bernhardt (2004) suggests that school districts should bid carefully on a data system because "the lowest price is not always the smartest buy" (p. 69).

***Consider future data use*.** Because access to a data system improves the chances that educators will use data, a school district should consider future data system use as part of data system selection (Cho & Wayman, 2012; Wayman, Cho, & Johnston, 2007). Data use interventions that target "multiple leverage points" and include data system access may have more "traction" than a single intervention (Marsh, 2012, p. 14). Therefore, Cho & Wayman (2012) caution that a data system with "powerful…and desirable" data analysis functions does not necessarily ensure future data use (p. 22).

Select a vendor and product. During vendor selection, a school district selects a data system and product (Schauffhauser, 2015). As part of this process, a district may contact other districts to "get practical feedback on the types of products and levels of service" (Wayman, Stringfield & Yakimowski, 2004, p. 12; Bush & Mott, 2009; Cho, 2011). A district can be "too optimistic" about vendors and data systems, and therefore should be careful in data system selection (Cho, 2011, p. 85).

The implementation stage. The multivocal literature casts data system implementation as related to educator data use, but frequently neglects to consider the

specific roles and responsibilities of central office personnel in this process. Honig (2003) notes that this oversight is not surprising, because district implementation studies often lack clarity on central office actions. With this liability in mind, this study defines "implementation" as any district action that occurs after vendor selection. The multivocal literature suggests that the implementation stage involves attention to system deployment, personnel, data quality, vendor relations, training, policies, and time.

Deployment. Deployment is the "point of introduction" for a data system (Wayman & Cho, 2008, p. 93; Cho, 2011; Means, Padilla & Gallagher, 2010). Some school districts deploy a data system all at once, but other districts deploy a data system in stages (Cho, 2011; Wayman & Cho, 2008). Educators need notice of data system deployment or otherwise they may be "unaware that there was a system they could access" (Means, Padilla & Gallagher, 2010, p. 4). If a district deploys a learning management system without attention to training and technical support, educator acceptance of a new system may be difficult (Parcell, 2017).

Personnel. Data system implementation requires support from district personnel (Cho, 2011; Knapp, Swinnerton, Copland & Monpas-Huber, 2006; Wayman et al., 2012b). An administrator experienced with instruction, data use, and data systems is helpful, as is a "champion" or project leader who can "interface" with personnel across departments (Cho & Wayman, 2015, p. 1230; Halverson, Grigg, Pritchett & Thomas, 2006; Wayman, Brewer & Stringfield, 2009; Wayman & Cho, 2014; Wayman & Conoly, 2006).

During data system implementation, district technical personnel clean data, maintain databases, upload data, and make decisions on data categorization

(Anagnostopoulous, Rutledge & Bali, 2013; Chen, Heritage & Lee, 2005; Lachat & Smith, 2005; Piccano, 2009; Wayman & Cho, 2008; Wayman, Stringfield & Yakimowski, 2004; Zavadsky, 2009). Districts without technical personnel may hire external consultants to do these tasks (Chen, Heritage & Lee, 2005; Lachat & Smith, 2005; Wayman & Cho, 2008; Wayman, Stringfield & Yakimowski, 2004). If a district does hire external help, Wayman, Stringfield & Yakimowski (2004) suggest that

> unless a district is certain that it has the expertise to deal with data problems quickly and efficiently in-house, the experience that an outside organization brings to the process is well worth the cost, especially when time and accuracy are considered (p. 8).

Data quality. A data audit ensures data quality (Mason, 2002; Means et al., 2011; Wayman & Cho, 2008; Wayman, Cho, & Johnston, 2007). An initial step in this process is a data inventory, which involves the identification of data formats, variables, sources, and locations (Wayman & Cho, 2008; Wayman, Stringfield & Yakimowski, 2004). To ensure data quality, technicians extract and clean data; create a data dictionary; eliminate overlapping variables or redundancies; standardize data elements; and verify data (Chen, Heritage & Lee, 2005; Hwang & Xu, 2008; Mieles & Foley, 2005; Rudner & Boston, 2003).

Vendor relations. To maintain a vendor relationship, a school district assigns personnel to act as a "bridge" between the district and the vendor (Cho & Wayman, 2015; Cho, 2011). As part of this relationship, a vendor troubleshoots operational problems or assists with educator training (Cho, 2011). A district's relationship with a vendor can "sour" due to a lack of vendor responsiveness or unrealized vendor commitments (Cho, 2011, p. 85).

Training. Data system implementation involves professional development for administrators and teachers (Beams, 2017; Cho, 2011; Cho & Wayman, 2015; Means, Padilla & Gallagher, 2010; Wayman & Cho, 2008). Ninety percent of school districts train personnel on the "basic functions" of a data system, and 70% of districts train personnel on data security issues (Means, Padilla & Gallagher, 2010, p. 32). Sometimes, a district delivers training in multiple modalities, such as online, hybrid, and in-person (Beams, 2017; Cho, 2011). A vendor may conduct training for district personnel, or assist a district with a train-the-trainer model (Cho, 2011). This model usually involves vendor training for a limited number of district personnel, who then train other district personnel (Cho, 2011). Some districts also target individual teachers for data system training (Means, Padilla & Gallagher, 2010).

Even though a district may neglect formal, data system training for teachers and administrators, educators care about data system training and its quality (Beams, 2017; Cho, 2011). In a study of professional development for elementary teachers on a learning management system, Beams (2017) found that teachers needed instruction on system use, integration with applications, pedagogy, tools for data use, and desired student outcomes. Beams (2017) also found that professional development in "hands-on, face to face settings allow[ed] for extensive exploration and trial and error" (p. 139).

***Policies*.** Data system policies "attend to how the system will fit into the everyday work of the educator" (Wayman et al., 2012, p. 23). Districts create informal policies around expectations for data use, as well as formal policies for accountability, compliance, and support for classroom practice (Wayman, Cho, Jimerson & Spikes, 2012a; Fisher & Frey, 2015). For example, a district's formal learning management

system use policy might limit student mobile device use during tests (Fisher & Frey, 2015). Poorly designed data system policies can result in educators "rejecting technologies that might otherwise have supported shared organizational aims" (Wayman, Jimerson & Cho, 2012, p. 172).

Time. Data system implementation takes a considerable amount of time (Bernhardt, 2004; Chen, Heritage & Lee, 2005; Cho, 2011; Mieles & Foley, 2005). Districts need time for system deployment, cleaning data, troubleshooting system problems, and educator training (Chen, Heritage & Lee, 2005; Cho, 2011; Mieles & Foley, 2005).

Organizational Actions and Contextual Forces

In the evaluative literature, organizational processes and contextual forces influence school district data system adoption and implementation. This literature identifies organizational processes as internal, district actions that direct adoption and implementation of a data system. These actions include formalization, coupling, alignment, adaptation, and accountability. This literature also identifies contextual forces as external pressures on a district to adopt a data system. These contextual forces include accountability, privatization, and diffusion of innovation. Although threadbare, this literature offers limited insight into how these processes and forces may influence district data system adoption and implementation.

Formalization. Cho (2011) defines formalization as an organizational process that involves mobilization of "people, policy, and resources toward data use and computer data systems in a concerted way" (p. 152). As part of formalization, a district gains support from high-ranking district administrators and educators; integrates

technology and non-technology personnel and offices; allocates resources; and employs people as boundary-spanners between departments to ensure communication and alignment for data system use (Cho, 2011; Curtis, 2010; Honig, 2006). Formalization creates awareness that data system adoption and implementation are not necessarily linear, but involve a process of continuous "sense-making, improvisation, and adjustment" (Cho, 2011, p. 178), which facilitates "building a learning organization…[to] produce dramatically improved results" (Curtis, 2010, p. 28).

If a district does not attend to formalization, then it can be susceptible to departmental isolation and fragmentation (Brooks, 2011; Cho, 2011; Cho, Jimerson & Wayman, 2015; Cho & Wayman, 2015; Curtis, 2010). Brooks (2011) notes that departmental isolation occurs when a district fails to "shift from a focus on technology in isolation to a focus on how technology [can] change student learning and teaching practices" (p. 12). Failure by a district to formalize data system use and bring data, technology, and instruction under one roof can lead to organizational fragmentation, or a "disjoint between knowledge and action" (Cho, 2011, p. 168; Cho, Jimerson & Wayman, 2015). If organizational fragmentation occurs, district personnel compartmentalize and strand technologists to keep "extant bureaucratic structures intact, despite their misfit to the work at hand" (Cho & Wayman, 2015, p. 1217). In that case, district leaders can be unpleasantly surprised when they realize that they are unable to get their "vision for the use of a system…[into] one that will be enacted" (Cho & Wayman, 2012, p. 6).

Coupling. Coupling as an organizational process is represented in the theoretical literature on organizations, as well as in the evaluative literature on school district data systems. For example, Young (2006) and Burch (2010) suggest that tightly or loosely-

coupled school district bureaucracies influence district actions around data system adoption and implementation. Theoretically, tightly-coupled districts meet accountability demands, which means that district actions have an intended effect, such as gains in student achievement (Young, 2006). In contrast, a loosely-coupled district may signal a "gap between government policy and school practice," and the possibility that a district's actions will not produce the desired results (Burch, 2010, p. 158). Using this logic, a district may signal compliance with accountability demands intended to improve student achievement through data system adoption (Young, 2006; Burch, 2010).

Alignment. Alignment as an organizational process focuses on data system use and how educators will "make sense" of a data system and its data (Wayman et al., 2012a, p. 23; Cho, 2011). Once implemented, a district expects that educators will know how to use a data system to chart and improve student achievement (Cho, 2011; Wohlsetter, Datnow & Park, 2008; Young, 2006). However, educator data use is a complex process that involves access, information, knowledge, and response (Mandinach, Honey, Light, & Brunner, 2008; Mason, 2002). Educators want clear "linkages" between data use interventions, processes, and outcomes (Turner & Coburn, 2012, p. 4; Beams, 2017; Choppin, 2002; Mandinach et al., 2008; Marsh, 2012; Young, 2006). These linkages can be simple, such as the delivery of accurate, relevant, and timely data to educators, or complex, such as new norms to improve data system literacy (Bernhardt, 2005; Hamilton et al., 2009; Means et al., 2009; Means et al., 2011; Young, 2006).[9]

[9] Means et al. (2011) describe data literacy as a five-step process that involves data location, data comprehension, data interpretation, instructional decision-making, and questioning (p. ix).

Educators can have preconceived notions about a data system prior to its use, which may lead them to "promote some system features as worthy of use or adaptation, while obscuring the significance of others" (Wayman et al., 2012a, p. 23). Educators also need time to "attain comfort with a particular system… even if the newer system is ultimately better or more user-friendly," as well as receive professional development on data system use and data use (Cho, Jimerson & Wayman, 2015, p. 139; Beams, 2017; Young, 2006).

Adaptiveness. Adaptiveness as an organizational process is a district's ability to be flexible during data system adoption and implementation (Cho, 2011; Cho, Jimerson & Wayman, 2015; Cho & Wayman, 2014; Wayman, Cho, & Shaw, 2009). Adaptive central offices engage in strategic planning and act on feedback (Cho, 2011; Cho, Jimerson & Wayman, 2015; Cho & Wayman, 2014). Adaptiveness is a desirable organizational trait in data system adoption that occurs as part of continuous improvement (Cho, 2011).

Accountability. Because both internal, organizational processes and external, contextual forces influence accountability, accountability operates as both a contextual force and an organizational process in this literature. As an organizational process, accountability involves district support for professional development, attention to student achievement data, and educator access to student data (Cho, 2011; Halverson & Shapiro, 2012). As a contextual force, national and state laws, policies, and incentives influence district data system adoption and implementation (Cho, 2011; Curtis, 2010; Means, Padilla & Gallagher, 2010; Wayman et al., 2012a). For example, NCLB required districts to use assessment systems to "report, measure, assess, communicate, and guide

instructional effectiveness" (NCLB, 2001, p. 2). Similarly, Race to the Top (2009) encouraged districts to purchase data systems that created teacher-student data links and charted data to inform instructional decisions (Curtis, 2010, p. 7; Boser, 2012; Burch, 2010; Piety, 2013). These accountability demands forced districts to consider the purpose of data system adoption and implementation, and how data systems may improve student achievement (Curtis, 2010; Piety, 2013).

Privatization. Privatization as a contextual force involves how, if at all, private companies or industries influence district adoption of a technology (Burch, 2010; Burch & Hayes, 2009). For example, Burch (2010) suggests that a school district may adopt an interim assessment system as a response to state or local policies aligned with educational privatization norms. In particular, privatization in the context of public education promotes "competition and consumerism" between school districts, which may shape a public-private relationship between districts and the selected vendor (Burch, 2010, p. 149). Instead of district personnel who decide on data access, analysis, and reporting, vendors or external consultants may do these tasks (Burch, 2010). In that case, vendors and districts can develop an intense private-public relationship in which vendors "act as critical extensions of educationally central policy processes" and potentially redirect district goals (Burch, 2010, p. 158).

Diffusion of innovation. Diffusion of innovation is a theory in which an "innovation is communicated through certain channels over time among members of a social system" (Rogers, 1995, p. 5).[10] As a contextual force, diffusion of innovation

[10] Although the data systems literature does not mention diffusion of innovation as a contextual force on adoption, this concept has potential utility for future studies of learning management systems, particularly in higher education. Therefore, it is included in this study as a contextual force.

suggests that a school district adopts an educational technology in order to model the innovative behaviors of other school districts (Rogers, 1995). Applied conceptually to data system adoption, diffusion of innovation suggests that a school district adopts a data system to gain knowledge, reduce uncertainty, and improve communication (Piety, 2013; Rogers, 1995).

Theoretical Lenses: Rational Theory and Institutional Theory

Two perspectives from organizational theory, the rational perspective and the institutional perspective, have utility as theoretical lenses for this study. The rational perspective presumes that tightly-coupled organizations with bureaucratic actors seek technical efficiency and certainty for measureable outcomes (DiMaggio & Powell, 1983; Senge, 2006). In contrast, institutional theory suggests that loosely-coupled organizations pursue conformity and legitimacy rather than efficiency (DiMaggio & Powell, 1983; Meyer & Rowan, 1977). These frameworks represent two competing 'logics' of organizational theory that researchers use in education policy analysis (Ogawa et al., 2003, p. 151; Rowan & Miskel, 1999). This section describes these lenses and broadly explicates this theory in relation to education policy, schools as organizations, and educational technology.

The rational perspective. The rational perspective presumes that an organization exists to attain specific goals (Ogawa, 1994; Parsons, 1960; Senge, 2006; Simon, 1997). This perspective originated in the 1700s, when industrial age scientists conceived of the world as "made up of discrete components" like a machine (Senge, Cambron-McCabe, Lucas, Smith, Dutton, & Kleiner, 2000, p. 29). Through this lens, rationality is the "construction of alternative means that are considered appropriate for reaching desired

ends" (Simon, 1997, p. 73), and rational decision-making maximizes efficiency or "the attainment of maximum values with limited means" (Simon, 1997, p. 75).

In the rational perspective, an organization is a system in which "the attainment of a goal produces an identifiable something which can be utilized" (Parsons, 1960, p. 17). Through this lens, an organization contains 1) goal-seeking actors that work towards best solutions and 2) corresponding, formalized, organizational structures and processes designed to optimize efficiency (Meyer & Rowan, 1977; Parsons, 1960; Scott, 1998; Selznick, 1948; Senge, 2006; Simon, 1997). Because organizations in this perspective pursue unambiguous goals, decision-making involves the comparison of alternatives, and the selection of efficient and effective ways to achieve these goals (Ogawa, 1994; Parsons, 1960; Scott, 1998; Simon, 1997).[11] Once an organization defines its potential goals and outcomes, goal-setting continues "until a relatively final aim is reached" (Simon 1997, p. 324).

In the rational perspective, an organization adopts structures to maximize efficiency and to meet defined goals (Ogawa, 1994; Selnick, 1957). The most common type of organizational structure in this model is bureaucracy (Meyer & Rowan, 1977; Perrow, 1961). A bureaucracy has a hierarchical structure, a formal chain of command, and a division of labor (Perrow, 1961; Weber, 1978). This type of organizational structure is "tightly-coupled," which means that "leaders make formal decisions from the top-down and subordinates act on those decisions accordingly" (Grusky & Miller, 1981,

[11] Simon (1997) offers three steps for making decisions in a rational organization: 1) list alternative strategies; 2) determine the consequences of each strategy and 3) evaluate consequences.

p. 27).[12] Theoretically, an organization that is tightly-coupled promotes maximally efficient actions aligned with organizational goals (Grusky & Miller, 1981; Meyer & Rowan, 1977; Scott, 1998).

In this model, actors are bureaucrats that seek efficiency for measureable outcomes (DiMaggio & Powell, 1983; Weber, 1978). Workers develop a "functional specialization" in standardized tasks, while supervisors control, change, and subdivide work as needed (Grusky & Miller, 1981, p. 26; Perrow, 1961). Managers expect each worker to make a distinctive contribution to organizational productivity in a specialized area, and an organization uses "technical assistance, rewards, and sanctions" to increase worker productivity and compliance (Cuban, 1986, p. 138; Barr & Dreeben, 2008).

A key concept of the rational model is organizational learning (Copland, 2003; Honig, 2003; Ogawa et al., 2003; Senge, 2006; Simon, 1997). The rational perspective assumes that productive, goal-oriented actors strive to learn, and that an organization develops competencies that "continually expand (its) capacity to create results" (Senge, 2006, p. 3; Fullan, 1992; Simon, 1997). As part of organizational learning, individuals expand productivity and achieve goals through informational feedback loops, while an organization implements resources, procedures, and processes to "create strategies that allow the organization to continue learning" (Senge, 2006, p. 24; Copland, 2003; Honig, 2003; Ogawa et al., 2003; Parsons, 1960). This structure creates conditions that increase productivity, and allow an organization to "systematically assess the extent to which goals are attained and use [that] feedback to revise goals" (Ogawa et al., 2003, p. 152).

[12] Simon (1997) notes that for groups, a rational decision is "consistent with the values governing the group, and information the group possesses relevant to the decision" (p. 324). For individuals, a rational decision is "consistent with the values, alternatives, and the information…weighed in reaching it" (Simon, 1997, p. 324).

The rational perspective as a study lens. Rational theory has historically operated as a lens for researchers to interpret organizational actions related to education and technology. This section broadly explicates this theory in relation to education policy, schools as organizations, and educational technology.

Education policy. Rational theory has a long history as a lens to examine education policy. In the 19th century, educators borrowed the model for public schools from manufacturers in the industrial age that wanted efficient factories with assembly lines (Senge et al., 2000; Cuban, 1986; Tyack, 1974). In this model, students sit passively while teachers efficiently deliver standardized curriculum (Cuban, 1986; Senge et al., 2000). Consequently, policy analysts use this model to understand school systems as a "rational environment" (Huber, 1981, p. 3) where bureaucratic actors work in "stable lines of authority," and adopt educational policies to improve the technical efficiency of schools as organizations (Selznick, 1948, p. 29; Ogawa, 1994; Senge et al., 2000).

School districts as organizations. In the rational perspective, school districts as organizations have an assembly-line model of education (Senge et al., 2000). In this model, a school district is a multi-level educational organization where "activities are carried out in a connected and coherent way" (Barr & Dreeben, 2008, p. 73). A school district reflects the structure of a rational organization with formal rules and authority, work procedures, and an appropriate division of labor (Meyer, 1992; Meyer, Scott & Deal, 1992). State and federal bureaucracies generate, implement, and monitor educational policies that school districts coordinate with tightly-coupled organizational actions (Barr & Dreeben, 2008; Cuban, 1990; Meyer, 1992). Labor in a school district includes specialized workers (teachers), and managers (school and district

administrators), who coordinate measurement of student outcomes and instruction, and teachers are organizational actors who carry out the "technical function of schooling" with student learning as the desired output (Parsons, 1960, p. 60; Barr & Dreeben, 2008; Cuban, 2001; Grusky & Miller, 1983; Meyer & Rowan, 1992; Meyer, Scott & Deal, 1992; Parsons, 1960; Senge et al., 2000).

The multivocal literature suggests that school districts as learning organizations seek "continuous improvement" to meet established goals (Means, Padilla & Gallagher, 2010, p. 1; Anagnostopoulous, Rutledge & Bali, 2013; Bernhardt, 2004; Curtis, 2010; Learning Point Associates, 2006; Wayman, 2005). Continuous improvement means "measuring and evaluating processes on an ongoing basis to identify and implement improvement" (Bernhardt, 2004, p. 13). As part of continuous improvement, school districts seek to "identify student needs" (Bernhardt, 2004, p. 230) and achieve "clear, quantifiable goals" (Anagnostopoulous, Rutledge & Bali, 2013, p. 220). In this perspective, a school district develops organizational competencies to increase productivity, efficiency, knowledge, for "the overall continuous improvement" of schools (Curtis, 2010, p. 3; Senge, 2006; Simon, 1997).

Educational technology. In the rational perspective**,** technology is an innovation that improves organizational performance and efficiency (Bamburger, 1995; Ogawa et al., 2003; Selnick, 1957; Scott, 1998). Organizations seek technologies that are "novel and useful" to organizational goals (Bamburger, 1995, p. 173), as well as technologies that enhance organizational efficiency and certainty (Ogawa et al., 2003; Scott, 1998; Senge et al., 2000). If an organization identifies technical objectives, then theoretically an

adopted technology should reflect "precise" organizational goals and encourage "technical or functional rationality" in an organization (Selnick, 1957, p. 16).

Technical rationality allows an organization to acquire resources and establish procedures to maximize efficiency (Scott, 1998, p. 33; Meyer & Rowan, 1977; Parsons, 1960; Scott, 1998; Selznick, 1948). Through this lens, information systems are technologies that operate as "coupling devices that coordinate planning, improve management control" (Keen, 1981, p. 25), facilitate decision-making, and operate as "an interface for identifying, obtaining and ingesting information selectively" (Simon, 1997, p. 241). Even though information system development is a highly technical process that involves "long-term change and innovation" (Keen, 1981, p. 24), a rational view suggests that these systems theoretically optimize or improve organizational performance when and if an organization takes "into account the capabilities and characteristics of the humans who are going to use them" (Simon, 1997, p. 227). Therefore, information management systems represent an innovation that "can be replicated on a meaningful scale at practical costs" (Senge, 2006, p. 5; Bamburger, 1995).

School districts in the United States have a "rapid rate of innovation" (Meyer, 1992, p. 240), and a rational view of technology adoption encourages "technical innovations…that have a direct impact on the technical work activity of the organization, such as teaching methods, curriculum, [and] materials" (Bamburger, 1995, p. 173). Theoretically, because bureaucratic actors seek technical certainty for measureable outcomes, they implement technically-oriented, educational technologies that facilitate the continuous improvement of schools (Curtis, 2010; DiMaggio & Powell, 1983; Meyer, 1992; Senge et al., 2000).

The institutional perspective. The institutional perspective suggests that an organization incorporate structures and processes that reflect "norms, values and ideologies institutionalized in society" (Rowan, 1995, p. 3; DiMaggio & Powell, 1983; Meyer & Rowan, 1977). Instead of goal-seeking actors who work towards measureable outcomes, actors in the institutional perspective conform with society's perceived norms and values "despite the immediate efficacy of the acquired practices and procedures" (Rowan & Miskel, 1999, p. 363). As a result, an organization seeks legitimacy and conformity with other institutions to ensure long-term survival (DiMaggio, 1988; DiMaggio & Powell, 1983; Meyer & Rowan, 1977; Scott, 1998; Weick, 1976).

In the institutional perspective, organizational goals are "vague and imprecise" (Scott, 1998, p. 50), and represent "directions of action rather than specific objectives" (Parsons, 1960, p. 172). Both the visible, stated goals of the organization, as well as the unseen "maintenance goals" lack definition (Scott, 1998, p. 57). Without clear goals, an organization operates as an "organized anarchy" in which "ambiguous goals, uncertain technologies, and unstable participation" threaten stability and survival (DiMaggio, 1988, p. 5). As a result, "the necessary means may need to be created" by organizational actors to accomplish specific outcomes (Selnick, 1957, p. 135; Rowan & Miskel, 1999; Scott, 1998).

Instead of tightly-coupled, organizations in this perspective may be loosely-coupled (Weick, 1976). The structure of a loosely-coupled organization is not hierarchical, but instead reflects "physical or logical separateness" (Weick, 1976, p. 4). Although a loosely-coupled organization can be more "adaptive and responsive" than a tightly-coupled organization (Weick, 1976, p. 7), loose-coupling can also result in an

organizational structure designed to "preserve [the organization's] identity" instead of support organizational goals (Weick, 1976, p. 3).

Institutional theory suggests that an organization without clear goals is subject to institutionalization (Cibulka, 1995; DiMaggio, 1988). Meyer & Rowan (1997) define institutionalization as "social processes, obligations, or actualities [that] come to take on a rule-like status in social thought and action" (p. 341). In institutionalization, organizational actors "interpret trends and changes in the larger societal environment," and adapt organizational structures to meet external demands (Cibulka, 1995, p. 127; Meyer & Rowan, 1977; Selznick, 1948). As a result of this normative process, an institutionalized organization conforms to "rationalized myths" of how similar organizations operate in order to survive (Rowan & Miskel, 1999, p. 363).

In the institutional perspective, organizational actors develop "shared meanings and values" that strengthen a "participant's commitment to support the structural façade" of an organization (Ogawa et al., 2003, p. 161). These constructed meanings can positively or negatively shape organizational goals. Actors who correctly interpret an organization's values engage in strategies that enhance organizational goal achievement (Cibulka, 1995). Alternatively, actors who misread an organization's values send "diffused, defused…and lost signals" through "tenuous" organizational linkages that do not support organizational interests (Keen, 1981, p. 25; DiMaggio, 1988; Selznick, 1948). In the latter case, an organization develops "deeply ingrained habits and procedures based on inarticulate knowledge and beliefs" (Scott, 1995, p. 54), which make it "difficult or impossible for actors to understand the relationship between means and ends" (DiMaggio, 1988, p. 5).

Three key concepts help explain organizational actions from the institutional perspective: isomorphism, conformity and legitimacy. In isomorphism, an institution mimics other institutions "that face the same set of environmental conditions" in order to maintain legitimacy and long-term survival (DiMaggio & Powell, 1983, p. 149; Cibulka, 1995; Ogawa et al., 2003; Scott, 1995). Isomorphic organizations develop structures, actors, and a language that closely reflect the norms and the environment of similar institutions (DiMaggio & Powell, 1983; Meyer & Rowan, 1977).

DiMaggio and Powell (1983) suggest three types of isomorphism that may be relevant to this study. Coercive isomorphism "stems from political influence and the problem of legitimacy" (DiMaggio & Powell, 1983, p. 150). This type of isomorphism occurs when an organization responds to formal and informal pressures from society as to how it should function. Mimetic isomorphism results from "organizational responses to uncertainty" (DiMaggio & Powell, 1983, p. 152). This type of isomorphism occurs when an organization models itself on similar organizations perceived as "more legitimate or successful" (DiMaggio & Powell, 1983, p. 152). Normative isomorphism occurs when an organization adopts "procedures, policies and structures" that other organizations interpret as "normatively sanctioned and legitimated" (DiMaggio & Powell, 1983, p. 152). Although isomorphism may be ceremonial, it can also result in conformity with other institutions that enhances an organization's legitimacy in its wider environment (DiMaggio & Powell, 1983; Meyer & Rowan, 1977).[13]

[13] Two other types of isomorphism are not as relevant to this study. Structural isomorphism occurs when an organization experiences a "convergence in policies and practices…operating in a similar environment or competing for the same goods" (Burch, 2007, p. 85; Ogawa, 1994). Competitive isomorphism assumes a "system rationality that emphasizes market competition, niche change, and fitness measures" (DiMaggio & Powell, 1983, p. 150).

Conformity is a key element of isomorphism. Conformity is a process in which an "organization conforms to rationalized rules [and] procedures…in order to gain increased support and legitimacy" (Rowan, 1995, p. 3). Organizational conformity involves "structural homogeneity, structural conformity… and constituency satisfaction" (Meyer, Scott & Deal, 1992, p. 57), as well as the "adopt[ion] of practices viewed as exemplary, normative, or routine" (Burch, 2007, p. 85). These normative processes often align with rationalized myths of how an institution should appear to outsiders (Meyer & Rowan, 1977; Rowan & Miskel, 1999). Although an organization's appearance is important for its long-term survival, in exchanging conformity for technical efficiency, an organization can develop "rigid conformity to institutionalized prescriptions" that interfere with its productivity (Rowan, 1995, p. 3).

If organizational isomorphism and conformity are in play, an organization reflects legitimacy in its institutional environment. Legitimacy is "social approval as expressed in norms and beliefs about the effectiveness and efficiency with which the institution meets its socially defined purposes" (Cibulka, 1995, p. 127). An organization gains legitimacy through 1) adoption of practices from other model organizations (Burch, 2007); 2) incorporation of organizational structures to "increase the commitment of internal participants and external constituents" (Meyer & Rowan, 1977, p. 347); 3) reliance on "established and legitimated" procedures and policies (DiMaggio & Powell, 1983, p. 155); and 4) the creation of vocabularies that are isomorphic with other similar institutions (Meyer & Rowan, 1977). These actions align and legitimize an organization with other similar organizations, which increases the likelihood of its long-term survival (Cibulka, 1995; DiMaggio & Powell, 1983; Parsons, 1960).

Institutional theory as a study lens. Like rational theory, institutional theory operates a lens to interpret organizational actions in school systems. This section briefly explicates this idea in the three areas mentioned in the rational perspective: education policy, schools as organizations, and educational technology.

Education policy. Although institutional theory draws many of its conclusions from comparisons to the rational perspective, this perspective has utility in education policy because school districts are "institutional structures that emerge through definition of roles and programs that are both rational and legitimate" (Meyer, Scott & Deal, 1992, p. 46). In the institutional perspective, education is not just a rational activity, but a "loosely controlled environment" that minimally guides actions at the technical core of the organization (Rowan & Miskel, 1999, p. 369; Burch, 2007; Meyer & Rowan, 1978; Weick, 1976). Through this lens, school districts adopt societal-type rules that result in a "perceived break" between policy and practice (Burch, 2010, p. 14).

School districts as organizations. In the institutional perspective, cultural beliefs and societal expectations shape school districts as organizations (Burch, 2007; Meyer & Rowan, 1977). Pulled to conform by "potentially inconsistent, rules and regulations" (Burch, 2007, p. 85), a school district adopts a "logic of confidence," which Rowan (1990) defines as "a set of face-saving norms that allow schools to appear rational but which avoid any substantive inspection of this assumption" (p. 355).

If a school district is sensitive to societal demands, it becomes isomorphic to societies expectations (Meyer & Rowan, 1978; Rowan, 1982). Burch (2010) suggests that a school district can be so normatively sensitive to external demands that it adopts policies and practices from organizations in "diverse settings" with seemingly "little

interaction" or connection to schooling (p. 149). If successful, these actions legitimize a school district in its wider education environment and ensure its long-term survival (Cibulka, 1995; DiMaggio & Powell, 1983).

Educational technology. In the institutional perspective, a technology does not have clear goals, but instead promotes organizational conformity, legitimacy, and myths that "buffer" the technical core of the organization (Freeman, 1973, p. 758; Meyer & Rowan, 1977; Ogawa, 1994). Without clear goals, an organization may adopt a technology that is poorly understood or neglect to assess it strengths and weaknesses (DiMaggio & Powell, 1983; Fullan, 1992). In that case, technology actors can "discard information…[and] avoid bringing in expertise" (Keen, 1981, p. 24), which can lead to "institutionalized rules and practices," or a technology that is "infused with value beyond the technical requirements of the task at hand" (Selnick, 1957, p. 14; DiMaggio & Powell, 1983; Meyer & Rowan, 1977).

In this perspective, "institutional norms, values, and technical lore" play an important role in educational technology adoption (Rowan, 1982, p. 260). A school district may respond to urgent calls from the federal government to adopt and implement a particular technology, only to find it lacks utility in relation to organizational goals (Bamburger, 1995; Meyer, 1992). This disconnect between the perceived utility and the actual utility of an educational technology may occur because the federal government has "little responsibility to make sure that innovations are consistent with present educational realities," or because an innovation diffuses widely across school districts without stability (Meyer, 1992, p. 248; Rowan, 1982).

A technology that society endorses makes school district adoption of that technology more likely (Meyer, 1992; Rowan, 1982). School districts in the United States tend to value educational innovation, and therefore adopt innovations with a "strong technical base and substantial interest group support" (Meyer, 1992, p. 247). Despite the potential for educational technology adoption and use in schools, an educational innovation is sometimes more "organizational than substantive" (Meyer, 1992, p. 247). For example, an educational technology can have "abstract goals" (Bamburger, 1995, p. 189) that "persist with little impact" on instruction (Meyer, Scott & Deal, 1992, p. 60). As a result of this technological persistence, "institutional forces are often more important than innovation effectiveness" in educational technology adoption and implementation (Bamburger, 1995, p. 186).

Strengths and Weaknesses in the Multivocal Literature

The multivocal literature for this study has strengths and weaknesses. Strengths in this literature include identifiable contextual forces and organizational processes in data system adoption, details of a school district's adoption process, and the utility of rational theory. Weaknesses include outdated sources, ambiguous terminology, lack of rival theoretical lenses, and scant evaluative literature on learning management systems and data system implementation.

Strengths. One strength of the multivocal literature is the identification of contextual forces and organizational processes. As external forces, privatization and accountability operate as pressures on a school district to adopt a data system to meet policy demands. Once a district adopts a data system, organizational processes, such as

formalization, accountability, coupling, alignment, and adaptiveness, guide district actions.

The multivocal literature also provides details of a school district's adoption process. For example, district actions in data system adoption include a needs analysis, formation of a selection committee, and selection of a product and vendor. Additionally, the specialized literature provides detailed steps in a needs analysis and factors involved in learning management system deployment that the evaluative, status report, and prescriptive literature do not contain.

The evaluative literature provides a distinct direction for the use of rational theory as a theoretical perspective for this study. Due to the technological nature of this topic, rational theory is the default lens in most of these studies, which assume that a school district invests in a data system for the purpose of continuous improvement. Institutional theory is rarely used in this literature. However, it is present in limited studies on data systems, and in the educational reform literature, as a competing perspective that is relevant to a study of data system adoption and implementation.

Weaknesses. This literature has a number of weaknesses. First, studies in the evaluative and status report strands are outdated. For example, a major contribution to the status report strand, Means, Padilla and Gallagher (2010), relies on survey data collected in 2007. Similarly, empirical studies on data systems in the evaluative strand date from 1999 to 2017, with 52 of 69 studies dated prior to 2013.

Another liability in the evaluative and status report strands is that these sources use the ambiguous term "computer data system" or "data system," but neglect to identify the system under study (Brunner et al., 2005; Chen, Heritage, & Lee, 2005; Cho, 2011;

Cho & Wayman, 2012; Lachat & Smith, 2005; Wayman, Cho & Shaw, 2009). Although these studies investigate educator data use, study findings lack clarity and precision in regard to the type of system in use and its requisite data. As revealed in this literature review, districts often deploy multiple data systems with different purposes and functions, which means that identification of the data system under study is important.

Other concerns in regard to this multivocal literature are as follows. First, most studies do not investigate central office actions. The extensive narration in qualitative studies hints at central office processes; however, many of these studies neglect to identify who in a central office guides adoption and implementation of a particular type of data system. Second, many studies do not provide details on district data system implementation. The specialized literature strand neglects learning management system implementation altogether; the evaluative literature strand focuses heavily on adoption, rather than implementation, of data systems. Third, this literature does not clarify the rational perspective as an investigative lens, and only a few studies employ an additional theoretical perspective or rival perspective. Additionally, the specialized literature on learning management systems has limited findings with questionable rigor. These weaknesses in the multivocal literature indicate that an exploratory study of a learning management system would contribute to the extant literature on this topic.

Conceptual Framework

An initial conceptual framework derived from the multivocal literature offers a roadmap for this study. In this framework, learning management systems are part of the larger constellation of data systems currently in use by school districts. Federal laws, policies, and incentives demand that school districts adopt and implement data systems

for reporting, assessment, and learning management purposes. Privatization, accountability, and diffusion of innovation operate as additional contextual forces on district adoption of a data system.

The multivocal literature approaches the study of data systems primarily from a rational perspective. This literature suggests that a school district engages in a two-stage process to adopt and implement a data system. Organizational processes in formalization, accountability, alignment, adaptiveness, and coupling guide district actions in these two stages. Eventually, in theory, these processes lead to educator data use for instruction.

Some studies in the evaluative literature suggest that institutional theory has utility as a rival perspective to rational theory to explain school district actions. Therefore, this study used institutional theory to investigate adoption and implementation of a learning management system. Theoretically, data system implementation leads to educator data use for instruction (see Appendix E for the initial conceptual framework).

Chapter Two Summary

The multivocal literature lacks a systematic study of how a school district adopts and implements a learning management system. The literature that informs this question is rational and multivocal, which means that sources contain multiple forms and voices on this topic. A review of this multivocal literature suggests that it has four strands: evaluative, status report, prescriptive, and specialized.

Federal laws, policies and incentives encourage data system adoption, as do contextual forces in privatization, accountability, and diffusion of innovation. Two rival theoretical lenses, the rational perspective and the institutional perspective, have utility to answer study questions. In the multivocal literature, a district engages in a two-stage

process to adopt and implement a learning management system. Actions identified as organizational processes in this literature include formalization, coupling, accountability, alignment, and adaptiveness. Although this literature has weaknesses, an exploratory case study of district adoption and implementation of a learning management system interpreted through rival theoretical lenses hopefully will contribute to the extant literature on this topic.

Chapter Three: Study Methods

This study used an exploratory, case study method to investigate adoption and implementation of a learning management system. Researchers often use case study method when they want to explore a process and use theory to explain findings (Yin, 2003). In this case, the investigative nature of this topic and analysis of findings through rival, theoretical lenses, means that case study is an appropriate method for this investigation (Stake, 1995; Yin, 2003).

With this explanation in mind, this chapter presents the research design and method for this study. The first section offers the rationale for a case study on this topic. The second section explains the study design. The third section provides the criteria for site selection. The fourth section describes collection procedures for study documents, interviews, and procedures for data analysis. The fifth section reviews researcher controls for validity, bias, and error. The final section discusses how this study attended to ethical considerations.

Case Study Rationale

Case study method is useful when a researcher wants to explore a process and uses theory to explain findings (Merriam, 1999; Stake, 1995; Yin, 2003). For example, Yin (2003) suggests case study method when a researcher wants to answer "how and why" questions, and uses theory to focus on events that "defy behavioral or experimental controls" (Yin, 2003, p. 13). Case study method is also appropriate when a researcher wants to explore a process with specific boundaries in terms of location, time, data collection, number of interviewees, and theory (Merriam, 1999; Stake, 1995). In alignment with this approach, this study focused on a specific timeframe for district

adoption and implementation of a learning management system; collected data from limited number of informants; and used theory to explain findings.

Case studies require documents from multiple sources to triangulate findings (Merriam, 1999; Yin, 2003). This study had multiple sources of data in public records, district documents, and interviews. Public records provided information about the district's context and conditions prior to adoption and implementation. District documents collected on site provided operational details and a timeline of district actions, as well as information about each stage in the district's process. Interviews rounded out this data set to provide an in-depth understanding of central office actions.

Although this study responds nicely to an exploratory, case study method, case studies have liabilities. For example, because case studies involve a small sample size, findings are analytically generalizable, but not generalizable to a population (Patton, 2014). Case study researchers must be careful to attend to qualitative representations of rigor and validity, which are not the same as in quantitative analysis (Patton, 2014). Case studies can also be time-consuming, involve a lengthy narrative, or require development of a conceptual framework that can be difficult for researchers to use in future studies (Patton, 2014). Despite these potential pitfalls, exploratory case study was an excellent match for this research study and questions.

Study Design

Depending on a researcher's goals, case studies can have a multiple case or a single case design (Merriam, 1999; Yin, 2003). Because a single case study design offers a researcher the opportunity to focus on a particular phenomenon, or investigate how specific conditions may change over time, a researcher uses this design when research

questions focus on an event or process (Creswell, 2003; Yin, 2003). If a researcher selects a single case study design, the type of single case study can vary depending on the case study rationale. For this study, an exploratory, single, case study approach was appropriate because district adoption and implementation of a learning management system is a contemporary topic that uses a conceptual framework to explain findings (Creswell, 2003; Stake, 1995; Yin, 2003).

Site Selection

This study sought a school district engaged in learning management system adoption and implementation as a case study site. This site selection process had multiple steps. First, this study received Institutional Review Board (IRB) approval. The IRB review required documentation of research questions; recruitment procedures; enrollment and rationale for enrollment; procedures, risks and benefits; consent and confidentiality; and compliance issues. This process also required submitting a consent form, interview protocol, and recruitment letter to districts.

After receiving IRB approval, the criteria to select a school district were determined. Non-negotiable selection criteria were: a district that had adopted and implemented a learning management system in the last three years; 15-20 central office personnel available for interviews; an approach to subject recruitment that reduced the possibility for bias and error; and adequate site access to conduct and complete research. Negotiable criteria included the availability of study subjects to meet in a condensed period of time and the study location.

With these criteria established, a search for a study site was conducted. First, citations and vendor websites in the specialized literature were used to identify school

districts with a learning management system. This initial search yielded 40 school districts in the United States that were possible locations for this study. Next, all 40 district websites were visited to ensure that the district had adopted and implemented a learning management system in the last three years, and that the district allowed outside studies. Out of 40 districts, 23 districts met these criteria. Then, organizational charts or directories in each of these districts were reviewed to determine if the district's central office had 15-20 personnel available for study recruitment. Out of 23 districts, seven met these criteria. Study applications were sent to all seven school districts, and three districts offered to host this study.

Of the three potential study sites, the school district selected was "Oak Trail" (a pseudonym). At the time of data collection, Oak Trail was in its second year of learning management system implementation. Over 15 central office personnel were knowledgeable about the district's process and were willing to be interviewed. The district complied with a request to reduce bias and error in subject recruitment, as well as a condensed period of time (two weeks) to conduct all interviews. The district had experience with data systems, and was willing to provide internal documents that were relevant to this study. When combined with Oak Trail's match to site selection criteria, these factors suggested that Oak Trail was an excellent choice for this study.

Document Collection, Interviews, and Data Analysis

This section presents procedures for document collection, interviews, and data analysis used for this study.

Document collection. Case studies require collection and review of multiple data sources (Merriam, 1999; Patton, 2002; Yin, 2003). Merriam (1999) notes that in a search

for study documents, a researcher should identify the relevance and purpose of a document, as well as its capacity to answer research questions. Additionally, researchers should triangulate sources, determine data accuracy and authenticity, and reduce the possibility for bias and error (Creswell, 2003; Merriam, 1999; Yin, 2003). For this study, three types of documentary sources were collected and evaluated to answer research questions: public records, district documents, and online sources.

Public records. Guba and Lincoln (1987) note that public records, such as state laws, policy statements, regulations, and financial information, often serve as a starting point for studies that require official confirmation of an event or process (Creswell, 2003; Guba & Lincoln, 1987; Merriam, 1999). For this case study, public records were accessed through state and district websites prior to data collection. For example, on the Department of Education website in this state, relevant documents included state laws on student testing; strategic plans for student assessment, instruction, instructional technology, and digital infrastructure; and state guidelines for instruction, instructional technology, and digital infrastructure. As these records were accessed and read, they were checked for authenticity, bias, and error either through links either provided in the documents or with a Google search.

In addition to state websites, Oak Trail's official website was also searched for public records. Public records accessed from the district's website included Oak Trail's three-year strategic and instructional technology plan; transcripts of school board meetings; presentations on Oak Trail's adoption and implementation process; spreadsheets with financial data and vendor payments; and instructional standards. As with the state public records, district public records were accessed and reviewed prior to

the data collection in Oak Trail. These documents provided important insight into the district context for this study in terms of digital infrastructure, data systems, and policies that guided Oak Trail's process to adopt and implement a learning management system.

Following searches on state and district websites, a Google search was conducted for additional documents that might be relevant to this study. This search produced spreadsheets with details of state and district expenditures on digital infrastructure; records of vendor payments; learning management system vendor information; and Oak Trail's Request for Proposal document. Although it is not clear why these some of these documents were not available on the state and district websites, nevertheless they provided useful details about Oak Trail's adoption and implementation of a learning management system (see Appendix F for a list of public records).

District documents. In addition to public records, Oak Trail provided internal documents for this study. Some of these documents were offered by the district at the start of data collection, and others were collected during the study. These documents included a timeline and plan for adoption and implementation of Oak Trail's learning management system; handouts on the learning management system to parents, teachers, and students; and professional development materials. These documents provided additional insight about Oak Trail's process to adopt and implement its learning management system (see Appendix G for a list of district documents).

Online sources. In addition to public records and district documents, websites contained relevant information for this study. Websites reviewed for this study included learning management system vendors; the State Department of Education website; the official State government website; Oak Trail's official website; and a website posted by

Oak Trail's Information Technology Department. Because much of the information on these websites could not be downloaded as readable files, I took notes on this information and then uploaded those notes into the qualitative, analytic software program. These notes contained information on vendors and their products; state standards and curriculum; timelines for state tests; online course offerings and schedules; and district plans for adoption and implementation of Oak Trail's learning management system for students and parents (see Appendix H for a list of online sources).

Interviews. In addition to documentary evidence, 15 semi-structured interviews were conducted with Oak Trail personnel. These interviews used a standardized, open-ended format, which is useful when the interview protocol will be published as part of the study, and when the interviewer wants to "maximize interview time and minimize variation" (Patton, 2014, p. 441). Because interview data comprised a large portion of the data for this study, this section describes the procedures for sample selection, solicitation of informants, instrumentation, digital recording and data storage, and confidentiality.

Sample selection. Qualitative inquiry uses the logic of "purposeful" sampling to identify study informants (Patton, 2002, p. 230; Creswell, 2003; Merriam, 1999). Although in quantitative methods purposeful sampling might constitute a bias, Patton (2002) suggests that this approach is a strength of qualitative methodology, because purposefully sampled informants "yield insights and in-depth understandings" that help answer research questions (p. 230). In addition to purposeful sampling, a qualitative researcher should also welcome the opportunity for interviews recommended by key informants (Patton, 2002). When a researcher uses this "snowball" approach for

informant selection, these informants can broaden a sample, provide context, and confirm emergent themes in study findings (Patton, 2002, p. 237; Stake, 1995).

Accordingly, this study used both purposeful and "snowball" sampling methodologies. Prior to site entry, a list of 23 possible informants who worked in Oak Trail's central office was composed from public documents and Oak Trail's website. Then, at an introductory meeting with Oak Trail personnel, informants from this list were confirmed as particularly knowledgeable (or not) about Oak Trail's adoption and implementation process. In this initial meeting, personnel who were no longer involved in the project or had left their position in the school district were noted. This process resulted in a list of 18 potential informants in Oak Trail's central office with varying roles and responsibilities who were currently employed by the district and who might be willing to participate in this study.

With this initial list compiled, additional criteria were applied to select informants who would receive an initial study inquiry. The current position of the informant in Oak Trail's central office was considered, as well as their role as a key informant, which Patton (2002) notes is a critical step for an information-rich case. Due to the timing of this study in the second year of implementation, the roles and responsibilities of the informant in the adoption and implementation process also were taken into account.

Based on these criteria, initial requests for interviews were sent to 12 informants, all of whom agreed to participate in this study. During the first few interviews, three additional key informants who were not included in the original list were identified and contacted. These informants also agreed to be interviewed for this study. This selection process resulted in 15 interviews conducted over two weeks in October 2017. All

interviews took place in district offices, schools, or the surrounding area at the convenience of the informant. Interviews lasted 60 to 90 minutes and used a semi-structured interview format.

Solicitation of informants. Study informants were contacted with an introductory letter sent to email addresses provided by Oak Trail (see Appendix I for the introductory letter). If informants indicated that they would like to be interviewed for the study, a date and time for the interview was determined either by phone call or email. Once an interview date and time was set, the informant received a description of the case study and the IRB consent form (see Appendix J for a copy of IRB consent form). As mentioned previously, interviews were scheduled in a location convenient for the informant, which for this study included informants' offices, school conference rooms, and off-site locations. Oak Trail personnel also provided an interview space in the central office if an informant requested that location.

Instrumentation. Interviews for this study were conducted using a standardized, semi-structured protocol (Merriam, 1998; Patton, 2002). A standard protocol is useful when a researcher needs to comply with IRB requirements, seeks consistency in the interview process, and wants to use an informant's time efficiently (Patton, 2002). A semi-structured approach allows a researcher to ask probing questions, mix formal and informal inquiries, and conduct an interview like a conversation (Merriam, 1998; Patton, 2002). A mix of these two approaches provides a researcher the opportunity to elicit specific information from informants, while also responding to the "emerging worldview of the respondent and new ideas on the topic" (Merriam, 1998, p. 74).

A semi-structured interview has advantages over a less formal interview approach. Respondents answer the same questions in the same order, which facilitates data organization and analysis (Patton, 2002). If done carefully, this approach provides a complete data set, which reduces bias and error. On the other hand, a poorly delivered interview with a semi-structured approach may "constrain and limit the naturalness and relevance" of study questions, and result in a lack of flexibility in responses to study questions (Patton, 2002, p. 349).

In order to address these liabilities, the semi-structured protocol used for this study included both formal questions and informal prompts or "probing questions" (Patton, 2002, p. 373; Merriam, 1999). Probing questions are useful when an interviewer wants more detail from an informant, needs clarity in an answer, or seeks to contrast or compare an answer to a previous response (Patton, 2002). Additionally, probing questions can facilitate a natural conversation, and indicates that the interviewer is "sensitive to the feedback needs of the person being interviewed" (Patton, 2002, p. 373). In this protocol, potential prompts were noted prior to the first interview, and then refined with additional interviews as needed. This approach facilitated a natural conversation and solicited responses that answered study questions (see Appendix K for the study protocol).

Digital recording and data storage. The IRB requires that informants be notified of their rights in regard to digital recording and data storage. This study complied with these requirements. With permission of the informant, interviews were digitally recorded. All informants were notified of their right to decline a digital recording or turn off the recorder at any point in the interview, although none did so. In addition to a digital

recording of each interview, handwritten notes were taken. These notes provided a backup to the digital recording, as well as a memo of informant answers.

Following interviews, all recordings were immediately downloaded to an external hard drive for storage and coding. Interviewees were assigned a code known only to the researcher, and recordings were stored with this code. A second, digital copy of each interview was created and transferred to a flash drive as an emergency backup. All data were stored in password protected computer, or if in paper form, a traditional, locked filing cabinet.

After following proper storage procedures, interviews were transcribed in their entirety with transcription software. Although transcription software allows a researcher to transcribe an interview quickly, it also requires a researcher to listen to the interview after transcription in order to correct errors. For this study, interview transcriptions were coded, reviewed, and stored within 24 hours the interview. Then, in the two weeks following data collection, interviews were replayed to correct errors and begin the process of qualitative coding.

Confidentiality. The IRB process requires a guarantee of interviewee confidentiality. This study complied with these requirements. The right to confidentiality was in the IRB consent form, and was explained in person to informants before the interview. As mentioned previously, informants were assigned a code to protect their identity, and as much as possible, informant identities are concealed in this manuscript.

Data analysis. Coding data assists a qualitative researcher to organize and arrange data in a systematic, meaningful way (Saldana, 2009). This approach helps a researcher confirm existing concepts, and allows for the identification of emergent

themes and theories (Maxwell, 1996; Merriam, 1999). For this study, qualitative coding software was used to code interviews and documents, as well as facilitate data analysis.

Saldana (2009) suggests that a qualitative researcher engage in at least three coding cycles. In the first coding cycle, codes should focus on organizing data in a manner that makes sense for study questions, such as a priori codes developed from a literature review. In the second coding cycle, categories and subcategories developed from initial codes should reflect an emergent study narrative, and signal concepts or themes that may be important to theory. In the third coding cycle, accurately categorized themes and concepts should begin to generalize and connect to theory. In this way, coding moves from the "real and particular" to the "general and abstract," in order to transfer "what may be observed into what may happen in similar or future contexts" (Saldana, 2009, p. 13).

In keeping with Saldana's (2009) approach, data in this study were coded in three cycles. In the first coding cycle, keywords from the literature review were used as a priori, initial codes. These codes were embedded in the interview guide for ease of initial coding, and were attached to either "adoption" or "implementation" processes. As interviews and documents were entered into the coding software, a priori codes helped to organize data and to confirm the triangulation of findings (Patton, 2002).

In the second coding cycle, codes labeled as categories and concepts in the literature, such as formalization or privatization, were identified. In this second round of coding, subcategories developed for a priori codes reflected specific processes or stages related to district actions, such as the "Request for Proposal" and "pilot." As these subcategories and concepts developed, they were resorted and recoded to reflect Oak

Trail's authentic narrative, such as an additional stage or details of the district's adoption and implementation process.

With an emergent narrative in place, the third coding cycle focused on a "holistic picture" of the case (Merriam, 1999, p. 194). Rational theory and institutional theory operated as lenses through which data were analyzed. In this final round of coding, categories and themes were connected to either rational theory or institutional theory (or both), within the context of Oak Trail's narrative on adoption and implementation of a learning management system. As this theoretical coding cycle became more abstract, manual coding and analytic memos were used to discern and refine themes and conclusions for the final manuscript (Saldana, 2009).

Validity, Bias and Error

As with quantitative research, qualitative research must attend to processes that ensure the rigor and the credibility of a study (Creswell & Miller, 2000). For this study, attention to internal validity, reliability, and external validity ensured that it met accepted standards in qualitative research to reduce bias and error (Merriam, 1999; Yin, 2003).

Internal validity. In qualitative research, internal validity involves attention to the credibility of a study (Creswell, 2003; Merriam, 1999). To establish internal validity, qualitative researchers use a variety of strategies. For this study, internal validity was established with triangulation, disconfirming case analysis, peer review, and awareness of researcher orientation (Creswell, 2003; Maxwell, 1996; Merriam, 1999; Murphy, 1980; Yin, 2014).

Triangulation is when a researcher uses multiple data sources to develop "converging lines of inquiry," and to avoid bias in data analysis (Yin, 2014, p. 119;

Patton, 2002). This study employed triangulation through its variety of sources. Public records and district documents allowed information to be compared between internal and external sources. Interviews with informants corroborated these data. Additionally, triangulation of informant data by code assessed the consistency of informant statements with public records and district documents.

This study also took into consideration the limitations of data collection and reliance on individual explanations for district actions. This study sought to minimize this concern through triangulation of informant data with district documents, follow up questions both within and after interviews, detailed coding procedures, and multiple visits to the study site. Although it is possible that informant accounts represent rationalizations, instead of explanations, of district decisions, I remained cognizant of these limitations during data collection, which is an acceptable procedure in an exploratory case study (Merriam, 1999; Stake, 1995).

Disconfirming case analysis requires a researcher to investigate alternative or rival explanations for evidence (Creswell & Miller, 2000). For this case, rival perspectives in rational theory and institutional theory provided this opportunity. As data were collected, institutional theory provided an alternative lens to the prevailing rational perspective in the data systems literature. This approach discouraged data collection that aligned with pre-existing assumptions, and promoted the acceptance of alterative evidence and rival interpretations. This approach also enhanced internal validity, and helped to mitigate bias and error in data collection and analysis.

Peer review is the use of colleagues to offer alternative interpretation of evidence or provide constructive feedback (Creswell, 2003). Peer review establishes the credibility

of a study by "playing devil's advocate, challenging the researcher's assumptions…and asking the hard questions about methods and interpretations" (Creswell & Miller, 2000, p. 129). For this study, a dissertation committee and advisors filled this role. Prior to data collection and after data analysis, the dissertation committee and co-chairs provided constructive criticism. Additionally, during data analysis, dissertation co-chairs offered feedback, reviewed the strength of data analysis, and tested interpretations of study conclusions.

Acknowledgement of researcher orientation is "clarifying the researcher's assumptions, worldview, and theoretical orientation at the outset of the study" (Merriam, 1999, p. 97). For this study, a conceptual framework and rival theoretical lenses focused this research on the theoretical orientation of the study, instead of the researcher's assumptions.

Reliability. In qualitative studies, reliability involves attention to the consistency and dependability of research methods and results (Merriam, 1999; Yin, 2003). For this study, reliability was established through the examination of fundamental assumptions of this study, triangulation, and an audit trail (Maxwell, 1996; Merriam, 1999; Yin, 2003).

Because a qualitative researcher serves as the primary instrument for data collection and analysis, reliability requires an understanding of the fundamental assumptions of the study (Merriam, 1999). In this study, fundamental assumptions included the rational perspective of the data systems literature, the limitations of the specialized literature on learning management systems, the exploratory nature of the topic and questions, and a single, exploratory case design. Cognizance of these assumptions during data collection helped focus data analysis on theory that was both consistent with

previous studies, as well as reliable for use by other researchers.

As with internal validity, reliability in a qualitative study involves triangulation (Maxwell, 1996; Yin, 2003). Yin (2003) suggests that triangulation as it relates to reliability involves attention to study design and a clear "chain of evidence" for data collection and analysis (Yin, 2003, p. 106). For this study, the chain of evidence involved a conceptual framework derived from the literature; a case study protocol linked to study questions; a case study database; and the use of additional evidentiary sources to answer study questions (Yin, 2003). This chain of evidence controlled the quality of study procedures, which allowed for accurate data analysis and study reliability.

Reliability is enhanced by an audit trail (Creswell & Miller, 2000; Yin, 2003). An audit trail keeps track of the" process and product" of a study so that findings can be considered reliable and trustworthy (Creswell & Miller, 2000, p. 128). For Yin (2003), an audit trail is a database, which was the method used for this study. This study had three audit trails. The first audit trail recorded all public records and district documents. After taking notes on these documents, these notes were uploaded to the qualitative software and coded. The second audit trail logged all contacts with informants in the study site. This audit trail included a list of district personnel and their positions, dates of emails exchanged in regard to interview times and places, and interview codes. The third audit trail involved interview data. After storing interview data securely, interviews were transcribed, reviewed, and uploaded into coding software. These data were coded with the same codes used to triangulate findings from study documents.

External validity. In qualitative research, external validity involves the generalizability or transferability of findings (Merriam, 1999; Patton, 2002). Establishing

external validity in qualitative research can be challenging because a researcher cannot rely on statistical sampling for comparability (Creswell, 2003). Instead, qualitative researchers seek transferability or generalizability in study findings through the use of purposeful sampling, "thick description," and analytic generalization through a conceptual framework (Stake, 1995, p. 39, Merriam, 1999; Patton, 2002; Yin, 2003). This study used all of these approaches to establish external validity.

Purposeful sampling contributes to external validity because specific criteria are used to select an information-rich case. In this study, purposeful sampling was employed to ensure that the selected case would be information-rich and provide the opportunity for analytic generalizability. For example, purposeful sampling in this study targeted knowledgeable informants who would be "good examples for study and good interview participants" (Patton, 2002, p. 243).

Purposeful sampling of informants assists a researcher in collecting data that leads to a "thick description" of a case (Patton, 2002; Stake, 1995). "Thick description" of a case establishes external validity because the researcher seeks "what the experience itself would convey" to a reader with knowledge similar cases (Stake, 1995, p. 39; Patton, 2002). In pursuing thick description, a researcher intentionally collects data to ensure that the "voices, feelings, actions, and meanings of interacting individuals are heard" (Denzin, 1989 in Patton, 2002). This process involves examination of multiple data streams, a chain of evidence, and "convergence amongst data types and investigation of rival explanations" (Sipple, 1999, p. 458). For this case, thick description involved attention to the district context, the timeline for the case, the roles and responsibilities of informants, and careful identification of stages for district actions.

If done properly, thick description of a case leads to analytic generalizations that connect findings to theory (Patton, 2002; Yin, 2003). Intentional focus on analytic generalization contributes to the external validity of a case, because a researcher uses theory as a "template with which to compare the empirical results of the case study" (Yin, 2003, p. 33). For this case, rational theory and institutional theory were used as rival lenses to explain district adoption and implementation of a learning management system. Additionally, a conceptual framework derived from the data systems literature was used to generalize and connect findings to the wider educational technology literature.

Ethical Considerations

As in all type of research, ethics are an important consideration in case study research (Merriam, 1999; Patton, 2002). In accordance with University of Maryland policies, this research study obtained permission from the Institutional Review Board (IRB) and followed IRB guidelines for data collection. Informed consent was obtained from all study participants. Informants were told that interviews would be digitally recorded and could turn down that request. Informant data was coded and stored securely either digitally or in a traditional, locked filing cabinet.

In addition to the safeguards offered in IRB guidelines, this research kept in mind the ethical relationship between the "observer and the observed" (Patton, 2002, p. 328). In naturalistic inquiry, an observer is responsible for ethical data collection that accurately reflects the informant's perspective on the phenomenon under study (Murphy, 1980; Patton, 2002). In this study, ethical data collection strategies included detailed field and interview notes, transparency in all interactions with informants, separation of "description from interpretation and judgment" in data analysis, and a "grounded" focus

on the purpose of the study for analytic generalization and connections to theory (Patton, 2002, p. 331).

Chapter Three Summary

This chapter presented the methods used for this case study of Oak Trail's adoption and implementation of a learning management system. A single, exploratory, case study method and design provided the opportunity for an in-depth examination of this topic and questions. Data collection strategies and analysis ensured the rigor of the process and, as much as possible, mitigated bias and error. Attention to internal validity, reliability, and external validity fostered the dependability, credibility, and transferability of findings. Additionally, IRB guidelines and additional safeguards took into account ethical considerations in case study research.

Chapter Four: Study Findings

This chapter presents findings from this case study on district adoption and implementation of a learning management system. As mentioned in Chapter 3, this single, exploratory case study was conducted in October 2017 in Oak Trail School District (OTSD). Public records, district documents, and interviews were used to answer two, central research questions: 1) how does a school district adopt and implement a learning management system and 2) how, if at all, do rational theory and institutional theory explain organizational actions and contextual forces in this process?

In Chapter 2, I presented the rational perspective and the institutional perspective as rival theoretical lenses to analyze study findings and explain organizational processes and contextual forces. The rational perspective presumes that organizations exist to attain specific goals, and that bureaucratic actors seek technical efficiency and certainty for measureable outcomes (Ogawa, 1994; Parsons, 1960; Senge, 2006; Simon, 1997). Seen through this theoretical lens, Oak Trail's presumed goals might be improvement in student achievement through adoption, implementation, and use of a learning management system.

In the institutional perspective, organizations pursue change but lack concern for organizational efficiency (DiMaggio & Powell, 1983; Meyer & Rowan, 1977). Instead of goal-seeking actors who work towards measureable outcomes, actors in the institutional perspective seek legitimacy and conformity with society's perceived norms and values "despite the immediate efficacy of the acquired practices and procedures" (Rowan & Miskel, 1999, p. 363). Seen through this theoretical lens, Oak Trail may have a stated goal to improve instruction, but organizational actors would cultivate legitimacy and

conformity with established norms and values in the adoption and implementation process, which might eventually interfere with learning management system survival or use for instruction.

With this explanation in mind, this chapter analyzes how Oak Trail School District adopted and implemented a learning management system using rational theory and institutional theory. This chapter has four sections. In the first section, the study context is presented. In the next three sections, Oak Trail's three-stage process for adoption, planning, and implementation of a learning management system analyzed through rational and institutional lenses. These three sections also explain how organizational processes and contextual forces shaped district actions.

Study Context

This section presents the context for this study. This section has two parts. The first part presents the policy context for this case. The next part presents information on Oak Trail as an organization, which includes the district's digital infrastructure and organizational structure.

Policy context. The multivocal literature presented in Chapter 2 suggests that federal laws, policies, and incentives promote school district adoption of data systems. In Oak Trail, this policy context was more complex. Federal law demands that school districts comply with data privacy, security, and access laws, and well as administer summative testing on an annual basis. In this state, a state law aligned with the federal law that required the district to administer standardized tests, and report test data to the state for annual review and reporting. State instructional policies encouraged Oak Trail to build the digital infrastructure needed to implement the state's standardized assessment

system, which required high-speed Internet and computers. State incentives offered funds to districts for high-speed Internet, as well as the hardware and software needed for this purpose. In addition to state assessment policies, state educational technology policies encouraged learning management system adoption. This section presents this policy context.

Federal and state laws. The Every Student Succeeds Act (2015) requires that states and school districts assess students annually with standardized tests that measure student progress and achievement. In alignment with federal law, this state also has a law that requires a district to deliver annual, standardized tests in grades three through twelve (State Administrative Code: School Accreditation, 2017; State Administrative Code: Student Achievement Expectations, 2017).[14] In this state, a district delivers standardized assessments through a state-approved, summative assessment system (State Department of Education: Online Assessment, 2017). After annual standardized testing, the district sends student test scores to the state for analysis, and the state sends student achievement data to the U.S. Department of Education in compliance with ESSA regulations (State Strategic Plan, 2015).

In addition to federal laws that mandate standardized assessment, data systems must comply with federal data security and access laws. These laws include the 1) Family Educational Rights and Privacy Act (FERPA, 1974), which protects the privacy of student education records; 2) the Child Online Privacy and Protection Rule (COPPA, 1998), which protects children under 13 from unregulated access to the Internet; and 3) the Individuals with Disabilities Act (IDEA, 1973), which requires districts to encrypt

[14] Document titles and numbers have been changed to protect Oak Trail's anonymity.

data and protect Personally Identifiable Information (PII). In Oak Trail, informants reported compliance with these laws for all digital devices and data systems (Informants 5, 6, and 11).

***State policies and incentives*.** In this state, a State Strategic Plan (2016-2018) outlined policy goals for annual standardized testing, instructional improvement, and student performance.[15] For example, this state has curriculum standards for kindergarten through 12th grade in math, English, social studies, and science that align with the state assessment for that course and subject (State Department of Education: Curriculum and Standards, 2017).[16] The state encourages school districts to provide laptop computers or touchscreen devices for state tests with the capability to run the state-approved assessment system and the network capacity to access the Internet. To help districts meet these requirements, the state offers incentives to districts to "develop the capability for high speed Internet connectivity in schools" (State Strategic Plan, 2016, p. 42). Theoretically, a district that accepted these incentives would have the network capability to implement the state-approved assessment system, transfer student test data to the statewide longitudinal data system (SLDS), or adopt a learning management system (State Department of Education: State Longitudinal Data System, 2017; State Strategic Plan, 2016).

The State Educational Technology Plan (2016) contains policy objectives for online courses, digital infrastructure, and the adoption and implementation of educational

[15] The State Strategic Plan has other goals unrelated to this study.
[16] To facilitate connections between state standardized tests, state standards, and local curriculum, educators can access a state website with 120,000 curricular learning objects (State Electronic Media [Website], 2017).

technologies, such as learning management systems.[17] This plan provides guidelines for district development of digital infrastructure; accessible technology for disabled students; virtual and blended courses; and professional development for educator data use (State Educational Technology Plan, 2016).[18] In the most recent version of this plan, the state encouraged district adoption of a customizable, interactive, learning management system to facilitate data-driven decision making (State Educational Technology Plan, 2016).

District policies. This state requires its school districts to submit an educational technology plan that is "aligned with state educational technology goals and objectives" (State Strategic Plan, 2015, p. 42).[19] To meet this requirement, Oak Trail has a three-year Instructional Technology Plan (2015-2018). In the current plan, district goals include updates to data security, privacy, and access policies; improvements to digital infrastructure; funds for technical support personnel and instructional technology teachers in elementary schools; and the adoption and implementation of a learning management system.[20]

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[17] Instructional goals included in this plan are: a safe and effective learning environment for all students; meaningful content for students that use technology; the opportunity to apply technology effectively, gain skills, and create artifacts; access to appropriate technology tools for learning; and technology to evaluate teaching and learning (State Educational Technology Plan, 2016).

[18]To assist students with state graduation requirements, the state offers virtual courses through approved online providers (State Department of Education: Online Course Providers, Frequently Asked Questions, 2016). To meet state graduation requirements, students can take state-sanctioned online courses, or districts can use state-sanctioned private or non-profit organizations to deliver local, online courses (State Department of Education: Virtual School Programs, 2017-2018).

[19] Oak Trail's Strategic Plan (2015-2018) outlines the district's current goals, which focus on student safety, academic achievement, proficiency gaps, and communication with parents and the community (OTSD Strategic Plan, 2015). In order to meet these goals, this plan calls for continued measurement of student progress, and analysis of summative and formative test scores (OTSD Strategic Plan, 2015).

[20] Oak Trail also has an Instructional Technology Alignment Plan with these same goals and objectives that covers a slightly different time period (2016-2018).

Oak Trail as an Organization

Oak Trail School District is located on the East Coast of the United States. The district has approximately 50,000 students in rural, suburban, and urban areas. The central office has a top-down organizational structure, with a superintendent and assistant superintendents who supervise departmental directors and specialists. The organizational culture is reportedly data-driven and goal oriented. In the past 20 years, the district invested in its digital infrastructure, which included one-on-one laptops for secondary students. This section presents details about Oak Trail as an organization, which include Oak Trail's digital infrastructure and organizational structure.

Digital infrastructure. In the last 20 years, Oak Trail invested in its digital infrastructure. All district educators and secondary students receive a laptop; elementary students have access to classroom laptops, Chromebooks, or iPads in a ratio of one-to-two students (OTSD Instructional Technology Plan, 2015). All schools have high-speed Internet, which students and educators use for instruction, and to access the state's summative assessment system. The district's Internet bandwidth is adequate enough for students to take state standardized tests simultaneously without delays or problems (Informant 6).

To ensure that Oak Trail's digital devices are up-to-date, the Operations Department negotiates these purchases on a six-year replacement cycle. In 2017, the district refreshed laptops in secondary schools. In 2018, the district plans to refresh digital devices in elementary schools (OTSD Instructional Technology Plan, 2015). In order to keep costs down, the Operations Department negotiates right-sized contracts for

Internet access and other services, such as providers of third-party, single sign-on software and instructional technology applications (Informant 6).

Prior to Oak Trail's adoption of a learning management system, Oak Trail had four data systems in use (OTSD Audio Update 1, 2015). For state tests, the district used the state-approved, summative assessment system. For benchmark tests, the district used a formative assessment system (OTSD Testing Guide, 2015-2016). For managing student information, the district used a four-year old student information system (Informant 6). For instruction, educators and students used an Angel 8 course management system, which the district purchased in 2009 (Informants 4 and 6).[21]

Oak Trail's course management system contained accessible digital curriculum, discussions boards, homework folders, quizzes, tests, and links to external resources (OTSD Audio Update 1, 2015). Only secondary educators used this data system**,** which the vendor did not update after Oak Trail purchased it (Informants 3 and 6). Prior to the district's decision to search for a learning management system, some educators frustrated with the condition of the district's course management system had downloaded free, learning management software to deliver instruction, such as Google Classroom, Schoology, and Edmodo (Informants 1, 4, 13, and 15).

Organizational structure. Oak Trail has top-down, organizational structure with a superintendent and multiple, central office departments (OTSD Financial Plan, 2017).[22] The district also elects a school board (OTSD School Board [Website], 2018). The

[21] In the early 2000's, Oak Trail used a Blackboard course management system (Informant 11). In 2009, the district acquired an Angel 8 course management system hosted on an internal server (Informants 3, 12, and 15). Although the vendor's website currently advertises this system as a learning management system, and some interviewees used the same terminology, the system's date of initial service and limited capabilities for data analysis compared to current learning management systems places this system in the category of a course management system (Blackboard, Inc., 2017; Cengage, Inc., 2009)

[22] To protect the anonymity of the district, this list of central office departments is not comprehensive.

Operations Department is responsible for the district's digital infrastructure and instructional technology, which includes the district's data systems. An Assistant Superintendent of Operations supervises the Operations Department, which had a $26 million budget for the 2017-2018 school year (OTSD Financial Plan, 2017).

Oak Trail's Technology Department falls under the Operations Department. This department has Director of Technology who oversees both operational technology and instructional technology (OTSD Financial Plan, 2017). The Technology Department has approximately 70 personnel, many of whom are Technical Support Personnel (TSPs) who work in schools and maintain the district's networks, software, and audio-visual equipment. This department also employs information technology personnel who assist with data system problems (Informants 3, 7, and 8). In 2017-2018 school year, the Technology Department had a $3 million budget (OTSD Financial Plan, 2017).

An Assistant Director of Instructional Technology supervises the district's Instructional Technology Department, which falls under the Technology Department (OTSD Instructional Technology Department [Website], 2017). This department has approximately 40 personnel, most of whom are assigned to schools as Instructional Technology Teachers (ITTs) (OTSD Financial Plan, 2017). ITTs are certified teachers who work in schools and help educators to use the district's course management system, digital tools, and instructional technology applications (OTSD Instructional Technology Plan, 2017). ITTs report to instructional technology specialists in the central office, who supervise instructional technology for elementary, middle, and high schools. Currently, the district has one ITT assigned per middle and high school, as well as one ITT assigned

to every three or four elementary schools.[23] The district also assigns an ITT to work in the central office on special projects.

Oak Trail's Instruction Department is responsible for instruction and curriculum (OTSD Instruction Department [Website], 2018). Within this department, content specialists supervise educators in a specific subject area at each school level, such as elementary language arts or high school science. Content specialists align state standards to district curriculum, create lesson plans, observe teachers, supervise school improvement teams, and design staff development. In order to create content and lessons that meet Oak Trail's instructional technology goals, content specialists work with instructional technology specialists (OTSD Instructional Technology Alignment Plan, 2016).

To connect state standards to district curriculum, Oak Trail's Instruction Department hosts a website with state curriculum standards, a pacing guide, and instructional materials organized by grade, semester, and standard (OTSD Pacing Guide, 2017; OTSD Instructional Department [Website], 2018). The district also offers online and virtual courses for student credit, such as history and physical education, and Advanced Placement courses hosted by external, private providers (OTSD Student Guide, 2017-2018; OTSD Virtual Physical Education Courses, 2017-2018).

In addition to Operations, Technology, and Instructional Technology personnel, personnel in Oak Trail's Finance, Communications and Staff Development departments assisted with the district's adoption and implementation of a learning management

[23] Every elementary school has a "technology liaison" who assists ITTs with instructional technology. These paid personnel serve as a "liaison between the school, instructional technology, and operational technology" (Informant 2). Teachers, resource specialists, and librarians tend to apply for this position and use it as preparation for an ITT position (Informant 13).

system. Finance personnel created the documents needed for the district's Request for Proposal to vendors (OTSD Request for Proposal, 2015). Communications personnel assisted with flyers, posters, and emails for teachers and students about the learning management system (Informant 4). Staff development personnel assisted instructional technology personnel with professional development (Informants 11 and 12). Although this study did not interview these personnel, informants noted their contribution (Informants 4, 11, and 12).

The Adoption Stage

In the multivocal literature, adoption of a data system occurs prior to the selection of a vendor and product. In this case, Oak Trail's adoption stage started with the district's decision to adopt a learning management system. Once the district made this decision, central office personnel engaged in a multi-step process, which included a needs analysis, a Request for Proposal to vendors, and a selection committee that deliberated on a learning management system and vendor. This section provides a synopsis of Oak Trail's adoption stage; explains findings from the rational perspective and the institutional perspective; and presents how contextual forces and organizational processes shaped district actions.

Synopsis. In 2009, Oak Trail implemented an Angel 8 course management system. Secondary educators and students used this system to deliver curriculum, instruction, and formative assessments. Central office personnel and building administrators also used this system for discussion groups, distribution of curriculum, and professional development. Although elementary educators did not have access to this

system, elementary administrators used it for document storage and to communicate with the central office.

By Spring 2015, Oak Trail's course management system was outdated. The district's contract with the system vendor expired in 2016, and district administrators announced the search for a learning management system. Technology and instructional technology personnel conducted a need analysis, and included this information in the district's Request for Proposal to vendors. At the same time, the Assistant Superintendent for Operations appointed a committee to review vendor bids and select a new system. In Fall 2015, these deliberations resulted in the selection of a learning management system vendor and product, which the district intended to implement over the next three years.

Adoption through a rational lens. In the multivocal literature, data system adoption is a process in which a district selects a vendor and product prior to implementation (Cho, 2011; Wayman, Cho & Johnston, 2007; Wayman, Stringfield & Yakimowski, 2004). As noted in Chapter 2, suggested district actions in the adoption stage include formation of a selection committee, a needs analysis, evaluation of cost, vendor and product selection, assessment of future data use, and system development. Oak Trail followed similar, but not the same, steps to select a learning management system and vendor. The district conducted a needs analysis, then drafted a Request for Proposal with this information to vendors. Once the district received vendor bids, a selection committee hosted suitable vendors, evaluated products, calculated costs, and chose a product. This section interprets these actions from the rational perspective.

Needs analysis. The rational perspective presumes that an organization exists to attain specific goals and outcomes (Parsons, 1960; Senge, 2006; Simon, 1997). In Oak

Trail, informants indicated that the district decided to search for a learning management system for a variety of reasons. First, the current learning management system had become outdated (Informants 3, 11, and 14). Second, the district's contract with the course management system vendor expired in less than two years (OTSD Audio Update 1, 2015). Third, even though elementary administrators had access to the course management system, elementary educators and students did not (Informants 3, 10, and 13). After the identification of this problem, the district started the search for a new learning management system.

In the rational perspective, school districts reflect the formal structure of a bureaucratic organization as "tightly-coupled," which means that "leaders make formal decisions from the top-down, and subordinates act on those decisions accordingly" (Grusky & Miller, 1981, p. 27). Oak Trail reflected this formal structure and process. The Assistant Superintendent of Operations supervised the adoption process, and tasked central office personnel from the Technology and Instructional Technology Departments to assist (Informants 6, 11, and 13). Depending on the task, personnel from the Instruction Department and the Finance Department also assisted this group (Informants 11, 12, and 14).

Looking back on this period of time, central office personnel noted the district's problems with its outdated system:

> There were no enhancements made for a long time with that product, so it was pretty much stagnant (Informant 8).

> It was like they handed us a disk and plugged it in, and it never changed from that day. So it was just aging (Informant 10).

Even administrators had stopped using the course management system:

> [Administrators] had moved on and had gone into Google to do all their agendas for leadership meetings and things like that (Informant 10).

As a result of these issues with the aging course management system, educators created course websites or downloaded free learning management systems to facilitate instruction. Instructional technology personnel reported that this mix of learning management systems and websites created a confusing instructional landscape for students and parents:

> It was the wild, wild west of learning systems...if you were a student, you could walk into one classroom and one teacher could be using Edmodo. You walk into your next classroom, and your teacher could be using Google Classroom. Go into the next one, the teacher could be using "the adopted system" so to speak (Informant 9).

Once the district decided to assign personnel in the Operations Department to head up the adoption process, Oak Trail's first step in the adoption stage involved identification of the district's needs in a learning management system. The rational perspective suggests that technologies should reflect "precise" organizational goals and "specialized and technical…operations" (Selnick, 1957, p. 16). One informant explained how the district decided not only to collect information on the operational requirements and technical features in a new learning management system, but on the district's instructional needs as well:

> So we started with data collection on what was working, and what the challenges were with our current system, to figure out what problem we were trying to solve. And we knew this was an instructional tool, not just a technology tool (Informant 11).

The multivocal literature suggests that a district conduct an operational needs analysis to identify the "functions that a learning management system must perform in

order to meet learners' needs" (Aslan et al., 2011; p. 96; Berking & Gallagher, 2014; McMurray, 2017). Some of the learning management system "needs" cited in the specialized literature match data system "needs" in the evaluative, status report, and prescriptive literatures. These needs include interoperability, accessibility, hosting, formatting, reusability, scalability, extensibility, and durability.

Oak Trail informants explained how in alignment with this literature, the district conducted a two-part needs analysis. Technology personnel conducted the operational needs analysis, which identified the district's technical requirements and specifications in a learning management system. In this step, technical personnel attended to interoperability, accessibility, hosting, scalability, and extensibility. The district also contacted learning management system vendors to inquire about their products, which informants identified as a process called a "request for information":

> It's a "request for information." It's kind of like you don't know what you don't know. It's hard to ask a company in the [formal selection] process things that they offer, functionality, features, if you are not familiar with what platforms [they] were offering (Informant 3).

In addition to this operational needs analysis, the district also conducted an instructional needs analysis. In the rational perspective, organizations expand productivity and goal-attainment through informational feedback loops, which encourage "technical or functional rationality" (Scott, 1998, p. 33; Copland, 2003; Honig, 2003; Ogawa et al., 2003; Senge, 2006). In Oak Trail, the instructional needs analysis reflected this approach. Instructional technology personnel sent a survey on potential instructional needs in a new system to teachers and students:

> I know that there were surveys, even to the point of 'are they using [the old system]? If not, are they using Google Classroom? Why? What are the key features that you want to see in there' (Informant 2)?

These personnel also hosted focus groups and collected feedback through ITTs, teacher advisory council representatives, and elementary technology liaisons.

This instructional needs analysis resulted in a list of features that district educators wanted in a learning management system, such as a user friendly interface that felt social, a platform that felt like a "one-stop shop" to deliver instruction, and tools for collaboration and communication:

> So I was looking for ease of use, a good user interface, and flexibility in terms of what users would see (Informant 6).

> And that's what we were looking for – a one-stop shop (Informant 7).

> That's one of the things that we wanted, we wanted a tool that would help facilitate communication and collaboration (Informant 11).

Educators also wanted a mobile application, instructional content migrated from the previous system, access to state standards, and tools for data analysis (OTSD Request for Proposal, 2015).

Central office personnel also reached out to other school districts with learning management systems to get feedback on desired features, vendor relationships, and what they might change in their adoption process or product. This approach aligns with the suggestion by Wayman, Stringfield and Yakimowski (2004), who note that a district may want to contact other districts to "get practical feedback on the types of products and levels of service" offered by vendors (p. 12):

> I had a network of people who have used learning management systems and [I] asked them what do you like? What do you want? What are some of the 'must haves' in learning management systems (Informant 12)?

Once the district collected this information, it included both operational needs and instructional needs in its Request for Proposal to vendors.

Request for Proposal. Personnel in Oak Trail's Finance Department wrote the district's Request for Proposal (2015) to vendors (Informant 11). In the rational perspective, organizations are likely to make decisions about a technology when the "goals of an organization are clear cut based on known technical objectives" (Selnick, 1957, p. 137). In Oak Trail, the Request for Proposal was an official document that contained the district's technical and instructional objectives for a learning management system. In alignment with the specialized literature on learning management systems, this proposal asked vendors to document system interoperability, accessibility, hosting, scalability, and extensibility; plans for data migration and customization; and how the vendor would stage the system prior to full implementation. The proposal also listed the instructional demands from the needs analysis, such as a user-friendly interface; tools for communication and collaboration; and terms for professional development and vendor support (OTSD Request for Proposal, 2015).

In the multivocal literature, a critical step in data system adoption is system interoperability (Berking & Gallagher, 2014; Foreman, 2013b; Means, Padilla & Gallagher, 2010; Means et al., 2009; Molinar, 2014a; Wayman, Cho & Johnston, 2007; Wayman et al., 2010b; Watson & Watson, 2007; Yildrim et al., 2014). Interoperability refers to a district's infrastructure, as well as the technical standards that ensure compatibility between instructional components, data, and user accounts (Berking & Gallagher, 2014; Fenton, 2018; Foreman, 2013a). Because Oak Trail required a learning management system that could share data with its student information system, the

selected vendor had to guarantee that data could be transferred between these two systems at the teacher, classroom, course, and school levels. The system also had to comply with SIF and LTI standards, as well as have the ability to transfer grades between systems (LMS LTI Guide, 2016). Due to those requirements, Oak Trail's proposal listed technical specifications for the student information system; hardware and software by school level (high, middle, and elementary); fiber-optic bandwidth and Internet connectivity; and e-learning applications (OTSD Request for Proposal, 2015).

Interoperability also determines how educators will access a data system (Berking & Gallagher, 2014; p. 39; Foreman, 2013a; Herold, 2014; Wayman, Cho & Johnston, 2007). The specialized literature associates accessibility with the educator access from multiple locations and devices, as well as single sign-on capability (Foreman, 2013a; Herold, 2014). In alignment with this literature, Oak Trail's proposal required the selected product to be extensible for multiple languages, mobile use, applications, and third-party software; integrate with Oak Trail's single sign-on solution; host the system remotely in compliance with federal, state and local law; guarantee encryption for stored and in-transit data; and exclude commercial content (McIntosh, 2016; Molinar, 2014b).

Another specification in learning management system adoption is scalability (Berking & Gallagher, 2014; Foreman, 2013a; Molinar, 2014b). In the specialized literature, scalability refers to the number of concurrent users, as well as potential users (Berking & Gallagher, 2014; Molinar, 2014b). Oak Trail's proposal specified total, concurrent users, as well as users disaggregated by school level (secondary and elementary), and type (teachers and students). In Oak Trail, scalability potentially

impacted the district's ability to bring the system to scale over time for all users, both in the pilot and as part of the district's plan for a graduated implementation.

As previously noted, learning management system vendors and school districts must comply with federal data security laws and policies (Aslan et al., 2011; Berking & Gallagher, 2014; Foreman, 2013a; McIntosh, 2016). Oak Trail's proposal required the selected vendor to comply with the FERPA (1974), COPPA (1998), and IDEA (1973). The proposal also required a vendor to encrypt Personally Identifiable Information (PII), and to secure the migration of instructional content from the course management system into the learning management system prior to implementation.

The multivocal literature notes that in order to inform practice, data systems should allow educators to collect and organize instructional materials (Cho & Wayman, 2012; Cho & Wayman, 2014). Similarly, Oak Trail's proposal asked vendors to support instructional functions such as a drop-box for student work; the ability to integrate with plagiarism tools; immediate feedback on assignments; and a function that allowed teachers to enter grades that a student could not view. Learning management systems also have instructional functions that target communication, such as discussion boards and tools for communication and collaboration with students and other faculty members (Berking & Gallagher, 2014; Herold, 2014; Molinar, 2014a; Yildrim et al., 2014). Oak Trail requested functions such as tools for email, discussion boards, video conferencing, and other forms of electronic communication; collaboration tools such as blogs, groups, whiteboards, and wikis; an announcement tool; and a calendar tool that integrated with Google, iCal and Outlook (OTSD Request for Proposal, 2015).

Oak Trail's proposal also required the vendor to provide maintenance and support. For example, the selected vendor needed to provide documentation and support materials for all system users, such as tutorials, contextual help, and guides; 24-hour phone support; data on current average response times; descriptions of regular maintenance procedures and schedules; and system training. For system training, the district requested professional development for 60 teachers and administrators; training materials, online video materials, and downloadable tutorials. To meet these requirements, the vendor needed to submit a written project plan, as well as assign a project manager and information technology personnel to assist the district with the system pilot and deployment.

Selection committee. In the multivocal literature, a district forms a selection committee with building and central office administrators, teachers, community members, clerical assistants, instructional personnel, school board members, outside contractors, and information technology professionals (Berking & Gallagher, 2014; Bernhardt, 2004, Cho, 2011; Foreman, 2013a; Foreman 2013b; Wayman, Cho & Johnston, 2007). In Oak Trail, the Assistant Superintendent of Operations formed a selection committee to review vendor bids and choose a new learning management system. This committee included the Assistant Superintendents for Operations and Instruction; Directors of Technology and Instruction; content specialists; educational technology specialists; instructional technology teachers; classroom teachers; community members; two students; and an outside consultant. An instructional technology specialist chaired the committee, which took approximately three months to meet with vendors and decide on a product.

Vendor selection. Oak Trail tasked the selection committee to find a "replacement solution" for the district's outdated learning management system (OTSD Audio Update 1, 2015). The data systems literature suggests that because a school district faces a variety of choices in data systems, "correctly choosing a data system that fits [a] district's need is an important process" (Wayman & Cho, 2008, p. 92; Cho, 2011; Wayman, Stringfield & Yakimowski, 2004). Although deliberations of Oak Trail's selection committee are not public record, committee members interviewed for this study reported that their process took steps in alignment with the multivocal literature.

First, the committee evaluated vendors and narrowed down possible learning management systems based on the criteria listed in the Request for Proposal (Informants 2, 6, and 11):

> So as part of the selection process so we got a lot of different proposals from different vendors. They came to the table based on the requirements defined in the Request for Proposal**.** And then we trimmed that down to a certain number of vendors (Informant 6).

Then, in alignment with the specialized literature, the committee hosted a limited number of vendors for a "scripted demonstration" of their systems (Foreman, 2013a, p. 4):

> So each of the vendors came and they had half a day, two vendors a day…to give their demonstration as to how their product worked and to answer questions (Informant 8).

Next, the committee selected two vendors for a final product evaluation. As part of this final evaluation, vendors staged each learning management system (Informants 6 and 11). Committee members also considered the system's scalability, vendor support, training, technical assistance, instructional features:

> Does it scale based on use? You don't want to buy into a system that actually doesn't scale based on how often it's being used. It needs to be able to scale with use and need to be able to perform (Informant 6).

The Request for Proposal required vendors to complete a cost estimate for central office and educator professional development, maintenance of the system over five years, and any other projected costs associated with the system (OTSD Request for Proposal, 2015). After reviewing final proposals, selection committee members reported the considerable expense of one other system over another system:[24]

> And so we had considerations as to what the budget was, and one was more substantially more expensive than the other (Informant 11).

Informants reported that the selection committee chose a product and vendor that matched the district's operational requirements. The rational perspective assumes that a technology improves organizational performance and efficiency (Bamburger, 1995; Ogawa et al., 2003; Scott, 1998; Selnick, 1957). Oak Trail informants shared why they thought this learning management system did so. Operationally, the cloud-based system came "ready out of the box" (Informant 7), "always on" (Informant 10), "scalable" (Informant 6), and "able to evolve" for K-12 use (Informant 1). The system had "anytime, anywhere" access through a mobile application, and easily synchronized data to the district's student information system with a 'sync' function (Informant 6). In terms of features, the system seemed user friendly and easy to operate:

> I think that one of the reasons we chose [this vendor] is…how it looks K-12 and that it was just very user friendly (Informant 10).

[24] Oak Trail's Request for Proposal (2015) and public records suggest that the district decided on a five-year contract with a "subscription" and "per user" cost (Vendor Payments [Spreadsheets], 2016; 2017, 2018).

The recommended system also had many of the features that educators requested in the instructional needs analysis. These features included a calendar; discussion boards; audio and video capabilities; tools for communication, collaboration and data analysis; unlimited storage for instructional materials; and links to the state curriculum standards. In late 2015, the committee's deliberations resulted in a recommendation to the Oak Trail School Board for a new learning management system vendor and product, which the school board approved.

Adoption through an institutional lens. Although Oak Trail's adoption process responds nicely to explanation through a rational lens, district actions can also be interpreted through an institutional lens. This section interprets Oak Trail's actions in the adoption stage from this perspective, which includes the needs analysis, the Request for Proposal, and vendor selection.

Needs analysis. In the institutional perspective, an organization seeks conformity in "rationalized myths" of how similar organizations operate for long-term survival (Rowan & Miskel, 1999, p. 363). Oak Trail informants offered hints that a rationalized myth also played a role in the district's decision to adopt a learning management system. For example, in order to keep up with the technology of other school districts, informants noted that Oak Trail may not have been up-to-date with technology trends, such as adoption of a learning management system:

> I think looking at how technology is evolving as a whole outside of education and choosing a platform that is going to evolve with it (Informant 1).

One secondary ITT noted that educators who appeared to be "innovative" had "moved on" to other products:

> Our best most innovative teachers, many of them had moved on from [the old system]. They were looking at [another learning management system] that had just come out, or they had made their own websites because the [old system] didn't advance with the rest of the technology. So a lot of our stakeholders, our teachers, had already moved on (Informant 10).

Additionally, some administrators who did not enforce educator use of the course management system may have contributed to the district's rationalized need for a new system, even if the previous system remained operable:

> But as technology started to progress, [the previous system] was not doing as much for teachers as they wanted it to do, and there wasn't really 'you are using [the previous system].' There wasn't really any push by administration (Informant 9).

From an institutional perspective, endorsement of this rationalized myth may have led the district to consider adoption of a learning management system, but without attention to the operational efficiency of this type of system, or a clear goal as to how it would be used for instruction.

The district's decision to start the search for a learning management system involved a needs analysis. One informant suggested that the purpose of the needs analysis was not only to collect information on technical requirements and instructional features in a learning management system, but also to assess educators' "perceived" needs in a new system:

> [It was] not just our perception and what our perceived needs were, but really getting a pulse on what we were hearing from the field…we knew that we had to capture that voice (Informant 11).

Seen through an institutional lens, this highly visible needs analysis not only operated as a method to gather information, but also operated as a "direction of action" that may have

produced a "logic of confidence" around the district's adoption process (Rowan, 1990, p. 355).

As part of the needs analysis, Oak Trail's instructional technology personnel reached out to colleagues in other districts to ask how they adopted a learning management system (Informants 2, 10, and 12):

> So we have done a couple of phone calls with other districts to find out what they are doing. And some of those conversations involve company support and wins, and what were challenges, things like that (Informant 10).

This contact between Oak Trail and other districts suggests that the district valued the norms and environments of similar institutions (DiMaggio, 1988; Meyer & Rowan, 1977; Ogawa, 1994; Scott, 1994). In Oak Trail, contact with these districts clarified norms, as well as provided the opportunity for instructional technology personnel to "interpret trends and changes" in similar institutions that they admired (Cibulka, 1995, p. 127). These conversations also conveniently allowed central office personnel to share the news that Oak Trail had started the adoption process, which operated as a de facto announcement of the district's conformity with peers. Theoretically, these actions promoted the district's legitimacy relative to other school districts, which suggests a certain degree of normative isomorphism embedded in the district's adoption process.

Request for Proposal. In the institutional perspective, organizational conformity involves "structural homogeneity, structural conformity… and constituency satisfaction" (Meyer, Scott & Deal, 1992, p. 57), as well as the "adopt[ion] of practices viewed as exemplary, normative, or routine" (Burch, 2007, p. 85). In Oak Trail, the Request for Proposal appears to serve this purpose. Operations personnel noted that this document was part of the district's routine vendor selection process (Informants 11 and 13). These

personnel also indicated that they were familiar with this document and its normative role in vendor selection, which suggests that the Request for Proposal had structural conformity and constituency satisfaction (Informants 1 and 15).

Oak Trail's use of a Request for Proposal also suggests that the district relied on "established and legitimated" procedures and policies for vendor selection (DiMaggio & Powell, 1983, p. 155). While this type of document may be part of a school district's routine procedure for the purchase of a product, it also signals that, in this case, the district may have moved ahead with a plan to adopt a learning management system without clear understanding of the efficacy of this type of data system, or how, if at all, it might improve instruction. In other words, as a normative, organizational procedure, the Request for Proposal theoretically increased the support of internal and external stakeholders who were familiar with this document, as well as brought legitimacy to the adoption process.

Vendor selection. As previously noted, Oak Trail's selection committee deliberated on a learning management system vendor from behind closed doors. One informant who did not participate on the selection committee reported that ITTs were "in the dark" about the committee's deliberations until the district's official announcement:

> I was as much in the dark as all the other ITTs until it was officially announced. So there wasn't that much transparency until the decision was made, announced, and approved by the school board (Informant 1).

In the institutional perspective, actions by a formal but unseen interest group may represent an organization's attempt to "conform to rationalized rules [and] procedures…in order to gain increased support and legitimacy" from stakeholders (Rowan, 1995, p. 3). In Oak Trail, the selection committee's attention to the normative

rules and procedures of vendor selection potentially resulted in support and legitimacy for the district's process and product. One informant noted this possibility in the district's intentional commitment to the system selected by the committee:

> And if you believe it's the right container to deploy content and interact with and do, then you need to commit to that from the beginning as well (Informant 11).

This comment suggests that formal procedures in the Request for Proposal and the vendor selection process helped the district reduce the likelihood that key stakeholders, such as ITTs, might question the committee's decision. Considering the potential financial investment in a learning management system, visible commitment by the district to a formal process would have been an important signal for vendor legitimacy and long-term survival of the new system.

The involvement of technology and instructional personnel in the selection process also had institutional benefits for those departments. In the institutional perspective, the adoption of an innovation can sometimes lead technology actors to "discard information…[and] avoid bringing in expertise" (Keen, 1981, p. 24). In Oak Trail, the district trusted internal technology and instructional technology personnel to conduct the needs analysis and lead the selection committee. In particular, the visible investment of time from instructional technology personnel suggests that, at least for this interest group, adoption of a new learning management system may have become "infused with value beyond the technical requirements of the task at hand" (Selnick, 1957, p. 14). In other words, because instructional technology personnel added credibility to the selection committee's choice of vendor, and cultivated eventual buy-in for the

product with educators, they may have interpreted their involvement as critical to the adoption process.

Oak Trail's year-long process for system adoption also suggests a "direction of action rather than specific objectives" (Parsons, 1960, p. 172). This interpretation through an institutional lens makes sense in light of the alternative - if the absence of a learning management system obstructed daily instruction, then a year-long adoption stage would have been unrealistic. This lack of urgency around learning management system adoption reinforces the previous claim that the district may have started the adoption process based on the perceived need of a learning management system, and the district's position in relation to other districts in terms of educational technology. This finding is consistent with institutional perspective, which suggests that an organization may adopt a technology not based on its utility, but instead to align with the norms and environments of similar organizations.

Organizational processes and contextual forces. The data systems literature suggests that organizational processes and contextual forces shape district adoption of a learning management system. In the adoption stage, organizational processes in formalization and coupling, and contextual forces in privatization and diffusion of innovation, shaped district actions.

The data systems literature identifies formalization as a process that utilizes "people, policy, and resources toward data use and computer data systems in a concerted way" (Cho, 2011, p. 152). If districts do not attend to formalization of data system use, then they may be susceptible to departmental isolation and fragmentation (Brooks, 2011; Cho, 2011; Cho, Jimerson & Wayman, 2015; Cho & Wayman, 2015; Curtis, 2010). In

Oak Trail's adoption stage, tensions between formalization and fragmentation started with the outdated course management system. Lax attention by the district to data system use led some "innovative" educators to abandon the old system, which produced fragmentation of the district's learning management landscape. These problems accumulated over time until the district decided to search for a new learning management system.

Oak Trail may have formalized the adoption process to relieve the isolation of the Instructional Technology Department. This claim is supported by the visible role played by instructional technology personnel in the adoption stage. Personnel pressures can push districts to adopt data systems (Burch & Hayes, 2009; Cho, 2011; Curtis, 2010; Means et al., 2009; Wayman, Jimerson & Cho, 2012). In Oak Trail, ITTs dealt with the problems created by an outdated course management system and the fractured landscape of different data systems in schools and classrooms. In pushing for a learning management system, ITTs operated as an interest group that communicated school-level instructional issues to the central office, which in turn pushed administrators to look for a new learning management "solution."

Tight-coupling in the Operations Department also formalized district actions. Tightly-coupled school districts have formal rules, clear lines of authority, and explicit work procedures (Meyer, 1992; Meyer, Scott & Deal, 1992). In Oak Trail, tight-coupling included a formal vendor selection process, which central office personnel implemented in alignment with explicit work procedures and pre-existing lines of authority. These tightly-coupled actions led to the adoption of a learning management system for Oak Trial that reportedly met district goals.

Districts adopt data systems as a response to policy incentives aligned with educational privatization norms that "help schools comply with accountability" pressures (Burch, 2010, p. 149). In Oak Trail, central office personnel did not share whether or not the district's decision reflected accountability or privatization pressures. Instead, they referenced the Request for Proposal process as the established norm for major district purchases, and cited legal issues with free versions of learning management software as a reason that the district wanted an official system. These findings suggest that, due to legal issues and the complexity of learning management systems, privatization as a contextual force may currently operate as a given in learning management system adoption.

Oak Trail informants did share that the district had an ongoing relationship between with private vendors for a variety of services, such as single sign-on, instructional technology applications, broadband services, and digital devices. This finding suggests that a school district may have a continuous, public-private relationship with educational technology and digital infrastructure vendors. Although it is not obvious from this study whether or not this relationship constitutes privatization, it seems that a school district would have difficulty maintaining its digital infrastructure without the assistance of external technology vendors.

Oak Trail's actions in the adoption stage also suggest diffusion of innovation. In this model of technology transfer, school districts adopt technologies in order to model the innovative behaviors of other districts, gain knowledge, or reduce uncertainty (Rogers, 1995). In Oak Trail, Operations personnel expected the new system to enhance the transfer of information between educators; improve instructional communication and outcomes; and alleviate the district's uncertainty around data management for instruction.

These actions suggest that diffusion of a learning management system as an innovation may encourage mimetic or normative isomorphism, as well as increase the conformity and legitimacy of a district relative to its peers.

The Planning Stage

As noted previously, the data systems literature suggests a two-stage process for district adoption and implementation of a learning management system. However, findings in this study point to a planning stage between Oak Trail's adoption and implementation stages. This section provides a synopsis of the planning stage, explains findings from the rational perspective and the institutional perspective, and interprets contextual forces and organizational processes in light of district actions.

Synopsis of the planning stage. In late 2015, Oak Trail planned for the implementation of its newly-purchased learning management system. As a first step in implementation, The Assistant Superintendent of Operations appointed the instructional technology specialist who chaired the selection committee to head up a planning team. The first action of the planning team was to create an implementation plan and timeline that aligned with the district calendar. This timeline was as follows: planning and pilot school selection in Fall 2015; a secondary school pilot in Spring 2016; secondary teacher training in Spring and Summer 2016; full secondary school implementation in Fall 2016; elementary school pilots in Spring 2017; elementary teacher training in Fall and Spring 2017; and elementary implementation in Fall 2017 (OTSD Timeline, 2015-2017; OTSD School Board Update, June 2016).

To train district personnel on the learning management system, the planning team chose a train-the trainer model of professional development. In Oak Trail, this model had

the following steps. In December 2015, the vendor's professional development specialist trained the selection committee, central office personnel, ITTs, and educators in pilot schools. In Spring and Summer 2016, ITTs trained secondary educators in schools, and the district trained elementary pilot teachers and school administrators. In Fall 2016 and Spring 2017, the district offered training for elementary educators.

In Summer 2016, Oak Trail turned off the course management system and migrated secondary content into the learning management system (OTSD LMS Flyer, 2015). At the same time, the district encouraged content specialists to begin the migration of district-level instructional content by grade level and subject area from a district website into the new system. Theoretically, this process resulted a learning management system populated with instructional content for teachers upon implementation.

The district selected one middle school and one high school for a secondary pilot, and four elementary schools for an elementary pilot (OTSD Audio Update 2, 2016; OTSD School Board Update, June 2016). In addition to these six pilot schools, all schools selected educators to participate in a "mini-pilot" with three teachers, the school librarian, and the teacher-leader (OTSD School Board Update, June 2016). By Fall 2017, the district completed the pilots and fully implemented the system in all schools.

Planning through a rational lens. In the rational perspective, goal-seeking actors create formalized organizational structures and processes to optimize efficiency (Meyer & Rowan, 1977; Parsons, 1960; Scott, 1998; Selznick, 1948; Senge, 2006; Simon, 1997). Similarly, Oak Trail's planning team decided on a three-year implementation plan that operationalized the district's goals for the learning management system. This plan included central office preparation, system deployment, professional development,

content migration, and a pilot. This section explains these actions from the rational perspective.

Central office preparation. As in the adoption stage, Oak Trail used its top-down structure to organize central office personnel in the planning stage (Grusky & Miller, 1981). The instructional technology specialist who chaired the selection committee led the planning team, which the Assistant Superintendent of Operations supervised. This planning team included specialists and instructional technology teachers from the Instructional Technology Department, technical personnel, the Director of Technology, communications personnel, a district project manager, the vendor's project manager, and the vendor's technical lead (Informants 6, 7, 11, and 13).

In the evaluative literature, a project leader helps a district "interface" with personnel across central office departments (Cho & Wayman, 2015, p. 1230; Wayman, Brewer & Stringfield, 2009; Wayman & Cho, 2014). In Oak Trail, planning team participants commented on the lead person's gift for implementation planning:

> [He/she] really spearheaded a lot of this, working with the directors… and really pulling things together (Informant 2).

> [He/she] was the mastermind behind it (Informant 7).

> [He/she] is fabulous at planning and laying out implementation plans and then of course delivering on the plan (Informant 10).

The planning team's first action was to create an implementation plan and timeline. Due to a previous technology implementation that Oak Trail educators perceived to be ineffective, the planning team decided on a graduated timeline for implementation of the learning management system:

> When they originally pushed out [another product] three years ago, they didn't do a good job pushing that out, and so teachers kind of rebelled against it. So we have learned from that and we had a different approach for this one (Informant 13).

Wayman and Cho (2008) suggest that a district should decide between gradual deployment or whether to "roll out all functions of a data system at the same time" (p. 93). Technical personnel reported that a graduated approach allowed the district time to work with the vendor, as well as test the system, migrate content, and train educators. Planning team members reported that they hoped educators would appreciate this gradual, implementation approach:

> Our primary goal was to have this [implementation] as seamless as possible (Informant 14).

This decision resulted in the district's three-year implementation plan and timeline (OTSD LMS Timeline, 2015-2017; OTSD LMS Implementation Q & A, 2016).

After deciding on an implementation plan, communications personnel created an infographic with critical information on "when things were going to happen" (Informant 14; OTSD LMS Flyer, 2015). In creating this infographic, the planning team seemed to understand the suggestion in the multivocal literature that educators "need to be told" that a new data system is ready (Means, Padilla & Gallagher, 2010, p. 4). Planning team members distributed the infographic in schools and placed it on the Instructional Technology Department website. In addition to the infographic, instructional technology personnel updated the department's website with the implementation plan, links to the vendor's homepage, and a blog for educators on system features and functions (OTSD Instructional Technology [Blog], 2017; OTSD Instructional Technology Department [Website], 2017).

System deployment. A key piece of Oak Trail's implementation plan involved an agreement with the vendor to deploy the system in stages. The evaluative literature indicates that a district needs time to deploy a data system, but that vendors often want a single point of implementation rather than a phased approach (Cho, 2011; Cho & Wayman, 2015). Oak Trail informants noted a similar issue with Oak Trail's vendor:

> The vendors goal is to get everything up as soon as possible, whereas the schools goal is to get everything up effectively (Informant 8).

The planning team negotiated with the vendor for a graduated approach to system deployment over the next two and half years (OTSD LMS Flyer, 2015). As previously noted, the plan involved a secondary pilot in Spring 2016, secondary school implementation in Fall 2016, an elementary school pilot in Spring 2017, and full implementation in all schools in Fall 2017.

After the vendor agreed to this plan, technical personnel prepared the system with the help of the vendor's technical lead. These personnel noted that the most important step in system deployment involved the integration of data between the district's student information system and the learning management system. In the multivocal literature, interoperability is critical for data system deployment (Berking & Gallagher, 2014; Foreman, 2013b; Means, Padilla & Gallagher, 2010; Means et al., 2009; Molinar, 2014a; Wayman, Cho & Johnston, 2007; Wayman & Stringfield, 2003; Wayman et al., 2010b; Watson & Watson, 2007). In Oak Trail, technical personnel reported that the two systems needed to integrate "lots of dynamic data elements" between the district's student information system and the learning management system, such as student data, teacher data, course data, and school data (Informant 8). These data

had to "show up the right way" on a daily basis, or teachers would not have an accurate roster of students (Informant 6).

In the multivocal literature, a district is "often dependent on one person" (Davis, 2014, S10) or a "high quality…internal team" of technical personnel for system deployment (Mieles & Foley, 2005, p. 9). In Oak Trail, these conditions existed as well. Although a team from the Technology Department guided deployment, one person was the "brains" behind this work:

> We are very lucky though to have [person's name]! He/she is amazing and one of the smartest people I have ever met. And he/she has always found a way to make it work (Informant 3).

Instructional technology personnel noted that due to the hard work of this one person, integration of the learning management system and the student information system often appeared "seamless" to teachers and administrators (Informants 3 and 14).

Along with attention to interoperability and data security, technical personnel set up rosters, roles, and permissions; initiated single-sign on; migrated content; and secured data. These personnel explained how they were careful during system deployment to ensure that data were secure and compliant with federal privacy, encryption, and access laws (Informants 5, 6, and 11). This initial round of system deployment occurred prior to the secondary pilot in January 2016, and continued as the district brought the system to scale in all schools in the next two years.

Professional development. The planning team decided on a train-the-trainer model for professional development facilitated by ITTs. In the multivocal literature, data system implementation involves professional development for administrators and teachers (Beams, 2017; Cho, 2011; Cho & Wayman, 2014; Means, Padilla & Gallagher,

2010; Wayman & Cho, 2008). Districts may choose to deliver training in multiple modalities, such as online, hybrid, and in-person (Beams, 2017; Cho, 2011). A vendor may conduct training for district personnel, or assist a district with a train-the-trainer model, which usually involves vendor training for a limited number of district personnel, who then train other district personnel (Cho, 2011).

In Oak Trail, professional development with a train-the-trainer model represented the district's commitment to provide professional development on the learning management system prior to its implementation in schools. The district asked the vendor to train members of the selection committee, central office personnel, ITTs, and the three teachers from each secondary school. As part of this initial round of professional development, the vendor also provided a "sandbox" for educators to test the system (Informant 15).

After receiving professional development from the vendor, ITTs created district-specific materials to train educators. Planning team members noted that ITTs had multiple reasons for this decision. First, they thought that the vendor's online tutorials and materials were not adequate. Second, they wanted specific information for educators on the integration of the student information and learning management system. Third, the group thought that district-specific professional development materials would help educators feel more "comfortable" with the new system**:**

> The big thing that we had a problem with is that [the vendor] made these long documents. It had every single thing but teacher may have only needed one (Informant 3).

> We are prideful and we want to take things that exist and make them look like they belong in our district so that our teachers feel even more comfortable (Informant 10).

ITTs and their supervisors split into teams and used professional development days to create these training materials. This effort resulted in training videos for secondary and elementary teachers, as well as handouts on system features and instructional functions (OTSD LMS Media Album Directions, 2016; OTSD LMS Remote Login Handout, 2016). ITTs reported that they hoped educators could consume these "relevant" materials easily:

> We kind of like to do our own thing a lot of the time to make it really relevant for our teachers so it looks like our computer screen and it looks like our school (Informant 10).

The planning team tasked ITTs with the implementation of the train-the-trainer model in schools. In the rational perspective, organizations "train members to execute prescribed production operations," and expect each worker to make a distinctive contribution to organizational productivity in a specialized area (Ogawa et al., 2003, p. 166; Barr & Dreeben, 2008). In Oak Trail, ITT's carried out the majority of specialized work involved in professional development. From April to June 2016, secondary ITTs trained school-level personnel on how to use the learning management system. In alignment with the multivocal literature, ITTs reported that teachers completed two hours of paid professional development modules either in-person, online, or "customized" to meet their needs. ITTs also trained administrators and other school staff members, such as secretaries and school counselors:

> So it was really about tailoring [educators] training to fit their needs (Informant 3).

> I personally worked with [school staff members]. I showed them how to do specific tasks…they know how to get into courses and view what the teachers are doing, or the teachers that they oversee (Informant 1).

In addition to professional development with ITTs, Oak Trail offered teachers the opportunity for summer training (OTSD School Board Update, June 2016). The district paid teachers who attended summer sessions with professional development funds provided by the vendor. In Summer 2016, the planning team also trained building administrators and central office personnel who did not receive the initial training (OTSD School Board Update, June 2016; OTSD LMS Summer PD Opportunities, 2016).

Content migration. Oak Trail's contract with the vendor required migration of instructional content from the course management system into the learning management system. The multivocal literature suggests that a district populates a data system with standardized test scores and grades (Means, Gallagher, & Padilla, 2009; Wayman, Cho & Johnston, 2007; Wayman et al., 2012b). However, in Oak Trail, content migration had two parts. The first part of content migration focused on secondary educators, who had stored instructional materials, such as lesson plans, handouts, quizzes, and tests, in the course management system. The second part of content migration focused on content specialists, who had responsibility to connect district curriculum to state standards in the learning management system.

In order to facilitate content migration for secondary teachers, the district notified them of the course management system's "end of life" date, which took place after teachers left for the school year (OTSD Content Migration Flyer, 2016). ITTs created specific instructions on how educators should save and store instructional materials prior to system shutdown (OTSD Content Migration Flyer, 2016; OTSD LMS Flyer, 2016). At the end of the school year, the district required secondary teachers to sign a form that confirmed they had stored and secured instructional content (OTSD Content Migration

Flyer, 2016; Informant 5). After the district turned off the course management system, the district and vendor worked over the summer to migrate content into the learning management system. If done properly, this process populated individual, instructional content for each secondary teacher into the learning management system for the start of the next school year.

Content specialists in each subject area and grade level had responsibility to connect the district's curriculum to state standards stored in the learning management system (Informants 4, 11, and 12). At this time, Oak Trail used a website with K-12, district curriculum directly connected to state standards (Informant 4). In the planning stage, instructional technology specialists and content specialists reported working together to coordinate and attach district-level instructional content to the state standards in the learning management system (Informants 10 and 12).

System pilot. The specialized literature suggests that a district should "stage" a learning management system prior to deployment (Berking & Gallagher, 2014; Foreman, 2013b). In alignment with this suggestion, Oak Trail piloted the learning management system, first in secondary schools and then in elementary schools. Planning team members visited schools that expressed interest in a pilot, and told faculty members about the benefits and challenges of pilot participation. For example, they noted that during the pilot, the system may or "may not" be operational:

> And we were honest that we knew that some things weren't going to work or may not work, but that was the point and I think that they appreciated that (Informant 3).

After these presentations, Oak Trail selected one middle school and one high school for a system pilot. Technical personnel prepared the system for all educators and students in these two schools:

> We had full access…teachers didn't have to go in and do any settings or preferences or anything like that (Informant 7).

Secondary ITTs supervised the pilot, trained educators, and worked with technical personnel on system deployment in the pilot schools. In addition to the two secondary school pilots that included all teachers and students, the district conducted "mini-pilots" with three teachers, the school librarian, teacher-leaders, and the ITTs in all schools. Planning team members indicated that the mini-pilots built instructional capacity prior to full implementation:

> At the other [mini-pilot] schools it was about building leaders for the next year…it was about building capacity (Informant 10).

In Fall 2016, Oak Trail repeated the pilots and mini-pilots in elementary schools. Due to the absence of district documents, limited data exists on the elementary pilots. However, available data indicate that the district implemented the elementary pilots in the same manner as the secondary pilots (OTSD Audio Update 2, 2016). Elementary directors worked with elementary principals to identify four schools that wanted to participate (OTSD Audio Update 2, 2016). Additionally, all elementary schools conducted a mini-pilot with teacher-leaders, the school librarian, technology liaisons, and ITTs.

Planning team members noted that the pilots allowed technical personnel time to address operational issues, as well as encourage a "community" of "first followers" on the system prior to full secondary implementation:

> The full school pilot successes I think that were that we built a big community; in the mini-pilots, we definitely saw leaders in the building that became trainers that helped support instruction (Informant 10).

> And one smart thing we did too was that we did that scaffolding, the pilot phase. We had folks out in the field, so they were the first followers, that cohort that the ITTs invested in (Informant 11).

After conducting secondary and elementary pilots, the district fully implemented the new system in all schools in Fall 2017.

Planning through an institutional lens. This section discusses Oak Trail's actions in the planning stage from the institutional perspective. District actions discussed in this section include central office preparation, messaging, single sign-on, professional development, and the pilot.

Central office preparation. In Oak Trail's planning stage, organizational actions seen through an institutional lens suggest that the district may have aided the long-term survival of the learning management system, but not necessarily its efficient implementation. These actions took a variety of forms. First, loose-coupling in the central office resulted in a planning team comprised of members primarily from the Technology and Instructional Technology departments. One planning team member noticed this loose-coupling in the "hands-off" approach of assistant superintendents in other departments to implementation planning:

> I think [assistant superintendents in other departments] were more consulted. I don't think they were really responsible for what was happening [during planning] (Informant 7).

Another approach to implementation planning that appeared to be aimed at the long-term survival of the learning management system was the graduated, two-year implementation plan. Members of the planning team admitted that educators perceived a

previous technology implementation to be less than successful (Informants 3, 10, and 11). Due to this previous concern, the district needed to "protect the plate" of educators during implementation. A planning team member explained what "protecting the plate" meant to the planning team:

> Way back in the beginning, one of our directors talked about 'protecting the plate', which I remember as teachers always have a lot on their plate. And so our strategy was that if we are going to show them something new then we were going to have to put just a little thing on the plate (Informant 10).

In the institutional perspective, an organization incorporates actions to "increase the commitment of internal participants" (Meyer & Rowan, 1977, p. 347). In this way, "protecting the plate" of educators through graduated implementation of the learning management system created a strategy to increase participant commitment. For example, planning team members noted that they designed the two-year timeline to build "momentum" (Informant 11) for a "teacher friendly" (Informant 10) implementation that educators would not perceive as overwhelming. In this case, the implementation timeline appeared intended to cultivate support for the learning management system with internal stakeholders, who might reject the new system if they could not accommodate a change to their current approach to instruction.

Previous insights from the adoption stage support this finding as consistent with the institutional perspective. If Oak Trail had an urgent need for a learning management system to deliver instruction, then a two-year implementation timeline would have been unrealistic. In that case, instead of concern about educator support of a new system, the district would have introduced the system as soon as possible. This finding supports the

claim from the adoption stage that the district did not have an urgent need for a learning management system, and may have adopted the system to conform with other districts.

Messaging. Another example of Oak Trail's actions that are consistent with an institutional perspective involves the planning team's decision to "brand" the district's message about the new system (Informant 11). Personnel in the Communications Department created an infographic with the implementation timeline, which informants reported was eye-catching (OTSD LMS Infographic, 2016; Informants 7, 11, and 10). The district distributed this infographic as a poster in all schools, and placed it on the Instructional Technology Department website (Informants 7, 11, and 13; OTSD Information Technology Department [Website], 2017).

However, close inspection of the infographic reveals that its information is more symbolic than substantive. The predominant feature in the infographic is a picture that visualizes the implementation timeline. Information on the implementation timeline emphasizes steps in the implementation process, such as professional development and the pilot. In fine print, the district has limited information about the features of the learning management system. Considering that the planning team may have used this infographic as the main conduit of information on the new system and its implementation, it appears that it is intended it to create visibility for the new system rather than share substantive information (OTSD LMS Implementation Infographic, 2016). One informant supported this interpretation of the infographic and its purpose:

> And those [infographics] were hanging up. They were in the teachers lounges and stuff. I don't know how much that helped but it did get it [the new system] on people's radar (Informant 13).

Another informant admitted that one of the purposes of the infographic was to create a "win" with stakeholders:

> I think that was a big win for us to have something to go to, that one pager [the infographic] to reach all the stakeholders (Informant 10).

These actions by the planning team suggest that it was important for the district to control the message around the implementation plan, and that branding of this plan and timeline created visibility and support for the learning management system, which is a finding consistent with the institutional perspective.

Single sign-on. Informants noted that an important step in the planning stage involved how educators made initial contact with the learning management system (Informants 6, 10, and 11). Practically speaking, initial contact with the learning management system would occur when an educator or administrator logged into the system with a username and password for the first time. In the multivocal literature, the most desirable approach for login to multiple data systems is single sign-on, which means that a user does not need a separate username and password for each data system. The specialized literature notes that a key feature of a learning management system is its ability for single sign-on, either through the system or with a third-party, single sign-on provider (Smith, 2018).

Prior to Oak Trail's adoption of a learning management system, the district contracted with a third-party, single sign-on vendor, whose software allowed district personnel to sign on to multiple data systems with a single username and password (Informants 6, 8, and 10). Because the district already used single sign-on, the planning team perceived that interoperability between the third-party, single sign-on vendor and

the learning management system vendor was a critical first step to gain buy-in from educators for the new system:

> We have seen, I know as a teacher, sign-on could be the biggest disaster. If you lose people at sign-on or it takes 20 minutes to create an account, people aren't going to be interested (Informant 10).

In the institutional perspective, an organization gains legitimacy through "established and legitimated" procedures and policies (DiMaggio & Powell, 1983, p. 155). In Oak Trail, the planning team perceived single sign-on to be necessary as the initial point of contact for the learning management system. Through this lens, single sign-on represents a normative structure that the planning team wanted to continue so that the new system appeared to conform to routine district practices. Alternatively, the inability of the district to ensure single sign-on for the learning management system represented a potential threat to system legitimacy, especially with educators who may not have been confident technology users, or who had reason to lose interest in the new system if they could not access it immediately with a recognized process. This finding supports a view of single sign-on as an organizational structure intended to increase the legitimacy of the learning management system with internal participants, which is a finding that aligns with the institutional perspective.

Professional development. In the institutional perspective, technology enhances organizational myths and "buffers" the technical core of the organization (Freeman, 1973, p. 758; Meyer & Rowan, 1977). In Oak Trail, this buffer is visible in the attention given by ITTs to professional development. ITTs reported that they worked long hours to design district-specific materials. From an institutional perspective, these actions focused educators away from the vendor and onto the district, which potentially buffered the

vendor from educator scrutiny. As with district messaging of the implementation plan, the district's professional development materials also allowed it to control information to educators about the system's value.

After ITTs created professional development materials, the planning team asked them to lead training. In the institutional perspective, schools as organizations adopt routines and procedures as "a set of face-saving norms that allow schools to appear rational, but which avoid any substantive inspection of this assumption" (Rowan, 1990, p. 355). ITTs noted that even though educator and administrator training had a clear purpose, they aligned their actions with district norms to avoid substantive inspection of their process. For example, even though the district promoted training sessions with secondary ITTs in schools, some secondary ITTs admitted that they used a relatively hands-off approach to training, especially with educators who seemed competent with the previous course management system (Informants 1, 5, 9, and 15):

> So most of them basically taught themselves by going through those modules (Informant 1).

> In this building, could I have rolled out an LMS from the hip and said we are going to a new system and run one or two trainings? Maybe (Informant 5).

ITTs admitted that even though teachers were training themselves to use the learning management system, they felt obligated to adhere to the ritualized procedure around training. One ITT kept track of educators in their school as they progressed through the professional development modules:

> [The learning management system] creates a log for me to be able to cover my rear and say I have provided training, I have provided to a group, I have done one-on-one with teachers and I document that **(**Informant 9).

Some secondary ITTs also noted that administrator professional development seemed to be guided by norms and rituals. For example, some ITTs noted difficulty with administrators who appeared to have more important obligations than training on the learning management system (Informants 1, 5, and 15):

> Administrators? I was supposed to train [them], but also I can't make them come if they have a meeting (Informant 5).

> They don't tend to be very instructionally focused, they don't pay attention to instruction, they are there for discipline (Informant 15).

Although ITTs would not have been expected to enforce administrator training, this gap between accountability for data system training and expected data system use for administrators became an issue in later stages of implementation, when informants reported that administrators did not necessarily know how to use the new system. This finding suggests that Oak Trail may have focused on the norms and the perceived value of professional development on the learning management system, rather than its intended outcome, which is a finding consistent with institutional theory.

System pilot. Oak Trail's decision to host a pilot reflects not only attention to testing the learning management system operationally, but also to the creation of value and legitimacy for the system prior to full implementation. For example, informants noted that the rationale for the pilots may have been to create a group of "first followers," which included some educators who did not have a choice but to participate:

> So [the rationale for the pilots] was finding a first group of leaders and then finding their first followers, and then we went with the plan in which we did pilots in a few schools (Informant 11).

> We were presenting to a group of people [about the pilot] who had no choice and were told 'you will do this.' So you are going to have dissenters (Informant 15).

These comments suggest that even though the pilots had operational value in testing and troubleshooting the learning management system prior to full implementation, for some educators, the pilot may have lacked clear instructional objectives. Through this lens, the system pilot served to legitimate the value of the system with teachers as technology important enough to warrant testing and review by knowledgeable educators, in order to cast the new system as a valuable tool for instruction.

Oak Trail's elementary pilot also reflects the possibility that, in some schools, the pilot was more symbolic than substantive. In the institutional perspective, an organization develops "shared meanings and values" that strengthen a "participant's commitment to support the structural façade" of an organization (Ogawa et al., 2003, p. 161). In regard to the elementary pilots, informants noted that at times it seemed unfocused and without clear a purpose (Informant 2, 4, and 12):

> So we piloted in four schools, we had the teachers in early, provisioned [professional development] for them, and that was kind of a 'build your airplane as you are flying it' mode (Informant 2).

These comments suggest that in elementary schools, the pilots may have lacked clear instructional objectives and instead created meaning and value for the learning management system. This approach with elementary educators strengthened educator commitment to the process and product prior to full system implementation, which is a finding consistent with the institutional perspective.

Organizational actions and contextual forces. As mentioned previously, the multivocal literature suggests that organizational processes and contextual forces influence data system adoption and implementation. In the planning stage, organizational processes in formalization, coupling, alignment, and accountability, and contextual forces

in accountability and privatization, shaped Oak Trail's actions. Additionally, informants reported that in the planning stage, the district intended for content migration and professional development to build capacity for instruction, which may represent a new organizational process in this literature.

Oak Trail formalized organizational processes in three ways in the planning stage. First, the planning team negotiated with the vendor for a gradual deployment of the system. Second, ITTs delivered professional development to educators in schools, which formalized their role as boundary spanners who were critical for system implementation. Third, content migration and professional development helped formalize district expectations that teachers would engage in instruction upon system availability.

In contrast to formalization, some actions of the planning team appear to be compartmentalized and fragmented. Cho and Wayman (2015) note that central office personnel may compartmentalize in order to keep "extant bureaucratic structures intact" (p. 1217). In this case, the Assistant Superintendent of Operations assigned an instructional technology specialist to head up the planning team. This person tasked instructional personnel to guide implementation, which may have isolated this group from other departments in the central office.

Coupling of central office personnel also shaped organizational actions. The district's top down, tightly-coupled approach to system deployment allowed educators ample time for a pilot, content migration, and professional development. In contrast, loose coupling between the Instruction and Instructional Technology Departments may have isolated instructional personnel, who could have provided input on the district's implementation plan and timeline.

In the evaluative literature, educators need time to "attain comfort with a particular system" in order to align data system use with data use (Cho, Jimerson & Wayman, 2015, p. 139; Young, 2006). Professional development, content migration, and a system pilot in Oak Trail's planning stage theoretically accomplished these goals. First, the district used a multi-modal, train-the-trainer model of professional development. Then, the district migrated secondary instructional content prior to the start of the school year. Next, the district conducted pilots in each school, which allowed teachers time to familiarize themselves with the system and it use for daily instruction. These organizational actions suggest that in this stage, the district recognized the implications of alignment between data system use, instruction, and future data use.

On the other hand, Oak Trail's infographic may be organizational alignment designed to head off potential criticism of the implementation plan. The planning team intentionally "branded" the publication to create awareness of the new system, which appeared to control information and reinforce the district's message about the implementation plan and timeline. This finding suggests that the district may have sought alignment between the implementation plan, branding, and educator perceptions of the district's planning stage and decision process.

Cho (2011) suggests that educator access to student data as part of data system implementation supports accountability for data system use. Oak Trail's effort to keep secondary educators accountable for content migration and professional development in the planning stage supports this claim. Content migration allowed secondary educators to use their instructional materials upon implementation, and professional development prior to the start of the school year further reinforced accountability for learning

management system use. These actions suggest that goals in the planning stage included secondary educator data system use upon implementation.

On the other hand, ITTs reported that even though the district directed them to engage building administrators in professional development, some administrators did not take advantage of that opportunity. This finding suggests that Oak Trail held educators in schools accountable for professional development and content migration, but not necessarily building administrators. Considering that secondary educators would need to use the learning management system for instruction at the start of the school year, this alignment of internal accountability mechanisms towards educators makes sense. However, this alignment also indicates that the district did not necessarily consider administrator use of the learning management system to be a priority. ITT reports of uneven use of the learning management system by secondary administrators in both the first and second year of implementation further supports this finding.

A potentially new finding in the planning stage involves the district's intent to use professional development and secondary content migration to build capacity for data system use and instruction. In studies of data systems, the term "capacity" refers to the "capacity" of the data system (Lachat & Smith, 2005), such as the system's ability to store and analyze data (Brunner et al., 2005; Chen, Heritage & Lee, 2005, Cho, 2011; Means, Padilla & Gallagher, 2010; Means et al., 2009; Mieles & Foley, 2005). Only one study in the data systems literature, Wayman, Jimerson and Cho (2012), found that "frequent learning activities" on a data system builds teacher capacity for instruction (p. 165). Although very tentative, this finding suggests that building capacity for instruction, which in this study required systematic attention to professional development, content

migration, and educator accountability for these activities, may be a new addition to organizational processes in the planning stage.

As noted in the previous section on learning management system adoption, as part of privatization, districts may develop intense private-public relationships with the vendor (Burch, 2010). In these relationships, a district may rely on a vendor for more than just technological support. Vendors may "act as critical extensions of educationally central policy processes" and redirect district goals (Burch, 2010, p. 158). In Oak Trail, interactions between the planning team and the vendor suggests that this private-public relationship existed, although its intensity is unclear. Although district officials convinced the vendor to implement the system gradually, they had to overcome the limitations of the vendor's product and personnel to do so. This problem suggests that Oak Trail engaged in a private-public relationship of unclear intensity with the selected vendor in the planning stage.

The Implementation Stage

As previously noted, Oak Trail's implementation stage involved a gradual deployment of the learning management system, first in secondary schools and then in elementary schools. As mentioned in Chapter 2, the multivocal literature on implementation is limited. Therefore, it is fair to say that the multivocal literature provides limited guidance on how a district implements a learning management system.

Because this study occurred in October 2017, data on the implementation stage reflects secondary implementation at one year and elementary implementation at two months. With this timeline in mind, this section provides a synopsis of Oak Trail's implementation stage, explains findings from the rational perspective and the institutional

perspective, and presents the organizational processes and contextual forces that shaped district actions.

Synopsis of the implementation stage. In Fall 2016, Oak Trail implemented its learning management system in secondary schools. This stage overlapped with the elementary system pilot, which occurred in the 2016-2017 school year. The planning team supervised secondary implementation with assistance from secondary ITTs. Secondary teachers and students gained access to the system in the first semester of the 2016-2017 school year (OTSD LMS Implementation Plan 2016-2017). After secondary school implementation, elementary schools gained access at the start of the 2017-2018 school year.

Implementation through a rational lens. In August 2016, Oak Trail deployed the learning management system in secondary schools. Technical personnel said that they felt ready for implementation:

> There was support available to those people to use it. So it wasn't just 'here is this great tool to use, see you later.' Or we are learning how to use it to we will get back to you when we figure it out (Informant 8).

Secondary ITTs noted that educators also appeared ready for system implementation. Secondary administrators, support personnel, and department chairs reportedly used the system for professional development and to communicate with educators. Secondary teachers used the system for a variety of purposes, such as curriculum storage, instruction, quizzes, tests, homework and communication:

> Our English department uses it; they have folders in their group resources that everyone can access and all the teachers can add materials to them. [And] I know that some of the Calculus teachers, they have this database with all of this stuff that they can borrow from each other (Informant 1).

In early 2016, secondary school parents gained access to the learning management system (OTSD LMS Parent Access Letter, 2016). Oak Trail's planning team disseminated a flyer with instructions for parents on how to create an account and access the system from a computer or mobile device (OTSD Instructional Technology Department [Website], 2017; OTSD LMS Parent Access Flyer, 2016). For security reasons, the district provided parent access to the system through the student information system, which contained a student's gradebook of record (OTSD LMS Parent Access Letter, 2016).

By Fall 2017, secondary educators and central office personnel had used the system for one year, and elementary educators had used the system for less than two months. In the rational perspective, data systems are "technical innovations…that have direct impact on the technical work activity of the organization, such as teaching methods, curriculum, [and] materials" (Bamburger, 1995, p. 173). In Oak Trail, informants offered examples of system use in the second year of implementation. For example, content specialists used the system for teacher communication and professional development:

> In central office we're really using it more as a communication tool and trying to get teachers to see the power of the [learning management system] and using it with their students. And I created a [professional development] session that should last about an hour for teachers to sit on their own time and watch the videos respond to the questions (Informant 4).

ITTs and central office personnel called elementary school teachers who seemed comfortable with the new system "early adopters" (Informants 2, 4, and 13). These personnel also noted that Oak Trail's vision of future learning management system use at

this point in implementation included alignment with the district's new learning model, which incorporated the system as a tool for "anywhere, anytime" learning to help students access individualized curriculum. One informant summarized the district's vision for the learning management system:

> We have started using [the system] as the tool and the housing, to get to more personalized learning and to model difference in the way the instruction would be developed (Informant 3).

Implementation through an institutional lens. In August 2016, Oak Trail implemented its learning management system in secondary schools. The institutional perspective suggests that organizations implement a technology to promote conformity, or to align a district with the norms and values of similar organizations (Cibulka, 1995; Meyer and Rowan, 1997; Ogawa, 1994). At the start of the first year of implementation, the district had turned off the course management system and migrated instructional content into the learning management system. So, at this point in implementation, the learning management system was the primary delivery mechanism for instruction in secondary schools.

However, prior to the district's selection of a learning management system, some district educators had bypassed the outdated course management system and downloaded free learning management software. ITTs and technology personnel noted that the district did not block educator use of these alternative learning management systems, although they could have (Informants 3, 14, and 15). Faced with potentially competing learning management systems, ITTs reported their attempts to create meaning and value for the district's learning management system over other, free systems:

> We tried to stress the fact that [a different vendor's free software] is more of a content management system versus whereas [this product] is a

> learning management system so it does a little bit more than [that system]. We said 'hey, if you want to use [that system], that's fine, but we're going to really try and push [the district's system]' (Informant 7).

In the institutional perspective, organizational conformity involves "the "adopt[ion] of practices viewed as exemplary, normative or routine" (Burch, 2007, p. 85). At this point in implementation, it seems that secondary ITTs sensed that educators had a choice in learning management systems, and therefore tried to associate free learning management systems with Oak Trail's outdated course management system. In other words, by touting the features of the district's learning management system, secondary ITTs framed the learning management system as exemplary and legitimate, and its use in practice as instructionally normative.

This finding also suggests that some secondary ITTs may have cast educators who continued to use free learning management systems as outside of Oak Trail's new instructional norms. In the institutional perspective, legitimacy develops as part of the "social approval expressed in norms and beliefs…with which the institution meets its socially defined purposes" (Cibulka, 1995, p. 127). After secondary implementation, the learning management system was the official or legitimate system for instruction, and so the district would have expected secondary educators to use it. Although central office personnel may have assumed that efforts around professional development and content migration in the planning stage constituted direction as to the new norms of learning management system use, ITTs may have sensed that educators felt otherwise. Thus, the intent of ITTs to cast the free learning management systems as inferior to the district's official learning management system not only expressed the norms and beliefs of the district, but may have been intended to increase the "commitment of internal participants

and external constituents" for the official learning management system (Meyer & Rowan, 1977, p. 347).

In Fall 2016, elementary schools piloted the learning management system. In this semester, the district asked elementary content specialists to populate the learning management system with curriculum linked to state standards. As previously noted, Oak Trail's long-term use of an in-house curriculum and standards website meant that for educators to view district curriculum connected to state standards, content specialists needed to facilitate this connection in the learning management system.

However, informants reported that some content specialists decided not to do so. One content specialist offered a potential reason for this decision, which involved the time-consuming nature of this manual task due to the number of 'clicks" needed to complete it:

> It's not quite as easy, because you have to drill down to this set of standards, this subcategory, this standard, this bullet. It's like nine clicks for each time you tag something (Informant 4).

Other reasons given for the decision not to connect state standards to district curriculum involved the update of state standards in the next calendar year, and the well-functioning district website (Informants 2, 4, and 13). This finding suggests that, for some content specialists, the district's learning management system was not yet connected to teaching and learning in the classroom, which suggests a disconnect between the purpose of the learning management system as a core technology aimed at instruction.

This disconnect from instruction potentially impacted elementary implementation. Central office personnel noted that elementary educator system use in the first year reflected the institutional value of a learning management system as a desirable

innovative technology, but perhaps without full consideration of the challenges of implementation in all elementary schools. For example, informants who worked with elementary educators did not report the same sense of accountability for learning management system use in elementary schools:

> It is not an expectation. But as we get to third, fourth and fifth grade, the expectation is not that they are using [the system] all the time but where do you see that it fits (Informant 2)?

Although issues with elementary implementation may reflect lapses in planning, or the challenges that can accompany implementation, they may also provide support for an institutional perspective, if in the future, district officials fail to address the challenges in the future or limit expectations for the system's instructional use.

Also in Fall 2017, secondary schools headed into a second year of implementation. At this time, secondary ITTs noticed that secondary teachers did not always use the new system, but that most "existed" in it:

> Yes, they are existing in [the system] now. But they could be using it in a way that is less work for them and makes more sense for the students. It's a slow process, we are getting them there, we are making progress, but it's baby steps (Informant 1).

Some informants reported that the district made it clear that secondary educators should be using the learning management system for instruction by the second year of implementation (Informants 1, 3, 11, and 15). However, other informants were not as sure about that directive from the district (Informants 5, 6, and 9):

> There is not a directive that the learning management system is the one you have to use. Nobody is going to sit there and say you have to use it (Informant 9).

As previously noted, the goal of learning management system implementation is use of the system for instruction. In the institutional perspective, "ambiguous goals, uncertain technologies, and unstable participation" can threaten organizational stability (DiMaggio, 1988, p. 5). In Oak Trail, these conditions were visible in the second year of implementation. For example, despite a year to build capacity for elementary instruction, elementary educators started the year with a technology with unclear goals for teaching and learning. Through an institutional lens, this lapse by the district to prepare the system for elementary educators may have led to unstable participation, and mixed expectations around learning management system use for instruction upon implementation.

For secondary educators, lack of accountability mechanisms for learning management system use by the second year of implementation may have led educators to "exist in," but not necessarily use, the learning management system. For secondary educators, this condition may have existed because the district did not restrict educator access to free learning management systems, and therefore educators familiar with these other systems continued to use them for instruction. In the institutional perspective, educator use of multiple, competing learning management systems places the district's official system as an uncertain technology with ambiguous goals for teaching and learning. Even though these findings refer to learning management system use, which was not thoroughly investigated in this study, these data support an institutional view of the status of the district's learning management system at the time these data were collected.

Organizational actions and contextual forces. In the implementation stage, organizational processes in formalization, adaptiveness, and accountability shaped district

actions. Brooks (2011) notes districts that do not attend to formalization may experience a "shift from a focus on technology in isolation to a focus on how technology [can] change student learning and teaching practices" (p. 12). In Oak Trail, these formalization challenges appeared in the first two months of elementary implementation. Unlike secondary instructional personnel, who only had a few months to connect state standards to district curriculum, elementary instructional personnel had the elementary pilot year to do this task. Considering that the learning management system had pre-loaded state standards, the district could have given notice to educators that the district's curriculum website would be disabled upon full system implementation. This action would have encouraged instructional personnel to put district curriculum into the system, which would have provided elementary educators with an immediate reason to use the system for instruction.

Organizational adaptiveness is also desirable in data system implementation (Cho, 2011). In Oak Trail, central office personnel identified the learning management system as adaptive in relation to online instruction and the district's goal for "anywhere, anytime" learning. However, early rejection of a new system by educators, particularly at the elementary level, inserts a potential challenge for teachers and students to the adaptiveness of this new system, especially considering the availability of one-on-one digital devices and the viability of early elementary students to login to the system with fidelity.

The district also sent mixed signals in regard to accountability for educator data system use. For example, ITTs noted that some educators perceived data system use to be optional, or did not associate accountability with learning management system

implementation. Although central office personnel hoped that educators would use the system, they also offered a realistic interpretation of data system implementation – namely that some educators would use the system and some would not. These findings suggest that accountability as an internal organizational process may need to be formalized in relation to data system use.

Unlike in previous stages, external contextual forces do not appear to play a role in Oak Trail's implementation stage. This finding could be due to the timing of the study or the absence of those data. Alternatively, it could represent a true gap in the influence of these forces in the implementation stage in this district. Due to the inconclusive nature of this finding, further research might be warranted on the influence of contextual forces, if any, in the implementation stage.

Chapter Four Summary

This chapter presented findings from this case study on the adoption and implementation of a learning management system in Oak Trail School District. The multivocal literature takes a primarily rational view of district adoption and implementation of a learning management system. However, this study suggests that both the rational perspective and the institutional perspective had utility to explain district actions.

Federal and state laws, state policies and incentives, and district policies provided the policy context for this case study. District policies aligned with state policies to encourage Oak Trail to adopt a learning management system. In the past 20 years, Oak Trail invested in its digital infrastructure and data systems, which included high-speed Internet access, a student information system, a formative assessment system, and a

course management system. The district has a top-down organizational structure, with an Assistant Superintendent of Operations who supervised both the Technology Department and the Instructional Technology Departments. These two departments employ personnel who maintain computers and equipment, as well as instructional technology teachers who work with educators in schools.

A rational lens explained Oak Trail's adoption process, which aligned nicely with the multivocal literature. Tightly-coupled personnel from the Instructional Technology Department spearheaded the adoption process, which included a need analysis, a Request for Proposal, appointment of a selection committee, and the selection of Oak Trail's learning management system. An institutional lens provided additional insight in this stage. The district rationalized its need for a learning management system based on instructional fragmentation. Instructional technology personnel engaged with other districts, which suggested attention to the norms and values involved in data system adoption. These actions theoretically increased the system's long-term survival with stakeholders, and signaled Oak Trail's focus on technological improvement to other districts. These findings also suggest that organizational processes in formalization and coupling, and contextual forces in privatization and diffusion of innovation, were salient concepts in Oak Trail's adoption stage.

A rational lens also explained many of Oak Trail's actions in the planning stage. Tightly-coupled personnel on the planning team crafted the district's implementation plan. Steps in this plan included an implementation plan and timeline, system deployment, professional development, content migration, and a system pilot. The planning team formalized organizational processes with boundary-spanning instructional

technology teachers, who supervised professional development in schools. In particular, the system pilot appeared to be an approach that accommodated the district's goal to deploy the system and bring it to scale on time. The district aligned these actions with building capacity for secondary data system use and instruction upon full implementation.

An institutional lens provided further insight into organizational actions in the planning that do not align with the rational perspective. Loose-coupling between the district's planning team and other central office departments may have caused a disconnect in preparation of the system for instruction. The planning team headed off potential criticism of the system with a graduated implementation plan, messaging, and single sign-on. These actions legitimized the district's plan and system in the eyes of future users, as well as cultivated the system's long-term survival. These findings also suggest that organizational processes in formalization, coupling, alignment, and accountability, and contextual forces in accountability and privatization, shaped district actions.

In the implementation stage, a rational lens revealed that Oak Trail attended to the operational needs of the learning management system. The district distributed information to educators and parents on how to use the system through handouts and a website, and ITTs coached educators in secondary and elementary schools on how to use the system for instruction. However, an institutional lens provides additional insight into Oak Trail's implementation stage, particular in relation to elementary implementation. Through this lens, Oak Trail's actions suggest attention to norms and legitimacy over substantive data system use. For example, even though the district knew that elementary

educators did not have access to the previous learning management system, it neglected to hold central office staff accountable for population of the system with elementary curriculum tied to state standards. This oversight meant that the system appeared as a "blank slate" to elementary teachers who had never used a district learning management system.

These challenges meant that despite adoption and planning stages that aligned with organizational goals, in the implementation stage the district faced issues that threatened educator system use, which may constitute a clear threat to the long-term, system survival. Theoretically, the approach that Oak Trail takes to address these difficulties in the future will either strengthen or weaken an institutional interpretation of the implementation process. For example, if the district focuses on constituent satisfaction without substantive alignment of the system with the instructional needs of elementary students and teachers, an institutional perspective would suggest that the learning management system is more symbolic than rational, at least from this current view of the district as an organization.

Chapter Five: Discussion of Study Findings and Conclusions

This study explored school district adoption and implementation of a learning management system. A substantial body of literature exists on school district data systems. However, this multivocal literature is primarily rational in its view of data systems, and has limited studies on learning management systems. With these liabilities in mind, this study asked two, central questions: 1) how does a school district adopt and implement a learning management system and 2) how, if at all, do rational theory and institutional theory explain contextual forces and organizational actions in this process? These questions were answered with an exploratory case study in Oak Trail School District, which had recently adopted and implemented a learning management system.

The purpose of this chapter is to discuss the utility of the theoretical lenses used in this study and key findings in light of the multivocal literature. With this purpose in mind, this chapter presents a revised conceptual framework based on study findings. Then, it discusses the utility of rational theory and institutional theory as rival lenses; key findings in relation to the multivocal literature; study limitations; and suggestions for future research. This chapter ends with a conclusion that summarizes this study and findings.

Revised Conceptual Framework

The initial conceptual framework for this study offered a preliminary roadmap to answer study questions. In this framework, learning management systems are part of the larger constellation of district data systems. Federal laws, policies, and incentives place demands on school districts to adopt and implement data systems for reporting,

assessment, and learning management purposes. Privatization, accountability, and diffusion of innovation operate as contextual forces on data system adoption.

The multivocal literature suggests that a school district engages in a two-stage process to adopt and implement a data system. Organizational processes in formalization, accountability, alignment, adaptiveness, and coupling guide district actions in these two stages. Eventually, in theory, these processes lead to educator data use for instruction. This literature also suggests that institutional theory may have utility as a perspective to explain district actions, and so this study used institutional theory as a rival perspective to rational theory for this investigation (see Appendix E for the initial conceptual framework).

A revised conceptual framework based on study findings suggests that a variety of forces shape learning management system adoption and implementation. In alignment with the multivocal literature, a district may have multiple data systems prior to learning management system adoption. At the time of this study in Oak Trail, district data systems included a student information system, a state summative assessment system, a district formative assessment system, and a learning management system.

The policy context in this study included not only federal laws, policies, and incentives, but also state laws, policies, and incentives. In alignment with federal law, laws in this state encompassed data security, personally identifiable information, and digital access. State educational technology policies offered guidance on learning management system adoption, and the state offered incentives for digital infrastructure and assessment systems. Oak Trail's district instructional policies reflected these demands prior to learning management system adoption. Contextual forces in

privatization, diffusion of innovation, and accountability also shaped Oak Trail's context for adoption of a learning management system.

In addition to external contextual forces, Oak Trail's policies, organizational structure, digital infrastructure, and personnel influenced the district's decision to adopt a learning management system. The district aligned instructional technology policies with the state's educational technology policies. Oak Trail's top-down organizational structure grouped technical and instructional technology personnel under the Operations Department, which facilitated feedback and discussion about learning management system adoption. The district's 20-year investment in digital infrastructure, such as Internet access and one-on-one digital devices in secondary schools, also allowed the district to consider learning management system adoption.

Rational theory and institutional theory had utility in this study to view Oak Trail's three-stage process to adopt, plan, and implement a learning management system. In alignment with the multivocal literature, the rational perspective confirmed organizational processes in accountability, formalization, coupling, alignment, and adaptiveness. The institutional perspective also suggested that loose-coupling may be a salient concept seen through a rival lens. Learning management implementation theoretically led to learning management system use and educator system use for instruction (see Appendix L for the revised conceptual framework).

The Utility of Rival Lenses

One advantage of the use of rival theoretical lenses in this study is that they provide the opportunity for a dialectical approach to the examination of this topic and questions. Although a dialectical approach is not new to education policy analysis

(Coburn & Talbert, 2006; Ogawa et al., 2003; Rowan & Miskel, 1999), for the purposes of this study, this approach had utility because it created the potential for new ideas and insights not visible through a rational lens. In other words, because rational theory is the default theoretical perspective in this highly technical literature, institutional theory offered the potential to reveal district actions that did not align with previous findings.

Use of rival lenses also aligned this study with research on other types of educational reforms. For example, Ogawa et al. (2003) used rational and institutional theory to examine implementation of a standards-based curriculum. Coburn and Talbert (2006) used sense-making theory and institutional theory to examine evidence use and research-based practice at multiple levels of a school system. More broadly, Burch (2007) suggest that studies that introduce institutional theory into a topic defined by the rational perspective not only brings "nuance" to an understanding of educational policies and practices, but also illuminates "non-rational factors" that may or may not shape their intended impact (p. 85).

With this discussion in mind, this study revealed the utility of both the rational perspective and the institutional perspective for this topic and questions. A rational lens had the following benefits. First, because the multivocal literature primarily views data system adoption from a rational perspective, a rational lens provided context for the first study question on how a district adopts and implements a learning management system. Questions in the interview protocol used evidence from the multivocal literature, and answers to these questions generated data that revealed the overlapping stages and discrete steps in Oak Trail's process. In particular, a rational lens helped to identify a planning stage and clarify details of that process.

Second, use of a rational lens supported claims in the evaluative literature that certain organizational processes shape data system adoption and implementation. Formalization, tight-coupling, alignment, adaptiveness, and accountability all proved to be salient concepts in this study that responded to a rational lens. Additionally, this lens revealed connections between accountability as an external, contextual force, and policies that shaped Oak Trail's decision to adopt and implement a learning management system.

Third, use of a rational lens supported claims in the theoretical literature that a school district as an organization is a "rational environment" for technology adoption (Huber, 1981, p. 3). In this case, bureaucratic actors worked in "stable lines of authority" to adopt an educational reform that theoretically improved the technical efficiency of schools and schooling (Selznick, 1948, p. 29; Ogawa, 1994; Senge et al., 2000). This view adds depth to the idea in the theoretical literature that learning management systems are part of the broader context of educational and information management technologies that facilitate teaching and learning in schools.

The use of an institutional lens also proved critical to this study. Although not as prevalent as findings explained by the rational perspective, this lens revealed that Oak Trail occasionally engaged in actions that might be considered institutional in nature. For example, in the adoption stage, the district's outreach to peer districts theoretically conformed and legitimized Oak Trail's process with other similar institutions. In the planning stage, the district sought an "early win" in system deployment, and messaged information with district-specific materials. These actions buffered the learning management system as a core technology, protected district actions from educator

scrutiny, and theoretically forwarded the rationalized myth that the learning management system was legitimate and important to the district's long-term survival.

The institutional perspective also had utility in this study to uncover how "actors develop shared meanings and values" around organizational goals that can strengthen a "participant's commitment to support the structural façade…" (Ogawa et al., 2003, p. 161). In Oak Trail, activities around messaging of information, a system pilot, and professional development revealed the district's attempt to engage participants in the shared value and meaning of the new system, despite unclear organizational goals. For example, the district engaged elementary educators in a system pilot and professional development designed to prepare them for learning management system use. However, as secondary schools implemented a new learning management system with one-on-one laptop computers and migrated instructional content, elementary educators prepared to use a system that looked like a "blank slate" without preloaded content or one-on-one digital device access. Seen through this lens, Oak Trail's actions aligned elementary educators with secondary educators around the shared meaning and value of the system, strengthened participant commitment in elementary schools, and supported the rationalized myth that the system was user-ready for instruction upon deployment.

An institutional perspective also supported the claim in the theoretical literature that even if an innovation is more organizational than substantive, district actions associated with data system adoption and implementation may legitimize schools in the wider education environment (Cibulka, 1995; DiMaggio & Powell, 1983). Regardless of the fidelity of implementation in Oak Trail's elementary schools, district officials could accurately claim that they had implemented a learning management system across the

district. This accomplishment allowed Oak Trail to claim conformity with peer districts, as well as legitimize the system with internal stakeholders, which in turn may have guaranteed the system's survival.

Although each perspective had utility for data analysis, it is the use of rival lenses in this study that proved worthwhile. In addition to the reasons stated previously in regard to a dialectical approach, this study benefitted from an alternative lens in the study design, data collection, and data analysis. For example, consideration of institutional theory as a counterpoint to rational theory generated the second study question, which arguably focused this study in a different direction than previous studies in this literature. Also, use of rival lenses to create the interview protocol provided a bias check in data collection. Protocol questions reflected the possibility that the district did not have rational goals, as well as provided an opportunity to ask questions of informants with an open mind.

Rival theoretical lenses also served a critical purpose in data analysis. As findings were reviewed, alternative explanations for informant responses were considered, which reduced the possibility of investigator bias and error in data interpretation. This point is nicely illustrated by concepts identified as organizational processes in the evaluative literature. For example, loose-coupling does not usually generate rational actions that result in goal attainment. Therefore, the use of a rival lens provided insight into organizational processes that were not necessarily institutional, but also did not forward Oak Trail's rational goals. These findings in regard to the utility of rival lenses suggests that this topic responds nicely to a dialectical approach, both methodologically and theoretically.

Key Findings: Alignments and Misalignments

This discussion of study findings expands on claims made in Chapter 4 and the revised conceptual framework, which revealed alignments and misalignments between study findings and the multivocal literature. This section prioritizes these insights, which include the policy and district context; a three-stage process and the importance of the planning stage; and findings on how, if at all, contextual forces and organizational processes shaped district actions.

The role of policy. In the multivocal literature, federal policy and incentives act as accountability mechanisms on data system adoption. For example, this literature presents Race to the Top as a federal policy lever on districts to adopt data systems for the continuous improvement of schools. However, in this study, state educational technology policy, not federal policy, appears to be the primary influence on Oak Trail's decision to adopt a learning management system.

This finding is important because it provides insight into state policy as an accountability mechanism in data system adoption, as well as reveals how alignment between state and district educational technology policies influence district decision making. In previous studies, the theory of action for data system adoption involved vague accountability mechanisms in federal policies aimed at continuous improvement. In this study, the theory of action for data system adoption depended on the type of accountability mechanism (law, policy, incentive), who employs that mechanism (federal, state, local entity), and the educational technology or data system in demand.

In Oak Trail, this theory of action appeared to be as follows. In this state, state law aligned with No Child Left Behind (2001) and ESSA (2015) to demand school

district use of a state-approved assessment system. This state provided incentives for districts that did not have adequate resources for this purpose, and had an educational technology plan that encouraged, but did not require, district adoption of a learning management system. Oak Trail's educational technology plan cited many of the state's suggested goals for educational technology, which included adoption of a learning management system. Although some districts may have needed state incentives to build the requisite infrastructure for a learning management system, Oak Trail's long-term investment in digital infrastructure and previous implementation of a course management system allowed the district to move forward with the adoption of this type of data system.

This finding has implications for how rival lenses explain the logic of district actions related to accountability as either rational or institutional. Through a rational lens, the logic of data system adoption as it relates to accountability is that it improves student outcomes. Through an institutional lens, the logic of data system adoption is less clear. If sanctions are involved, then accountability may operate as an environmental factor that requires a district response. Alternatively, a district may use accountability as an excuse to reinforce practices, or it may operate as a rationale to follow the actions of other districts. In that case, district adoption of a data system may be isomorphic, and occur as a result of the educational technology environment, or due to a perceived need to conform with other districts.

District context. Although not well-represented in the multivocal literature, Oak Trail's district context operated as an important precursor to learning management system adoption. For example, the multivocal literature hints at the importance of digital infrastructure as part of data system adoption, but this literature does not clearly specify

what, if any, elements of infrastructure may be important. In this study, specific elements of Oak Trail's digital infrastructure played a fundamental role in the district's ability to adopt a learning management system, which included one-on-one computers for secondary students and educators, access to laptops and iPads for elementary students, and high-speed Internet.

In addition to digital infrastructure, Oak Trail data systems had specific functions related to information management. A course management system stored instructional materials and delivered student assignments; a formative assessment system delivered and processed benchmark assessments and data; and a student information system processed student data in real time. In this case, learning management system adoption made sense as the final piece of Oak Trail's constellation of data systems, which contributes to this literature on how a district's data systems may work together to promote teaching and learning.

Although the specialized literature suggests that technical personnel play a role in learning management system adoption, the multivocal literature does not disaggregate the roles and responsibilities of personnel in this process. However, in this study, central office personnel with specialized roles proved critical to Oak Trail's adoption and implementation of a learning management system. In schools, the district employed technical support personnel to maintain digital infrastructure. Between schools and the central office, instructional technology teachers operated as boundary spanners to facilitate learning management system use. In the central office, personnel with information technology experience worked with the vendor to deploy the learning management system and bring it to scale. Also in the central office, instructional

technology specialists worked with instructional personnel to facilitate professional development and instructional use of the system upon implementation. These findings add clarity to the multivocal literature on the roles and responsibilities of central office personnel and suggest that, depending on the size of the district and its investment in personnel as a resource, personnel with specialized roles may be critical to data system adoption, planning, and implementation.

The last element of context that represents a potential addition to this literature involves the role of the school district as an organization. Honig (2003) notes that educational implementation studies sometimes underestimate the role of the district or a central office in the enactment of complex organizational processes. This study appears to support this claim. In this case, instructional technology policies generated by central office personnel laid the groundwork for learning management system adoption. These policies aligned with state educational technology policies, and provided district personnel with a roadmap for future instructional technology decisions.

Additionally, the organizational structure of Oak Trail's central office facilitated communication between instructional technology and technology personnel, which allowed for centralized coordination of organizational actions. Although a potential disconnect emerged in the implementation stage between instructional and instructional technology personnel, it is fair to say that the pre-existing organizational structure of the district's central office played a vital role to align organizational actions with district goals. These findings add detail to this literature on the importance of a district's context in data system adoption.

A three-stage process. The multivocal literature suggests that a district engages in a two-stage process to adopt and implement a data system. In this case, Oak Trail engaged in a three-stage process of adoption, planning, and implementation. Due to the use of rival lenses to view district actions, each of these stages had unique characteristics that currently are not well-represented in the multivocal literature.

During the adoption stage, Oak Trail focused on actions that met the district's rational goals. The district conducted an operational needs analysis and an instructional needs analysis, created a formal Request for Proposal, and formed a selection committee to decide on a vendor and product. These actions resulted in the selection of a learning management system that informants claimed aligned with the district's operational demands and met educators needs to deliver instruction. However, in pursuing learning management system adoption, Oak Trail administrators appeared to be sensitive to a wider trend in educational technology. The district realized that learning management system adoption helped to conform the district with other districts, as well as potentially legitimized the district with educators who had already endorsed learning management system use.

Once Oak Trail selected a learning management system, the district seemed to understand that learning management system implementation required planning. Oak Trail used this planning stage to develop an implementation plan and timetable, pilot and deploy the system, and train educators. The district developed district-specific professional development materials, wrote a blog for parents and educators, and created an infographic with the implementation timetable. Although these actions and materials conveyed a visible goal to prepare educators for learning management system use, they

also helped message the value and utility of the system to educator prior to system implementation.

In the implementation stage, as secondary schools implemented the system with one-on-one laptops for students and migrated content for educators, elementary educators prepared to use a system that looked like a "blank slate" without preloaded instructional content or curriculum. A system pilot aligned elementary educators with secondary educators around the shared meaning and value of the system, strengthened participant commitment in elementary schools, and supported the perception that the system would be ready to use for instruction upon deployment. These actions allowed Oak Trail to legitimize the new system with stakeholders, and perhaps guarantee the system's future survival. These findings suggest that a district may engage in a complex, three-stage process of adoption, planning, and implementation of a learning management system that may meet rational goals, as well as cultivate conformity, legitimacy, and system survival.

A key takeaway from this three-stage process is the existence of Oak Trail's planning stage. This stage represents a potential new addition to the data systems literature as a stage with actions that facilitate implementation of a data system and its use in schools. For example, once Oak Trail decided on a learning management system, the planning team created a plan and timeline that guided district implementation. This plan accommodated the district's need for operational scale-up of the learning management system, as well as theoretically built capacity for instruction.

An important detail from this stage is alignment with the claim in the multivocal literature that data system implementation takes a considerable amount of time. In accommodating a planning stage, Oak Trail took approximately two months put together

a planning team; create and advertise a timeline for system deployment; negotiate with the vendor to deploy the system gradually; receive professional development from the vendor; develop district-specific training materials for teachers; and prepare the system for the secondary pilot. These actions reportedly helped to prepare educators for system deployment, as well theoretically facilitated future data system use.

The specialized literature strand provides operational and technical details involved in the deployment and scale-up of a learning management system, which in this case fell in the planning stage. First, Oak Trail's technical personnel worked with the vendor to merge data between the student information system and the learning management system. Then, these personnel set up single sign-on and ensured that students and teachers could access third-party applications. Next, the district launched a system pilot that allowed teachers to test the system and provided feedback to the district on system use, which allowed technical personnel time to troubleshoot system problems prior to the scale-up of the system to 60,000 users in all schools.

Despite this systematic approach to scale-up, Oak Trail's plan revealed unforeseen barriers. For example, the Request for Proposal did not list parents as users of the learning management system, which would have put projected users over 60,000, and explains why parents as users may have been problematic for the district in the first year of implementation. Additionally, even though the district had a year and a half in the planning stage to provide one-on-one digital technology in elementary classrooms, it did not do so, which suggests that infrastructure costs may have been a barrier to elementary school scale up and implementation.

Another addition to the multivocal literature from Oak Trail's planning stage involves time to prepare educators to use the learning management system for instruction. Hatch (2013) suggests that in an educational reform, "it takes organizational capacity to build instructional capacity" (p. 36). In this case, the district not only focused on operational scale-up, but also aimed organizational actions at the future instructional use of the system through professional development and content migration.

Hatch's (2013) framework helps interpret Oak Trail's actions in this stage. This framework suggests that instructional capacity-building occurs at the classroom, school, and district level. At the classroom level, instructional capacity-building involves attention to improvement in practice. In Oak Trail, district handouts and videos on how to create media albums, use third-party applications, and other instructional resources theoretically prepared educators for practice. The district also migrated individually stored content for secondary teachers and, in some cases, connected state standards to district curriculum.

At the school and district level, Hatch (2013) suggests that instructional capacity-building involves a focus on student learning. In Oak Trail, informants noted that the district trained administrators to use the system and its data to supervise teacher progress toward student instructional goals. At the district level, central office personnel built instructional capacity through the development of online courses and digital citizenship curriculum. Although this study did not collect data on learning management system use, the district appeared to understand the need to invest in how educators and administrators might use the system and its data in the future. These findings suggest that a planning stage represents a potential addition to the data systems literature as a stage that allows a

district time for both operational scale-up and to build instructional capacity for learning management system use and future data use.

Alignment with the specialized literature. The specialized literature on learning management systems focuses on district actions in the adoption stage, many of which align with the evaluative and prescriptive literature. However, the specialized literature also suggests that once a district chooses a learning management system vendor, the district works with the vendor to develop the system.

For example, Oak Trail technicians reported that integration of the learning management system with the student information system was "a big job" because it required the two systems to share "lots of dynamic data elements" such as student data, teacher data, course data, and school data. In Oak Trail, glitches in this process occurred as part of rostering, which required data elements to "show up the right way" so that teachers could view the correct roster of students in their classes. A key technical person solved this problem with a script that allowed for one class or course at a time to be populated into the system. Additionally, technical staff configured the learning management system to accommodate the district's single sign-on solution. These findings suggest that Oak Trail's actions align with the specialized literature, and therefore may deserve support and consideration as valid claims in the wider body of literature on district data systems.

Privatization versus a private-public relationship with vendors. Burch (2010) notes that districts face "complex pressures" in the adoption of data system technology, which can shift the roles of the private sector in public education (p. 147). In keeping with this claim, Oak Trail informants described a multi-stage and multi-faceted

relationship with vendors in the adoption and planning stages. This relationship included a continuous cycle of contract negotiation with private providers for Internet access, laptops, iPads, applications, and single sign-on providers, as well as informal and formal contact with learning management system vendors.

This finding suggests a distinction in this study between privatization as a contextual force and the nature of a private-public relationship with vendors after system selection. Privatization in this study points to how, if at all, a district manages pressure from private vendors as part of learning management system adoption. As previously noted, over 200 vendors develop learning management systems, and many vendors offer a free product to educators and a paid, subscription-based product to school districts (McIntosh, 2016). In Oak Trail, classroom teachers reportedly circumvented the district's outdated course management system with downloads of free learning management system products, which the district reportedly did not prohibit even though it was concerned with data privacy and security. This action by classroom teachers suggests that privatization as contextual force played a role not only in the delivery and management of instruction, but also in the district's context for learning management system adoption.

As part of the adoption process, central office personnel noted that they engaged in a Request for Information to vendors. Although informants did not provide details of this process, they did indicate that they contacted vendors to get information on the operational and technical requirements of their products. This engagement by district personnel in a Request for Information suggests that privatization as a contextual force played a role in the adoption stage, as the district informally navigated learning management system vendors and products.

Privatization may have also played a role in Oak Trail's formal Request for Proposal. Although the selection committee's deliberations are not publically available, the Request for Proposal document suggests that the district expected multiple learning management system vendors to compete for a contract. Selection committee members supported this claim in their description of the multi-step, vendor selection process. Therefore, Oak Trail may have used the Request for Proposal document as the roadmap for formal navigation of privatization pressures on district adoption of a learning management system.

. After Oak Trail selected a learning management system, the district engaged in a private-public relationship with the vendor to pilot and deploy the system, migrate content, bring the system to scale, and train educators. Informants noted that the district had previous experience with this type of vendor relationship. Technical personnel reported that although the learning management system vendor's technicians were unable to write an appropriate script for the pilot, they did migrate content, assist with merging data between the student information system and the learning management system, and helped to bring the system to scale. This finding supports a claim in the multivocal literature, which suggests that due to the necessity of system deployment, an operational relationship with a certain degree of intensity may exist between a district's technical personnel and the vendor's personnel, particularly if system deployment is problematic (Wayman, Stringfield & Yakimowski, 2004).

On the other hand, central office personnel appeared to shy away from engagement with the vendor and its representatives related to professional development training and materials. Once central office staff received training from the vendor, Oak

Trail decided on a train-the-trainer model for professional development. Although it is possible that the district based this decision on cost, ITTs noted the inadequacy of the vendor's training and the subsequent creation of district-specific materials for this purpose. This finding suggests a potentially strained relationship between the district and the vendor related to professional development, and the possibility that the district did not trust the vendor to deliver this service.

Although this study did not thoroughly investigate the effect of privatization on learning management system adoption, or the details of Oak Trail's private-public relationship with the vendor, rival lenses helped clarify and distinguish these concepts. A rational lens uncovered a private-public relationship between Oak Trail and the learning management system vendor in the planning stage that contained operational and instructional components. An institutional lens pointed to privatization as a contextual force on technology adoption, and the possibility that a district may need both informal and formal processes in order to navigate these external pressures. These lenses also revealed variations in the intensity and complexity of these relationships from the classroom to the central office, which supports Burch's (2010) claim in regard to the importance of both privatization and public-private relationships in technology adoption.

Coupling of key personnel. In this study, tight-coupling between Oak Trail's technology and instructional technology personnel in the adoption and planning stages shaped district actions. This finding supports the claim in the evaluative literature that, as part of formalization, a district integrates technology and non-technology personnel and offices, and employs people as "boundary spanners" between departments to ensure

communication and alignment for data system use (Cho, 2011; Curtis, 2010; Honig, 2006).

In Oak Trail, tight-coupling occurred between technology and instructional technology personnel in the Operations Department. The district's organizational structure formalized and aligned central office personnel around learning management system adoption and planning. In the adoption stage, central office personnel conducted a needs analysis in which technical personnel used their expertise to collect information on technical needs, and instructional technology personnel used their expertise to collect information on instructional needs. Similarly, in the planning stage, personnel worked together on the implementation plan and timetable. Technology personnel formalized actions around system deployment, content migration, and a pilot, and instructional technology personnel spearheaded professional development activities.

The actions of Oak Trail's instructional technology teachers also support the claim in the evaluative literature on the importance of personnel as boundary spanners between schools and the central office in data system adoption and implementation. In the adoption stage, ITTs communicated problems with the outdated course management system to central office supervisors. In the planning stage, they designed professional development materials, trained personnel in schools, and provided feedback during the system pilot. These actions formalized district planning and implementation of the learning management system through alignment of district plans with intended outcomes.

Despite Oak Trail's tight-coupling of technology and instructional technology personnel in the adoption and planning stages, a rival lens trained on organizational processes revealed gaps in central office personnel formalized and aligned actions in the

implementation stage. For example, a system pilot and content migration formalized learning management system use for secondary educators, but not for elementary educators. Similarly, misalignment and fragmentation between the instructional and instructional technology personnel resulted in the "blank slate" appearance of the new system to many elementary educators. This finding reveals the complexity of learning management system planning and implementation, and how continued attention by the district to formalize people and resources across central office departments may have helped the district to operationalize goals for secondary instruction in the implementation stage.

The role of information control and messaging. The use of an institutional lens in this study revealed how Oak Trail controlled information and messaging around learning management system adoption and implementation. The multivocal literature does not contain this finding, perhaps due to the lack of a rival lens to explain district actions. In Oak Trail, these actions potentially shaped whether or not educators viewed the new system as legitimate.

In the adoption stage, the district controlled information through a stakeholder survey and a closed-door vendor selection process. Because informants clearly stated that educators knew the vendor selection process would not be made public, the survey effectively gave voice to key stakeholders in advance of the district's admittedly behind-the-scenes vendor selection process. This action theoretically resulted in legitimacy for the adoption process and the selected system with key stakeholders.

In the planning stage, the Oak Trail's planning team crafted a clear message about the learning management system for educators. After the planning team created the

implementation plan and timetable, Oak Trail's Communications Department "branded" this plan with an infographic. District informants noted that messaging the implementation plan avoided missteps from a previous implementation, as well as "protected the plate" of educators who may have been overwhelmed the district's implementation of a new learning management system. In this case, intentional messaging of the new system not only notified educators that the system was ready for use, but also controlled the district's message to educators about system deployment and implementation.

Oak Trail's approach to professional development also suggests attention to messaging. After ITTs received professional development from the vendor, they decided that the vendor's materials were not suitable. To remedy this problem, ITTs designed training materials tailored to district educators with information on system access, features, functions, and instructional uses. These actions theoretically focused attention away from the vendor and onto the district for information about the learning management system.

Oak Trail's control of information suggests that the district sought alignment and formalization of learning management system messaging to educators. Because the district's approach was intentional, it does not exactly align with the institutional perspective. However, these findings do suggest that the district sought to avoid fragmentation and misalignment of information around the new system, which potentially cultivated system legitimacy. Therefore, in this case the use of a rival lens uncovered how non-rational, district actions may create conditions that serve an institutional purpose (Burch, 2007).

A Broader Context: Data Systems, Reform and Policy Implementation

In addition to key findings from this study that deserve discussion, data system adoption and implementation can be interpreted in the broader contexts of education reform and policy implementation. In the education reform literature, data system technology is often cited as a part of a comprehensive strategy for federal, state, district, and school reform (Desimone, 2002; Goertz, Floden & O'Day, 1995**;** Odden, 2000; Hatch, 2012). For example, Goertz, Floden and O'Day (1995) cite technology as a key resource in systemic educational reform, not only to build instructional capacity, but also to build organizational capacity. Boser (2012) notes that Race to the Top's imperative for school districts to build data systems that "measure student success" operates as a systemic educational reform aimed at the closing achievement gaps (p. 12). This claim aligns with Halverson and Shapiro's (2012) assertion that the federal government views data systems as information technologies that fulfill a federal "accountability-driven reform agenda" for systemic reform aimed at standards-based curriculum and assessment (p. 6).

The role of technology in state education reform has resonance in this wider literature as well (Anagnostopoulous, Rutledge & Bali, 2013; Hamilton, 2002; Kerr et al., 2006; Massell, 1998). In addition to systemic reforms focused on accountability, standards, and assessment, Anagnostopoulous, Rutledge and Bali (2013) note that Race to the Top incentives for state longitudinal data systems contain requirements to link "individual student information with teacher information…to promote the use of teacher pay-for-performance policies" (Anagnostopoulous, Rutledge & Bali, 2013, p. 222; Piety, 2013). Hamilton (2002) visualizes state longitudinal data systems as key to educational

reforms aimed at the overall effectiveness of schools, such as educational programs, student mobility, and enrichment. More ominously, Kerr et al. (2006) warns that states seek longitudinal data systems not only for data analysis and reporting purposes, but as an "early warning system" to track district and school progress on state standards in real-time (p. 508).

The education reform literature suggests that data systems also have a greater purpose as part of district reform initiatives. Although outdated, Welhage, Smith, and Lipman (1992) note the theoretical power of information management systems to develop comprehensive, community-based strategies aimed at dropout prevention and "serving young people at risk for failure" (p. 55). Similarly, Johnson (2002) suggests that school districts may want to consider how data systems operate as a reform targeting challenges to school equity. More recently, data systems played a prominent role in pay-for-performance and teacher evaluation reforms to measure a teacher's contribution to student achievement, and to promote district efforts at "human capital management" with value-added algorithms (Milanowski, Heneman & Kimball, 2010, p. 3).

Data systems also play a role in school reform initiatives. For example, professional development reforms that utilize data systems may seek "lasting changes in practice" (Wayman, Jimerson & Cho, 2012, p. 165; Borko, Wolf, Simone & Uchiyama, 2003; Desimone, Porter, Garet, Yoon & Birman, 2002). These reforms may be operationalized by investment in data analysis skills in professional learning communities (PLC's) for educators, or improvements that target school leadership (Anderson, Mascall, Stiegelbauer & Park, 2012; Wayman et al., 2012a). In schools with data system technology, a principal may act as a "data cruncher" that operates the equivalent of a

"modern day corporation in its complex layered decision-making structure and highly regulated systems" related to data analysis, decision making, and enactment of school reform (Spillane, Diamond, Burch, Hallett, Jita & Zoltners, 2002, p. 742). If that statement is true, and school leaders understand the progression of data to knowledge, then data systems may play a key role in school reforms aimed at sustainable changes in instructional practice (Levinson & Boser, 2014; Mandinach et al., 2006; Wayman et al., 2012a).

However, the rational perspective may be overly optimistic in its promotion of the positive effects of data systems on educational reforms and their survival. For example, Fullan (1996) argues that non-linearity is part of systemic reform, and that organizational "overload and fragmentation" are to be expected in any educational reform process (p. 420). Cuban (1990) cautions that school systems sometimes pursue reforms "again, and again, and again," not to enact measureable change, but instead to seek legitimacy and credibility with the public (p. 3). Similarly, Odden (2002) notes that educational reform can be "difficult and complicated" due to problems with organizational change, sustainability, and implementation challenges (p. 433).

These comments point to the importance of understanding the connection between the multivocal literature on data systems and policy implementation. As Honig (2006) aptly notes, the recent wave of educational policy implementation in the United States reveals ongoing tension between policies that are "implementable" and "successful," and policies that work to improve school and student performance (p. 3). In this context, data systems may be considered as policy "tools" that educators use to inform and change practice (Honig, 2006, p. 12). This view of tools in policy implementation leans towards

the "technical-rational" perspective, which suggests that local variations in implementation fidelity represent dilemmas that may challenge organizational "command and control" (Datnow, 2006, p. 106). In contrast**,** Berman & McLaughlin's (1978) well-known alternative view of implementation as "adaptation" suggests a dynamic context for policy implementation takes into account schools as complex settings for reform (p. 34).

Interestingly, Berman and McLaughlin's (1978) report cites "federal education policy failure" as partially based on the "misconception that improving educational performance requires innovative technologies" (p. 5). This statement calls into question the more recent, rational view of data systems and data use as key to the continuous improvement of schools (Means, Padilla & Gallagher, 2010; Wayman, 2005). As noted in Chapter 4, informants in this study did not connect learning management systems to continuous improvement. This persistence in the idea of technology as a powerful tool in educational reform reinforces Honig's (2006) suggestion that policy implementation requires researchers and practitioners to confront the "complexities" of policy implementation alongside a call for reform (p. 9).

Some of the potential complexities in policy implementation related to data systems may be as follows. First, districts that adopt sophisticated data systems with powerful analytic tools may need to invest more heavily than expected in professional development for data system use and data use (Cho, 2011; Halverson & Shapiro, 2012; Means et al., 2011; Wayman & Cho, 2008; Wayman et al., 2010a). For example, according to Wayman et al. (2010a), an "exemplary" implementation of data system may require direct instruction, not a train-the-trainer model of professional development (p.

21). A district also may need to consider how data system policies shape organizational improvement, such as policies that guide data and data system access, "collegial relationships," and how a district may become a "stronger learning organization" (Wayman, Jimerson & Cho, 2012, p. 170).

A district may also need to consider the "recursive" nature of a reform and subsequent policy implementation (Fixsen & Blase, 2009, p. 2). As noted in this study, data system implementation takes time, and is not necessarily a linear process with benefits that can be easily measured (Bernhardt, 2004; Chen, Heritage & Lee, 2005; Cho, 2011; Mieles & Foley, 2005). No "simple recipe" exists for data system implementation, which means that a school district may need to consider a long-term policy strategy that takes into account both the impact of a specific technology, as well as local conditions (Means, Padilla & Gallagher, 2010, p. xi; Fixsen & Blase, 2009). In particular, sustainability of a data system implementation, particularly related to policies aimed at curriculum and instruction, may be difficult and need considerable attention (Wayman & Conoly, 2006).

These concerns suggest a connection between reform, policy, and practice that may need refinement in this literature. For example, as classroom tools, learning management systems target the technical core of schooling, namely teaching and learning (Meyer & Rowan, 1978; Rowan & Miskel, 1999). In this role, data systems focus on the "central goal of improved student learning," and theoretically provide an initial point of access for students to their potential academic success (Elmore, 1993, p. 97). Therefore, it may be important for educational policymakers to take into account the systemic nature of this type of reform, the need for policy coherence around a "common set of

objectives," and a view of implementation as practice that places learning management systems in a broader context as a reform strategy aimed at organizational learning, instructional improvement, and student success (Elmore, 1993, p. 97; Honig, 2006).

Study Limitations

This study had a number of limitations. First, data collection was limited to a single study site. Although this limitation is acceptable due to the exploratory nature of this topic and research questions, a single study site limits the generalizability of findings, even to sites that may be considered similar to the district under study.

A second limitation of this study is that informants worked primarily in or for Oak Trail's central office. Although the purpose of the study was to focus on central office actions, the position of informants limited their view of how the district adopted and implemented the learning management system in schools. This limitation was particularly noticeable in the data on secondary implementation provided by instructional technology teachers, which may have 'fogged' the limited findings in this study on school-level implementation. However, despite the secondhand nature of this information, these interviews with boundary-spanning personnel who worked both in schools and in the central office provided important information on the district's adoption and planning process at the school level. Additionally, this study was not a multi-level study, which is another limitation in the focus of this research on central office actions.

A third limitation of this study is that it relied on individual accounts from Oak Trail informants. Although district documents often supported statements made by study informants, this process is not fail safe. Therefore, it is possible that informant statements may contain rationalizations that masked the original intent of district actions, or are not

completely accurate, or both. This limitation in regard to individual accounts was potentially exacerbated by the timing of data collection. For example, central office personnel who worked with elementary educators could not provide detailed information about elementary implementation, and informant recollection of district actions prior to the adoption process was sometimes distant or non-existent. Additionally, some central office personnel involved at the start of the district's process had left their positions and were no longer available for interviews. Although it is not clear what, if any, information these key informants may have provided to this study, their absence should be noted as a limitation.

A final limitation of this study involves the utility of the institutional lens. As previously stated, the use of an institutional lens made sense for this investigation because it is often used as a rival lens to rational theory in education policy and reform studies. However, in this study, an institutional lens seemed to reveal non-rational, district actions as much as the institutional environment for district actions. This liability in the institutional lens may have evolved in this study for the following reasons. First, this study did not investigate multiple cases of district adoption and implementation of a learning management system. This limitation meant that evidence and support for concepts in the institutional perspective could not necessarily be seen from the theoretical view provided by a single case study. Second, all informants in this study worked for Oak Trail School District. Interviews with the vendor or vendor representatives, parents, or consultants may have provided a wider lens through which to analyze institutional forces. Third, the topic of this study is highly technical, and therefore leans heavily rational in its explanation of district actions, as does the multivocal literature on this topic.

These findings suggest that an institutional lens may have utility in later stages of data system implementation, such as data system use at the school or classroom level, or in a multi-level study. For example, informants noted that future data system use appeared to rely on a complex set of factors, such as administrator support, utility of the system by grade and subject area, and the availability of formative and summative data. This finding suggests that an institutional lens may have utility to examine internal, district actions on future data use in a more granular context, as well as the institutional environment for learning management system adoption on a state level.

Despite these limitations, this study delved into a topic that remains almost untouched by the data systems literature. The use of rival lenses, a taxonomy of the multivocal literature, an initial conceptual framework, and a study design that mitigated bias and error provided a solid foundation for data collection and analysis. Hopefully, these study strengths and the interpretation of findings through rival lenses overcome study limitations, and provide a worthwhile look into how rational theory and institutional theory can explain organizational processes and contextual forces in district adoption and implementation of a learning management system.

Directions for Future Research

This section adds to the previous section on key findings for this study, which by the nature of that discussion suggests directions and questions for researchers interested in this topic. In order not to repeat that discussion, this section touches on key points from the previous section, but also offers additional insights for future research.

First and foremost, this study revealed that learning management systems deserve future attention in the wider literature on district data systems. Although these

systems have many functions, this study revealed that the primary reason a school district adopts a learning management system is to deliver daily instruction to students. Theoretically, daily use of a learning management system by educators leads to collection of student work and grades, which generates formative data for data analysis to track student progress towards instructional goals. Because no other type of data system performs this function at the classroom and student level, data collected and analyzed in a learning management system may play unique role in connecting summative and formative data to chart daily student progress.

With this purpose for a learning management system in mind, future research may focus on how, if at all, educators analyze student data collected in a learning management system. Theoretically, if a district implements a learning management system with capability for formative student work, then an educator should be able to analyze those data. However, many factors appear to influence educator data system use and data use. These factors include the availability of meaningful, high quality, professional development on system use and data use; time for educators to learn how to use a learning management system; the availability, quality, and utility of student data in the system; and the variability of system use amongst educators in different subjects and grade levels. Future research into these areas would help connect data system use to data use that measures student academic progress and achievement.

A critical precursor to learning management system use is successful implementation. Unfortunately, this study only provided a glimpse into school and classroom level implementation of a learning management system. However, these findings did reveal that system implementation may involve building capacity for

instruction. Future studies in this area could investigate how, if at all, educators use a learning management system for grades, formative assessment, or to meet curricular requirements. Additionally, school-level analysis of learning management system implementation might reveal how, if at all, administrators or other personnel use a learning management system for data analysis, communication, collaboration, and professional development.

Another critical piece of learning management system implementation is digital access. In this study, secondary school students and teachers could access the system through individual laptops, but elementary students did not have one-on-one access to digital devices. Oak Trail parents also struggled with learning management system access. In this study, these issues involved access via the Internet; one-on-one devices; and mobile devices. Additionally, district and state documents revealed potential issues of digital access related to students with disabilities; student and parent access; and community challenges with adequate digital infrastructure and Internet access. These findings suggest that digital access is fruitful area of future research related to data system adoption and implementation.

One of the most interesting findings in this study was the long-term commitment of this state and Oak Trail to digital equity. Although this investment centered on access to digital devices and the Internet, the attention of the state and district to digital infrastructure created the digital equity needed by the district to consider learning management system adoption. This finding suggests that research into state and district resources for digital infrastructure may be important to understanding the context for digital equity in learning management system adoption.

This state's role in learning management system adoption also suggests that additional, state-focused research on data systems may be useful. As previously noted, with the exception of studies on state longitudinal data systems, many studies in the multivocal literature skip over the role of the state in district data system adoption. This gap in the literature means that investigation into the role of the state, and particularly policy levers aimed at educational technology and learning management, would have utility in future data systems research.

The prominence of state policy in this study contrasts with the prominence of federal policy in the multivocal literature. This finding suggests that future research on data systems might focus on how, if at all, federal policy shapes data system adoption. Potential investigations on this topic might include differences between Race to the Top participants and non-participants; the potential influences of federal policy on the adoption of different types of data systems; and whether or not a district considers data system adoption as key to the continuous improvement of schools. Future attention to the complexity of federal, state, and local policies as levers on district data system adoption would be particularly useful to reveal district perceptions in regard to the utility of different types of data systems for instruction and student achievement.

The use of institutional theory as a rival lens to explain district actions in learning management system adoption and implementation provided a readily accessible and arguably successful alternative to rational theory. Future use of this lens would be particularly useful in cross-case studies of learning management system adoption at the state and local level; investigation of private-public relationships between vendors and districts; alignment, if any, between state and local educational technology policies

across districts; and examination of how, if at all, districts view data system adoption and implementation in the broader landscape of educational reform.

Even more importantly, the use of rival lenses in this study reduced bias and error in the study design, as well as in data collection and analysis. In this study, an institutional lens not only offered insights into district actions aligned with institutional theory, but also provided insight into non-rational district actions. This finding suggests that future studies should consider use rival lenses for this area of research. Additionally, this finding also serves as a reminder to researchers in regard to the importance of multiple, competing theoretical perspectives on a research topic and questions.

Study Conclusion

This study investigated school district adoption and implementation of a learning management system. This study posed two, central questions: 1) how does a school district adopt and implement a learning management systems and 2) how, if at all, do rational theory and institutional theory explain contextual forces and organizational actions in this process? These questions were answered with a single, exploratory case study in Oak Trail School District (a pseudonym), which is a school district that recently adopted and implemented a learning management system.

A typical school district has many types of data systems, each with a different purpose and target audience (Bernhardt, 2005; Means, Padilla & Gallagher, 2010). Depending on a school district's investment in data system technology, it may have a student information system that organizes individual student data in real-time for educators and administrators (Thorn, 2002); a summative or formative assessment system that delivers student tests and collects assessment data for educators (Burch, 2010); a

course management system that manages and facilitates student instruction in a classroom (Simonson, 2007); and a data warehouse that stores and processes student data for analysis by administrators and school districts (Curtis, 2010).

Within this constellation of data systems, learning management systems are a new type of data system that integrates the functions of a student information system, a course management system, and a formative assessment system into a single, unified platform for educator and student use (Berking & Gallagher, 2014; Cho, 2011; Halverson & Smith, 2009). Software vendors originally developed learning management systems for universities to deliver online courses and to "support faculty and student workflow" (Molinar, 2014, p. S12). In the past five years, learning management systems slowly replaced course management systems, and school districts acquired these systems in order to facilitate instruction, assessment, and data analysis at the classroom level (Berking & Gallagher, 2014; Ferriman, 2015; Foreman, 2013b).

The literature review for this study revealed that it is both rational and multivocal (Ogawa & Malen, 1991). The foundation of this literature focuses on four types of data systems: student information systems, assessment systems, course management systems, and data warehouses. This literature views data system adoption and implementation primarily through a rational lens. A comprehensive review of literature that includes learning management systems indicates that it is "multivocal," which means "comprised of all accessible writings on a common, often contemporary topic" (Ogawa & Malen, 1991, p. 265). For this study on learning management systems, I separated the wider, multivocal literature into four strands, which for the purpose of this research I labeled evaluative, status report, prescriptive, and specialized.

Academic researchers author the evaluative literature strand, which contains empirical literature on data systems used in public school settings. Government agencies or education researchers author the status report literature strand, which contains reports and surveys that chart the conditions and the context of data systems. Education researchers, or writers interested in education issues, author the prescriptive literature strand, which provides suggestions for school districts on the adoption and implementation of educational data systems. Data system vendors or consultants author the specialized literature strand, which provides operational and technical details on learning management systems.

Forty years of federal laws, policies, and incentives encouraged school districts to adopt and implement data systems. In 1960s, 1970s, and 1980s, federal policies promoted the collection of standardized assessment data to improve educational equity. In 1980s and 1990s, federal policies promoted school district adoption of student information systems to organize student data, and course management systems to deliver instruction. In the 2000s, policies mandated that school districts deliver standardized tests, and in response, districts implemented assessment systems and data warehouses. In the past decade, Race to the Top (2009) and ESSA (2015) pushed school districts to adopt data systems that improved teaching and learning, such as learning management systems. Additionally, federal law mandates that school district data systems comply with data privacy, security, and access laws.

The multivocal literature suggests that a school district engages in a two-stage process to adopt and implement a data system. In the adoption stage, a school district forms a selection committee; conducts a needs analysis; evaluates cost; selects a vendor

and product; considers future data use; and develops the system. In the implementation stage, system deployment, personnel, data quality, vendor relations, training, policies, and time are factors in a district's process. Additionally, the evaluative literature offers insight into organizational processes and contextual forces that influence district adoption and implementation of a data system. In this literature, internal, organizational processes include formalization, coupling, alignment, adaptation, and accountability, and external, contextual forces include accountability, privatization, and diffusion of innovation.

Strengths in this literature include identifiable contextual forces and organizational processes in data system adoption and steps in a district's adoption process. Weaknesses include outdated sources, ambiguous terminology, lack of rival theoretical lenses, and scant evaluative literature on learning management systems. Despite these concerns, this multivocal literature created an appropriate starting point for an investigation of district adoption and implementation of a learning management system.

This study analyzed findings through competing perspectives within organizational theory known as the "rational" perspective and the "institutional" perspective (Ogawa et al., 2003). In the theoretical literature on organizations, the rational perspective presumes that an organization exists to attain specific goals, and that bureaucratic actors seek efficiency and technical certainty for measurable outcomes (DiMaggio & Powell, 1983; Senge, 2006). Through this lens, rationality is the "construction of alternative means that are considered appropriate for reaching desired ends" (Simon, 1997, p. 73), and rational decision making maximizes efficiency or "the attainment of maximum values with limited means" (Simon, 1997, p. 75). Institutional

theory suggests that an organization enacts change without concern for organizational effectiveness or efficiency (DiMaggio & Powell, 1983; Meyer & Rowan, 1977). In this perspective, an organization adopts an innovation to enhance legitimacy and conformity (Meyer & Rowan, 1977). Organizational actors do not work towards measurable outcomes, but instead align with society's perceived norms and values "despite the immediate efficacy of the acquired practices and procedures" (Rowan & Miskel, 1999, p. 363).

In the context of schools as organizations, rational theory suggests that when a school district adopts an educational technology, it engages in a shared organizational vision for change, and chooses goals purposefully designed to "contribut[e] to organizational improvement" (Wayman, Jimerson & Cho, 2012, p. 170). Through this lens, district adoption and implementation of a learning management system represents rational goal attainment focused on improvements in teaching and learning (Wayman, Jimerson & Cho, 2012; Wayman, Johnston & Cho, 2007). Institutional theory offers the possibility that a school district may adopt an educational technology that is poorly understood, or has "abstract goals" that are misaligned with teaching and learning (Bamburger, 1995, p. 189; DiMaggio & Powell, 1983). Through this lens, district adoption and implementation of a learning management system may not serve a rational purpose, but instead promotes institutional legitimacy, conformity, and long-term survival (DiMaggio & Powell, 1983; Selznick, 1957).

An initial conceptual framework derived from the multivocal literature offered a roadmap to answer study questions. In this framework, learning management systems are part of the larger constellation of data systems currently in use by school districts. Federal

laws, policies, and incentives, as well as privatization, accountability, and diffusion of innovation as contextual forces, pressure a district to adopt a data system. If a district decides to adopt a data system, then it engages in a two-stage process. Organizational actions in this process may include accountability, coupling, alignment, adaptiveness and formalization. Two rival perspectives from organizational theory, rational theory and institutional theory, operate as theoretical lenses that help to explain district actions. In theory, district implementation of a data system leads to educator data use to improve instruction.

This study used case study method. Yin (2003) suggests that case study method is valuable when research questions 1) use theory to focus on events that defy behavioral or experimental controls and 2) investigate a contemporary phenomenon in its "real-life context" (Yin, 2003, p. 13). Because this study met these criteria, a single, exploratory case study methodology was appropriate. The case study site, Oak Trail School District, was selected with criteria developed for these research questions. Site selection occurred through careful examination of over 40 school districts with a learning management system. Oak Trail was selected because the district was willing to share district documents, and had central office personnel who were knowledgeable about the district's adoption and implementation process.

State and district documents collected and examined for this study included reports, strategic plans, transcripts of school board meetings, district handouts, and curriculum standards. Fifteen formal interviews were conducted with central office personnel in a two-week period in October 2017. Interviews used formal protocols, anonymous coding, and procedures to reduce bias and error (Merriam, 1999; Patton,

2003). Triangulation of sources and three rounds of coding in data analysis provided specific themes and cogent findings that answered study questions (Saldana, 2009).

Study findings are as follows. Federal and state laws, state policies and incentives, and district policies provided the policy context for this case study. District policies aligned with state policies encouraged Oak Trail to adopt and implement a learning management system. In the past 20 years, Oak Trail invested in its digital infrastructure and data systems, which included high-speed Internet access, a student information system, a formative assessment system, and a course management system.

A rational lens explained Oak Trail's process to adopt a learning management system. Tightly-coupled personnel from the Instructional Technology Department spearheaded the district's adoption process, which included a need analysis, a Request for Proposal, appointment of a selection committee, and the selection of Oak Trail's new learning management system. An institutional lens provided additional insight in this stage. The district rationalized its need for a new system based on instructional fragmentation. Instructional technology personnel engaged with other districts, which suggested attention to the norms and values involved in data system adoption. These actions theoretically increased the new system's survival with stakeholders, and signaled Oak Trail's focus on technological improvement to other districts. These findings also revealed that organizational processes in formalization and coupling, and contextual forces in privatization and diffusion of innovation, were salient concepts in the adoption stage.

A rational lens also explained Oak Trail's actions in the planning stage. Tightly-coupled personnel on the planning team crafted the district's implementation plan, which

included system deployment, professional development, content migration, and a pilot. The planning team formalized organizational processes with boundary-spanning instructional technology teachers who supervised organizational actions at the school level. In particular, the system pilot appeared to be an approach that accommodated the district's goal to deploy the system and bring it to scale on time. The district aligned these actions with actions aimed at building capacity for secondary data system use and instruction upon full implementation.

An institutional lens provided further insight into organizational actions in the planning stage that did not align with the rational perspective. Loose-coupling between Oak Trail's planning team and other central office departments caused a disconnect in the instructional readiness of the learning management system in elementary schools. The planning team headed off potential criticism of the system with a graduated implementation plan, messaging, and single sign-on. These actions legitimized the district's plan and system in the eyes of future users, as well as cultivated system survival. Rival lenses also suggested that organizational processes in formalization, coupling, alignment, and accountability, and contextual forces in accountability and privatization, shaped district actions.

In the implementation stage, a rational lens suggested that Oak Trail attended to the operational needs of the learning management system. The district distributed information to educators and parents on how to use the system through handouts and a website, and ITTs coached educators in secondary and elementary schools on how to use the new system for instruction. These actions suggest that, particularly in secondary schools, Oak Trail pursued organizational goals in this stage.

The institutional perspective provided additional insight in the implementation stage, particularly in relation to elementary implementation. Through this lens, Oak Trail's actions suggested that the district may have favored norms and legitimacy over substantive data system use. For example, even though the district knew that elementary educators did not have access to the previous learning management system, the district neglected to hold central office staff accountable for elementary curriculum tied to state standards. This oversight meant that the system appeared as a "blank slate" to some elementary teachers who had never used a district learning management system. These challenges meant that despite adoption and planning stages that aligned with organizational goals, in the implementation stage the district faced issues that threatened educator system use, which may constitute a clear threat to the long-term survival of the system.

A revised conceptual framework based on study findings suggested that a variety of forces shaped Oak Trail's learning management system adoption and implementation process. First, district may have multiple data systems in play prior to learning management system adoption. Federal laws, policies, and incentives, as well as state laws, policies, and incentives, operate as demands prior to a district's consideration of a learning management system. Contextual forces in privatization, diffusion of innovation, and accountability, as well as a district context, influenced Oak Trail's decision to adopt a learning management system.

Once Oak Trail decided to adopt a learning management system, the district engaged in three-stage process to adopt, plan, and implement a learning management system. Rational perspective and institutional perspective had utility to examine district

actions in these stages. The rational perspective confirmed organizational processes in accountability, formalization, coupling, alignment, and adaptiveness; the institutional perspective suggested that loose-coupling also may be a salient concept. Learning management implementation theoretically led to learning management system use and educator system use for instruction.

This study revealed the utility of both the rational perspective and the institutional perspective for this topic and questions. A rational lens had the following benefits. First, a rational lens provided the context for the first study question on how a district adopts and implements a learning management system. Second, use of a rational lens supported claims in the evaluative literature that certain organizational processes shape district data system adoption and implementation. Third, use of a rational lens supported claims in the theoretical literature that a school district as an organization is a "rational environment" for technology adoption (Huber, 1981, p. 3).

The use of an institutional lens also proved critical to this study. Although not as prevalent as findings explained by the rational perspective, this lens revealed that Oak Trail occasionally engaged in actions that might be considered institutional in nature. For example, the institutional perspective uncovered how "actors develop shared meanings and values" around organizational goals that can strengthen a "participant's commitment to support the structural façade…" (Ogawa et al., 2003, p. 161). An institutional perspective also supported the claim in the theoretical literature that even if an innovation is more organizational than substantive, actions associated with data system adoption and implementation may legitimize schools in the wider education environment (Cibulka,

1995; DiMaggio & Powell, 1983). Rival theoretical lenses also served a critical purpose in analysis of study data.

This study revealed key alignments and misalignments between study findings and the multivocal literature, which included the policy and district context; a three-stage process and the importance of the planning stage; and findings on how, if at all, contextual forces and organizational processes shape district actions. In addition to key findings from this study that deserved discussion, data system adoption and implementation can be interpreted in the broader contexts of education reform and policy implementation.

This study had a number of limitations. Data collection took place in a single study site, which limited the generalizability of findings. Individual accounts of Oak Trail's adoption and implementation process may have contained rationalizations that mask the original intent of district actions, or are not completely accurate, or both. This limitation is potentially exacerbated by the timing of data collection in year three of Oak Trail's five-year process. Additionally, these findings suggested that an institutional lens may have utility in later stages of data system implementation, or in a multi-level study.

Despite these limitations, this study revealed that learning management systems deserve future attention in the wider literature on district data systems. Future studies could more closely examine operational scale-up of learning management systems, or how a district builds capacity for instruction with this type of data system. Researchers could investigate the claim made by Oak Trail informants that a learning management system has particular utility as a "one-stop shop" for instruction, or how educators may use a learning management system for formative assessment and data analysis.

Operationally, future studies might focus on digital equity and access, or relationships between district digital infrastructure and data systems. Additionally, state-focused research on data systems, as well as research that establishes firmer connections between federal policies, incentives, and learning management system adoption, would be fruitful.

The use of institutional theory as a rival lens to explain district actions in learning management system adoption and implementation provided a readily accessible and arguably successful alternative to rational theory. Future use of this lens would be particularly useful in cross-case studies of learning management systems; investigation of private-public relationships between vendors and districts; alignment, if any, between state and local educational technology policies across districts; and examination of the how, if at all, districts view data system adoption and implementation in the broader landscape of educational reform. These findings also serve as a reminder to researchers in regard to the importance of multiple, competing theoretical perspectives to investigate a research topic and questions.

Appendix A: Evaluative Literature Strand

Authors	Year	System or focus	Source type
Anagnostopoulos, Rutledge & Bali	2013	State longitudinal data	Article
Aslan, Huh, Lee & Reigeluth	2011	Personalized integrated educational	Article
Beams	2017	Learning management	Dissertation
Breiter & Light	2006	Management information	Article
Brooks	2011	State longitudinal data	Article
Brunner, Fasca, Heinze, Honey, Light, Mandinach & Wexler	2005	Data use	Article
Brush, Armstrong, Barbrow & Ulintz	1999	Course management	Article
Burch	2010	Assessment	Article
Burch & Hayes	2009	Data use	Book chapter
Bush & Mott	2009	Educational technology	Article
Chen, Heritage & Lee	2005	District data	Article
Cho	2011	District data	Dissertation
Cho, Jimerson & Wayman	2015	District data	Article
Cho & Wayman	2012	District data	Conference paper
Cho & Wayman	2014	District data	Article
Cho & Wayman	2015	District data	Article
Choppin	2002	Data use	Conference paper
Cooley & Glaser	1967	District data	Article
Cuban	1986	Educational technology	Book
Cuban	2001	Educational technology	Book
Curtis	2010	Data warehouse	Dissertation
Gutiérrez-Carreón, Daradoumis & Jorba	2015	District data	Article
Halverson, Grigg, Pritchett & Thomas	2006	Student information, data warehouse, assessment	Article
Halverson & Smith	2009	Educational technology	Article
Hwang & Xu	2008	Data warehouse	Article
Keleher	2007	Student information, data warehouse, assessment	Dissertation
Kerr, Marsh, Ikemoto, Darilek, & Barney	2006	District data	Article
Lachat & Smith	2005	Data use	Article
Lochner, Conrad & Graham	2015	Learning management	Article
Long, Rivas, Light & Mandinach	2008	Data warehouse	Book chapter

Mandinach, Honey, Light & Brunner	2008	Data use	Book chapter
Marsh	2012	Data use	Article
Mason	2002	Data use	Project evaluation
Parcell	2017	Learning management	Dissertation
Piccano	2009	District data	Book chapter
Streifer & Schumann	2005	Data use	Article
Szabo	2002	Learning management	Conference paper
Thorn	2001	District data	Article
Turner & Coburn	2012	Data use	Article
Wayman	2005	Data warehouse	Article
Wayman, Brewer & Stringfield	2009	Data use	Conference paper
Wayman & Cho	2008	District data	Book chapter
Wayman & Cho	2014	District data	Conference paper
Wayman, Cho, Jimerson & Snodgrass-Rangel	2010a	Data use	Conference paper
Wayman, Cho, Jimerson & Spikes	2012a	Data use	Article
Wayman, Cho & Johnston	2007	Data use	Project evaluation
Wayman, Cho & Shaw	2009	Assessment	Project evaluation
Wayman & Conoly	2006	Course management; data warehouse	Article
Wayman, Conoly, Gasko & Stringfield	2008	Course management; data warehouse	Book chapter
Wayman, Jimerson & Cho	2012	Data use	Article
Wayman, Snodgrass-Rangel, Jimerson & Cho	2010b	Data use	Project evaluation
Wayman, Spring, Lemke & Lehr	2012b	Data use	Conference paper
Wayman & Stringfield	2006	Data warehouse	Article
Wayman & Stringfield	2003	Data use	Conference paper
Wohlstetter, Datnow & Park	2008	Data use	Article
Young	2006	Data use	Article
Yildrim, Reigeluth, Kwon, Kageto & Shao	2014	Personalized integrated educational	Article
Zavadsky	2009	Assessment; data warehouse; student information	Book chapter

Appendix B: Status Report Literature Strand

Author(s)	Year	System or focus	Source type
Boser	2012	State longitudinal data	Report
Halverson & Shapiro	2012	District data	Policy brief
Hamilton	2002	State longitudinal data	Policy brief
Lang & Pirani	2014	Learning management systems	Report
Means, Chen, DeBarger & Padilla	2011	Data use	Report
Means, Gallagher & Padilla	2007	Student information	Report
Means, Padilla, DeBarger & Bakia	2009	Data use	Report
Means, Padilla & Gallagher	2010	Student information, data warehouse, assessment, course management	Report
Mieles & Foley	2005	Data warehouse	Report
National Commission of Equity and Excellence in Education	1983	Educational technology	Report
Wayman	2007	District data	Conference paper
Wayman, Stringfield & Yakimowski	2004	District data systems	Report

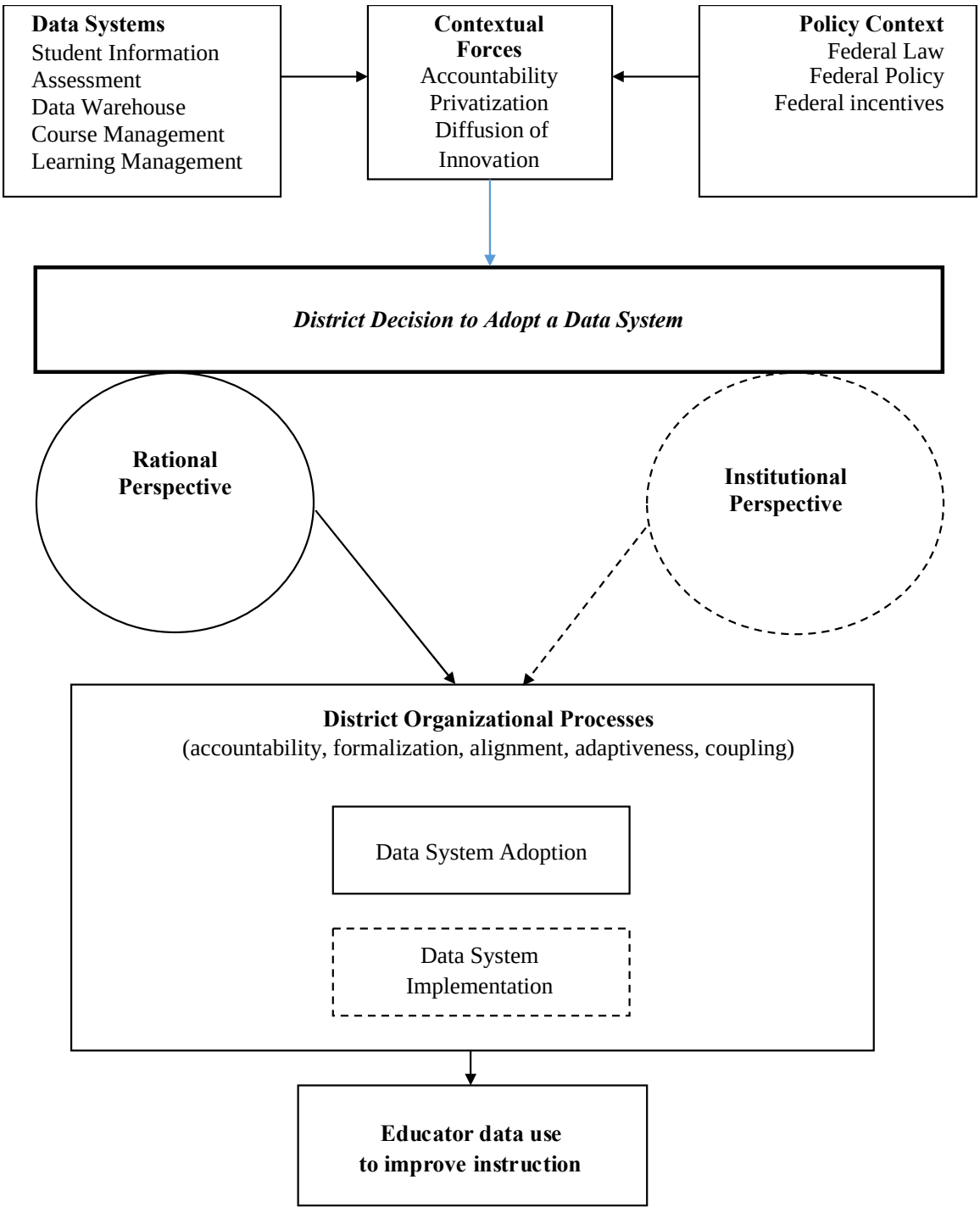
Appendix C: Prescriptive Literature Strand

Author(s)	Year	System or Focus	Source Type
Bernhardt	2004	Data use	Book
Bernhardt	2005	Data use	Article
Clements	2000	Student information	Technical brief
Condelli, Shaewitz, Hollender, Movit, Yin, Cronen & Garrity	2012	State longitudinal data	Technical brief
Fox, Waters, Fletcher & Levin	2012	District data	Report
Hamilton, Halverson, Jackson, Mandinach, Supovitz, & Wayman	2009	Data use	Policy brief
Johnson	2002	Data use	Book
Knapp, Swinnerton, Copland & Monpas-Huber	2006	Data use	Report
Learning Point Associates	2006	District data	Report
Levinson & Boser	2014	District data	Report
National Forum on Education Statistics	1997	District data	Report
National Governors Association	1986	Educational technology	Report
Rudner & Boston	2003	Data warehouse	Article
Simonson	2007	Course management	Article
U.S. Congress, Office of Technology Assessment	1988	Educational technology	Report

Appendix D: Specialized Literature Strand

Author(s)	Year	System Focus	Source Type
Ash	2013	Learning management	Article
Berking & Gallagher	2014	Learning management	Technical brief
Blackboard	2018	Learning management	Web page
Davis	2014	Learning management	Article
Fenton	2018	Learning management	Article
Ferriman	2012	Learning management	Blog
Foreman	2013a	Learning management	Article
Foreman	2013b	Learning management	Article
Fisher & Frey	2015	Learning management	Article
Herold	2014	Learning management	Article
Hill	2018	Learning management	Article
Instructure by Canvas	2018	Learning management	Web page
McIntosh	2016	Learning management	Report
McMurray	2017	Learning management	Article
Molinar	2014a	Learning management	Article
Molinar	2014b	Learning management	Article
Moodle, Inc.	2018	Learning management	Web page
Remis	2015	Learning management	Article
Schaffhauser	2016	Learning management	Article
Schoology, Inc.	2018	Learning management	Web page
Stephens	2016	Learning management	Article
Systems Interoperability Framework Association	2015	Learning management	Web page
Watson & Watson	2007	Learning management	Article

Appendix E: Initial Conceptual Framework



Appendix F: Public Records

Oak Trail School District Public Records

Accessed from Oak Trail School District Website, 2017

1. OTSD Assessment Tests, 2016
2. OTSD Audio Update 1, 2015
3. OTSD Audio Update 2, 2016)
4. OTSD Financial Plan 2015, 2016, 2017, 2018
5. OTSD Instructional Technology Plan, 2015-2018
6. OTSD Instructional Technology Alignment Plan, 2016-2018
7. OTSD Pacing Guide, 2017
8. OTSD Stakeholder Survey, 2016
9. OTSD Strategic Plan, 2015-2018
10. OTSD Student Guide, 2017-2018
11. OTSD Superintendent's Budget, 2013-2014
12. OTSD Virtual Physical Education Course (2017)

Accessed with Google Search, 2017

13. Oak Trail School District, Request for Proposal, 2015

<u>State Public Records</u>

Accessed from State Government Website, 2017

14. State Administrative Codes, School Accreditation (2017)
15. State Administrative Codes, Student Achievement Expectations (2017)
16. Information Technology Accessibility Act (1999)

Accessed from State Department of Education Website, 2017

17. Online Assessment (2017)
18. Philosophy, Goals and Objectives (2017)
19. State Educational Technology Plan (2015-2018)
20. State Longitudinal Data System (2017)
21. State Online Providers, Frequently Asked Questions (2016)
22. State Standards and Curriculum (2017)
23. State Strategic Plan (2016-2018)
24. Test Score Reports (2017)
25. Virtual School Programs (2017-2018)

Appendix G: District Documents

Documents provided by Oak Trail in October, 2017

1. LMS LTI Integration Guide, 2016
2. OTSD LMS Content Migration Flyer, 2016
3. OTSD LMS Flyer, 2015
4. OTSD LMS Implementation Plan, 2015
5. OTSD LMS Implementation Plan 2016-2017
6. OTSD LMS Implementation Q & A, 2016
7. OTSD Learning Model, 2017
8. OTSD LMS Media Album Directions, 2016
9. OTSD LMS Parent Access Letter, 2016
10. OTSD LMS Parent Access Flyer, 2016
11. OTSD LMS Remote Login Handout, 2016
12. OTSD LMS Summer PD Opportunities, 2016
13. OTSD LMS Summer Quick Facts, 2016
14. OTSD Testing Calendar, 2016-2017
15. OTSD Testing Guide, 2015-2016
16. OTSD LMS Timeline, 2015-2017

Appendix H: Online Sources

Accessed in 2017 unless otherwise noted

1. Oak Trail Instruction Department
2. Oak Trail Instructional Technology Department
3. Oak Trail Instructional Technology Department [Blog]
4. Oak Trail School Board
5. Oak Trail School District
6. Official State Government
7. State Department of Education
8. State Electronic Media

Appendix I: Email Script for Interview Recruitment

Dear [*insert specific name of subject*],

My name is Laura Hyde and I am a doctoral candidate at the University of Maryland, College Park. I am conducting research on learning management systems in Oak Trail School District as part of my dissertation. Specifically, I am hoping to learn more about how districts adopt and implement learning management systems.

As part of my research, I hope to interview individuals who have been involved adopting and implementing the current learning management system used in your school district. Based on your role as [*insert specific stakeholder role*], I hope that you might be willing to speak with me about your experience with this process.

If you agree to participate in an interview, I will conduct the interview at your school, office, or other location convenient for you. The interview will take between 60-90 minutes of your time. You will be asked questions about your personal experience with learning management system adoption and implementation. Interviews and focus groups will be conducted in a private area, away from where others can hear. Your name will be kept confidential, and you will be assigned a code in all research notes to protect your identity. If you are a public official, it may not be possible to fully protect your identity, but I will make every effort to do so.

If you are interested in participating in an interview for this research, please let me know times that might be convenient for you in the next two weeks.

I look forward to hearing from you soon.

Sincerely,
Laura Hyde
Doctoral Candidate
University of Maryland, College Park

Appendix J: IRB Consent Form

University of Maryland College Park

Initials _____ Date _____

Project Title	**Exploring New District Data System Technology: An Examination of Contextual Forces and Organizational Processes in a District Adopting and Implementing a Learning Management System**
Purpose of the Study	This research is being conducted by **[Laura Hyde]** a graduate student under the supervision of Dr. Robert Croninger at the University of Maryland, College Park. The purpose of this research project is to provide qualitative data for a case study on district learning management systems. The research will involve interviews with district officials and other persons involved in this process, and a review of relevant public documents. We are inviting you to participate in this research project because you are knowledgeable about [school district's] process of adopting and implementing a learning management system.
Procedures	You will be asked to participate in a one-on-one interview or focus group with the principal investigator. During the interview, you will be asked to respond to questions about the adoption and implementation of [school district's] learning management system. Potential interview questions may include Why did [school district] begin the process of adopting and implementing a learning management system? What successes and challenges have occurred as part of the adoption and implementation process? Interviews will last approximately 60-90 minutes and will be conducted in a private area, convenient for you, and away from where others can hear. Your name will be kept confidential, and you will be assigned a code in all research notes to protect your identity. If you are a public official, it may not be possible to fully protect your identity, but every effort will be made to do so. You will be asked for permission to audio record the interview. You may decline to give permission. If you decline to have the interview recorded, notes from your interview will be taken with a laptop computer. You may also be asked to participate in an informal, follow-up conversation to clarify information provided in the initial interview.
Potential Risks and Discomforts	You may skip any questions you do not feel comfortable answering. There are no known risks to this study.
Potential Benefits	There are no direct benefits to you as an individual from participating in this research. We hope that, in the future, other people might benefit from this study through improved understanding of the processes involved in adopting and implementation of district learning management systems.
Confidentiality	Any potential loss of confidentiality will be minimized by storing information in password-protected, electronic form; coding data so that no participant can be individually identified; limiting data access to myself or dissertation supervisors; and shredding or erasing upon study completion. If [I] write a report or article about this research project, your identity will be protected to the maximum extent possible. Your information may be shared with representatives of the University of Maryland, College Park or governmental authorities if you or someone else is in danger or if we are required to do so by law.
Right to Withdraw and Questions	Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you

University of Maryland College Park

Initials _____ Date _____

	stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify. If you decide to stop taking part in the study, if you have questions, concerns, or complaints, or if you need to report an injury related to the research, please contact the investigator or faculty supervisor: **Laura Hyde. Principal Investigator** **University of Maryland College Park, 2311 Benjamin Building, College Park, MD 20742; 301-405-3324; lhyde@terpmail.umd.edu** **or** **Dr. Robert Croninger, Faculty Supervisor** **University of Maryland College Park, 2215 Benjamin Building, College Park, MD 20742; 301-405-2927; croninge@umd.edu**	
Participant Rights	If you have questions about your rights as a research participant or wish to report a research-related injury, please contact: **University of Maryland College Park** **Institutional Review Board Office** **1204 Marie Mount Hall** **College Park, Maryland, 20742** **E-mail: irb@umd.edu** **Telephone: 301-405-0678** This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.	
Statement of Consent	Your signature indicates that you are at least 18 years of age; you have read this consent form or have had it read to you; your questions have been answered to your satisfaction and you voluntarily agree to participate in this research study. You will receive a copy of this signed consent form. If you agree to participate, please sign your name below.	
Signature and Date	**NAME OF PARTICIPANT [Please Print]**	
	SIGNATURE OF PARTICIPANT	
	DATE	
	If you agree to an audio recording of this interview, please initial in this box:	

Appendix K: Interview Protocol

The purpose of this study is to explore district-level processes involved in adopting and implementing a learning management system. I selected Oak Trail School District for this study because it has recently adopted and implemented a learning management system. You have been identified by your school district or colleagues as a person who was involved in these processes, and may have information that is valuable to this study. I appreciate your participation and willingness to be interviewed today.

Professional Background

1. Can you briefly tell me about your career and how you came to your current position?
2. What is your role in this position? Responsibilities?
3. Can you give me a brief overview of your involvement with adoption and/or implementation of Oak Trail School District's learning management system?

Data Systems Background

I would like to understand the history of Oak Trail's acquisition and use of data systems prior to your adoption and implementation of a learning management system.

1. What data systems has your district used in the past?
2. What was the purpose of these data systems at the time they were adopted and implemented?
3. Are any of these data systems currently in use?
    a) If so, what are they?
    b) Why are they still in use?

Adoption

I would like to understand how Oak Trail School District decided to adopt a learning management system.

1. Why did Oak Trail begin the process of adopting a learning management system?
2. When did the adoption process start?
3. Who was involved in the adoption process? Why were they involved?
4. What goals did Oak Trail have in adopting a learning management system?
5. What, if any, timeline or steps did the school district identify in the adoption process?
    a) What were these steps?
    b) Were there deadlines?
    c) Were deadlines and steps met? Why or why not?
6. What, if any, successes or challenges emerged as part of the adoption process?
    a) If successes, what where they? Why do you think they were successes?
    b) If challenges, what were they? Why do you think they were challenges?
7. What learning management system did Oak Trail select and why?

Implementation

I would like to understand actions of central office administrators, not necessarily school administrators or teachers, in implementing a learning management system.

1. Who in the central office was involved in implementing the learning management system?
    a) Why were they involved?
    b) Were any external or additional personnel involved? If yes, what were their roles in implementation?
2. What, if any, steps did central office administrators or staff identify for implementation of the learning management system?
    a) What were these steps?
    b) Were there deadlines or a timeline?
    c) Were deadlines or steps met? Why or why not?
3. What, if any, steps did additional or external personnel identify for implementation? Were these suggestions followed? Why or why not?
4. What, if any, successes or challenges emerged as part of the implementation process?
    a) If successes, what where they? Why do you think they were successes?
    b) If challenges, what were they? Why do you think they were challenges?
5. Do you remain involved in implementation of the learning management system? Why or why not?
6. Is district implementation ongoing? Explain.

Overall appraisal

1. Keeping in mind that this study focuses on *district-level* actions associated with adopting and implementing of a learning management system, what is your overall appraisal of this process to date? Was it successful? Unsuccessful? Explain.

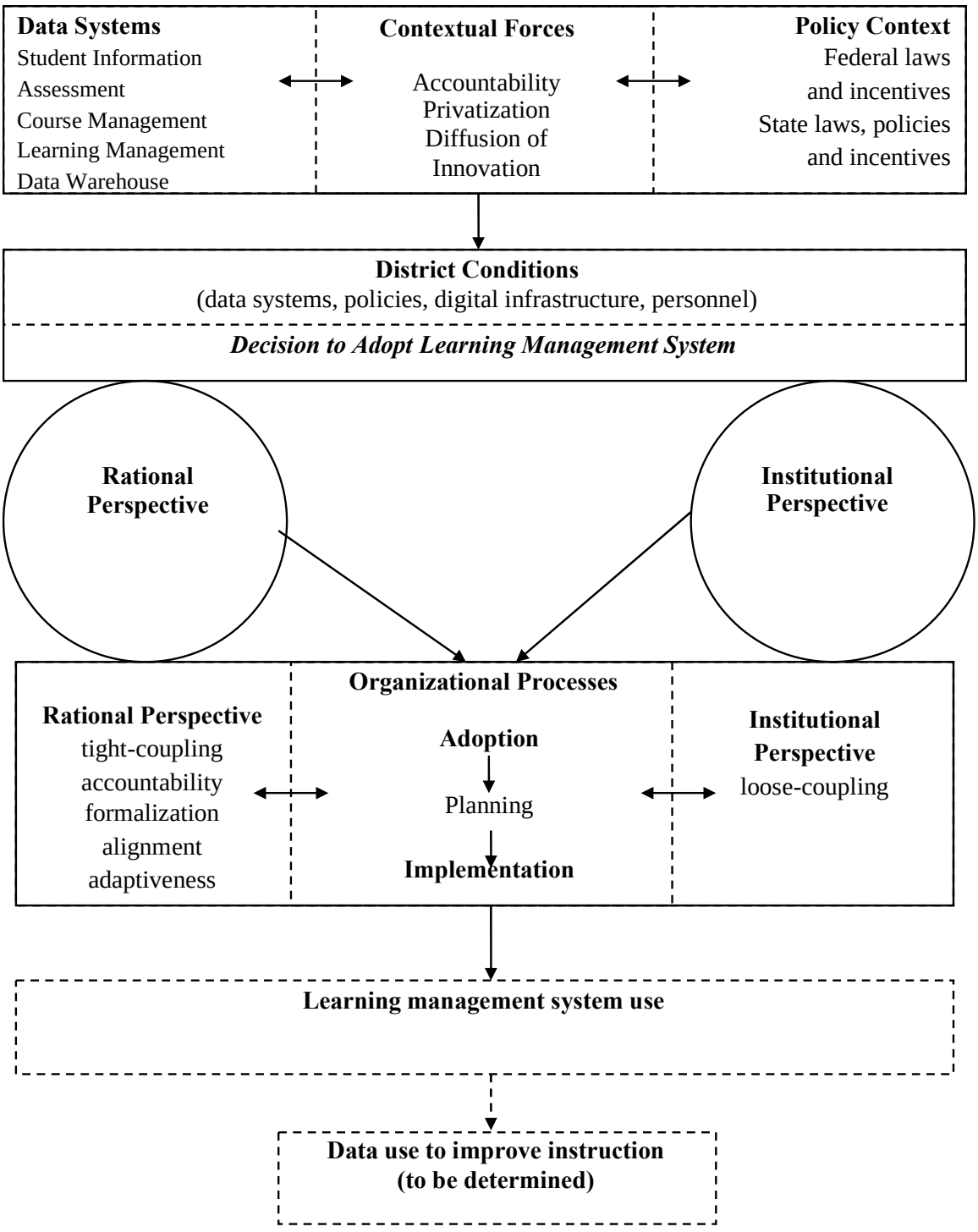
2. What, if any, external factors may have shaped this process? If any:
    a) What were these factors?
    b) Why are they worth mentioning?
    c) What impact did they have on adoption or implementation and why?

3. Do you think this learning management system a good fit for Oak Trail School District? Why or why not?

4. Is there anything specific about the district-level process of adopting and implementing a learning management system, in contrast to adopting other types of data systems, that would be important to understand?

5. Is there any other information related to this study you would like to share?

Appendix L: Revised Conceptual Framework



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