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Stakeholders' Communication During Learning Analytics Implementation in Higher Education

Grace Jackson
Walden University

Walden University

College of Education

This is to certify that the doctoral dissertation by

Grace Jackson

has been found to be complete and satisfactory in all respects,
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Review Committee
Dr. Patricia Mc Gee, Committee Chairperson, Education Faculty
Dr. Christopher Rasmussen, Committee Member, Education Faculty
Dr. Danielle Hedegard, University Reviewer, Education Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
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Abstract

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MA, Houston Baptist University, 2003

B.S., University of Utah, 1997

Dissertation Submitted in Partial Fulfillment

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Abstract

Higher education institutions (HEIs) implementing learning analytics (LA) use student data to improve the learning experience. The problem for LA implementation originates from individuals responsible for analytic programs from different institutional departments and the lack of a framework for communication and productive dialogue about usages of data. As a result, LA implementation remains isolated and disparate, which impedes universal student benefit. The purpose of this qualitative case study was to explore how HEI stakeholders use communication channels and engage in dialogue that occurs during the LA implementation process intended to improve student learning outcomes. The diffusion of innovation and let's talk learning analytics (LTLA) frameworks were used for this study to provide a lens through which to view the innovation implementation process and the corresponding LA dialogue content. The research questions were developed to determine how stakeholders use different communication channels during LA implementation and engage in dialogue. In this qualitative case study, data were collected through semistructured interviews with 10 stakeholders from a single HEI institution. Data analysis involved inductive reasoning in identifying themes that addressed the research questions. The findings showed the stakeholders used interpersonal communication almost exclusively to share knowledge about the LA implementation. The topics of stakeholder dialogue included surface-level domains recommended in the LTLA framework. Positive social change could result from the findings through improved systems for student data use among stakeholders, leading to enhanced teaching and student performance and success postdegree.

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Dedication

I dedicate my dissertation work to my husband, Larry Jackson. His love and dedication to me during the doctoral journey gave me the emotional fortitude to preserve. When he would see my face with fatigue and anguish, he would say, “keep digging, Grace, you can do it.” He would listen while I would talk about what I was learning and discovering, as well as what I wanted to know regarding my research. When he knew I had a deadline that kept me up most of the night, and I finally crawled into bed in the wee hours of the morning, he’d roll over and sleepily ask, “did you submit?” If I said yes, he’d congratulate me. If I said no, he’d encourage and sympathize with me.

When I reached the “all but dissertation” (ABD) stage, I had a job that I loved but required a significant amount of time and mental energy. The demands of work and school were having a negative effect on my health. Larry decided to support me financially so I could focus on my schooling. His actions always backed up is verbal praise and support.

Larry and I are best friends and partners, and I’m looking forward to the rest of our life together. We’ll continue our discussions of my studies and his studies. He is pursuing a dream of being a master machinist. He dove into his craft with his usual level of passion for learning, and I get to hear all the details.

Thank you, Larry. I love you.

Acknowledgments

I wish to thank my committee members for their time and expertise. A special thank you to my chair, Dr. Patricia “Rikki” McGee; she was incredibly generous with her time and genuinely cared about my success. Dr. McGee held regular live forum meetings that helped create a community of scholars with my research forum members. The community of scholars as well as the insightful presentations she provided, were integral to my success in the pursuit of my doctoral degree. Her guidance was proactive, and she was readily available anytime I needed help. Thank you, Dr. Christopher Rasmussen, and Dr. Danielle Hedegard, for agreeing to serve on my committee. Your targeted feedback added to the refinement of my research.

I want to acknowledge the institution that allowed me to conduct my study, especially my main point of contact. Thanks to each interviewee for your time and thoughtful consideration during our conversations; this study would not have been possible without you.

To all my friends and family that made me smile and laugh over the past several years, I can’t thank you enough for your genuine interest in my research and well-being. I relied heavily on a group of friends during my dissertation journey. The group came together through the love of the outdoors and grew into a close-knit circle of soul sisters. Thank you for understanding when I canceled engagements, helping me celebrate events in life, and listening to me talk about my research.

Thanks to my fellow scholars who shared this journey with me. Through the community developed by Dr. McGee, I learned from the scholars ahead of me in the

program and shared experiences with those a few steps behind. I felt like I belonged to the group of scholars in the research forum. A couple of scholars were at my same pace, and I appreciate the encouragement they gave me to persist and finish the dissertation. I made other friends through coursework and residencies that also inspired me; thank you all.

I want to thank co-workers and employers who supported my efforts to complete my coursework and dissertation. Several co-workers would ask me about my research and show interest in work over the past eight years. I am grateful to the people in my life and their support through this journey.

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Chapter 1: Introduction to the Study

The increased use of digital tools in education, elearning, and the world in general has facilitated massive data collection about people, operations, and systems (Adejo & Connolly, 2017; Alamuddin et al., 2016; Ifenthaler, 2016; West et al., 2016). However, deciding how to use and interpret the data to promote student success and improve learning environments is still in the development stages (Arroway et al., 2016; Avella et al., 2016; Ifenthaler, 2016; West et al., 2016). The first introduction of mining and analyzing big data in higher education occurred in the mid-2000s in tandem with the big data era (Slater et al., 2016). In the context of big data, learning analytics (LA) emerged out of educational data mining and aligned with business intelligence techniques customized for teaching and learning (Adejo & Connolly, 2017; Ferguson, 2012). With advances in computing, the internet, elearning, and online education, there was an increase in student digital data that led to opportunities for applying business intelligence techniques to educational data (Ferguson, 2012).

The collection of student data has been occurring on a massive scale, particularly in higher education institutions (HEIs) using elearning tools (West et al., 2016). A parallel trend in HEIs is that state agencies are pushing for documentation of programmatic efficacy and student achievement (Martin et al., 2016; West et al., 2016). One option for program documentation is LA, which uses student data to make decisions for improvement (Avella et al., 2016; Lester et al., 2017). LA systems can allow HEIs to utilize collected data to show stakeholders and governing agencies performance patterns and specific indicators of student achievement (Avella et al., 2016). The Society of

Learning and Knowledge Analytics defined LA as "the measurement, collection, analysis, and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs" (Siemens & Gasevic, 2012, p. 1). A LA system can help students succeed by improving retention, reducing time to degree, and increasing completion rates (Lester et al., 2017). However, the effective implementation of LA systems requires significant resources and the collaborative efforts of all campus stakeholders (e.g., information technology [IT] staff, student services staff, educational technology staff, administrators, and faculty members) to engage in the process (West et al., 2016).

In this study, I examined one institution's process of adoption and implementation of LA by exploring the communication channels, both interpersonal and mass media, used to promote the flow of information. In addition, I explored the use of dialogue among stakeholders during the LA implementation process. A high level of engagement among instructors, administrators, instructional designers, and informational technologists is critical to educational technology's success in general (Van Merriënboer & de Bruin, 2014). However, since LA is an emerging yet potentially powerful tool for a dynamic group of HEI stakeholders, the need for engagement is essential (Adejo & Connolly, 2017; Alamuddin et al., 2016; Alhadad et al., 2015; Arroway et al., 2016; Avella et al., 2016; Dunagan, 2017; Ifenthaler, 2016; Lester et al., 2017; West et al., 2016). Dialogue across departments has and can promote engagement, collaboration, and alignment with the LA implementation vision. Van Merriënboer and de Bruin (2014) also noted that technology performs differently in various environments. When technology is

dependent on human interaction from multiple stakeholders, then communication regarding implementation is crucial to sustained use (Rogers, 2003). Given the barriers to LA implementation, such as a wide variance of student data use, complex integration, unclear ownership of data, and technical challenges (Alamuddin et al., 2016), there is a need for customizing an LA initiative based on institutional needs and priorities.

This chapter includes a summary of the background literature related to LA implementation in higher education. Additionally, the purpose statement, problem statement, and research questions are provided to help define the study's scope. An explanation of the conceptual framework and significance of the study provides context. The final sections of the chapter include a presentation of definitions specific to the study, a description of the nature of the study, relevant assumptions, and an explanation of the scope and delimitations for the study.

Background

LA is a rapidly emerging technology that holds the promise to support data-driven decisions, respond to accountability pressures, and improve student success (Alamuddin et al., 2016; Avella et al., 2016; Ifenthaler, 2016; Lester et al., 2017; West et al., 2016). Therefore, institutional leaders have moved forward with implementation plans and action despite minimal empirical evidence of LA outcomes or a model for education implementation (Adejo & Connolly, 2017). LA system designs are modeled from other disciplines and based on literature reviews rather than empirical studies (Lester et al., 2017). Designers and decision makers use broad guidance to facilitate complicated and expensive projects involving multiple stakeholders to improve the student experience

(West et al., 2016). These factors, combined with no integrated model to follow, have created confusing and conflicting priorities about operational units, resulting in implementation that has often been slow and challenging (Pomeroy, 2014). If institutional leaders had a framework for productive dialogue suited for LA implementation, then challenges and barriers could be better managed (Lester et al., 2017). Therefore, a productive dialogue would reduce implementation issues.

Barriers to LA implementation have included financial, cultural, and technical hurdles (Ifenthaler, 2016; Lester et al., 2017; West et al., 2016). The financial barriers consist of the LA software's expense, qualified personnel needed for support, and the cost of analytic data systems (Lester et al., 2017). Cultural issues related to analytics in the HEI setting have created other personnel challenges (Ifenthaler, 2016). For example, fears regarding loss of power and disclosure of low performance. A lack of willingness to share across departments also hinders implementation. Another issue is technical challenges that have been consistent due to insufficient infrastructure for the current data and support tools (Arnold et al., 2014; de Freitas et al., 2015; Ifenthaler, 2016). The communication efforts regarding operational and cultural challenges documented in LA implementation associated with elearning options were the focus of this study.

Research about LA implementation has revealed that it is complex and needs to be situated in the institutional culture and aligned with institutional goals (Adejo & Connolly, 2017; Ifenthaler, 2016; Lester et al., 2017; West et al., 2016). Institutional goals supported by LA include increased student retention and resource efficiency as well as improved student academic performance and course design (Lester et al., 2017).

However, each stakeholder may have different goals and expectations (Avella et al., 2016). Avella et al. (2016) found that students expressed a desire for optimal program guidance, personalized intervention, and real-time feedback, while instructors claimed a need for information about student learning activities and background to better monitor and assist student performance. Thus, communication between students and instructors can facilitate LA implementation. Furthermore, communication between other stakeholders also plays a role in LA systems.

Additional stakeholders that have a role in LA implementation include instructional designers, administrators, and information technologists. Instructional designers have requested learning analytic information to evaluate learning materials and adjust because they have a need to understand the effect of interventions. Ifenthaler (2016) found that administrators used LA data to make decisions, analyze student attrition, and identify curricular gaps. Given these disparate priorities, it is not clear how a system can serve all groups. Lester et al. (2017) defined another layer of the implementation complexity after finding that informational technologists or administrators often design the LA system, suggesting that their vision of system use may have excluded other stakeholders' needs. Cultural alignment and a shared vision to tie various stakeholders' needs together in a unified manner are integral to successful implementation. The dialogue used and communication channels explored in this study may show promise for unifying stakeholders.

The gap in knowledge regarding LA that I addressed in this study was the role of dialogue among stakeholders in the implementation process. Several researchers found a

need for more empirical studies on the topic (Avella et al., 2016; Ifenthaler, 2016; Lester et al., 2017; West et al., 2016). I explored how stakeholders engaged in internal departmental and cross-departmental dialogue and analyzed the content of the dialogue that occurred during LA implementation. Furthermore, I investigated how communication channels engaged various stakeholders in dialogue about educational data needs (see Avella et al., 2016). Stakeholders need to collaborate during the LA implementation process (West et al., 2016). This study's findings contribute knowledge about how dialogue among stakeholders facilitates LA implementation and compliment a framework for building collaboration across operational units.

Problem Statement

The capacity of LA depends upon the use of elearning platforms to deliver instruction. Although most stakeholders associated with elearning platforms have an awareness of LA, analytics often occurs in fractured or isolated departments (Alamuddin et al., 2016; Gašević et al., 2019; Pomeroy, 2014; West et al., 2016). Disconnected efforts create communication challenges and impede the innovation process in an organization (Rogers, 2003). The problem in current implementation processes is that individuals responsible for implementing analytic programs are from different institutional departments and lack a framework for productive dialogue about the implementation plan and usages of data. As a result, LA implementation remains isolated and disparate, which impedes universal student benefit (Alamuddin et al., 2016; Arroway et al., 2016; Avella et al., 2016; Broos et al., 2017; Knight et al., 2016; Nafea & Toplu, 2018; West et al., 2016). Researchers have not examined the dialogue among stakeholders or the

communication channels used during an LA implementation. Therefore, the role between dialogue and effective LA implementation to advance student success and retention was unknown.

Purpose of the Study

The purpose of this qualitative case study was to explore how HEI stakeholders from different departments that used elearning tools in one U.S. institution employed communication channels and engaged in dialogue during the LA implementation process intended to improve learning and teaching. West et al. (2016) explained LA as the access and use of data to inform stakeholders about learning activities and teaching practices. Furthermore, West et al. defined dialogue as the formal and informal conversations among stakeholders for LA use. In addition, West et al. outlined six domains of dialogue content to address during implementation. The domains in the Let's Talk Learning Analytics (LTLA) framework mirror components of other frameworks outlined for LA and technology implementation (Colvin et al., 2015; de Freitas et al., 2015; Greller & Drachsler, 2012; Scheffel et al., 2014; Tsai et al., 2018). Communication channels focus on information flow across the institution about the LA innovation.

Research Questions

The following research questions (RQs) served as a guide for this study:

RQ1: How do stakeholders use different communication channels during LA implementation in a HEI using elearning options?

RQ2: How do stakeholders engage in the LA domains of dialogue during implementation in a HEI using elearning options?

Conceptual Framework

The conceptual framework of this study comprised one theory and one framework. The first was the theory of diffusion of innovation (DOI) developed by Rogers (2003). The theory of DOI provides a framework for adoption level and the rate for innovation. Analytics is a complex and multidisciplinary innovation that requires more development to be scalable (Lester et al., 2017). Consequently, there is a need for examples of implementation, opinion leader influence, and communication channels to know how to use and how not to use student data to move the innovation forward (Rogers, 2003). According to the DOI theory, champions of innovation need to communicate the relative advantages of innovation to promote adoption. Relative advantage is the degree to which stakeholders perceive the innovation as more advantageous than the previous solution, including whether it is easier to use, more convenient, and cost effective as well as whether it improves student outcomes, students' experiences, or increases the ability to anticipate student needs. The greater the perceived advantage, the greater the rate of adoption

The second lens for this study was the LTLA framework (West et al., 2016) related to LA implementation at HEIs. In this framework, the dialogue topics are outlined in six domains determined to be helpful for analytics implementation. The framework contains discussion prompts for each domain so stakeholders can promote LA adoption among other dynamic stakeholders (West et al., 2016). I used the LTLA framework domains as a priori codes for analyzing the data collected from interviews of study participants.

Both frameworks align with innovation, adoption, and implementation, which was the focus of this case study exploring the LA implementation process. The DOI theory is a foundational framework for the adoption of innovation, while the LTLA framework is specific to the dialogue used during LA implementation. Together, they provide a complementary lens through which to view the data and inform the findings of this study. In Chapter 2, I will provide a more in-depth explanation of the conceptual framework.

Nature of the Study

I conducted a basic, qualitative, single-case study. A qualitative case study design works well when the research focuses on understanding the perspectives of those in the bounded system under study in a naturalistic setting (Merriam & Tisdell, 2015). The qualitative approach aligns with aims to improve one's practice, such as with the LA implementation process, which involves multiple stakeholders who have different priorities and may work in isolation from decision makers. The exclusion of other qualitative traditions, such as ethnography, phenomenology, and narrative inquiry occurred because a critical part of this research was understanding the bounded system of an institution during the LA implementation process. I did not use the quantitative approach because my research questions were open ended; therefore, predefined answers and data points associated with a quantitative study method would not have been appropriate (see Merriam & Tisdell, 2015). However, a future quantitative study may be helpful to compare to the findings of this qualitative study.

A basic, qualitative, single-case study design is appropriate for answering "how" and "why" questions because the meaning of dialogue for the stakeholder is contextual

and constructed in the real world naturally (see Merriam & Tisdell, 2015). Qualitative research questions probe participants' perspectives regarding one or more aspects of the situation, processes, or relationships (Starman, 2013). The case study allowed me to generate in-depth detail regarding dialogue used during the implementation process of LA that revealed communication channels.

Primary data collection comprised semistructured interviews with higher education administrators, faculty, and IT professionals regarding LA practices and institutional objectives. Other data sources included records of meetings, strategic initiative plans, and policies regarding student data use and collection. Initially, I analyzed the document sources of data and interview data using a priori themes from the six domains of LTLA and identified the sources and channels of information as defined in the theory of DOI. First, I reviewed the interview data, followed by coding to determine similarities, differences, frequency, and correspondence relations patterns. Finally, the data were organized in emerging thematic patterns.

Definitions

The following key terms are used throughout this study:

Academic analytics: Analytics of collected data used to support services and business intelligence for institutions (Lester et al., 2017).

Big data: Data housed in an extensive database that spans longitudinal timeframes and granular details on a given topic (Picciano, 2012).

Communication channels: The process of message sharing in a community. The main channels are mass media or interpersonal (Rogers, 2003).

Data: Digital objects collected from elearning environments and recorded systematically in relational data sets that can be searched, aggregated, cross-referenced, and examined (Fricke, 2015; Kitchin, 2014).

Data warehouse: A digital space used to store large amounts of data, creating a foundation for historical records and efficient data management (Moscoso-Zea et al., 2016). Data are put into the data warehouse in three-step processes using extraction, transformation, and loading.

Departments: Different business units or academic groups that use the LA system (West et al., 2016).

Dialogue: Communication defined as formal and informal conversations among stakeholders for LA use (West et al., 2016).

Dialogue domains: Six domains that characterize communication-based dialogue throughout LA implementation: the institution's context, transitional elements, data system infrastructure, strategy, stakeholders, and evaluation (West et al., 2016).

Educational data mining: Analysis of students' actions, collected as data, to identify patterns in large data sets (Avella et al., 2016).

elearning: Learning options facilitated through wired, desktop computers (Yeap et al., 2016)

Mobile learning (mlearning): Learning mediated through a mobile device with a wireless connection to information facilitates learning any time and place (Yeap et al., 2016). Mlearning includes various options, from simple applications to support

traditional teaching to complete educational ecosystems (Pappas et al., 2017). The use of concepts for mlearning and elearning occurs interchangeably in the context of this study.

LA: The analysis of data collected from learning activities and student demographics using software with data visualization, aggregation, and real-time capabilities (Avella et al., 2016; Lester et al., 2017; Siemens & Gasevic, 2012)

Stakeholders: Members of the academic community who use, design, or make decisions related to the LA system, including students, instructors, administrators, facilitators, information technologists, and instructional designers (Ifenthaler, 2016). The community members may have different names at various institutions but have similar roles and associations with the LA system.

Assumptions

It is informative to list assumptions about the facts related to the study that I verified directly. First, the study participants shared their understanding of how dialogue impacts the implementation process at their institution. Therefore, I assumed that the interview responses contained forthright and honest information. Second, I assumed that organizational documents written or published communication about the LA implementation existed and thus I gained access for analysis. I also assumed that the interviewees' responses represented their perspectives and dialogue events from the stakeholders at the institution who participated in the case study. Finally, it was assumed that dialogue patterns found illuminated communication channels and the flow of information in the case study institution. With the acknowledgment of these assumptions, I avoided the influence upon the outcomes drawn from the data.

Scope and Delimitations

The problem I addressed in this study was fractured implementation practices for LA. To reach the full potential of LA, stakeholders from multidisciplinary backgrounds need to work together; however, LA adoption instances have been specific to individuals or departments rather than entire institutions (West et al., 2016). In this case study, I examined stakeholders' perspectives developed through dialogue, which showed how dialogue and communication among stakeholders at one institution dispersed ideas and concepts related to the innovation implementation process in a bounded system. Some aspects of the dialogue and communication channels were specific to the institutional culture and context; however, the details revealed in the stakeholder communication may inform other institutional stakeholders implementing LA.

The conceptual framework drove the focus on dialogue among adopters and the flow of communication at one institution. Using a conceptual framework composed of the DOI theory and LTLA framework, I revealed the alignment of leadership styles, technology design, privacy issues, and ethics. Other theories related to technology innovation and discourse not selected for use in this study include the community of inquiry framework and technological, pedagogical, and content knowledge theory. The community of inquiry framework has a strong focus on teaching presence that does not apply to all the stakeholders in the current study (see Garrison et al., 2000). The technological, pedagogical, and content knowledge theory has a pedagogical focus that is a component of LA and dialogue but also excludes the perspectives of some of the stakeholders in the current study (see Koehler & Mishra, 2009).

The findings in this study could be transferable to institutions looking to promote productive dialogue among the stakeholders. Open dialogue can prevent siloed LA adoption (West et al., 2016). The findings can inform other HEIs, professional organizations, and companies that build LA systems, whether targeted dialogue from the domains of LTLA or the relative advantage from DOI is used to inform the LA adoption and/or implementation strategy.

Limitations

One limitation of a qualitative single-case study is low external credibility, meaning the findings cannot be generalized to environments beyond the participating sample (Morrison & Ross, 2014). The trustworthiness and dependability of the study depended upon the care I took to follow replicable research methods. I completed member checks and external audits to ensure that the data supported the findings. The transferability, or external validity, of the current study that applies to other institutions depends on their environment and technology implementation needs.

One bias that I have as a researcher is that the LA system helps promote student success. My experience has shown that structured dialogue about technology innovations is beneficial; the benefit to students is worth the risk and effort of working toward successful LA implementation. I have worked as a client achievement coordinator using a siloed and makeshift spreadsheet collection format; the data were not as effective because the instance of the collection did not reflect real-time status. The data visualization tool was not standard or available for the entire system. To account for my biases, I recorded

interviews word for word and completed member checks to ensure the participants' meanings were captured and interpreted correctly in the findings.

Significance

Students in elearning environments leave a digital footprint or trace data that can provide insight about student achievement if aligned with HEIs' initiatives related to LA (Gašević et al., 2019). Increased student data collection, in conjunction with a growing elearning population, creates the need to understand and manage the analytics related to academic activities. While analysis of data provides a promising approach to advancing the understanding of the learning process (Viberg et al., 2018), the pathway to LA implementation is still largely uncharted. Instances for LA use show disparate data sources and narrow application (West et al., 2016). Known benefits of LA include the advancement of the science of learning, improving the instructional design, and the increased ability to predict student success (Alamuddin et al., 2016; Avella et al., 2016; Cope & Kalantzis, 2016; Pomeroy, 2014). However, LA systems require a large resource allotment of time and money to support systemic integration (West et al., 2016). Furthermore, starting an analytics program within an institution's culture requires that the plan is appropriate for that institution.

Findings from this study contribute to understanding how HEI stakeholders' dialogue can create a vision and plan for LA that fits their institution's context, thus advancing the utility of analytics to improve student performance. Additionally, the findings provide information for stakeholders to use regarding dialogue that promotes LA implementation and increasing technology use to improve academic success, resulting in

the improvement of retention rates and the numbers of students successfully completing their academic credentials. Furthermore, the use of the findings of this study to develop a framework for dialogue relevant to technology innovation implementation beyond LA is now possible.

Summary

In Chapter 1, I detailed how LA implementation is complex and best situated in an institutional context (see Adejo & Connolly, 2017; Ifenthaler, 2016; Lester et al., 2017; West et al., 2016). There is evidence that LA offers the benefits of increased student retention and resource efficiency as well as improved academic performance and course design (Ifenthaler, 2016; Lester et al., 2017; West et al., 2016). The problem is that LA implementation has been a fragmented process because of how individuals interact through course design or departmental policy; however, the potential of a LA system lies in institutional-wide implementation (West et al., 2016). It is unknown how dialogue among stakeholders will facilitate LA implementation (West et al., 2016). My objectives in this study were to understand how communication channels influence LA adoption and learn how the dialogue content stakeholders' use aligns with the LA domains during the implementation process. In Chapter 2, I will provide a description of the literature search strategy used, expand on the conceptual framework, and present an exhaustive review of the relevant literature.

Chapter 2: Literature Review

The use of LA has gained momentum in higher education, promising improved learning outcomes and individualized learning capabilities as well as increased retention and completion rates (Avella et al., 2016; Ifenthaler, 2016; Lester et al., 2017; West et al., 2016). The problem in current implementation processes is that individuals responsible for implementing analytic programs are from different institutional departments and lack a framework for productive dialogue about the implementation plan and usages of data. As a result, LA implementation remains isolated and disparate, which impedes universal student benefit (Alamuddin et al., 2016; Arroway et al., 2016; Avella et al., 2016; Broos et al., 2017; Knight et al., 2016; Nafea & Toplu, 2018; West et al., 2016). West et al. (2016) examined dialogue frequency among stakeholders during LA implementation and found that the highest percentage of participants reported no innovation dialogue. The purpose of this qualitative case study was to explore how HEI stakeholders from different departments that used elearning tools in one U.S. institution engaged in communication channels and dialogue during the LA implementation process intended to improve learning and teaching.

The findings from this study add to how stakeholders use communication channels (see Rogers, 2003) and engage in dialogue (see West et al., 2016) during LA implementation. Institutions have implemented LA to support student success initiatives, often focusing on reducing attrition rates (Colvin et al., 2015). Another driver for the use of LA is providing evidence for accreditation and other external pressures to demonstrate student success (Lester et al., 2017; Sclater, 2014). Research has indicated that a holistic

approach to LA is more effective than disparate LA initiatives (Arroway et al., 2016; Avella et al., 2016; Colvin et al., 2015; de Freitas et al., 2015; Nafea & Toplu, 2018; Prieto-Alvarez et al., 2018; Tsai & Gasevic, 2017). Furthermore, embedding LA in a way that aligns with current systems and organizational culture increases the adoption (Arroway et al., 2016). Engaging stakeholders through incorporating cultural context translated to a cross-discipline dialogue promoting holistic adoption for better student outcomes (Kitto et al., 2018; West et al., 2016).

Researchers have described LA as an emergent technology (Ifenthaler, 2016; Lester et al., 2017; West et al., 2016). In addition to the emerging status, researchers have reported that LA has a high potential to improve student success by implementing a complex, institutional-specific system (Avella et al., 2016; Ifenthaler, 2016; Lester et al., 2017; West et al., 2016). The combination of potential educational benefit and accountability has pushed the pace of LA implementation processes, which has distracted the stakeholders and impeded clear identification of the requirements and implications of using LA (Avella et al., 2016). Adejo and Connolly (2017) presented a different perspective of LA implementation status when they labeled the data growth and analytic movement as a revolution. They also reported that education was behind other sectors in adopting analytics. West et al. (2016) found that LA institutions often isolated implementation efforts in disparate courses or departments. Pomeroy (2014) conducted a study that explored barriers perceived by academic administrators in HEIs from adopting analytic tools and found cultural and infrastructure issues combined with a complex

system requiring specific support as barriers to use. Therefore, there is evidence that the strategy has not matured to supply a model for a holistic implementation process.

In Chapter 2, I discuss the literature search strategy, the theoretical foundation and conceptual framework, and a review of the literature in the context of concepts relevant to the topic of study.

Literature Search Strategy

In this section, I detail the keywords used and databases searched to discover the gap in knowledge that provided an explanation of the need for this study. The literature reviewed consisted of peer-reviewed sources, such as books, articles, conference proceedings, reports, dissertations, and journals obtained by searching EBSCO and ProQuest Library databases and internet source materials. My first searches consisted of fewer Boolean tools combining keywords than in the later searches. One of the first searches used the combination of the following additive key terms: *learning analytics and higher education and implementation*. I used limiters for peer-reviewed articles; however, initially, I did not specify databases. This search resulted in 123 articles; however, many were not empirical studies. I refined the Boolean search using the following keywords: *learning analytics* or *academic analytics* or *education* data mining*) AND AB (*higher education* OR *college* OR *university*) AND AB (*implement** OR *integrate** OR *impact*). The search resulted in 396 results. I then experimented with additional keywords to narrow the search focus to be more relevant to dialogue and communication. The words used in separate searches were *dialogue, communication, knowledge sharing or knowledge management*, and *change management*. These searches

produced very few articles, and the articles were not as relevant as needed. For example, a search for *knowledge sharing* and *knowledge management* resulted in five articles, but only one was relevant.

As I read literature sources, I paid close attention to the references for LA implementation, dialogue, and communication. I used the reference lists from peer-reviewed literature sources about LA and found additional studies completed in the field. When I began to identify sources that I had already read, I realized that my literature search had reached saturation.

Conceptual Framework

I combined the DOI theory (Rogers, 2003) and the LTLA framework (West et al., 2016) in the conceptual framework for the current study. In the DOI theory, Rogers (2003) proposed that the adoption or rejection of innovation depends on communication channels used over time in a social setting. The DOI theory lens helped me decode the channels of communication among diverse stakeholders during LA implementation. In the LTLA framework, West et al. (2016) defined six domains of dialogue that can affect the implementation and adoption of LA at HEIs. The LTLA framework provided a framework through which to view the content of dialogue used in the implementation process.

DOI Theory

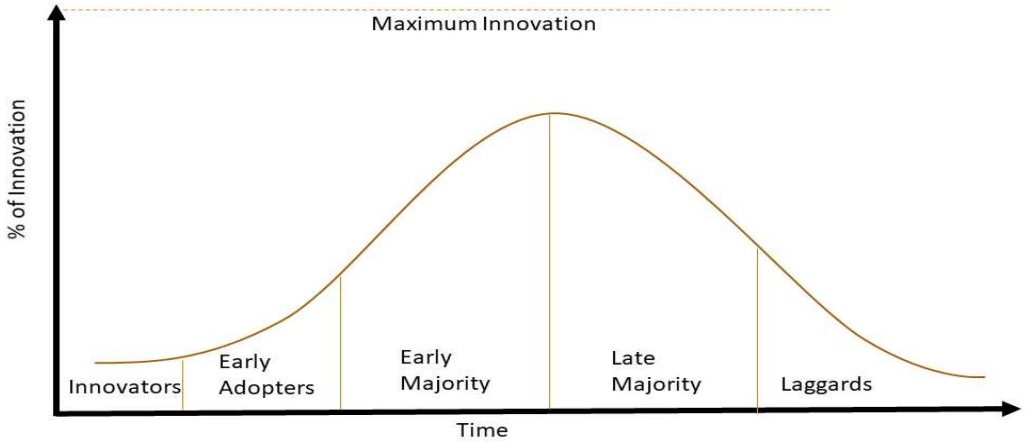
The concept of DOI originated from the scientific process of diffusion, in which particles move throughout a substance (Rogers, 2003). Researchers have used this concept to explain how innovative ideas spread across and within groups. DOI theory is

the study of how ideas, standard practices, and innovations spread throughout a social system (Rogers, 2003). The initial records of DOI date back to the 1900s. In the 19th century, a few disparate community leaders started taking notes and documenting how information spread throughout local communities. The label of the process of innovation dispersion through a population changed to the DOI. In 1943, Bryce Ryan and Neal Gross set the basic paradigm for studying diffusion from a study of the hybrid corn innovation. Their hybrid corn study became foundational for DOI because it established the methodology investigators used for subsequent diffusion research.

Furthermore, the method included using retrospective survey interviews to gather information about the time of adoption, from first awareness to incorporation in routine practices (Rogers, 2003). A diagram of adoption rates versus time plotted on a graph formed an S curve (see Figure 1). The illustration shows the trend of adoption as innovation diffused through a community of adopters. The adopter population under the S curve was divided into segments, which became the adoption categories of the DOI theory.

Figure 1

S-Curve Diagram Depicting Patterns of Adopter Rates Over Time



Note. Adapted from *Diffusion of Innovations* (5th ed., p. 281), by E. M. Rogers, 2003, The Free Press. Copyright [1995, 2003] by E. M. Rogers; Copyright [1962, 1971, 1983] by The Free Press, A Division of Simon & Schuster, Inc. Adapted with permission.

The foundational DOI corn hybrid study preceded an explosion of rural sociology diffusion research by a decade (Rogers, 2003). DOI research increased because of an increase in research funds from the U.S. Department of Agriculture and an informal network of researchers interested in diffusion. Rogers was one of the researchers who began their career during this time. The next wave of diffusion research occurred in developing countries and other disciplines beyond agriculture.

Education was one of the other disciplines that used DOI theory during the second wave of DOI studies. The number of educational innovation studies grew from 1961 to 1994 (i.e., 23 studies in 1961 to 359 studies in 1994) and then dropped off in 2003 (Rogers, 2003). The Teachers College at Columbia University conducted most of the educational diffusion studies. A focus of studies from that group looked to understand if

schools with local control were more innovative than federally controlled schools. Their findings showed that funding influenced innovation rather than locus of control. Another result exposed was a lag time for educational innovations in comparison to business sector innovations.

Furthermore, the rate of adoption varied from one innovation to the next. For example, U.S. schools took 50 years to adopt the kindergarten innovation; in contrast, the driver's training innovation took 18 years to be adopted and the modern mathematics pedagogy took 5 years to be adopted (Rogers, 2003). Driver's training had external factors supporting the innovation because insurance companies gave discounts for drivers who completed the training course, increasing the adoption rate. The National Science Foundation and the U.S. Department of Education promoted modern math; therefore, funding, and external promoting agencies affected innovation in educational settings. Another factor of adoption in education is the decision-making process.

In the DOI theory, Rogers (2003) described how decision making impacts the adoption of an innovation. A notable difference in education versus agriculture is that organizations, instead of individuals, complete the innovation/decision-making process. Therefore, innovation decisions in educational settings are either collective or authoritative instead of individual. The three innovation decision levels are optional, collective, and authoritative (Rogers, 2003). The individual's decisions are optional and independent of decisions made by other members of the social system. Decisions made through group consensus among the system members are collective, requiring that the group members conform. The third decision process is an authority innovation decision

made by a small number of members in a social system. The decision group consists of members who have power, status, and/or technical ability. The authority innovation decision is most common for hierarchical organizations, such as the military, factories, and schools. The innovation decision process will influence the communication channels in the institution that has decided to adopt the innovation. The fastest rates of adoption come from authoritative decision systems if the authority group is open to innovation.

The Elements of DOI

The DOI theory informs how individuals and groups share ideas and practices (Rogers, 2003). The central theoretical proposition of DOI employs four main elements to explain diffusion: innovation, communication channels, time, and social systems. For this study, I explored the use of communication channels during the implementation of LA in a HEI social system. I used the DOI lens to determine how stakeholders shared information about the LA innovation as they communicated within the institutional social system. Understanding how the communication channels flowed and dialogue moved from one department to the next informed the implementation process.

Innovations. An innovation is an idea or practice new to an individual or group (Rogers, 2003). The individual or group decides to adopt or reject an innovation during the implementation process. Evidence of adoption for innovation is routinization in daily practice. Rejection occurs when standard practice excludes innovation. In the current study, the innovation was LA. The LA innovation can involve different student data processes, such as collecting, measuring, and using data for academic and nonacademic purposes (Colvin et al., 2015). Regardless of the LA data use approach, the effect on

current HEI stakeholders involves new practices and ideas for teaching and learning. As with other innovations, the adoption rate of LA ideas will depend on how stakeholders perceive the innovation.

Rogers (2003) identified five perceived attributes of an innovation: relative advantage, compatibility, complexity, trialability, and observability. Relative advantage is the individual's perception that the innovation will be better than the process it supersedes. According to the end-user, the conscious or sub-conscious question of relative advantage is whether the innovation improves the status quo. Suppose the answer is yes, then the chance of the individual choosing the innovation increases. Also, compatibility is the degree to which an innovation is consistent with the organization's existing values. The complexity of innovation relates to how the end-user distinguishes the difficulty of using or understanding the innovation. Klein and Knight (2005) noted that if innovative technology is more complex than the technology it replaced, end users are likely to report a lower level of satisfaction. Trialability is the ability of users to experiment with the innovation on a limited basis, resulting in higher levels of adoption (Rogers, 2003). Finally, observability is the level of visibility for prospective users to see the innovation in action. For example, during the introduction of an innovation, if HEI stakeholders viewed the evidence and experienced the innovation's value, the adoption rate should increase. Therefore, explanations of the rate of adoption relate to the perceived attributes.

The adoption of innovations holds expected and unexpected outcomes. Innovations have moved educational systems in specific ways based on the impact of the

innovation. Dunagan (2017) completed case studies of institutions implementing innovative ideas and methods of providing education. Dunagan categorized innovation into two categories: sustaining and disruptive. A sustaining innovation aligns with the status quo and pushes for minimal improvement. Thus, sustaining innovations are more compatible with the system and provide a minor relative advantage, supporting more rapid adoption (Rogers, 2003). Disruptive innovations move improvement in a completely different new direction. Therefore, disruptive innovations require a shift in organizational priorities and risk rejection by organizations with strong business models. However, if end users can see a successful trial or the initiation of the innovation that proves a relative advantage to current practice, the chance of adoption will increase (Rogers, 2003). LA systems created to support student success often fall in line with HEIs stated and current priorities. However, the process to ensure all students obtain a high-quality education that reaches beyond the postsecondary school may require disruption.

Nafea and Toplu (2018) argued that quality education is only possible through fundamental, disruptive, and system-wide innovation. They argue that if one looks at disruptive innovations considering relative advantage and compatibility attributes, there must be an interplay between the user's level of frustration with the status quo and a desire to support the comfort level with a compatibility match the intervention. Furthermore, innovation is not possible without knowledge sharing among stakeholders. Knowledge sharing is another way of viewing the flow of information through communication channels in a social system.

Communication Channels. Traditionally communication channels fell into two categories, mass media and interpersonal channels (Rogers, 2003). However, social media has merged the source of mass media and interpersonal communication channels (Walther, 2017). The channels of communication depend upon the cosmopoliteness of members, system norms, and attributes of the innovations. Cosmopoliteness is the level of one's orientation beyond the local community to a broader context (Jeffres et al., 2004). In the context of an educational system, cosmopoliteness includes the range of interaction outside of an individual's immediate department. System norms relate to how innovation originates, either bottom-up or top-down. Attributes of innovations include options within the technology to interact across the community and beyond. For example, the internet allows one to explore information via links from one page to other sites with weak or strong connections. With data visualization options, a holistic LA system facilitates the user to view data across the organization or beyond and supports cosmopoliteness and communication channels.

Rogers's (2003) notion of communication channels originated from models of communication. For example, one early communication model was a metaphor for a hypodermic needle. The model stipulated that mass media injected information into society via newspapers and radio. A follow-up model was the two-step flow model. The first step involved media sources transferring knowledge to the opinion leaders. The second step was for the opinion leaders to spread information to the followers through interpersonal influence. These models oversimplified the process of diffusion. However, they provided building blocks for Roger's ideas about the social nature of diffusion.

Social Systems. According to Rogers (2003), the innovation decision-making process in an organization is directional. The directionality of the innovation-decision affects the flow of communication. One approach to the decision-making process is the authoritative-innovation decision method, a top-down tactic (Moscoso-Zea et al., 2016.) The top-down, authoritative-innovation decision aligns with the hypodermic needle model for communication channels (Rogers, 2003). Traditionally, most educational organizations used an authoritative innovation-decision process for technology implementation, which is most efficient for organizational adoption (Rogers, 2003). However, Prieto-Alvarez et al. (2018) reported that technology innovations had developed a reputation for imposed tools upon end-users, impeding adoption. Therefore, it is helpful to understand if the innovation-decision approach inhibits or eases LA implementation based on the dialogue among stakeholders.

A U.S. institution, the University of Indiana, launched a successful fellow's program to help LA implementation (Shepard et al., 2019). The researchers reported the institution used a top-down, middle, and bottom-up approach embedded in its strategic plan. Given the variety of innovation-making approaches and reported outcomes, it is inconclusive what role the innovation-decision type plays in adopting HEIs.

In the social system where the innovation-decision is at the organizational level, either collaborative or authoritative, the implementation involves two phases toward adoption (Rogers, 2003). One phase of adoption occurs at the organizational level and another at the individual level. Organization and individual adoption phases may occur at the same time. Leaders drive adoption at the organizational level or initiation stage. For

example, the administrators at a university would like to understand the actions that successful students take during the learning process. In the initiation stage, the focus is on the general organizational problem or need. If organizational needs show concerns about student success and retention, staff and faculty can provide targeted individualized support.

Next, the matching process involves fitting the problem to an innovation (Rogers, 2003). Administrators or other campus leaders decide to select an LA system to help the stakeholder analyze student data to identify successful student learning behavior and student needs. Part of the matching process involves the formation of a strategic committee to support the LA implementation. In between the second and third stages, a decision to implement the innovation occurred. The third stage is reflective, which allows for any restructuring. The strategic committee meets to discuss and review the LA implementation process. The strategic plan can include a pilot group. During the third stage, the organizational stakeholders customize the innovation to fit the organization. The LA system may need customization to provide the context and culture of the institution. Feedback from Stakeholders' feedback facilitates an organization fit for innovation. The fourth stage focuses on clarifying a relationship between the change and the organization. During the fourth stage, the strategic committee meets to evaluate the innovation and make necessary adjustments. The fifth stage is when the innovation has become an ongoing element of the organization and loses the identity as an innovation. In the final stage, the LA system's use across the institution is considered part of the everyday operation and not viewed as an innovation. To move through the organizational

adoption stages, interpersonal channels for sharing the benefits of the innovation, needed customizations, and perceived usefulness is necessary.

In the structure of networks, there are homophilous and heterophilous connections that help the diffusion of information. Homophilous relationships are between two similar individuals. Heterophilous relationships are between two individuals that are different. Rogers (2003) noted the basis of similarities and differences as beliefs, education, and socioeconomic status. Specific to this study, similarities and differences were departments, job title, interests, and beliefs. As detailed in Chapter 4, the homophilic connections were more common. Heterophilous relationships were less common but had more influence on diffusing information.

Rogers (2003) developed 13 generalizations to explain homophilous and heterophilous interpersonal networks and opinion leaders' influence on system norms and communication channels. The 13 generalizations fall into three categories: networks, opinion leaders, and communication channels. Networks of diffusion consist of interpersonal connections. Most diffusion networks are homophilous in which individuals connect more readily to others with similar ideas. However, if heterophilous networks exist - in which individuals acknowledge ideas different from their own- followers will seek opinion leaders of higher status, more cosmopolite, and innovativeness. Opinion leaders have a greater level of specific attributes such as a tendency to be cosmopolite, more contact with change agents, active social participation, higher socio-economic status, and a higher level of innovativeness than their followers. The level of

interconnectedness in a social network has a positive effect on innovativeness. Also, communication and dialogue support interconnectedness among group members.

The last two categories of interpersonal connections are system norms and communication channels related to homo- and heterophilous associations (Rogers, 2003). When the system norms of a social system favor change, the opinion leaders are more innovative. In contrast, when system norms do not favor change, the opinion leaders less innovative. Considering the communication channels in social systems, the potential for novel information exchange decreases with proximity and homophily levels. Nevertheless, the chance of individuals adopting innovation increases when others in one's network have adopted it previously.

Time. Klein and Knight (2005) noted that the time required to become competent using the innovation would affect end-user satisfaction and the adoption rate. Sclater (2014) conducted case studies of universities using LA. One university moved from using disparate excel files to an in-house enterprise system to manage LA data 15 years ago. Ferguson et al. (2016) studied a university that has also committed the past 15 years to the LA implementation process. Saxena and Kasparian (2019) reported that implementing the LA across 45 programs took several years. Therefore, the implementation timeframe recorded in the studies listed here was lengthy. With that in mind, it is helpful to note a historical perspective from Klein and Knight (2005). They found that when technology implementation requires a long-term orientation, a push for immediate task performance impedes adoption. Suppose end-users need to choose between meeting performance levels and devoting time and energy to implementing the

innovation. In that case, the choice will be to maintain that level of performance. Therefore, the time requirements and complexity of LA adoption are essential factors for stakeholders. Also, a balance of performance expectations and training periods. DOI offers a framework for understanding the implementation process for a technology system adoption.

DOI Use in Technology System Adoption. Research in higher education utilizing DOI to examine technology system adoption has focused on the categories of individual adopters and stages of innovation. For example, Porter and Graham (2016) investigated the drivers and barriers to faculty adoption of blended learning (BL) in HEI using the lens of DOI. The researchers selected a study site at an early implementation stage of the innovation and gathered information based on adopters' DOI classification (Graham et al., 2013). The researchers used a mixed-method design, a survey distributed to 214 faculty and 39 interviews supplied study data. The Graham et al. (2013) framework outlined strategy, structure, and support related to the BL innovation. Findings from the study showed that 53% of all faculty adopters felt that infrastructure was a significant influence for adoption, and 83% of the innovators rated infrastructure as the most influential aspect of adoption. Thirty-two percent of all adopters needed assurance about the availability of technical support for the innovation.

Furthermore, 28% wanted training support available, and 28% said an alignment between their view for promoting BL and the institutional rationale was critical. Findings showed that the current focus of communicating strategy for implementation had less value than sharing the support plan. The structure was more relevant to adopters when

moving from stage 1 to stage 2. Stage 1 involved awareness and exploration, where stage 2 focused on early implementation. The findings in the Porter and Graham study mirror findings from other literature reports that insufficient infrastructure, lack of technical support, and limited training access present barriers to LA implementation (Alamuddin et al., 2016; Ifenthaler, 2016; Lester et al., 2017).

One research question for my study was how stakeholders use communication channels to facilitate cross-departmental dialogue during LA implementation. Using the DOI lens allowed me to analyze the data collected from interviews and written communication artifacts such as announcements and policy documents to understand the communication channels among stakeholders. DOI provides a multidisciplinary lens, which was advantageous because stakeholders involved in LA implementation held backgrounds in administration, education, finance, informational technology, development, and instructional design (Rogers, 2003). The DOI theory is a recognized strategy in education to understand how innovation influences social change in a system.

LTLA Framework

LTLA is the second framework to inform this study. The LTLA framework is a dialogical tool designed to advance LA implementation for student retention in HEI (West et al., 2016). The government office of learning and teaching in Australia conducted a multi-institutional study to learn the status of LA implementation and develop a framework to promote adoption. Six themes emerged during the study, which facilitated the recommended domains' structure to address through dialogue during the LA implementation process.

Background of LTLA

The LTLA framework developed as an outcome of a project commissioned and funded by the Australian Government Office of Learning and Teaching (West et al., 2016). The project entailed a mixed-method study using surveys and interviews to gather information about the frequency and content of dialogue among 353 stakeholders at 24 institutions. To explore LA's experiences in more depth, 23 interviews from participants at 15 universities added qualitative data. Six themes emerged from the study regarding the current state of LA in the participating institutions.

Findings from survey and interview data showed that LA was in an early stage of development in the HEI sector, which other research corroborated (Adejo & Connolly, 2017; Alamuddin et al., 2016; Gašević et al., 2015; Ifenthaler, 2016; Lester et al., 2017; West et al., 2016). Data from the academic survey showed that stakeholders had awareness regarding the need for strategic planning associated with LA implementation (West et al., 2016). However, most never discussed LA. Another finding showed a significant variance between preparedness for LA implementation and institutional, cultural views of LA. Preparedness for LA implementation included the infrastructure of data and support systems for training and troubleshooting. Furthermore, findings identified tensions among stakeholders and questions participants had about LA systems' student experiences.

More findings from the study conducted by West et al. (2016) revealed significant gaps between the faculty participant's perception of what faculty needed and what LA systems provided. Also, a lack of communication about the plans and expectations for

use increased the fears concerning LA. For example, the negotiation between business wants, needs, and academic staff wants, and needs lacked reconciliation. Academic staff wanted LA to inform their work but not reduce academic freedom in any way. The themes reinforced the need for a flexible implementation model for LA and all stakeholders' engagement when planning for LA implementation.

To address the themes found from the study data, West et al. (2016) created a framework with six domains was to promote dialogue among stakeholders. See Table 1 with an overview of six domains LTLA for guiding dialogue during the implementation of LA.

Table 1

LTLA Framework for Stakeholder Dialogue Using Six Domains

LTLA - Domains	Description
Institutional context	Size and structure Location Strategic positioning of university Student demographics and characteristics Staff demographics and characteristics
Institutional transitional elements	Culture The positioning of LA in institution Level of sponsorship governance arrangements Alignment with institutional strategy Sustainability
Infrastructure: acknowledge the importance of data system infrastructure	Digital ability Integration data stewardship Policy and procedures Project manager experience
Strategy: transitional elements, specific to initiative	Strategic planning for initiative governance arrangements for initiative
Stakeholders: LA specific for an initiative	Questions from stakeholders The ability of a system to address questions Ease of use; accessibility Consideration of ethical issues
Intervention & evaluation	Endorsed processes around actions driven by data Training, support, and time for stakeholders to use the system Modifications relevant to the feedback of the system

Use of LTLA in HEI

The intended use of the framework was a dialogical tool to promote the implementation of LA. The input from participants helped to refine the domains and related dialogical prompts. West et al. (2018) then conducted a comparison study of the LTLA framework development in Malaysia, where interest in LA in Malaysia, as in Australia, was high. Malaysia showed a higher interest and lower maturity level for LA. Both groups reported minimal dialogue about LA, especially between the academics, institutional managers, and IT members. As noted in the LTLA model, dialogue with the

instructional managers and other stakeholders was integral for Domains 2 and 4 in setting the transitional elements related to sponsorship, governance, and alignment with institutional mission. Also, IT communication for data integration and digital ability was necessary for Domain 3, related to system infrastructure.

Findings in West et al. (2018) also allowed the team of researchers to compare areas related to professional development, data access, knowledge sharing, and academic's expected use of LA. Both Australian and Malaysian HEIs had a high interest in professional development related to LA. However, limited training opportunities existed. Even with little professional development, the Malaysian academics reported that LA's institutional capability was good to very good. However, the Australian academics rated institutional ability as poor to very poor. Both groups gained data access through learning management system (LMS) and student information system (SIS) systems. Australian academics gained most data access from LMS systems. Malaysia academics had limited use of LMS and, thus, relied on SIS systems for data. The interest in using LA for building one's ability and practice was high but low for knowledge sharing among academics and other stakeholders. West et al. (2016) and West et al. (2018) research resulted in one of many frameworks for comparison and understanding the field of LA.

Other LA Frameworks in HEI

Since the field of LA was young, at the time of this study, a wide variety of approaches, techniques, and proposed frameworks for understanding LA existed. Five other frameworks illustrated the similarities and differences in the context of LA. Early in LA history, Greller and Drachsler (2012) formulated six critical dimensions of LA. A few

years later, Scheffel et al. (2014) created a framework of quality indicators to standardize the evaluation of LA tools. Then, Colvin et al. (2015) interviewed 42 experts in LA and completed a cluster analysis of responses to capture the diverse view of stakeholders regarding LA. More recently, Tsai et al. (2018) developed the supporting higher education to integrate learning analytics (SHEILA) framework for LA policy and strategy. An intention of the SHEILA framework is an iterative approach to support LA's strategic planning in large-scale HEIs and real-world settings. Each framework defined vital points for LA implementation initiatives. See Table 2 for a comparison of the frameworks related to the LA Domains.

Table 2

Domains of LA Frameworks and Models

LA or System Framework Domains	LTLA Domains (West et al., 2016)	SHELIA framework dimensions (SHEILA project, 2018; Tsai et al., 2018)	LA Mediating dimensions (Colvin et al., 2015)	Learning Analytics Model (LAM) (de Freitas et al., 2015)	Quality Indicators for LA (Scheffel et al., 2014)	Critical Dimensions of LA (Greller & Drachsler, 2012)
Context	*"Institutional context"* Student demographics Staff demographics Size and structure Location Strategic positioning of university" (p.41)	*"Map political context" (p.1)* Contextual elements (e.g. institutional size, structure) Identify drivers for LA implementation	*Context:* institutional goals for LA (e.g., increase retention, support pedagogy)	"Linking LA within a wider dynamic context." (p. 1185) "Learner-centered service ethos – the unit of one" (p. 1184)	*"Organizational aspects"* Availability Implementation Training of educational stakeholders Organizational change	*"Internal limitations"* Competences Acceptance *External constraints* Conventions Norms
Leadership/ Governance	*"Institutional transitional elements* Culture Positioning of LA in institution Level of sponsorship Governance arrangements Alignment with institutional strategy Sustainability" (p. 41)	*"Identify desired behavior changes" (p.3)* Expected changes Areas of support for stakeholder engagement	*Leadership* Leaders with information and knowledge are critical. The use of distributed and centralized leadership occurred without significant difference.	"Rigorous view of ethics and adherence to the highest standard of ethical procedures" (p. 1185)	*Data aspects* Transparency Data standards Data ownership Privacy	*Data* Open Protected

LA or System Framework Domains	LTLA Domains (West et al., 2016)	SHELIA framework dimensions (SHEILA project, 2018; Tsai et al., 2018)	LA Mediating dimensions (Colvin et al., 2015)	Learning Analytics Model (LAM) (de Freitas et al., 2015)	Quality Indicators for LA (Scheffel et al., 2014)	Critical Dimensions of LA (Greller & Drachsler, 2012)
Infrastructure	*"LA infrastructure* Digital ability and integrity of data" (p. 41) Integration Data stewardship "Policy and Procedures" (p. 41) Project manager experience	*"Analyze internal capacity to effect change* Culture: trust in data and openness to change" (p. 6) The existing framework of ethics and privacy Evaluate financial and human capacity Infrastructure	*Technology* Establishment of an enterprise data warehouse (EDW)	"Commit to infrastructure for big data integration" (p. 1184)	*Data aspects* Transparency Data standards Data ownership Privacy	*Instruments* Technology Algorithm Theories Other
Strategy	*Transitional elements specific to initiative* Strategic planning for the initiative Governance arrangements for initiative	*"Develop engagement strategy" (p. 4)* Codes of practice Ethics committee Financial & Human resources Internal & external support Stakeholder engagement" (p. 4-5)	*Strategy* Use of a wide variety of implementation strategies; however, effective communication is needed to bring disparate units at institutions together. No dominant method of communication emerged.	"Develop a strategy." (p. 1183) "Adaptively model user behavior" (p. 1185)	*Objectives* Awareness Reflection Motivation Behavioral change	*Objectives* Prediction

LA or System Framework Domains	LTLA Domains (West et al., 2016)	SHELIA framework dimensions (SHEILA project, 2018; Tsai et al., 2018)	LA Mediating dimensions (Colvin et al., 2015)	Learning Analytics Model (LAM) (de Freitas et al., 2015)	Quality Indicators for LA (Scheffel et al., 2014)	Critical Dimensions of LA (Greller & Drachsler, 2012)
Stakeholders	*LA specific for the initiative* Questions from stakeholders The ability of a system to address questions Ease of use; accessibility Consideration of ethical issues	*"Identify key stakeholders" (p.2)* Primary users Senior management team Academic teams External partners Internal advocates Required expertise (e.g., IT, LA, statistical, educational, and psychological)	*Stakeholders* "People form a critical ingredient in the early stages of LA." (p. 28) Stakeholders mediate the potential of capacity through engagement and communication of goals and strategic vision.	"Qualitatively driven crowd-sourced hypothesis format." (p. 1185) "Dynamic look at the students' learning journey" (p. 1184)	*Learning Support* Perceived usefulness Recommendation Activity classification Detection of students at risk	*Stakeholders* Institution Teachers Learners Other" (p. 44)
Reflection	*"Intervention & reflection* Endorsed processes around actions driven by data Training, support, and time for stakeholders to use the system Modifications relevant to the feedback of the system" (p.41)	*"Establish monitoring and learning frameworks" (p.8)* Measuring milestones Establish indicators of success Seek stakeholder feedback	*"Conceptualizations of LA" (p.26)* Framing the problem is more important than how the problem is solved. The underlying epistemological and ontological values shape the pathways for achieving a vision related to LA	"External as well as an internal review of cross-validation" (p. 1186)	*Learning measures and output* Comparability Effectiveness Efficiency Helpfulness" (p. 133)	*Objectives* Reflection

The LA-related frameworks have more similarities than differences. Understanding the context and needs of the institution exists in each framework (Colvin et al., 2015; de Freitas et al., 2015; Greller & Drachsler, 2012; Scheffel et al., 2014; Tsai et al., 2018; West et al., 2016). All three included leadership and sponsorship through transparent governance, policy, vision, ethical considerations, and strategy. The frameworks also define the need for understanding the institutional readiness, ability, and technical infrastructure. A domain that related most closely to my study addresses the need to name and engage stakeholders. Finally, each study framework had a component of monitoring, evaluating, and reflecting upon the implementation process relative to the institutional context and other domains. The following section includes the literature review and themes from the LTLA framework and other LA frameworks throughout the research.

Literature Review Related to Key Variables and/or Concepts.

LA, at the time of this study, was an emerging field within educational technology and information management in HEI (Adejo & Connolly, 2017; Alhadad et al., 2015; Colvin et al., 2015; Ferguson et al., 2016; Motz et al., 2015). Also, LA has a multidisciplinary background. In higher education, the historical dynamics of pedagogy and technology have shaped LA and its institutional adoption (Colvin et al., 2015; Kitto et al., 2018; Lester et al., 2017; West et al., 2016). Professionals from the IT discipline often partner in educational technology implementations and course designs with academics and senior management. Furthermore, information systems (IS) and LMSs facilitated elearning and were precursors for LA systems (Adejo & Connolly, 2017;

Alamuddin et al., 2016; Avella et al., 2016; Lester et al., 2017; Mavroudi et al., 2018). Because IS was a precursor for LA systems, a study conducted by Doherty et al. (2012) is relevant to the implementation of LA systems. Doherty et al. reported that the 30 years of IS investments had a high failure rate. For example, one participant in the Doherty et al. comparative case study noted that the benefits planning process related to technology implementation felt imposed. The outcome was the hope of finding benefits that did not exist. Prieto-Alvarez et al. (2018) corroborated the finding that technology implementations had developed a reputation for end-user-imposed tools that do not work as expected. In the formative days of LA development, Clow (2012) noted that stakeholders needed to find value in relevant metrics measured using LA. Therefore, a critical difference in the LA innovation from other educational technologies is that an LA system's imposition will not be successful.

LA and elearning Applications

As elearning programs have expanded, they have supplied a rich data source for learning activities. The concept of elearning includes the design and delivery of instruction in a partial or complete digital format, with flexible access. Moreover, elearning creates trace data of learner's activities (Sener, 2015). Vijh et al. (2019) found that LA development was interdependent across technology systems and dependent on the institution's context. Multiple researchers have found that LA's progress and capability are dependent on other technologies (Colvin et al., 2015; Kitto et al., 2018; Lester et al., 2017; West et al., 2016). Specifically, research indicates that LMS systems and SIS supply student learning data for LA (Adejo & Connolly, 2017; Phua et al., 2019).

Also, Alhadad et al. (2015) found parallels between LMS and LA implementation processes. Other technologies, such as enterprise systems or data warehouses, have proven crucial for infrastructure used to support LA systems (Ifenthaler, 2016; Moscoso-Zea et al., 2016). Other research showed that multidisciplinary background, interdependent systems, and institution-specific needs behind LA implementation forced HEIs to use LA in various ways (Colvin et al., 2015; Kitto et al., 2018; Lester et al., 2017; West et al., 2016). According to Arroway et al. (2016), data suggested most knowledge and input from LA occurred in fragmented groups, and instructors had limited awareness of the initiatives taking place in their institutions.

Dawson et al. (2014) conducted a citation network analysis (CNA) to understand the field trends. The CNA included all the papers published in the first 3 years of the Learning Analytics and Knowledge conferences and three special issues from journals related to LA. The researchers used social network analysis to identify the author's network. The first step in the CNA was to set up each author of an article as a node. Then the citation network developed through the authors cited in the papers. Each citation had the value of "1" regardless of the number of times an article citation occurs in one document. A tabulation of the authors' home discipline, type of research contribution, and research methods resulted in 51% of the authors from computer science and 40% in education. The remaining home disciplines represented were mathematics, linguistics, engineering, industry, business, environmental studies, and medicine. In addition to the authors' multidisciplinary aspect, a minority of the literature held empirical studies and revealed a gap in empirical evidence for LA outcomes.

Educational professional organizations have supported LA research. For example, EDUCAUSE, a nonprofit association whose mission is to advance HEI using IT, started the LA's inquiry in 2012 (Arroway et al., 2016). The office of learning and teaching in Australia sponsored studies related to LA (Colvin et al., 2015; West et al., 2016). The number of LA studies increased from 2009 to 2015 (Mavroudi et al., 2018). However, I did not find sources with empirical studies showing clear evidence of LA benefits and pathways for implementation at an institutional level in this literature review.

Limited empirical research about LA exists (Dawson et al., 2014; Mavroudi et al., 2018). However, big data is related to LA and elearning, and studies about big data exist. Understanding big data systems adds insight into knowing how elearning systems collect data and LA systems analyze data. Cantabella et al. (2019) conducted a case study at the Catholic University of Murcia, Spain. The study's data consisted of over 70 gigabytes pulled over 4 years from 76,268 students who produced 79,432,423 data points. Students used an LMS in one of the three modalities available: online, blended, or on-campus. During 1 academic year, the staff made a lesson builder tool available to all students. Findings showed that student use of the tool increased their engagement and participation in forums. The researchers used big data to understand the influence of learning tools. Still, a gap exists between the possible benefit and current practice (Wei et al., 2019). As part of the LA growth, indicators for implementation readiness and quality program can clarify its function and practical use.

A factor of successful adoption is an institution's readiness for LA implementation. One study for LA readiness (Arnold et al., 2014) tested the LA readiness

instrument to indicate an institution's readiness for LA implementation. Then the researchers surveyed nine HEI stakeholders to collect responses aligned with the LA readiness instrument. The results showed five readiness components for LA implementations: ability, data, culture and process, governance and infrastructure, and overall readiness perception. Ifenthaler's (2016) quantitative study used an LA benefit survey to investigate HEI's capabilities for LA. The researcher determined that LA, an emerging field, for which HEI's infrastructure was unprepared. A study sponsored by the Australia Office of Learning and Teaching conducted by West et al. (2016) collected qualitative and quantitative data reported that stakeholders rated their institutional preparedness and support for LA as weak. The specific aspects of LA reviewed for the rating preparedness included information about how LA affected users, opportunities to provide feedback, ease of visualization, use of information, relevance and comprehensiveness of data, ease of data access, and professional development about LA. The significance of the findings in these studies shows a need for standards to guide senior management to target areas for LA implementation readiness within elearning systems.

A few studies focused on quality indicators related to LA. In the early development of LA, Pomeroy (2014) examined why administrators did not use analytics to identify key performance indicators in HEIs. The researcher found that academic managers had a limited level of awareness of analysis tools; thus, they did not support or encourage analytics. Scheffel et al. (2014) used a two-phase Delphi method to develop a list of LA quality indicators. First, they generated ideas from 74 stakeholders in the field

of LA. The second phase involved 55 experts clustering and rating the first group's ideas to produce a list of quality indicators for LA systems. The quality indicators fell into five categories: objectives, learning support, learning measures, data aspects, and organizational aspects. In the second phase, the findings of LA targeted in this study showed that organizations were most successful in LA acceptance when they made the system readily available, had an implementation strategy, trained stakeholders, and promoted openness to organizational change. Arroway et al. (2016) found that while LA was a minor priority for most institutions; however, most had planned deployments. The use of quality indicators in literature sources can help institutions prepare for LA implementation.

Context and resources of an institution are related to implementations' success; however, these approaches vary across institutions. Mavroudi et al. (2018) noted several types of measurements and metrics used for LA at different institutions. Data types collected and analyzed included collaboration data, time spent on learning materials, variety of completed assignments, exam scores, number of peer endorsements, self-graded responses, number of attempts, average student grade, average class grade for each question, time stamps, posture and gesture features, and number of posts. Mavroudi et al. found multiple tools in the field that collected data and generated feedback to users.

Although LA systems contain a wide variety of tools, some tools are more prevalent than others, such as data visualization (Avella et al., 2016; Mavroudi et al., 2018). Often the visual display is that of a bar, box, or line plots. The goal of the dashboard to quickly communicate trends or highlight actionable items. McKenna et al.

(2019) examined the use of dashboards as they provided students facing a visual form of LA to promote critical feedback. They showed graduate students a graphic of individual review quiz scores and then asked them to complete a vital reflection activity using the LA tool's visual form. Results indicated that the graphic increased the student's ability to remember the learning activities for self-reflection.

However, the dashboard and visual forms of LA support can only occur if the end-user views the graphic. Coverdale and Hendrickson (2019) conducted a study to understand the usage of a dashboard created for deans and program chairs to provide necessary data. Findings showed that only 33% of the users had accessed the data over three months. Thus, the influence of the LA tool on practice depends on the target audience's decision to access the dashboard.

Barriers and Challenges to LA Integration

HEI interest in LA implementation has been high; however, adoption levels have been low due to barriers and challenges related to immature integration (Tsai & Gasevic, 2017). Obstacles include a wide variance of data use, limited resources, complex data integration, technical challenges, and educational culture. Persistent barriers suggest a need for an adaptable implementation framework that fits multiple institutional environments and works between institutions (Alamuddin et al., 2016). Colvin et al. (2015) found that LA implementation required collaboration from disparate stakeholders. Yet, the process of implementation is uncharted, and institutional leaders have limited examples or guidance for teaching and learning standards for elearning and LA.

Wide Variance of Data Use

Drivers for LA increase comprehension of the wide variance of data use. The drivers behind LA implementation have depended upon the institutional context, mainly student and staff demographics and characteristics, and the size, structure, and strategic positioning of the institution. Ferguson et al. (2016) conducted an evidence-based inventory of 28 LA tools. They found the purpose varied from the generation of alerts for performance, prediction for future behavior, which produced recommendations for action or adapted learning material or activities. LA tools existed in different formats embedded in other elearning systems, management systems, stand-alone or enterprise, created in-house by the organization or provided by a third-party vendor. Avella et al. (2016) also found various approaches to LA, including visual data analysis techniques, social network analysis, semantic, and educational data mining, to analyze the data.

In addition to LA tools and approaches, one of the documented challenges for LA implementation is that stakeholders hold different perceptions of LA (Tsai & Gasevic, 2017). Individuals involved in the LA system as either beneficiaries, participants, or both play a role in an institution's dynamics. Furthermore, each person may have a financial, technical, motivational, and cultural investment in the LA project that could create obstacles or serve as an asset to progress, leading to a wide variance in student data practices across institutions (Alamuddin et al., 2016). Thus, the approach to LA implementation is context-specific for institutional and individuals. Arroway et al. (2016) found that the system's design was essential to accommodate data variability, provide universal definitions, and recognize diverse analytic methods. Thus, a key strategy to

achieve a practical system design may bring researchers, instructors, and faculty into the early design process.

Limited Resources

Using an outside vendor has been a solution for institutions with limited resources to manage LA's data requirements. However, a partnership with third-party entities has resulted in further challenges regarding data ownership. Arroway et al. (2016) found that data ownership challenges occurred when vendors and institutions did not clearly define data ownership. An example of management of limited resources and data rights came from a group at LaTrobe University in Melbourne, Australia, who implemented a system-wide student success initiative (Cox & Naylor, 2018). The group attributed the program's success to the use of in-house data and well-trained internal consultants that understood the student population. Therefore, institutions should evaluate current resources, set up external partnerships with full awareness of data ownership, and customize vendor-developed programs.

Difficult Data Integration

Data integration is the ability of disparate data systems to exchange data in real-time and maintain accurate information. Integration depends on the data sources' compatibility or the system's capability to interpret the data from disparate systems. A helpful system integrates the data in real-time for the student, the student's advisor, and the student's instructor (Pomeroy, 2014). The infrastructure of the system effects data integration. Infrastructure refers to the structure of the data system the either inhibits or eases the processing and flow of data. A well-designed infrastructure is critical to an LA

program (de Freitas et al., 2015). Parnell et al. (2018) examined how disparate data systems functioned on a campus. While all units contributed to institutional-wide goals and primary data-oriented roles and responsibilities, they worked in isolated environments. Colvin et al.'s (2015) study of Australian university's successful LA implementation required an Enterprise Data warehouse (EDW) to avoid isolated data management. Issues that can occur when data integration for an EDW is inaccurate or inefficient can result in incomplete data or slow report generation (West et al., 2016). The success of the implementation was reliant upon a user-friendly interface and accurate data. However, practical challenges regarding the infrastructure needed to support LA's tools exist (Cope & Kalantzis, 2016). If system architects do not communicate with the end-users during the development stages, problems are likely to ensue.

Technical Challenges

Historically technological innovations have failed if the technology does not work as expected, takes too much time to learn, is disruptive to practice, or the end-user does not understand the benefit of the technology (Christensen et al., 2015). Technology development includes design refinement. Early in the lifecycle of technology, breakdowns occur often, or end-users find the technology awkward to use. Furthermore, the cost of keeping pace with developments may create demands on institutional resources (Arroway et al., 2016). A literature review of Big Data in education focused on data generated from student writing Cope and Kalantzis (2016), found that LA facilitated a shift in assessment. A factor in the emerging assessment models was that learners and teachers need to be data literate and act as data analysts. Analytic dashboards and

visualizations support the capability of data analysis by a more extensive set of stakeholders. The shift in data literacy requirements aligns with the need for system-wide Stakeholder adoption for LA programs. Also, co-design work of data scientists who build the dashboards and those who are targeted users. Stakeholders involved in the learning environments include students, researchers, instructional designers, and educational software developers. Ifenthaler (2016) found that HEIs lacked staff and technology available for LA projects. Therefore, adequate and knowledgeable staffing is vital to implementation to fill the gaps that affect successful adoption.

Educational Culture

Educational culture differs from business and industrial cultures because the product in education is the development of a human being, which takes longer and is more dynamic than producing inanimate objects. Also, education has an established bureaucratic climate that has historically prevented a shared vision for the implementation and use of analytics (Pomeroy, 2014).

Three studies outlined here show different approaches to understanding educational culture and technology implementation. One study aimed to investigate the use of Excel in teaching basic statistic course using for preservice teachers (Aydin, 2016). The method used was a pretest and posttest quasi-experimental design. The study sought to answer two questions: one, the feasibility of using Excel in teaching a statistics course, and the second, about the effect of using Excel in instruction on pre-service teacher's attitude toward statistics. The study's findings were that most students had access to Excel and knowledge of file management with the software. However, the use of Excel

software in the course created a need for extra tutoring support. The attitude of the experimental group toward statistics was better than the control group in the post-test. The pre-test shows no significant difference between the control and experimental groups. In a literature review conduction by Tsai and Gasevic (2017) to understand the state of LA adoption regarding the challenges in HEI and how existing LA policies have tried to address the challenges. The researchers found that it was possible to bridge the gap in stakeholder perceptions by addressing different understandings and awareness through collaboration and cohesion during LA's implementation. Also, training is necessary to address the lack of staff analysis skills that impeded the school-wide implementation of LA. A study of HEI instructors used surveys to collect LA perspectives (Wei et al., 2019). Instructors did report that they wanted the university to devote more resources toward LA but did not want to participate in funded LA projects. The reason for the conflicting perspectives became clear after coding the open-ended responses. Instructors dealt with time pressures and had concerns about learning new software and taking the time to collect and analyze data. They also believed that the time it took to learn an LA system would only have minimal benefit for practice. Literature and studies regarding technology implementation outline practices that address adoption barriers, each with a component that requires stakeholder interaction with data analysis at some level.

Benefits of LA

LA provided data analysis to help stakeholders understand and track student attrition. For example, HEI student enrollment demographics have grown and become

more diverse (National Center for Education Statistics, 2019a). The increase in diversity without increased available resources required institutional leaders to find a solution to address student completion rates in an efficient manner (Stearns, 2016). LA systems can provide granular and timely analysis for student data (Avella et al., 2016; Tempelaar et al., 2015). In the 2018 National Center for Education Statistics (2019b) *Undergraduate Retention and Graduation Rates* report, the graduation rate was 60% for first-time, full-time undergraduates enrolled in a 4-year bachelor's degree program who completed in six years. As a result, external pressures to improve retention rates to keep accreditation and funding from government sources were a reality many HEIs face (Arroway et al., 2016). Alamuddin et al. (2016) created a report through interviews with leaders of student success initiatives in the United Kingdom and the United States. They used data to gain insights into student learning and instructional effectiveness. Findings indicated LA supported the student success initiatives by providing large-scale data with granular capabilities to analyze learning behavior with scope and depth.

Institutional stakeholders can use LA to create advantages for at-risk students. For example, an LA system using large datasets can generate predictions based on learners' actions and recommend interventions to improve learning. Alamuddin et al. (2016) noted that the data sets' use gave insight to patterns in learning behavior that administrators, advisors, and instructors used proactively to address barriers to completion. Thus, analytics made learning activities more visible and actionable.

Literature about the benefits of LA includes meta-analysis as well as studies. Avella et al. (2016) conducted a meta-analysis of 112 articles published between 2000-

2016 that directly addressed LA's benefits, methods, and challenges. An LA benefits Avella et al. found showed increased effectiveness of instructors in the classroom from information provided about student learning activities. Furthermore, Alamuddin et al. (2016) acknowledged that barriers to LA exist; however, the effort to overcome the challenges was worthwhile to achieve student benefits. Because of limited empirical data of LA outcomes, organizations that implement LA could use information from meta-analysis regarding the innovation benefits.

Organizations involved in LA implementation have experienced unintended consequences. Early on in LA research, Doherty et al. (2012) found that benefits arise from organizational change, including improved information usage, which goes with an IT implementation rather than directly from the technology itself. For example, faculty were more aware of student needs, students were more aware of their performance, and staff learned about other stakeholders. Sclater (2014) reported that two institutional case studies revealed that analytics improved communication channels between the organization's disparate parts. Another positive example written by Angotti and Rosenberg (2018), who used LA to evaluate the use of a Science, Technology, Engineering, and Math skills center, found that using data for LA facilitated cross-disciplinary communication among stakeholders, which increased collaboration and had a positive impact on the university community.

Institutions pursued LA to obtain a benefit; however, the rationale for implementing LA shifted as the implementation matured. Tsai et al. (2019) conducted a study with institutional leaders at 27 HEIs. The institutions fell into two categories-based

lengths of an LA program. A natural division occurred at 1 year, and only two had a program older than 3 years. All institutions had a strong co-occurrence between institutional goals and problem-led approaches. However, institutions with less experience had strong co-occurrences between institutional goals and measured criteria. In contrast, institutions with more experience showed more branching events to co-occurrences between institutional and teacher goals and institutional goals and exploratory approaches. The research trends indicate a shift toward a broader scope of data and plans regarding LA projects, which will require dialogue among various stakeholders.

Student Retention Supported by LA

Many institutions adopt LA to boost retention rates using an early warning system (EWS) to alert students, instructors, or professional staff of academic concern. Lonn et al. (2015) conducted a quantitative study that examined the consequence of an LA-supported EWS. Advisors used the EWS system to target student needs during one-to-one sessions with students to discuss the bridge program's progress. The bridge program helped at-risk students successfully transition from high school to college. Students completed surveys to determine their motivational orientation: mastery, performance, or performance-avoidance. The students with performance and performance-avoidance motivational orientation showed no significant difference from the pre- to post-survey. However, the mastery-orientated students showed a negative change correlated to the number of times the advisors showed the students the data in the EWS. Thus, providing data related to

learning performance to students had mixed results for the population of students in the Bridge program.

In contrast, a study conducted at a University in Saudi Arabi in a computer science course where the experimental group used a student-centered dashboard with LA data (Aljohani et al., 2018). Two independent groups in the same course with the same lecturer formed through a random selection process made up the control and experimental groups. The student data dashboard's introduction to the experimental group resulted in three indicators related to the LMS, engagement. The three indicators were LMS access, access to the discussion board, and the number of threads added to the discussion board. The students were able to view individual data and compared it to the course average and the top student. During the first 20 days, both groups were provided data by the lecturer. After 20 days, the experiment group learned how to access the dashboard in the course. The data analysis utilized MANOVA and statical-tests to determine if a significant difference existed among the groups. In the first 20 days, the control groups showed engagement levels related to the three indicators. However, after 20 days, the experimental group had a higher engagement level than the control group. In 40 more days, the difference in the three indicators was highly significant between the groups. The results showed that the student-centered dashboard stimulated the student's engagement and motivated them to engage more with the LMS. Although the academic performance was not an indicator included in the study, the experimental group did have higher academic performance. Given these studies' results, the development of LA systems

where students are the targeted audience should require student input and a clear view of intended and unintended consequences.

LA systems have identified patterns in student attrition. An institution that used LA tools designed to predict attrition rates based on a closed set of demographic variables showed attrition patterns for a student cohort. (Zhuhadar et al., 2017). The researchers examined demographic effects on graduation rates for Math majors using LA tools over 6 years. Sixty-two percent of the students graduated in 8 years. Researchers found that race and gender did not have a significant impact on graduation rates. However, high school grade point average combined with American College Test composite score had an inverse correlation with attrition math major degree completion. The design of logic models facilitated the identification of courses with poor performance correlated with attrition. The researchers located nine math courses in which high academic performance connected with degree completion in Math. Also, if students left the program in the first couple of years, they likely switched majors, but they usually dropped out of school if they went after four years. They also found that the attrition rates increased the longer it took to graduate. The researchers reported that LA tools were integral to understanding attrition patterns and learning the students' areas to address.

Another example of using LA for retention involved monitoring interventions related to retention rates of contacted students. The study occurred at the LaTrobe University in Australia (Cox & Naylor, 2018), where the school implemented an institution-wide student success initiative and examined its efficacy. To determine the efficacy, the researchers designed an experimental study to compare a treatment group

and a control group. The treatment group received contacts via phone to provide intervention options to improve performance. The control group received no communication. The treatment group determined through a random selection made up of 50% of the at-risk population (4,487) students enrolled at LaTrobe in 2017. No significant demographics existed between the contacted and noncontacted groups.

Data collection consisted of a system that recorded calls and the rates of successful connections and receptiveness of the request. Cox and Naylor (2018) used LA tools to analyze the attrition rates of students at LaTrobe. The entire student population had a 19.5% attrition rate, while the uncontacted group had a 27.35% attrition rate, and the contacted group had a 7.85% attrition rate. This study provided empirical evidence that successful contact with students correlated with LA prompted intervention action resulted in higher retention rates. Thus, LA tools that generated alerts for student performance during the course or program, which support staff acted upon with student contact, provided timely support to correct failures and boost retention.

Predictive Analytics

Predictions about future events in any market carry risks, but predictions that affect human subjects involve an increased level of concern regarding accuracy. To increase the accuracy of predictions made from human activity patterns, predictive models must use large data sets (Arroway et al., 2016; Avella et al., 2016). The benefit of predicting students' success based on known learning activities can guide interventions for all students; however, the predictions need to be accurate.

Gašević et al. (2016) examined the influence of instructional conditions on academic success. The sample population included nine first-year courses using a blended model and LMS across disciplines with an enrollment of 4,134 students. Student personal data from the SIS was correlated with student trace data and applied to a predictive algorithm. The predictive analysis used a general model to determine academic success in all courses. The results showed no single predictor existed across all three disciplines (English-communication, social sciences, math-science-technology). Therefore, generalized models can over or underestimate the predictive power of data. Consideration of instructional conditions to understand the variables required specific course or student characteristics. While findings suggest limitations of LA, it may be that instructors are integral in the development process of models. Also, it may be that customization of generic software at the course level would allow the management of course-specific models. LA is not about a generic model that fits all learners, courses, or institutions.

LA Used to Inform Pedagogy

The use of LA to improve pedagogy shifts the role of LA from reacting to learners' actions to influencing learner actions through teaching. Greller et al. (2014) stated that LA's use to initially guide learning and teaching focused on educational data mining and algorithmic approaches. However, the analysis of pedagogy can produce pedagogical consequences for personalized learning and curriculum adjustments. Thus, instead of playing a supporting role to improve the metrics associated with learning, LA served as a tool to direct instructional decisions for students, teachers, administrators, and

instructional designers. Alamuddin et al. (2016) found that representation of student learning through data increased personalized student feedback, thus improved outcomes. Researchers have found that targeted, personalized real-time feedback that occurs in adaptive learning coupled with data analysis and self-reflection training for students has allowed them to make instructional choices as they work toward mastery of content (McKenna et al., 2019; Mavroudi et al., 2018; Phua et al., 2019). Student's work toward content mastery with guidance from instructors and data analysis has shifted the learning environment, possibly disrupting the grade marks' traditional structure to reflect content mastery of a given course.

There are few empirical studies on the topic of LA used in practice to support pedagogy at any level: primary, secondary, or postsecondary. Some K-12 research provided insight into how LA can inform pedagogy at the HEI level. An example of LA that supported a student-centered mastery design occurred in an after-school online 7th-grade math course. Phua et al. (2019) examined the use of adaptive learning, an enhancement made possible through the interaction of online material completed by the learner and real-time analytics. In an AL system, as the learner completes activities, they receive feedback and tutorial support. If the student shows mastery of content, then new content is made available. If the student does not demonstrate proficiency, additional materials on the topic with another option to prove mastery and more materials become available instead. In Phua et al., student performance determined the pace of the course. A part of the study was a quasi-experimental evaluation of the implementation of an adaptive math platform. Findings showed all students mastered the material based on the

pre-quiz and final quiz. The implication for practice moving forward is that the AL, combined with the LA learning process, requires individual pacing for students. That requirement will change traditional classrooms' format in which teachers follow lesson plans based on pre-determined benchmarks. To move to a new form of learning, stakeholders will need to work as partners to support students.

Changing the traditional classroom format can be a disruptive innovation. Nafea and Toplu (2018) stated that quality education is only possible through disruptive, system-wide innovations. For example, Dunagan (2017) studied the decision-making processes used to solve problems through five case studies of HEIs. Findings indicated that changes fit either a pathway that sustained the current process or disrupted how the system works. Implementing mentor and coaching initiatives using LA met the classification of sustaining innovations in the study because LA moved the institution forward by deploying resources or new processes to enhance or complement existing practices. Organizations with well-established procedures and practices readily accept sustaining innovations.

In contrast, disruptive innovations can shift the organization's priorities and risk rejection, especially if it has long-standing traditional practices. Dunagan (2017) noted that both types of innovations had a purpose, and the value of the innovation lay in the stakeholders' perspective. As such, the inclusion of support to understand the innovation needs a part of the strategic plan and communication given the institution's business model.

Motz et al. (2015) examined how student data in a student portfolio report (SPR) helped instructors before meeting the students. An assumption related to providing the SPR to instructors was that instructors were more effective if they knew more about students before meeting them. Instructors in 41 courses received the SPR, which was the treatment. The control group consisted of 33 instructors and received no SPR. A comparison of grades between the treatment and control groups showed no measurable effect of inflation or deflation in the final letter grade outcome. Most instructors that received the SPR reported that they found the information interesting and provided a new perspective on their students. The SPR increased learner-centered views of faculty and indicated access to student data might be helpful. It is important to note that instructor knowledge about a student before the course did not produce a bias for pre-conceived expectations of student performance. Avella et al. (2016) conducted a literature review of LA implementation and reported that LA revealed instruction practices in elearning environments, which provided opportunities for instructor development. Trace data of student actions had a minimal effect on pedagogy but helped build awareness of interventions instructors and support staff can offer for student success.

Just as a wide variance of LA approaches exists, the same difference within the LA application for pedagogy improvement exists. The use of qualitative and quantitative methods of data collection guided pedagogy. Martin et al. (2016) conducted a study of one course where the instructors used Tableau to collect qualitative data from student learning activities and Many Eyes to analyze qualitative content from discussion boards. Instructors received Tableau reports with the student learning events. The instructors had

information about the quiz activity duration, the number of times the quiz attempts, and the score. Instructors provided intervention for students with low scores and recommended specific quiz-taking strategies based on their actions. Also, instructors received themed analysis from discussion forum posts and tailored course resources to address student interests and needs. The instructors reported that the LA tools data helped them target and adjust student's behavior to improve performance before the course ended.

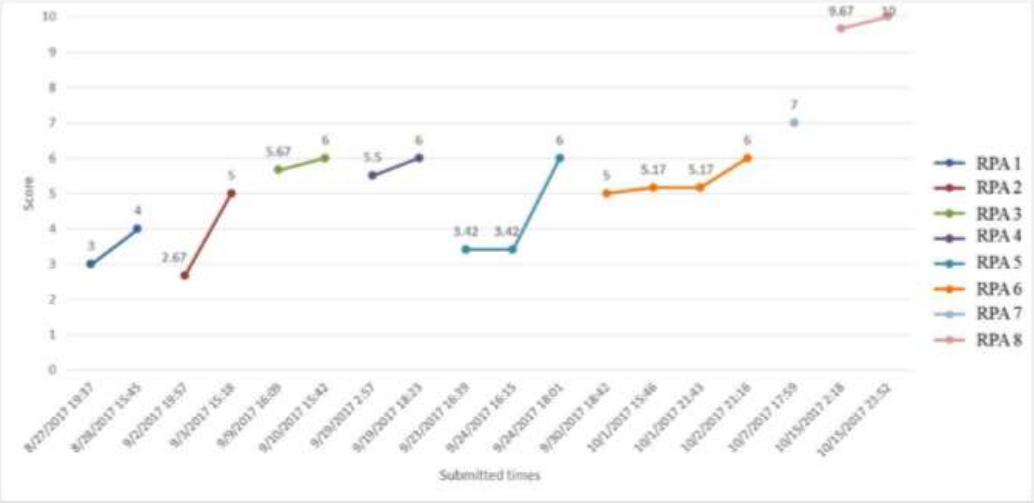
Studies from elearning environments at all levels inform instructors about the application of LA tools. An example involved a study from the elementary level regarding the instructor's interaction with the dashboard completed by Vijh et al. (2019). The study determined the effectiveness of offering LA reports to teachers with online students. The sample population included over 1.2 million individual scores from 40,000 learners enrolled in a K-6 online math program from 2017 to 2018. All students received LA support in 2018. A comparison to 2017 served as a control, as all other factors among the student groups were similar. The system tracked and generated reports of teacher dashboard usage. Dashboard usage fell into four groups, 0% access, 30% access, 30-60% access, and over 60% access. In the first month, no significant difference between treatment and control group scores existed. However, after one month, the student's scores with teachers accessing LA data increased. The students of the teachers who obtained the reports 60% or more presented with the highest performance, followed by the group with teachers using the system 30-60%. The results showed that when teachers

used LA data to track student performance, it positively influenced student academic achievement.

A study conducted by Wei et al. (2019) surveyed just over 100 HEI instructors to understand perspectives about LA. The researchers learned that instructors had concerns that LA systems would not address student needs beyond academic performance and retention, such as critical thinking and reflection. However, McKenna et al. (2019) examined graduate student use of an LA tool labeled as a visual form of LA to prompt critical reflection. Visual-form LA is a data approach that involved a graph or display of the data standing for student activity or learning. See Figure 2 for an example of the visual-form LA used in the study.

Figure 2

Example of a Student's Visual Form LA



Note. From "Visual-Form Learning Analytics: A Tool for Critical Reflection and Feedback"., by K. McKenna, B. Pouska, M.C. Moraes, and J.E. Folkestad, 2019,

Contemporary Educational Technology, *10*(3)*,* p. 220. Copyright [2019] by Kelly McKenna. Reprinted with permission.

The researchers' objective was to determine if the LA tool served as a pedagogical tool in promoting critical student reflection about learning outcomes and habits. The students reported that they understood the concept of high-impact learning practices (HILP), a significant curriculum focus of the course. Other findings revealed that although students intended to change behavior based on information they learned in the class, their engrained learning habits persisted. For example, the student behavior showed high score orientation, which meant that no more quiz attempts occurred after reaching the highest score possible. The HILP concepts students studied included interleaving and content retrieval. Therefore, students could take multiple quiz attempts from material covered earlier to increase knowledge retention. Taking the quizzes from the beginning of the class to later intervals even after the high score achievement would have demonstrated the HILP concept through interleaving and content retrieval behavior in practice. The study is an example of using an LA tool for pedagogical practice to guide learners to HILP, critical thinking, and self-reflection.

LA for Program Evaluation and Research

LA tools support efforts related to program evaluation and supply research data. LA is a valuable tool for understanding the use of student learning centers. For example, Avella et al. (2016) reported that LA data provided administrators and instructors information to improve course offerings. Also, Angotti and Rosenberg (2018) used LA to evaluate the use of the student skills center for gateway math and science courses. Results showed that females and underrepresented ethnic groups had higher usage of the skills

center relative to course enrollment demographics, thus helping administrators make decisions about the need for student support resources. Saxena and Kasparian (2019) examined work completed by the academic quality assurance team to develop a sustainable process to measure learner performance. Gaps identified to improve data reliability included: alignment- rubrics aligned with learning outcomes, consistency-same assignments used across class sections, and accuracy-rubric calibrated, so data is the same (interrater reliability). Findings showed that the faculty used the reports generated from data when accuracy improved through addressed gaps and increased data reliability.

Research studies require data, and LA systems collect data. Therefore, the fit between research and LA is often well matched. Nistor et al. (2014) used social network analysis, one type of LA, to verify the technology acceptance model and virtual Community of practice model. The LA system correlated data collected to participation, expertise, and use-behavior of educational technology. The findings showed a partial confirmation of the unified theory of acceptance and use of technology model and validation of the community of practice model. In another example, LA tools helped the researcher analyze skills and knowledge requirements from the job market and aligned student interests with the curriculum, thus increasing education's relevancy (Avella et al., 2016). LA tools provided data to facilitate research and evaluate programs. In both areas, the stakeholders sought data, and LA increased the efficiency and accuracy of data collection and analysis.

Effective LA Practices

HEIs vary in practice and implementation strategies; however, few institutions have employed full-scale implementation (Colvin et al., 2015; Ferguson et al., 2016). Broos et al. (2017) conducted a "small data" (p. 95) study with an introduction to a dashboard as an LA tool. The researchers invited 1,905 students to use the dashboard, for which 887 accessed the tool. Researchers found that students with higher performance had higher use rates of the dashboard. Thirty-two percent of the students that used the dashboard provided feedback with positive ratings for usefulness and clarity. Researchers attributed the success of the LA dashboard to beginning the program with a small group of students. Shepard et al. (2019) found that departmental culture influenced the adoption of new ideas and practices. Therefore, the strategy of a top-down, bottom-up, and middle-out approach worked best. Along those same lines, Colvin et al. conducted two studies and combined the findings to develop a model for system conditions for sustainable LA practice. The study results determined a need for a strategic plan to build stakeholders' interest in implementing the innovation. For these results, a sustainable LA system required integrating actionable data and tools aligned with educator practices. Also, organizational learning capacity should be in place to monitor the implementation and create information flow for improvements.

Early Engagement of Stakeholders

Themes in the literature regarding strategies for how to create inclusion, system-wide implementation mentioned engaging stakeholders throughout the process through the use of communication, conversation, knowledge sharing, and collaboration (Arroway

et al., 2016; Ferguson et al., 2016; Nafea & Toplu, 2018; Parnell et al., 2018). "Successful analytics does not begin with a set of data; they begin with an understanding of how people learn" (Ferguson et al., 2016, p. 38). To move toward understanding how people learn and the process of capturing the essence of learning, using a variety of stakeholder perspectives, researchers offered suggestions from previous studies. Early on in LA research, Doherty et al. (2012) found that stakeholders should tailor the program to the specific organizational context. Gašević et al. (2016) discovered that instructors were integral to the development process of LA models. Arroway et al. (2016) stated that the IT role was essential to LA implementation's success.

Researchers used various labels to define the stakeholders involved in LA. Some researchers describe the stakeholders by department: student affairs, IT, institutional research, academics, professional staff, program directors, faculty members, heads of school, and senior executives (Alamuddin et al., 2016; Arroway et al., 2016; Cox & Naylor, 2018; Parnell et al., 2018; West et al., 2016). Other researchers use the stakeholder's role: information officers, students, instructors, advisors, leaders, administrators, course developers, LA specialists (Alamuddin et al., 2016; Arroway et al., 2016; Avella et al., 2016; Gašević et al., 2015; Parnell et al., 2018; Tsai & Gasevic, 2017; Wei et al., 2019; West et al., 2016). Parnell et al. (2018) identified student affairs as leaders in using data to influence students.

Arroway et al. (2016) found that advisors had more favorable outlooks on LA than faculty members. IT and institutional research tend to work together on LA projects (Arroway et al., 2016; Parnell et al., 2018). An early LA research study from Greller and

Drachsler (2012) found that institutions labeled stakeholders as data subjects or data beneficiaries. Data subjects supplied data, and beneficiaries used the data. Instructors served as data subjects and beneficiaries. If students received data, they became beneficiaries. The researcher defined institutions as stakeholders but not data subjects. Mavroudi et al. (2018) divided stakeholders into two groups, called main participants and main beneficiaries.

In contrast to Greller and Drachsler (2012), Mavroudi et al. (2018) noted that students were the main beneficiaries. Another view from Knight et al. (2016) stated that students and teachers were the main beneficiaries. Regardless of the labeling scheme, the beneficiaries needed to perceive LA systems as applicable (Pappas et al., 2017). Dialogue between beneficiaries and system designers facilitates the process of matching user needs with the system function.

The inclusion of all stakeholders in a system-wide strategic plan was a goal reiterated in the literature for many LA programs. Brown (2014) conducted a study related to human learning complexity and found the social experience was more effective than learning in isolation. Therefore, developing the LA program using a social design system increase effectiveness for learning. Gašević et al. (2015) Found, when Stakeholders collectively decide on system metrics, it increased the value of the information. Avella et al. (2016) found that an inclusive strategy enhanced the student experience as all stakeholders worked to ensure learners benefited from data used consistently. According to Kitto et al. (2018), dialogue among stakeholders must build understanding and respect for various design and use criteria because LA is an

interdisciplinary system. With several groups involved in the process, stakeholders need system-wide inclusion related to the LA innovation.

Examples of inclusion practices that increase the understanding among stakeholders and engagement are helpful. de Freitas et al. (2015) conducted a mixed-method study with data from over 500,000 students and developed a learning analytics model (LAM) focused on stakeholders' interaction. Stakeholders used the LAM to develop an algorithm through collaboration used to describe each group of student behavior. In another example, Ferguson et al. (2016) examined five case studies of LA program implementations. The researcher found that a vital component of success included collaboration and networking that engaged stakeholders to create valuable features in the system. Another study at LaTrobe University investigated the student success initiative implementation. The academics, professional staff, and program directors met monthly to discuss student progress and support of student achievement (Cox & Naylor, 2018). Thus, the approach to inclusion varies from one program to another; however, if a structure and incentive from leadership exist, collaboration is more likely to occur (Nafea & Toplu, 2018).

Arroway et al. (2016) discovered evidence that risks existed the LA focused heavily on IT or academic issues. The risk is related to ignoring IT, limited scalability, or transfer from one department to the next. On the other hand, a narrow focus on IT reduced the inclusion of perspectives from different stakeholders and rationale for pursuing LA. There is evidence that a holistic approach can result in the inclusion of more stakeholders. A similar finding by Tsai and Gasevic (2017) revealed that

discrepancies among stakeholders resulted from the focus on technical issues rather than pedagogical concerns. These unintended consequences examples show that while institutions may include stakeholders, administrators may not understand how and when institutions include or exclude stakeholders.

If LA systems include student-oriented options, institutions commit to diligent accuracy, ethics, and inclusive practices. Drachsler and Greller (2016) found that when students used data, they required data literacy. Thus, including data literacy skills became a part of the implementation strategy. Knight et al. (2016) found a core need was input from students about LA systems' design. Information gathered from student beneficiaries included dashboard designs specific to the discipline and support management in the LA system.

LA Management Approaches

Successful technology implementation has occurred under top-down, middle, and bottom-up management approaches (Shepard et al., 2019). Regardless, Colvin et al. (2015) stated that leadership was a critical dimension for LA implementation. The researchers found that leaders with knowledge in the field were necessary; however, no significant difference existed between the centralized or decentralized leadership approach. Furthermore, leadership locally distributed may be more responsive to changes in the environment but less able to support system-wide cohesiveness. Policies can guide local and system-wide cohesiveness.

Tsai and Gasevic (2017) reviewed LA policies regarding both legislative and non-legislative components. The researchers found that communication was valuable to the

smooth implementation of any innovation, but policies had limited communication guidelines. The only clear policy statement about contact directed staff to inform students about the option to submit complaints about the system. None of the policies contained guidelines to facilitate two-way communication across departments and levels. Exact alignment between policy and practice may not be realistic; however, having policies as a reference for practice expectations can help mature the innovation and promote knowledge sharing.

Knowledge sharing requires culture for sharing support by top management and information repositories (Nafea & Toplu, 2018). Prieto-Alvarez et al. (2018) found that successful leadership avoided imposing educational tools misaligned with pedagogical needs, practical challenges, and learning designs. A strategy that reduced imposition was employment re-profiling to staff or a more flexible and dynamic context (de Freitas et al., 2015). Thus, the influx of new perspectives and dynamics to organizational culture can create openness to innovation.

Institutional Culture and LA Innovation

Culture is an ecosystem, and the elements of a culture interact with and reinforce each other (McGregor & Doshi, 2015). LA can provide a robust research layer to HEIs. However, successful adoption depends on organizational culture to recognize and respond to all stakeholders (Colvin et al., 2015). Nafea and Toplu (2018) found that a strong culture provided organizations with a competitive edge that led to superior performance, customer satisfaction, and long-term sustainability.

Educational institutions' culture varies; however, a commonality of the lack of a skill set for completing complicated analytic tasks exists among academics, support staff, and students (Shepard et al., 2019). Furthermore, a shortage of pedagogical-based LA approaches limits the usability of LA systems for practitioners. The student data presented to the instructor without a clear educational intervention pathway will not be used (Tsai & Gasevic, 2017). Therefore, to increase student data generated from LA systems, there is a need for an intuitive interface.

Concepts that apply to an intuitive interface include stakeholder customized LA systems rather than system with a wide array of features. Dunagan (2017) conducted research on innovation decisions and found that HEIs should not overserve the customer. Often more complex products tend to be more capable than most people require and overserve the customer. The extra features in a system added expense and increased the risk of rejection. Insight from the study from Broos et al. (2017) involved counselors in a cocreation process for LA tools. The cocreation process included various ways to collect information from stakeholders in focus groups and group-generated diagrams to understand, create, deliver, and support innovations (Prieto-Alvarez et al., 2018). Institutions' can use codesign techniques in different contexts to facilitate early engagement from various stakeholders and gather input to customize LA to fit the organization's needs.

Another example of a customized approach to LA is the Open University in the United Kingdom. The Open University created a dedicated team of data scientists with pedagogical experience as a support team, called data wranglers, and then conducted an

embedded case study to determine what worked well for them and what could be improved when working with key stakeholders (Rienties et al., 2017). The data wranglers provided support to non-data specialists to interpret and use biannual reports and real-time data. Findings from the study showed a mismatch between the data wranglers' actual practice and the intended position. There was an unrealistic expectation for one person to hold abilities as an expert data scientist, understand pedagogy at an elevated level, and have strong ambassadorship. The various designs and interest in support groups demonstrated that a representation of stakeholder perspectives and priorities is essential for successful LA implementation.

Indiana University used another approach to develop LA customization. Indiana University recruited fellows from various departments to research LA-based projects (Shepard et al., 2019). The fellows worked in research action clusters (RAC) with a data expert, facilitator, and administrator. Each RAC group developed a project that used LA to address an existing problem or need. Initially, the RACs formed a learning analytics research community (LARC) across the institution. However, the LARCs expanded to collaborate with stakeholders from other campuses. The RAC groups and LARC supplied a model for collaboration with LA to solve problems that informed the education field.

Summary and Conclusions

In this literature review, I investigated the constructs of the DOI and the LTLA conceptual frameworks related to LA innovation. Limited research existed for DOI in LA implementation, so I expanded my research to all educational technology studies completed in the last 5 years. The LTLA framework was developed in Australia and then

used in Malaysia in a follow-up study (West et al., 2018). Only two peer-reviewed studies found in the literature used LTLA; however, several frameworks related to LA implementation existed in other studies (Colvin et al., 2015; de Freitas et al., 2015; Greller & Drachsler, 2012; Scheffel et al., 2014). In an emergent field, LTLA is a framework that addresses dialogue, integral to the study regarding communication and exchange among stakeholders.

Studies related to LA innovation and elearning were reviewed and reported in this literature review. Literature sources provided information about the connection between elearning generating volumes of data and the emergence of LA (Adejo & Connolly, 2017; Colvin et al., 2015; Ferguson et al., 2016; Sener, 2015). LA is in developmental stages; therefore, literature sources included reports and overviews with limited empirical studies (Avella et al., 2016; de Freitas et al., 2015; West et al., 2016). Also, challenges and barriers exist to implementation and, thus, evidence of benefits was limited (Alamuddin et al., 2016; Ifenthaler, 2016). Studies showed disparate and fragmented implementation examples attempting to increase student retention, produce predictive analytics to identify student needs, and improve pedagogy (Adejo & Connolly, 2017; Arroway et al., 2016; Colvin et al., 2015).

Chapter 3 includes an outline of the study design. It also contains details of the research design and rationales, the researcher's role, and the methodology. I also provide the data analysis process and measures used to ensure trustworthiness and ethical research practices.

Chapter 3: Research Method

The purpose of this qualitative case study was to explore how HEI stakeholders from different departments that used elearning tools in one U.S. institution engaged in communication channels and dialogue during the LA implementation process intended to improve learning and teaching. In their seminal work on the emerging field of LA, West et al. (2016) found that dialogue was low among stakeholders during LA implementation. Findings from this study add to the understanding of how HEI stakeholders' dialogue informs institutional leadership's vision and plan for LA that fit in the context of their institution, thus advancing the utility of analytics to improve student performance. Additionally, the findings provide information for stakeholders to use regarding dialogue that promotes LA implementation and increases technology use to enhance academic success, resulting in improvements for retention and students' successful completion of academic credentials.

Chapter 3 contains a detailed explanation of the research design and rationale. I also provide a complete description of the methodology, including the instrumentation, participant selection, recruitment, data collection, and analysis plan. Information on issues of trustworthiness and ethical procedures are also presented in this chapter.

Research Design and Rationale

The following two research questions guided this study:

RQ1: How do stakeholders use different communication channels during LA implementation in a HEI using elearning options?

RQ2: How do stakeholders engage in LA domains of dialogue during implementation in a HEI using elearning options?

At the time of the study, LA was an emerging field (Alamuddin et al., 2016; Alhadad et al., 2015; Colvin et al., 2015; Ferguson et al., 2016; Shepard et al., 2019; West et al., 2016). LA is an inter- and multi-disciplinary field requiring a level of dependency among stakeholders for successful implementation (Colvin et al., 2015; Kitto et al., 2018; Lester et al., 2017; West et al., 2016). Literature about LA has shown that implementation efforts are fragmented and disparate (Arroway et al., 2016; Colvin et al., 2015; Lester et al., 2017; West et al., 2016). Other researchers have also noted that empirical research on the topic of LA is limited (de Freitas et al., 2015; Gašević et al., 2015; Lester et al., 2017; West et al., 2016).

Qualitative studies align with holistic, empirical, interpretive, and empathetic perspectives of a phenomenon (Stake, 1995). In this case, I used a holistic view to capture both the process and context, critical to LA implementation. Because implementation involves multiple stakeholders, each of whom has different priorities and perspectives, it was necessary to focus on gaining meaning and understanding by interpreting the data. Using a qualitative research method, I empathized with the participants to reflect their values related to the phenomenon and used questions to probe their perspectives regarding one or more aspects of the situation, processes, or relationships (see Starman, 2013). Therefore, the selection of a qualitative approach was mort suitable to study the LA phenomenon than a quantitative approach.

The collection of information to answer specific questions is integral to the quantitative study design (Egbert & Sanden, 2019). In the quantitative method, participants are selected randomly, and the data are numerically based and statistically analyzed to uncover a singular "truth." The researcher maintains an objective view, and often a treatment determines if the intervention causes and an effect. I did not use a quantitative approach because I did not seek to discover a singular truth or reality (see Toma, 2011). In the current study, I did not establish a causal relationship among predetermined variables; instead, the findings increased an understanding of a phenomenon (see Egbert & Sanden, 2019).

In this study, I analyzed the written and verbal data for patterns that provided specific information for the participating study site without direct application to other settings. As a qualitative researcher, my relationship with the participants and the data resulted in a perspective unique to the context and population. The quantitative approach was not suitable for the current study because my research questions were open ended and did not use predefined data points associated with a quantitative study method (see Merriam & Tisdell, 2015). Instead, the study was nonexperimental, conducted in a naturalistic setting, and my focus was on depicting events, people, and situations from the participants' viewpoint (see Toma, 2011).

I conducted a basic, qualitative, single-case study to provide a description that enriches the understanding of stakeholders' communication channels and dialogue during LA implementation (see Egbert & Sanden, 2019). The predetermined bounded case was stakeholders from one HEI working on one LA implementation project. The focus of this

study was to understand the context of the system rather than establishing definite and replicable truths. Yin (2013) stated that the case study research tradition works well for a complex topic. Because LA is an emerging field, communication was difficult to quantify; therefore, the subject of my research was complex. According to Merriam and Tisdell (2015), a qualitative case study design works well when the focus of the research is to understand the perspectives of those in the bounded system under study in a naturalistic setting.

Furthermore, the qualitative approach supports goals regarding improving one's practice, such as with the LA implementation process, which involved multiple stakeholders who had different priorities and worked in isolation from decision makers. Qualitative designs excluded were ethnography, phenomenology, and narrative inquiry. Ethnographies are conducted with a focus on participants' culture or everyday life (Marshall & Rossman, 2011). The phenomenological tradition captures the essence of the phenomenon's experience, exploring the lived experiences and perceptions of the participants (Creswell, 2012; Moustakas, 1994). The narrative tradition incorporates stories told by participants about the phenomenon, life experiences, or both (Clandinin et al., 2017; Moen, 2006). Because a critical part of the current study was to understand the bounded system of an institution during LA implementation, I studied a single case of LA implementation.

A basic, qualitative, single-case study is appropriate for answering the "how" and "why" questions because the meaning of dialogue for the stakeholder is contextual and constructed in the real world naturally (Merriam & Tisdell, 2015). This case study

generated in-depth detail regarding dialogue during the LA implementation process that revealed communication perceived to be helpful. As the researcher, I used in-depth analysis of a single case bounded by a place and time with multiple data sources, such as documents and interviews.

Role of the Researcher

The role of the researcher in a qualitative study is that of an instrument for data collection and analysis (Merriam & Tisdell, 2015). Furthermore, as a scholarly researcher, I was required to manage and review data and interpret findings (see Malagon-Maldonado, 2014). An advantage of the researcher acting as an instrument in the study is the ability to adapt as data are collected, ask for clarification from participants, and get feedback on the accuracy of interpretations (Merriam & Tisdell, 2015). Throughout this process, the researcher must be aware of and manage personal biases.

My role as a researcher required me to develop research questions relevant to the field of education technology that addressed a gap in the literature about the phenomenon of LA implementation. I selected a research design to align with exploratory questions; therefore, I (a) found willing participants, (b) interviewed participants, and (c) analyzed their responses. My goal was to interview participants involved in the LA implementation process from different disciplines and departments. My career in the educational field, working as a practitioner, instructional designer, a computer instructional technologist, and then an academic coordinator for over 2 decades, provided me with a background in technology integration processes and student data systems in educational institutions.

My potential bias was explicitly related to my professional experiences. When I began my doctoral studies, I worked as an academic achievement coordinator for an online K–12 educational company. I supported school administrators, teachers, support staff, and students with training and skills for tracking student data and achievement. The primary tool available during my tenure as coordinator was pivot tables derived from spreadsheets. I needed a way to access real-time, accurate data that provided a meaningful representation of student achievement. I began looking at big data in the learning environment, which led me to LA. Because of my background, the bias I brought to this study was that there was potential in the use of LA systems. Additionally, my view was that to realize the benefits, system-wide stakeholder engagement and data systems integration were necessary. I believed the stakeholders should adopt the LA innovation; therefore, I had a proinnovation bias (see Rogers, 2003). My professional background was in secondary educational institutions and corporate training. I have selected an HEI to conduct a case study because LA implementation is most advanced at higher education levels. I did not have any prior relationships with the study site or participants.

To manage biases, I used journaling, followed an interview protocol, and employed member checking (see Castillo-Montoya, 2016; Schaik et al., 2014; Simpson & Quigley, 2016; Sorsa et al., 2015; Wang et al., 2014; Yin, 2017). The journaling process involved keeping a journal of reflections and observation notes from participants' interactions and reading documents from the participating site (see Sorsa et al., 2015). As part of the interview protocol, I conducted semistructured interviews. I took notes of my

reactions related to my prior knowledge and used clear examples of the participants' voices on the topic (see Flick, 2014). I also recorded the interviews to capture the participants' voices and transcribed the interviews within 48 hours of the session (see Yin, 2017). To incorporate reflexivity, I reread the transcripts multiple times and looked for themes (see Sorsa et al., 2015). I checked my themes with peer reviewers. When no new themes emerged from the data, I had reached data saturation (see Antwi & Hamza, 2015). Then, the themes, summaries, and transcriptions were shared with the participants for review as a form of member checking (Simpson & Quigley, 2016). I used an iterative, reflexive process and involved third parties to manage bias.

In addition to managing bias, I addressed the ethical treatment of human subjects. Ethical considerations require participant confidentiality and consent. Merriam and Tisdell (2015) stated that having a signed consent form from a participant over the age of 18 years old provides evidence of their willingness to participate in the study. The consent form used in the current study included a description of researcher responsibilities and participant rights. I explained how I would secure participant privacy and confidentiality, so the participant was comfortable providing accurate responses to the interview questions. To safeguard participants' identities, pseudonyms are used in the study and the data are stored by ID number instead of name. The institution was not named to mask its identity. I offered participants the right to refuse participation, withdraw from the study, and terminate the interview at any time (see Silverman, 2016). Participants could have requested to have their responses removed before publication,

and the consent form listed the Institutional Review Board (IRB) approval number. I obtained a signed consent form from the participant before interviewing them.

Additional ethical considerations addressed issues of conflicts of interest, coercion, or power relationships. Conflicts of interest did not exist because I did not work at the institution and did not have existing contact with the institution or participants. Participants did not receive incentives to take part in the study. A power differential between the participants and me did not exist. I worked to establish a collaborative business relationship with the participants to build trust to yield quality data (see Malagon-Maldonado, 2014). Actions taken to build trust with participants included providing an introduction to the study and myself through phone and correspondence. I also explained the interview protocol to alleviate any anxiety or anticipation of a negative experience participants may have had (see Huang et al., 2016). I asked participants to ask any questions they had and responded to any inquiries from them.

To ensure my competency as a researcher, I completed a certification course from the National Institution of Health for protecting human research participants. Throughout the study, I followed the ethical research guidelines outline by the National Institution of Health which included documented the participant selection process and consent documents while maintaining confidentiality. The methodology section includes details of the measures outlined here and supports an ethically managed study.

Methodology

Participant Selection Logic

The study's target population was one postsecondary educational institution in the northwestern United States, where the implementation of an LA program is in progress. I invited administrators, IT leaders, academics, and persons in other roles involved in the implementation to participate in semistructured interviews. I interviewed 10 stakeholders, gaining representative input from the various groups involved in the LA implementation. Also, I reviewed documents related to the implementation policy or communication as part of the research plan. For example, documents that contained project goals and benefits, training and feedback options, and policies for LA projects.

I used purposive sampling to select the case study institution and participants because I wanted to understand the LA implementation process from stakeholders in various roles and departments at the institution (Patton, 2015)., Therefore, I selected one institution to understand the internal dynamics in an educational system during the implementation of LA. I used nonprobabilistic samples (Patton, 2015) to select participants. A criterion used to determine participants was that they served in some capacity with stakeholders implementing or planning to implement the LA project.

Criteria for the institution were evidence of LA program implementation, willingness to participate, and convenience based on the researcher's location. Targeted roles included institutional leaders, leaders in the IT department, practitioners with academic expertise, and academic support staff. All participants acknowledged an awareness of the LA program and their role in the implementation process; however, they

did not need to be adopters of the system. Because the LA project was not used directly by students, I did not recruit students. The initial institutional selection basis included information published on the institutions' website and confirmed by LA program administrators. Once I secured confirmation of participation as appropriate and required by the research site, I asked the administrators to identify individuals who were part of the implementation process based on action or role. In the recruiting process, I asked the potential participants if they would be willing to share their experience with the LA program, after which I asked each person to sign a consent agreement.

The basis for the number of participants depended on several factors. First, the stakeholders had a variety of disciplinary backgrounds and roles. Thus, the number of invitations depended upon the number of individuals involved in the program. The second rationale for the number of participants aligned with data saturation, where little new information or change to codebook occurred with additional data collection (Guest et al., 2006). Guest et al. (2006) stated that when the researcher is looking to confirm evidence or achieve maximum variations in the population, 12 to 20 data sources are needed. Guest et al. found that 73% of the codes had emerged after interviewing six participants, and after 12 interviews, 92% emerged. Thirty interviews completed with the same population showed that the last 12 interviews only generated five additional codes after the 18th interview. The same study conducted with 30 participants in another country showed a total of five new themes. The researchers concluded that the pattern of most codebook themes appeared in the first 12 interviews. Therefore, my research plan was 12 interviews. Guest et al. (2006) found six interviews provided three quarters of the

themes. In my study, only one administrator was willing to participant in the study. IT individuals provided documentation but were unable to participate because of the workload demands the COVID-19 pandemic had put on the team during my study. Thus, the interview numbers reflected the numbers of participants that matched the criteria up to 10 interviews.

Instrumentation

The data collection process I used were semistructured interviews and organizational documents. Semistructured interviews temper the highly structured rigid question format of entirely predetermined questions and the entirely naturalistic conversational style of unstructured interviews (Brown & Danaher, 2019; Merriam & Tisdell, 2015). Semi-structured interviews are often used for a qualitative investigation to collect data that address the research questions in an open-ended manner (Merriam & Tisdell, 2015). Appendix A details the interview questions and script I used as a guide for the interview conversation. The alignment of interview questions with the research questions provided additional measures that followed the interview protocol and constructed an inquiry-based discussion (Castillo-Montoya, 2016).

Table 3

Research Questions, Data Sources, Connection to LTLA and DOI

RQ1-How do stakeholders use different communication channels during LA implementation in a HEI using elearning options?
RQ2-How do stakeholders engage in LA domains of dialogue during implementation in a HEI using elearning options?

Research Question	Data Sources	Connection – LTLA (West et al., 2016)	Connection -DOI (Rogers, 2003)
RQ1	Interviews Organizational documents	Domain topics addressed • Institutional context • Transitional institutional elements • LA infrastructure • Transitional project elements • LA for Specific Project • Intervention and reflection	Communication channels used • Mass media • Interpersonal
RQ2	Interviews	Domain topics addressed	Communication channels used

The organizational documents did not provide evidence of mass media communication for the LA program. Most of the documents originated from the Office of Informational Technology (OIT) and centered on the implementation's technology installation portion. One document provided by the advising team manager outlined the advisor workflow supporting students using LA data.

Procedures for Recruitment, Participation, and Data Collection

Before I began recruitment, I secured approval from the Walden University IRB office of research compliance and the participating institution's IRB for external researchers. The IRB approval policies at both institutions allowed collaboration using IRB approval from either institution if the IRBs had federal-wide assurance from the

office of human research protection. The policy exists to reduce redundancies for researchers. As part of the Walden IRB approval process, I received a letter of deferment from the participating study site. The study site was not a partner in the research study but did defer to Walden IRB and allowed me to recruit participants for the study. Therefore, we did not enter into an institutional authorization agreement.

Recruitment

The recruitment required two levels of sampling—first, selection of the institution for the case study. Second, selecting people for interviews and documents in the case (Merriam & Tisdell, 2015). The documents were related to the LA program, and the interviewees served in the LA program in some capacity. I used a purposeful selection of participants involved in the LA program who occupied various institutions' roles. I identified a pivotal informant to help me access a representative group of stakeholders who served the LA project in some capacity (Toma, 2011). I used my Walden University email to contact the program directors for participant contacts. I worked with the department leaders regarding the process for invitations to potential participants aligned with the institution's culture. I then emailed potential participants the invitation and, if they agreed to participate, I sent the informed consent. I asked the participants to reply to the email and state, "I consent." In the communication of the invitation, I asked willing participants to share possible interview dates and times. Once I received the informed consent, I moved forward with scheduling the interview. Each participant agreed to the informed consent form before conducting the interview.

Participation

I worked with my point of contact at the participating study site to identify potential participants. I sent an invitation for participants to those individuals. When I gained permission to recruit in various campus units, the unit leaders volunteered additional potential participants. I asked my point of contact for additional qualified participants as I conducted one in-person interview before the stay-at-home order due to the crisis. I then switched to one-to-one interviews via phone or video conference. After the interview, I provided a one-to-two-page summary of the discussion to determine if my general understanding of the information aligned with what the participant intended to communicate. I ensured the participant had my contact, the Walden contact, and asked follow-up questions after reviewing the transcript. I shared the themes from my analysis and results with my point of contact and offered to share the study results with all participants upon request.

Data Collection

I interviewed participants over 3 months. I requested any document(s) (such as policies or announcements) produced by the institutional leaders to communicate information about the LA program. I contacted participants with follow-up questions for clarification or additional information after the initial interview. I asked for organizational documents related to the LA project for the participating study site.

All participants received my contact information and a contact for a Walden research administrator. Each participant received a summary of their interview for member checks that included my interpretation of the data provided (Toma, 2011). I let the point of contact know when the data collection period had ended, shared an outline of

the results, and provided access to my dissertation. Throughout the research process, I followed the interview protocol.

I used Audacity, a computer-based digital recording software, and a digital recorder as a back-up in the in-person interview. Storage of the computer files existed on a password-protected device only used by me. I stored the digital recorder in a locked filing cabinet in my home. For the remote interviews, I used a webinar software, Zoom. Zoom had an embedded video and audio-only recording feature that I used. The storage of the audio files exists on a password-protected computer. I used a recording app on my phone as a backup. When I confirmed the audio file from zoom was complete and transcribed, I deleted the backup recording on my phone.

Data Analysis

Data analysis in the qualitative study was an iterative process used to work with data to answer research questions. Yin (2017) proposed general steps for working with data to draw out meaning and develop conclusions.

1. Read all the data.
2. Prepare the data for analysis by compiling and organizing the data.
3. Disassemble the data into fragments using a coding schema related to the DOI and LTLA conceptual frameworks.
4. Reassemble the data into groups based on themes.
5. Interpret the meaning of the themes.
6. Develop the meaning of the data as it relates to the research questions.

Although the process was not linear, I used the steps as a guide to data analysis. The measures were repeated for each data source and revisited based on feedback from member checks.

Data from multiple sources and various stakeholder perspectives increased the credibility of the research. I used methodologic triangulation to compare data from different sources (Carter et al., 2014). For example, I compared the communication channels used for different stakeholders in various roles. I also examined the content of the responses with the domain topics to see if participants covered domain topics differently. I also compared the content of the interview responses with the content of the organizational documents. Triangulation helped develop a comprehensive understanding of LA implementation. I generated themes from data collected during interviews and organizational documents. I used thematic analysis to correlate themes to the literature and conceptual framework from the themes.

I used a priori codes based on the conceptual frameworks- DOI communication channels and LTLA domain topics- to organize data related to each research question. Table 4 includes a list of a priori codes from the conceptual frameworks

Table 4

Research Questions, Data Sources, and Conceptual Framework Precodes

RQ1-How do stakeholders use different communication channels during LA implementation in a HEI using elearning options?
RQ2-How do stakeholders engage in LA domains of dialogue during implementation in a HEI using elearning options?

Research Question	Interview Question	Document	LTLA Pre-code	DOI Pre-code
RQ1	Tell me about your role here at the university		Transitional institutional elements: Culture Level of sponsorship	Communication channels
RQ1	What aspects of your role are related to LA	Project goals	Transitional institutional elements: Alignment with institutional strategy	Communication channels
RQ1	Describe how you use the LA program?		LA infrastructure	Adopter category
RQ1	Take me back to the first time you heard about the LA program?	Training announcement policy	Transitional institutional elements: Culture Sponsorship intervention and reflection: Training Endorsement	Communication channels
RQ2	Tell me about a recent conversation with a colleague about LA		LA for retention: Address questions Accessibility Ethical issues	Communication channels Adopter level

Research Question	Interview Question	Document	LTLA Pre-code	DOI Pre-code
RQ1 & RQ2	What are your sources of information to learn about the LA system?	Training	Transitional institutional elements: Culture Positioning of LA Level of sponsorship Governance	Communication channels
RQ1	What option, if any, do you have available to provide feedback for the LA system?	Policy feedback information	Transitional retention elements: Strategy Planning, Intervention and reflection: Modification	Communication channels
RQ2	How do you think your colleagues would describe your role regarding LA?	Project goals	Transitional institutional elements Alignment with institutional strategy	Opinion leader Champion Adopter category

I took notes during the interview of observations and interactions with the participant (Flick, 2014). I also made notes of reactions that I have to my previous knowledge. I used interview recordings to create transcripts of each interview. After my first reading of the transcript, I made judgment-free notes before developing categories or applying pre-codes to the data (Lincoln & Guba, 1985). I used a thematic analysis to examine, identify, and record meaningful themes (Teruel et al., 2016). The data aligned with themes from the conceptual framework that addressed the research questions.

Qualitative data analysis (QDA) software is available for researchers to facilitate sorting and organizing data. Researchers use QDA to generate patterns and associations from data (Malagon-Maldonado, 2014). I used MAXQDA software for coding, sorting, and organized data into themes that helped answer the research questions.

When no new themes emerged after multiple readings and analyses, I knew that data saturation had been met (Antwi & Hamza, 2015). Merriam and Tisdell (2015) noted that data analysis must occur along with data collection to recognize data saturation. Therefore, I provided analysis data after each interview and before the following interview. I reviewed the transcripts and reflected on the descriptions looking for rich data to answers my research questions. I adapted my questioning and probes for information based on what I learned from my previous interviews. Also, I followed up with participants through email with a couple of questions for clarification. I also used follow-up questions if I felt more to learn (Merriam & Tisdell, 2015).

Two instances of discrepancy occurred. Two of the ten stakeholders were not aware of feedback channels for the LA implementation. Also, one implementation team

member stated the adoption stage matched the criteria of the trough of disillusionment. Another reported the adoption was beyond the trough of disillusionment that countered descriptions from data regarding the status of adoptions from other stakeholders. Thus, I noted the discrepant data (Toma, 2011).

Issues of Trustworthiness

Trustworthiness demonstrates credibility, transferability, dependability, and confirmability in a qualitative study (Lincoln & Guba, 1985). Marshall and Rossman (2011) noted a parallel to quantitative studies' attributes to build trustworthiness: internal validity, external validity, reliability, and objectivity. Although Toma (2011) argued that the terms are not congruent between the approaches, the comparison provides a reference for researchers less familiar or comfortable with the qualitative method.

In a qualitative study, trustworthiness is developed by triangulating sources and providing a substantial body of authentic descriptions (Toma, 2011). Comprehensive reports minimize misrepresentation and misunderstandings (Stake, 1995). Also, logical explanations and a transparent approach to the study increase trustworthiness. Another way to increase trustworthiness is to enlighten those who read the study. This section contains the details to explain credibility, transferability, dependability, and confirmability related to my study.

Credibility

The credibility (internal validity) of the study was developed through my attention to detail as a researcher and my ability to provide a detailed description to show evidence of the authenticity of how the stakeholders used communication channels and engaged in

dialogue (Toma, 2011). Credibility developed through detailed descriptions of the participants' processes and interactions, which revealed its complexity. If the description rang true to the stakeholders in the field and was considered accurate by those studied, credibility increased. I used the triangulation of stakeholders' various perspectives in different roles and organizational documents about LA at the institution. I also shared summaries and themes with the participants to check my interpretation of their comments. I also offered to share full transcripts upon request. I aimed to add credibility and produce accurate conclusions based on DOI theory and LTLA frameworks.

Transferability

Findings from a qualitative study have limitations in transferability (Toma, 2011). However, transferability resides in the reader's perception to determine if the information is helpful and applies to similar situations (Marshall & Rossman, 2011). The researcher's onus is to provide thick descriptions for study context and position so that potential readers can find similarities. Details that increase transferability included:

- descriptions of settings and boundaries
- detailed descriptions of findings,
- explanation of case study selection,
- examples of how results connect to prior theory,
- descriptions of the process and outcomes that may facilitate application to other settings.

The goal is to provide helpful information for those studied to be better informed and make better decisions about the LA implementation. Through my descriptions, I worked

to show how sharing of tacit knowledge occurred during LA implementation, thus provided transferable information to other settings (Toma, 2011).

Dependability

Dependability is the qualitative counterpart to the reliability, which is a factor in quantitative studies showing repeatable results (Toma, 2011). However, the intention of replication is counter-intuitive to the social world targeted by qualitative studies. (Toma, 2011). However, the degree that a researcher can show a rationale for the research design and account for changes during the study increases dependability. Therefore, I kept a reflexive journal to audit the trail of change during the study (Sutton & Austin, 2015), which allowed me to explain how and why the research needed to be adapted to represent the social world constructed through my findings. Also, I showed meaningful connections across data sources to support findings either by comparisons or similarities, strengthening the study's dependability. Methods used to ensure dependability was to interview the full range of respondents.

Confirmability

Confirmability is the qualitative counterpart to objectivity used in quantitative studies. Researcher reflexivity is a tool used to enhance confirmability. Evidence of the researcher's reflexivity is an apparent effort to minimize the researcher's prior knowledge and focus on the participants' viewpoints (Sorsa et al., 2015). Neutrality was a skill I used to detach from my perspective (Devotta et al., 2016). I used bracketing to focus on participants' viewpoints by suspending my natural assumptions about the world. To facilitate bracketing, I fully disclosed my past and became conscious of using my

background as a research tool. Journaling increased my awareness of my research position and focused my attention while gathering and analyzing data. As part of my journaling approach, I also developed a second set of judgment-free notes before developing categories (Lincoln & Guba, 1985). I was clear about how I used the theoretical background to influence my design and provided thick descriptions from my participants' perspective because I did not use the pre-codes until after the interview transcription.

The confirmation of data by someone other than the researcher increases the study's trustworthiness (Toma, 2011). Discussions with committee members about my reflections and journal entries added an outside viewpoint and increased confirmability. I was the only researcher coding the data. Therefore, my study had no applicable intra-or inter-coder reliability. However, I did provide opportunities for participants to validate my interpretations of the interview data, which was a necessary component of confirmability.

Ethical Procedures

Risks are inherent in research studies, and as a researcher, I handled mitigating risks. One way I increased the study's potential benefit while minimizing risks was to use sound research design standards. I followed ethical principles for the treatment of human subjects incorporating justice, benefice, and respect for persons. In this section, I detailed measures to ensure participant safety and privacy, which were provided in the IRB application and followed during recruitment, data collection, and data analysis for the study.

I secured approval to access participants, policy documents, and communication artifacts with Walden University and the participating university (IRB approval 02-27-20-0403840). The potential site was amenable to me working with stakeholders as participants in my study. I was an external researcher and not a partner researcher. The participating site's IRB office provided a letter of deferral to Walden for IRB approval for my research. I researched the potential site to find contacts with Internet publications showing involvement with the LA project. I emailed four contacts to see if any had an interest in working with me. I found a point of contact to help identify potential participants and the department leaders who granted approval to recruit participants. I had also initiated contact with the IRB of the potential participating site. After I completed my oral defense, I completed the Walden IRB application. Then I provided the Walden IRB approval number to the participating site IRB. The participating site preferred that the IRB approval number came from Walden, the institution claiming oversight of my study. I completed online human research ethics training and received a certificate of completion to conduct a study with human subjects.

Treatment of human participants included voluntary participants, who could decide to withdraw from the study at any time or abstain from answering interview questions. I did not use coercion for participation through power or bribes. Furthermore, I do not have a prior acquaintance of the study participants and thus no authority over them. I kept an open and transparent explanation of study processes, expectations, and data use with the participants. The informed consent form and interview introduction dialogue included information about the study processes, expectations, and data use.

Also, I provided participants the opportunity to contact me as needed and contact for Walden University IRB.

The invitation to participate explained the nature of the study, voluntary participation, the data collection process, and data security and privacy to address ethical concerns related to recruitment materials and processes. The consent form included information about the recording and transcribing of the interview and a description of secure data storage and privacy. Once participants signed the consent form, I conducted a one-to-one interview.

The treatment of data supported participant privacy through the de-identification of data and actions taken to protect data storage. I assigned participants an ID code based on the interview order to keep the associated data confidential. However, I kept a record of the names and contacts for interviews to complete member checks and follow-up questions. To ensure security, I stored data in a personal Microsoft One Drive account that is password protected and accessed only on encrypted networks with a password-protected wireless connection. Hard copy data items such as interview notes will be in a locked cabinet in my house. An agreement to mask the study site as part of the research design; therefore, no actual names appeared in the study.

I recorded interviews using a personal password-protected laptop computer and used Audacity to capture the audio file. For video conference software, Zoom, I had a private account and used a login code for the meetings. The storage location for sound files existed on my password-protected computer. I used transcription software TRINT (TRINT Ltd., 2019) to transcribe audio files. The data were uploaded based on

participant ID code without any identifying data. Data security for TRINT is in Appendix C. TRINT followed the International Organization for Standardization global standard 27001 for an information security management system. TRINT used an encrypted and secure data upload system. The company stored data in a center owned by Amazon Web Services. TRINT addressed employee security by completing employee background checks and following a policy for strong passwords and continuous password management. The company followed a computer equipment hardening process that guarded against malware. Academic researchers from Yale University, Berkeley University of California, Harvard University, Cornell University, Columbia University, and Massachusetts Institute of Technology used TRINT for transcription support during research projects.

The final step in data security is the deletion process. I will delete data from the files 5 years after the study in compliance with Walden University policy. I will also delete TRINT data permanently through a request I make directly to the support site. I will also delete all electronic files on my computer, mobile device, and One Drive containing data. Shredding of hard copy documents will occur in a home office shredder.

Consideration of other ethical issues that could apply to a research study includes a check for conflicts of interest and power differentials. I did not use incentives for participation, and it did not occur in my work environment. Therefore, the risks related to the study are minimal. However, a minimal risk included discomfort in giving answers about a person's workplace that may not have been complementary to the HEI. Trust for the researcher could have been an issue as I had no prior relationship with the

participants. There was also a minimal chance of a privacy concern regarding security breaches of the physical or digital storage spaces for interview data. I kept the filing cabinet locked and locked the house protected by a security system. I kept the computer and mobile device in my possession and locked when not on my person.

Summary

In this chapter, I have outlined the study design and plan. I began with a detailed description of the research design and rationale. Then I explained the role of the researcher, followed by details of the single case study methodology, including participant selection, instrumentation, data collection, and data analysis. The measures include means to address issues of trustworthiness as well as ethical procedures. The next chapter will cover the actual data and findings from the study.

Chapter 4: Results

The purpose of this qualitative case study was to explore how HEI stakeholders from different departments using elearning tools in one U.S. institution engaged in communication channels and dialogue during the LA implementation process intended to improve learning and teaching. Chapter 4 includes a description of the study setting, data collection and analysis process, evidence of trustworthiness, and study results. The chapter ends with a summary of the answers to the research questions.

Several conditions altered my plans for data collection and analysis and required strategic changes to the research plan, as detailed in this section. As I began the study's data collection, the United States started to shut down due to the COVID-19 pandemic. The state where the study occurred issued an emergency status declaration related to COVID-19 the day I began data collection. Mandated restrictions impeded participant recruitment and data collection for my research. Immediately, two individuals, who had agreed to take part, withdrew from the study.

All 11 participants met the desired characteristics: They were adults over 18 years of age, employed by the study site at the time of LA implementation, and involved in the implementation process as a stakeholder. Because of a possible institution or individual identification, I have withheld specific details about units involved in the study or any personally identifying characteristics. All participants held a bachelor's degree or higher. The participants worked at the institution between the years of 2013 and 2020. Their length of employment at the time of the interview varied from 2 to 8 years. The study site was a HEI that offers undergraduate and graduate programs. Elearning options were

ubiquitous across the institution, and students typically took at least one online course in their program of study before the COVID-19 outbreak. The unit responsible for implementing the LA program served fully online courses or fully online programs.

Data Collection

The collection of data occurred over 7 months. Eleven people participated in the study. One participant supplied documents but was unable to attend an interview due to their workload, so 10 participants took part in semistructured interviews, two of which also shared documentation regarding the implementation process. The interviewees' roles varied; there were two advisors, three managers, two directors, two with IT-related roles, and two faculty. I conducted the first interview in person; however, the remaining interviews occurred through a secure video conference. Table 5 shows the timing, format, and recording application used if applicable for data collection.

Table 5

Document Timing, Format, and Recording Method

Participant	Week of Collection	Format	Recorded	Duration of Interview (min)
P1	1 – also submitted one document	Face-to-face	Audacity	55:37
P2	3 – no interview, only submitted documents	Google drive to one drive	N/A	N/A
P3	11	Virtual	Zoom	16:03
P4	12	Virtual	Zoom	27:37
P5	12	Virtual	Zoom	16:28
P6	16- also submitted one document	Virtual	Zoom	26:30
P7	17	Virtual	Zoom	24:16
P8	20	Virtual	Zoom	35:36
P9	21	Virtual	Zoom	38:11
P10	21	Virtual	Zoom	36:07
P11	25	Virtual	Zoom	49:31

The Zoom video conference software had the capability to save recordings in different file formats, such as audio only and complete video and audio capture. I recorded in audio only and used it for the automated TRINT transcription service.

I used the same interview instrument for all interviews. The first interview was longer than the following interviews for several reasons. In later interviews, I learned to direct the conversation toward the research questions. The first interview was in-person, and the interviewee volunteered ample information for each question. The first interviewee also had a leadership role in the LA initiative and, thus, covered the project in more detail.

Two variations occurred from the data collection plan provided in Chapter 3. Because of the COVID-19 pandemic, data collection took longer than expected, and I conducted interviews remotely for my safety and that of the participants. No other unusual circumstances occurred beyond the adjustments needed for social distancing and mentally coping with a global pandemic for which there was no effective treatment or vaccine available.

Unanticipated factors played a part in securing and completing data collection. Five potential participants declined because of the workload added to their duties as a result of the COVID-19 pandemic. These individuals were integral in helping the institution move classes to an online format for the remaining term and upcoming term. One person declined because of a family crisis; it is unknown if the situation was related to the pandemic. Three potential participants declined because they did not feel knowledgeable about the LA system, and 14 never responded to the invitations. I

recruited 34 people, and 10 people completed interviews. Two interviewees also provided documents related to the LA implementation. One person was unable to participate in an interview but provided documentation about the LA implementation.

Data Analysis

Collecting data from semistructured interviews in a bounded social system ensured an in-depth look at the communication channels and dialogue used during LA innovation implementation. Data analysis is different for each qualitative study because of the iterative interaction between data collection, data analysis, and reporting (Merriam & Tisdell, 2015). This section contains a discussion the data analysis process, coding, development of themes, and identifying discrepant cases from the study.

The interview process was not linear, and it involved interaction between data collection, reporting, and data analysis. While conducting semistructured interviews, I took notes about the participants' comments that directly addressed the question, piqued my interests, or that I wanted to confirm with the participant during the interview. After the interview ended, I imported the audio files into a transcription application called TRINT. The transcription took less than an hour for each interview; however, the automated transcription system made errors in the speech-to-text translation. To ensure the accuracy of the transcript, I played the audio while reading the text. When needed, I corrected the translated text to match the interviewee's spoken words. I exported the Word document from TRINT to import into the QDA software and review it in printed form.

Within 2 days of the interview, I wrote a one- to two-page summary of the interview and shared it with the interviewee. Seven of the 10 interviewees confirmed that the summary of our conversation was accurate. Two participants sent back corrections with the confirmation, and I made notes of their changes to the data where applicable. Therefore, a majority of the participants confirmed the accuracy of the data.

The data analysis began as soon as the first interview and transcript were completed and continued until the themes that emerged provided evidence related to the research questions. For my first transcription, I performed open coding to practice the coding process. After this point, I analyzed the transcripts using my precodes and a QDA software application, MAXQDA. Initially, the QDA software helped me organize the coding system and keep track of the data. I entered the a priori codes into the QDA software from the DOI theory and the LTLA framework and assigned a detailed memo about each code (see Appendix C for the initial code system using precodes). This system was used to analyze the first two interview transcripts. At that point in the data collection and analysis, I had 24 codes and 190 coded segments. After I coded four transcripts using the precodes, I realized the need to break down the precodes to capture the participant's voice in the context of their experience. Table 6 provides an example of how I recoded one precode at this point of the data analysis process.

Table 6

Breaking Down the Precodes

Pre-Code	Memo	Revised Code	Memo
Leadership	Attributes that confirm leadership "Institutional transitional elements" Culture the positioning of LA in the institution level of sponsorship alignment with institutional strategy LTLA (West et al., 2016)	Clarity of leadership	Statements made about leadership, how is the leadership organized. Is the leadership evident or unknown
	centralized or distributed leadership, leadership's knowledge, and information (de Freitas et al., 2015) Areas of support for stakeholder engagement (SHEILA project, 2018)	Support for engagement	Evidence or statements of leadership support of engagement in LA
		Positioning in institution	Priority or authority of the implementation group
		Level of sponsorship	At what level is the decision about LA made or supported
		Leadership decisions	Management decision made about the LA system
		Governance arrangements	Evidence of data governance arrangements or lack of arrangements

The data analysis process required multiple reviews of coding to understand the data. Because I changed the code system using simplified codes from the precodes, I recoded the first two transcripts. I continued to refine the coding system as I finished the data collection. When the code system changed, I would go back to earlier transcripts and recode the transcript when applicable. By the end of data collection, several iterations and refinements for codes had been completed. At one point, I had 82 codes and 966 coded segments. MAXQDA was then used to compare codes across transcripts, but I felt limited in the options to filter based on emerging categories and themes, so I exported the codes to an Excel spreadsheet.

I would write out possible categories for codes on paper and then group the codes according to patterns. Handwritten diagrams were used to determine the patterns in the data, and then the data would be sorted in Excel to examine if coded segments showed the patterns that had been previously sketched out. Each review of the coded elements supplied rich detail about the stakeholders' experiences with LA.

After I had derived themes from the interview data, I analyzed the organizational documents related to the LA initiative that were also collected as study data. The purpose of the document collection was to determine if the papers corroborated the interview data or added new information. Table 7 displays a list of organizational documents collected and analyzed.

Table 7

Organizational Documents Related to LA Implementation

Document Study ID	Document Name	Participant Source
D1	[LA system] – Initiative proposal	P2
D2	[LA system] – Priority SSRS report validation planning	P2
D3	[LA system] –Reports uses and priorities	P2
D4	[LA system] –Implementation plan	P2
D5	Business needs for LA across levels	P2
D6	Initiative proposal – [LA system] data governance	P2
D7	[Data integration] strategy	P2
D8	University stakeholders	P2
D9	[LA system] advisor workflow	P6
D10	[LA system] pilot journal article	P1

In the first cycle of coding the documents, I read through them and highlighted phrases aligned with the interview themes or added further details. The majority of documents mainly contained information about the installation plan for the technology. The other documents provided additional details about the advisor workflow process and the first pilot of the LA system. No new themes emerged from the organizational documents.

In order to ensure I was answering my research questions, I redid the code system using process coding (see Saldaña, 2016). The process coding facilitated finding patterns for all stakeholders, stakeholders with similar and different roles, and differences among stakeholders. Patterns began to develop based on process coding, which formed themes through the final code refinement level. The method of coding the data to understand the

emergent themes involved an interactive process of multiple reviews of the transcripts and then the codes and code segments to refine the themes that emerged from the data. The final codebook had 648 coded segments, 515 codes, 47 categories, and seven themes. Table 8 lists the frequency of each theme. Appendix D contains a code system showing samples of the codes segments and categories for each theme.

Table 8

Themes and Frequency of Alignment with Coded Segments

Theme	Frequency
Theme 1: Stakeholders involved in LA implementation had multidisciplinary backgrounds and expertise	84
Theme 2: Intentional implementation of LA	69
Theme 3: Interpersonal approach to LA communication	112
Theme 4: Continuous transitions of LA implementation	144
Theme 5: Infrastructure, the backbone of LA data	36
Theme 6: Culture determined through leadership	58
Theme 7: Stakeholder's actions influenced by LA data	145

Evidence of Trustworthiness

Credibility

To build credibility as a researcher, I captured extensive data from one-to-one interviews and the implementation plan and process documentation. The rich qualitative data from different sources ensured a detailed and thick description of how the stakeholders' used communication channels and engaged in dialogue (Toma, 2011). Credibility was supported when participants described LA processes and interactions in enough depth to reveal the situation's complexity. Also, organizational documents outlining the data integration process, initiative proposals, and budget information

supplied a different data source for understanding communication and content at the institution. I used various stakeholders' perspectives in different roles and organizational documents to confirm the LA implementation to increase credibility.

Member checks I conducted increased the credibility of the study. As a strategy to check my data interpretation, I shared summaries with the participants as a form of member checking (Chang, 2014). Seven participants confirmed that summaries were accurate; three participants did not provide feedback or ensure accuracy. Two participants that provided confirmation included corrections to summaries, which I incorporated into the analysis and results. I also offered to share full transcripts upon request, but none of the participants wanted the full transcript. The summary verification incorporated the opportunity for participants to check the accuracy of the voice and information of my interpretation of the data, which increase credibility.

Transferability

Findings from this qualitative case study have limited transferability (Toma, 2011). However, transferability resides in the reader's perception to determine if the information is useful and applies to similar situations (Marshall & Rossman, 2011). My charge as a researcher was to produce thick and comprehensive descriptions for study context so readers can find similarities. I included details about the following:

- Descriptions of settings and boundaries while protecting the confidentiality
- Detailed descriptions of findings, supported with quotations
- Explanation of case study selection
- Examples of how results connect to prior theory,

- Descriptions of the process and outcomes that may facilitate application to other settings (Miles & Huberman, 1994)

While findings are limited in transferability, they offer insights about LA implementation initiatives to a general population. Through my descriptions, I showed how the sharing of tacit knowledge occurred during LA implementation, thus possibly transferring information to other settings (Toma, 2011).

Dependability

Dependability is the qualitative counterpart to reliability in quantitative studies. In quantitative studies, the reliability level indicates the possibility of another researcher replicating results following the same research plan (Toma, 2011). Although result replication for a qualitative study's naturalistic process does not exist, a researcher can explain the research design and account for changes during the study to increase dependability. I kept a reflexive journal during the study (Sutton & Austin, 2015). Thus, I documented how and why research processes adapted to represent the social world constructed through my findings. Also, I showed meaningful connections across data sources to support findings either by comparisons or similarities, which strengthened the study's dependability. Additionally, I maintained dependability by interviewing a full range of respondents and used member checking to verify accuracy; thus, the results represent the study participants' perspective and account.

Confirmability

Confirmability is the qualitative counterpart to objectivity used in quantitative studies. Researcher reflexivity is a tool used to enhance the confirmability of a study.

Reflexivity demonstrates an apparent effort to minimize the influence of the researcher's prior knowledge and focus on the participants' viewpoints (Sorsa et al., 2015). Neutrality was a strategy I used to detach from my perspectives (Devotta et al., 2016). To remain neutral, I used the technique of bracketing to focus on the viewpoints shared by participants by suspending my assumptions about the study context. To facilitate bracketing, I created journal entries and a set of free memo notes in the transcripts before developing categories (Lincoln & Guba, 1985). When I found my experiences connecting to the data, I made a note. I then made a mental note to review the segment, focusing on what the interviewee intended to communicate. The mental exercise and note-taking focused my attention on biases while gathering and analyzing data. Also, I did not use the precodes until after the interview transcription so that I did not allow the study frameworks to influence my design and provided thick descriptions from my participants' perspective.

Results

The communication channels stakeholders used intertwined with the information provided about their dialogue topics. Therefore, I organized this section by themes as they emerged through the data analysis. There are seven themes outlining components of the implementation process about the communication channels used and the domains of the dialogue shared among stakeholders. The themes include:

- Theme 1: Stakeholders involved in LA implementation had multidisciplinary backgrounds and expertise
- Theme 2: Intentional implementation of LA

- Theme 3: Interpersonal approach to LA communication
- Theme 4: Continuous transitions of LA implementation
- Theme 5: Infrastructure, the backbone of LA data
- Theme 6: Culture determined through leadership
- Theme 7: Stakeholder's actions influenced by LA data

The order of the themes follows a chronological order of implementation for LA. For the innovation to occur through communication and dialogue topics, it was necessary to understand the stakeholders involved in the process. Thus Theme 1 identifies and defines the stakeholders. Theme 2 addresses the institution's paradigm regarding data use and the LA implementation, influencing subsequent themes. The third theme reports the use of interpersonal interaction to implement the innovation. The fourth theme addresses the transition discusses by the stakeholders that occurred through the implementation. For the LA to be available for use at the institution, the infrastructure, Theme 5, needed to be in place. Once the infrastructure was in place, the leadership implemented the initiative driving the culture of LA, discussed in Theme 6. The final theme, Theme 7, covers the use of the LA innovation among the stakeholders.

Theme 1: Stakeholders Involved in LA Implementation had Multidisciplinary Backgrounds and Expertise

Stakeholders involved in the LA implementation included experts from a variety of disciplines. Three interviewees described the need for a diverse and skilled group of stakeholders to support the LA initiative. P9, a stakeholder engaged in LA implementation support, described the implementation stakeholders as "experts in the

field of online education and a variety of areas." P10 on the implementation team noted, "we have a very interesting collective of ed-tech or research, innovation, pedagogy experts." As I analyzed the data, three groups of stakeholders emerged. One group fit into the implementation support role. Participants in this role supported LA's implementation but did not directly use the LA system or data to help student success. Another group, the primary user group, used LA data to support student success. The final group had a dual role in supporting LA implementation and used data from the LA system to support student success. Below is a list of the stakeholders grouped per role.

- Implementation support
    - Associate deans
    - Managers
    - Data analysts
- Primary users
    - Associate directors
    - Advisors
    - Faculty
- Both the primary user and implementation support
    - Instructional designer/Faculty
    - Program manager
    - Lead faculty

Part of the data collection included documents related to the LA implementation. Seven of the 10 documents had stakeholders as a topic to either identify the stakeholder,

define the role pertaining to LA, or both. D8, a document dedicated to the university stakeholders used in planning the implementation process, defined the stakeholder groups by department or roles along with potential benefits, dependencies, and caveats related to LA. The anticipated audience for LA included stakeholders from various departments, Learning and Teaching Solutions, Center for Teaching and Learning, Office of Informational Technology, Online Campus Division, Advising, Institutional Research, and Undergraduate Interdisciplinary Studies. Interestingly, the document did not define faculty as a specific stakeholder group. However, in other documents, the faculty were clearly defined.

Document D5 outlined business needs for analytic groups defined at levels which included university leadership at Level 1, faculty at Level 2, supporting units at Level 3, departments, programs, colleges at Level 4, academic advising at Level 5, and online students at Level 6. The need for analytics to support research was noted in the document but not assigned a level. The supporting unit and student analytics focused on EWS. From the implementation picture created by the stakeholders involved in the LA implementation, a version of an EWS alerted advisors and faculty of student activity via reports. Interview data had a narrower scope of stakeholders than the Business Needs document. However, the stakeholders identified in the publication about the initial pilot group, D10, included researchers, administrators, a program director, a director of advising, a lead advisor, and a full-time faculty member, closely matching the interview data regarding the participants roles. All the data related to stakeholders confirmed that stakeholder expertise remained diverse and from multidisciplinary backgrounds.

Stakeholder Expertise and Background

Stakeholders in all three groups had one or more areas of expertise. For example, P7, who supported implementation and used the system, stated, "one piece that's missing in…understanding about online education or education broadly is how many people come together to make it happen." While the statement goes beyond the scope of LA implementation, the participant summarized the idea of many people's involvement in the implementation. Below a list of the expertise from the stakeholders involved in the LA implementation at the university:

- Statisticians,
- Data analysts,
- Research analysts,
- Researchers,
- Faculty,
- Instructors,
- Instructional designers,
- Instructional technologists, and
- Administrators.

Many of whom had backgrounds in one or more areas of expertise but were new to LA. P10, a data analyst and had been a math instructor, explained,

> I didn't come into this position knowing very much about the specifics and the nuances and the field of learning analytics. I came to my position from kind of a

> statistical background with the way it's employing statistics, data for quality improvement, program evaluation.

The team manager had a Ph.D. in educational technology and served as an administrator and researcher. P1 reported the division involved in LA implementation for an online program funded experts from other departments, including business intelligence, to support implementation because of the need for a wide range of expertise for the LA implementation.

To illustrate the need for a wide range of expertise, P10 explained how they worked with experts in other divisions regarding implementation support, "we have a team of business intelligence and reporting staff at our institution who do a lot of the backend administration for…LA systems. They keep the ETL [extraction, transformation, and loading] going." The team of expertise in IT, administration, research, instructional design, analytics, advising, and teaching worked together in LA implementation efforts.

The LA implementation required positions specific to LA support, which meant some stakeholders had multiple roles and filled new roles. Furthermore, some stakeholders had dual roles of implementation support and primary users. Four of the stakeholders held new positions created to support LA implementation. For example, P11 described their role as:

> Yeah, because my role in the University was kind of a new position, totally new position, and nobody ever had that before….it's called instructional design consultant slash research and retention analyst. The second half of the role is a totally new one.

Other expertise with dual roles included administration, online program management, and faculty leaders. Two things became apparent about the stakeholders, they had multidisciplinary backgrounds, and the LA roles were related to their expertise.

Stakeholder Responsibilities

Each of the three groups had unique responsibilities, and the members of each group corroborated the specificity of their duty. The implementation support stakeholders focused on support through communication, infrastructure tasks, and managing a technology suite for online learning. For example, P5, a member of this group, explained their responsibility, "I was there to bring the product on, connect to integrate it, tests the reports, make sure they were pulling accurate data." P9 supporting implementation portrayed a component of their role as overseeing the "unit for academic departments and faculty members who are interested in developing and delivering online courses and fully online programs." Also, the P1 described the responsibility related to their role, which included leading LA implementation as:

> I work in the [online division], which we support fully online courses and programs. So, we're a service centralized kind of service unit for online. And I lead a team called the [Research and Innovation Team], and we do this research and evaluation in supporting online learning. So that includes implementation of new practices and technologies, includes conducting research and literature, literature, reviews to help inform decision making.

P10 explained the research and innovation unit's aim as "a research team that wants to focus on inclusion, equity, diversity." Depending on the role of LA implementation stakeholders, they would support the innovation with IT assistance, training, and communication.

The primary user group of stakeholders fulfilled responsibilities related to serving students (such as advising), helping with retention, helping students stay on track, and supporting staff. P8 explained the primary responsibility as helping "students stay on track for graduation. I help with retention degree planning resources. Students need to be successful in their online courses." P4 described responsibilities aligned with LA as, "when I received those reports weekly, I…know who to reach out….to offer more support specifically to the students…falling behind or struggling". Faculty primary responsibilities focus on teaching students, the LA data aligned with teaching responsibilities on different cadence than the advisors. P3 said, "we [colleagues] talk about it [LA system]. Probably the most recent would be the beginning of every semester. I actually will help review it [LA data] and provide any suggestions, or there's any outliers." Three other stakeholders supporting LA implementation had similar explanations of how stakeholder responsibilities aligned with the LA system's use.

The first theme illustrates the stakeholders involved in the LA implementation. The stakeholder group had multidisciplinary backgrounds and required expertise related to their role. The implementation effort involved a diverse group of professionals working together to provide infrastructure for data and promote system use and knowledge. The stakeholders described how their background expertise supported

implementation and interactions among various stakeholders when discussing their LA innovation roles.

Theme 2: Intentional Implementation of LA

All the participants described LA's intentional implementation, mainly when discussing the LA innovation communication and the dialogue's content. The subthemes that emerged within the intentional implementation theme included ethical considerations for LA, that imposition of the LA innovation does not work, and publication of reports to share the process.

Ethical Considerations

From the inception of the LA implementation planning to the first pilot report, ethical considerations received acknowledgment of importance and were noted as an area to develop. Within the first year of the LA implementation initiative, the leadership members created an Initiative Proposal for the LA system's data governance. One objective of the proposal for data governance, document D6, requested the formation of "a team of 4-6 experts who are well-suited to answer questions related to student and instructor privacy and information security by the end of the calendar year." No additional information about the expertise or roles of the well-suited stakeholders accompanied the objective. However, findings from the first implementation pilot report included, "we ran across several instances where there were questions about who should have access to [LA system] data, and how that data should be utilized." Furthermore, the pilot highlighted outstanding questions about student access to data and awareness of data use, mitigation bias in interpretation and actions related to data, and data access for

faculty across the course level data. The organizational documents referenced needs for data governance but did not contain solutions.

In the interview data, two of 10 interview participants reported concerns about LA data's potential to exclude students. The LA data system could predict student performance potential or level of risk for not graduating. P10 noted that "universities who are using predictive modeling to filter out students from scholarships or from being part of programs," which the stakeholder viewed a marginalizing practice related to LA data use. Another stakeholder, P11, reported a decision point in the early implementation for the university. Once it became known that LA data identified applicants with risk factors, a discussion around that point was, "we would just decline their applications. Or what we should do is to provide some more resources to support them." P10 explained that the use of LA requires ethical considerations. Thus, they were glad to have a background in statistics and education to navigate the "promise and peril" of LA. The leaders supporting the LA implementation had similar concerns about using LA data and agreed about the need for intentional implementation.

Nine of the participants noted that LA's focus for student data use needed to help the students succeed while being aware of ethical considerations for data use. Participant P9 stated, "it's a true deep care about the student, and their engagement and where they're at…We wanted to avoid any kind of negative perception in relation to the usage of data." To ensure LA data use benefited students, P9 reported that the implementation team "wanted to make sure that conversation was framed appropriately and that…the student success and engagement was the primary factor." P5 corroborated P9, "learning

analytics are very interesting and potentially beneficial…but like anything...how it's used and…having a robust strategy and concrete policy around it, before implementing a tool." The institution posted a student data policy in the LMS to inform students and instructors of data collection and use. Stakeholder P7 said that faculty were "concerned about privacy rights and sort of the ethics of using that information." By framing the conversation around the use of student data to support student success and engagement, the stakeholders demonstrated an awareness of the privacy and ethics of LA. The participants showed understanding and intent to use the data to improve student success.

Stakeholders were aware that student data was readily available and desired to improve the educational experience. Four of the participants mention the volumes of data available. Stakeholder P3 reported,

> I mean, there's always reasons why students are not able to progress. And if it's on our end as a school, as someone providing a service and education environment, we should be doing our due diligence to look at that.

P9 stated, "we've been very intentional about making sure that people are informed that students know that data is available and how it's being…faculty have a choice in how they want to receive that information." Stakeholders from IT, administration, advising, and academic departments supported LA's ethical use.

Imposition of LA Does Not Work

The implementation team and support stakeholders reported building trust, democratizing data use, and not forcing the issue. Stakeholder P10 noted, "the first thing we need to do is build that trust. So that's our approach. Some people are really excited to

use it. Some people are more reluctant." As part of building trust, the implementation team worked to align with primary users and partner programs' goals. P9 said, "we wanted to be pretty intentional about the use of learning analytics …so working strategically with online programs, we wanted to partner with those programs to figure out what goals that they had"." P1 elaborated on this idea describing motivating factors through which the teams tried to "understand the needs of any partner that we're working with. What are the challenges they have, and then propose very pointed solutions to that?" Thus, gaining trust and a level of mutually beneficial partnerships to support students embodied the institution's implementation intended approach.

The approach of building trust and partnerships instead of imposing data did not always result in LA's adoption. One program has chosen not to adopt. The implementation team respected the choice of all stakeholders, as reported by two members. P10 said,

> Every time we consult, I really try to focus on how I can support you and the practices you're doing. Sometimes that works, and sometimes people are just, you know what, hands clean this is not for me. And we really try to respect that. And not force the issue.

P11 elaborated on this idea explaining that teams should not "promote or solicit learning analytics … to faculty members because that is not their priority." As an alternate approach to the solicitation of LA and to build trust in faculty, the team did document and publish progress and success regarding student data use to make it available.

Publications and Reports

The implementation team produced white papers and reports to share with faculty and advisors to communicate on a larger scale regarding the successes the programs using LA had experienced. Organizational documents comprised a component of data collection for this study. One document includes a report written as a perspective journal article to share the first pilot's results with the educational community. The published report supplies the current and future stakeholders at the institution details about LA's utilization and benefits in the pilot online program.

In addition to the document submitted by study participants, other implementation team members had the opportunity to copublish with faculty members. Stakeholder P11 reported that publishing opened new ways to communicate; "after that experience, I started to suggest … we can share this experience, and to turn it as an academic paper." Stakeholder, P9 stated, "[the Implementation Team Manager], their team, put together this great report on how advisors use that, and the faculty members use the information." P1 said, "We're actually just finished a paper kind of looking at a pilot that we did, and in terms of research." Thus, the team did not use a mass media channel to introduce the LA system campus wide. However, they did publish papers and reports of the system and pilots for educators interested in the topic.

The intentional implementation method was manifest with ethical considerations, primary users agreeing to pilot use, and publishing information about the process. The leaders supporting the LA implementation wanted to manage LA's ethical use and

implement with partners interested in using data to support student success. Published papers and reports increased awareness of the pilots and use of data to a larger audience.

Theme 3: Interpersonal Approach to LA Communication

Interpersonal communication occurs in a one-to-one or small group setting among heterophilous or homophilous stakeholders. The institution's strategic plan for LA implementation utilized interpersonal communication channels rather than mass media communication channels. All of the interview participants described the interaction among stakeholders as interpersonal. The implementation began with one pilot and then continued through a series of pilots working with fully online programs interested in partnering with the implementation team. P5, explained the approach as,

> They [implementation leaders] wanted to pilot it in small groups, starting with a group that was actually a part of [online division]. So the communication was probably done, you know, in meetings, over emails…nothing distributed in mass.

A program leader, P7, described the LA implementation – pilot introduction,

> The first communication was in a faculty meeting where we introduced the idea. And sort of established that early buy-in. Subsequent to that, we have been, sort of using email and one-on-one conversations to sort of triage sort of the immediate situation, but also reiterating that this is a way that we can use as a tool in our meetings with faculty who are specific to the program.

An implementation team leader, P1, noted that "If someone wants to have access to [LA system data] we have to sit down and have a meeting and talk with them through all the things." Each study participant corroborated these descriptions of implementation

through interpersonal conversations and interactions with other stakeholders regarding building awareness and training, and support for LA.

Mass media channels allow for implementation teams to build awareness of innovations (Rogers, 2003). Five of the stakeholders reported a lack of mass media or broadcast communication channels at the institution for LA implementation. P9 explained, “it wasn’t a broadcast of any kind. Instead, we approached online programs one on one.” P5 said, “for some reason [mass media] wasn’t ever anything that was really done.” As a result, there is limited awareness beyond the stakeholder directly involved in implementation or data use.

Stakeholders’ interview responses revealed insight regarding the effect of heavy use of interpersonal communication channels. P10 said, “there is a limitation that working with the only kind of word of mouth, small groups of people who are in the know.” Most stakeholders reported that decision-makers maintained an interpersonal approach for the intentional implementation and controlled the message about student data use. P9 said, “So there hasn’t been any institutional rollout with learning analytics…it’s just been ongoing conversations.” Therefore, the implementation approach at the institution involved interpersonal interactions.

Workflow Communication

Participant’s statements demonstrated interpersonal communications regarding the workflow communication processes for faculty, advisors, and students. P7 summarized the workflow as “information could be conveyed to the student, via the faculty member or an adviser in terms of what they could do to improve their engagement

and improve their success." More statements demonstrating the communication channels for LA came from primary users regarding their introduction to LA. P4 reported that their introduction to the LA tools came from one direct supervisor, described as the "one that introduced me." Another clue of the same stakeholder's interpersonal interaction about the data reports they "come up in conversation" during team meetings. Another stakeholder, P6, described the initial introduction as interpersonal contact from the implementation team manager who" actually reached out to us." The same stakeholder, when talking about the interaction with partner programs as they begin working together, said, "they [faculty]…get a firsthand glimpse of what our team [advisors] is going to be doing., It always starts with a lot of questions. They always feel better when I explain the role of the advisor." When P6 talked about training processes, they said, "we'll talk about the ability of what the system is capable of from a faculty standpoint," however, "when we're training and onboarding an advisor, we will often have them job shadow."

As part of the process, P6 developed a policy for the advising team and "talked it through with our learning analytics team." Another stakeholder, P7, provided details of the implementation process, from recognizing the need for a better understanding of student interaction with the learning environment to integrate the analytics tools as a series of interpersonal interactions. "And so, it became clear, both in both talking with students and talking with faculty, that we needed a deeper understanding of how students were interacting with the learning environment." The influence to use the analytic tool described by P7 as, "It really came from having that personal relationship with someone who is already using it for another program." The same stakeholder described one LA

data use as, “We…have a subset of faculty that meet ... once a quarter to talk about program progress, trends, and patterns.”

The communication between the advisors, faculty, and students related to LA data included information from the first pilot, which outlined LA reports’ workflow. At the beginning of the term, advisors check the LA reports to monitor students’ progress and contact students identified as at-risk, and loop in the faculty if necessary. The faculty received the LA report of a student who had not logged in to the course. The faculty contacted the student directly and carbon copied the advising coordinator. During the term, advisors check the LA reports to monitor student progress and track critical dates such as withdrawal date and internship deadlines. Depending on student needs, the advisor coordinated access to resources for extraneous life circumstances and informed the faculty of external factors that may affect success. If an advisor learned that a student planned to withdraw, they made sure the faculty was aware. The faculty also utilized LA to monitor student progress and contacted students while looping in the advisors. The advisors developed a specific workflow for communication with students with scripts for intervention prompted from the LA reports.

Interpersonal Language and Actions

Most of the exchanges described by the study participants regarding LA communication among stakeholders occurred in small group settings regardless of stakeholders’ composition. From the beginning, the implementation team introduced the pilots in small groups. The first LA pilot involved a program administrator, advisors, a lead faculty member, several adjuncts, and two lecturers. Also, a small group of primary

users and stakeholders with dual roles would meet as a team. P3 explained, "beginning of the semester, we meet as a team as the…it's lead faculty, advisors our director and our IT guy and the advisors go over the…LA system data." Two members of the core implementation team reported the meeting on a biweekly basis. P10 said, "we do have biweekly meetings…having that systematic check-in period, just for anything that comes up, and so that's been a way to ensure that we do have that channel open to discuss things." P8 described a training interaction related to LA as "more of a one-to-one training…or he trained myself and like another person that would be using [LA system] in the program so, it was pretty small." Stakeholder interaction occurred in small groups or one-to-one for training or discussing the use of LA.

The interactions included interaction through conversations, discussions, talking, meetings, small groups, and personal contact. Each stakeholder used terminology in responses about communications related to LA, demonstrating an interpersonal interaction. The implementation of leadership and oversight role comprised efforts to gain feedback from primary users. P1 stated feedback collection occurred from the stakeholder piloting the system "through face-to-face interaction or email." Also, "meeting every semester to check in." The first pilot report outlined feedback options such as requests via email a small meeting periodically during the semester. The implementation team worked to adjust to feedback from stakeholders.

Regarding adjustments based on feedback, P1, noted the need to "make sure no one's workflow was disrupted." P1 found it essential to "share success stories" as part of the implementation process. Another stakeholder, P3 describes interactions regarding LA

as “provide suggestions to” “they asked us to pilot,” “we talked about it,” “I actually corresponded,” all of which supply evidence of interpersonal connections.

More language that revealed the interpersonal interaction came from participant P8, P10, and P11. P8 said the implementation team manager “reached out to our program partners to see if they were interested in using this,” as the action taken to onboard more stakeholders. P10, said, “Up to this point, it has the word of mouth, you know, building relationships and networks.” P9 noted that feedback channels were informal, yet the leaders were responsive and listened to feedback. A different stakeholder, P11, described the interaction related to LA’s implementation as, “we are discussing how the learning analytics projects can improve the quality of the instruction at the university.” The stakeholders shared information and conducted training through small groups and interpersonal interactions.

In the examples provided by all 10 interview participants and the pilot journal report, D6, the stakeholders’ interactions occurred in small groups or one-to-one. Most of the small group interactions described were cross-departmental or heterophilous — interaction among people from different groups. Thus, the small group consisted of faculty, advisors, IT, analysts, and administrators. In contrast, homophilous interactions occur between people with many similarities. In this study, the interactions between stakeholders in the same department with similar roles were homophilous. Stakeholders from different departments with different roles were heterophilous.

Theme 4: Continuous Transitions of LA Implementation

The topics of transition from the past or into the future entered the interview conversations regularly. As indicated in West et al. (2016) and Rogers (2003), transitions are commonplace in LTLA and DOI. As stakeholders described shifts related to the innovation, related subthemes encompassed explanations of how the innovation was initiated, refined through research of LA, intertwined with going through the process and learning by doing, and talking about LA's future moving forward.

Initiation Stage

The institutional plan of implementing a LA service occurred 8 years before the study. Online learning options are precursor to LA implementation at an institution (Colvin et al., 2015; Kitto et al., 2018; Lester et al., 2017; West et al., 2016). Therefore, the LA initiative developed in conjunction with online learning at the institution. A few professors began building and offering online courses, from which a division formed with a small staff to support online efforts. Only a couple of the participants were on board with the university from the beginning of the LA innovation. P9 said, "we've had…online programs for a long time, but institutionally we needed to make that commitment to doing online education more expansively. And so that's when I started the conversation on learning analytics." P9 continued explaining, "that was the impetus for starting learning analytics is to be able to use that for student success and engagement, as well as to inform how best to design online courses and programs to help students succeed online." One of the first members of the online division, P11, talked about the decision-making process. There was a debate about creating an in-house system or

purchasing a commercial solution. P11 said, “And another way is to build up a home-grown data warehouse.…However, on the other side, if you purchase the commercial product, it means you need to pay a lot of money.” The LA system, an add-on to the LMS, replaced a home-grown system with a dashboard. The initiative proposal document for the LA system corroborates the timeline of the system installation planning and funding.

Refining Innovation Through Research

Five participants that were either implementation team members or administrators recognized they were working with a new process, and four were new to their roles. Thus, they did not have a foundation specific to LA. Therefore, each member researched solutions to improve the process. An implementation team member, P11, involved in the initiation stage, studied what was happening in the United States and the United Kingdom From that research, the stakeholder suggested the university join the predictive analytics research (PAR) initiative, which complied data from similar mid-size universities to understand patterns in the data. Later other implementation team members dug into the literature. P10 reported, “we were digging into the literature when I first started my job,” and the small team working on LA discussed the literature in biweekly meetings. Two other members said they looked to other institutions for best LA practices. P5 noted, “there’s others [schools] as far as the strategy around just policy, around student data…. that have pretty good examples.” P1 noted that an expectation of support from the LMS/LA vendor was to share examples from other institutions, for example, “how do they [other schools] … create that bridge in terms of …., we have a solution, a tool, and

here are some ways that you might want to use it." However, the stakeholder's perspective was that the vendor was not a reliable source for documentation about program use from other institutions. However, one of the documents provided by another stakeholder contained intervention recommendations for LA data. Regardless, the institutional implementation team relied on research to understand the use and implementation of LA data, which emerged as a subtheme in the LA innovation dialogue.

Learning by Doing

In addition to research, stakeholders refined the implementation process through trial and error, thus learning by doing. Three participants used the exact phrase, trial and error, during the interview when they described working with LA reports and data. P11 described the approach as "learning by doing." P10 explained it as a dual process,

> that's been kind of a dual creation where we had to learn what the system is doing and can do to have effective practice using it. But we can't have effective practice using it until we get actual information about what this system can do.

Two of the primary users corroborated the trial-and-error process. P8 explained, "Some of it was trial and error. I remember being a little gung-ho with it in the beginning and not having boundaries….and then we just have tweaked and kind of developed more of our process from there." P6 elaborated further, explaining, "I would ask a bunch of questions and say, how do we make this work between our two teams? But we've kind of figured it all out to the point that it's not super difficult for us." P1 summed up the process as, "It's just like, hey, you're learning by getting inside of the system as it's being tested and figuring stuff out." The installation stakeholders produced a spreadsheet that outlined the

testing process, effort, and notes on each measure used for the LA reports. The testing process description and notes provided further evidence of learning by doing. Part of the learning by doing included the use of feedback channels by the implementation team.

The implementation team supplied various feedback channels that started as periodic and morphed to continuous input. P1 reported that the approach to asking for feedback changed from the first pilot to the subsequent pilots. For the first pilot, P1 shared that the team sent student data reports to instructors for a given period. That message "had…embedded a Qualtrics link." For subsequent pilots, a change in the feedback question and format occurred. P1 reported that they wanted to collect feedback throughout the entire process. They asked primary users to "document any time that they had used information from learning analytics to make some kind of intervention or out-reach student to understand what that looks like." They also asked general questions about improving the reports. The implementation team reported that they received helpful feedback, specifically through small group meetings with primary users.

Primary users reported different information regarding feedback channels. Three of the five primary user participants reported that the LA system's feedback based on the pilot experience went to the implementation team. P3 said, "when I was actively using the software, I would just report back to this team." Advisor stakeholders also noted that feedback on the LA system did go to the implementation team. P6 said, "I send it [feedback] to the learning analytics team." P8, a primary user, perceived the feedback requests to focus on the system's functionality rather than the use of the LA data. Two primary users said they were not aware of how to share feedback about the system. P4

said, “I don’t really know…who I would go to for feedback.” An implementation team member noted that the feedback channels were informal and a low priority with the global pandemic.

Regardless of the variation in feedback channels’, both the primary users’ and implementation teams’ comments about the content of feedback aligned. Eight of the 10 participants described the clear benefit for advisors but not the faculty. The implementation team leaders stated that the LA system was more beneficial to the advisors than the faculty. The faculty stakeholders reported the same perspective. P3 said, “when we piloted it… as faculty, we were…this is a good tool for student advisors.” The advisors unanimously stated that the LA system improved their ability to support student success.

All 10 participants talked about the LA reports, and three of the organizational documents focused on the reports generated from the LA system. Six of the participants noted that the implementation team made a critical adjustment based on input from primary users regarding reports. Initially, the weekly report contained all students enrolled at some point during a 15-week timeframe. However, the length of the courses varies. Some courses had 7 or 10-week terms. Thus, the primary users had to sort out the students not yet started to use the data before using the reports. The primary users asked to hide or remove inactive students. The support team worked with the IT department to add a filter based on the enrollment period, which improved the primary user experience. P8, a primary user, said, “They did make some changes since we first started using it. That made it a lot easier to use. They added like where you could see all the different 7-

week sessions or like 10-week sessions or a 15-week session" The implementation team manager would ask for feedback about the system and changes the advising team would like to see made.

The stakeholders reported the process of using the LA system involved learning by doing. The options to refine the system included seeking feedback, information from literature, and other universities using LA systems. Evidence of efforts to collect primary users' feedback and make adjustments showed in the stakeholders' data.

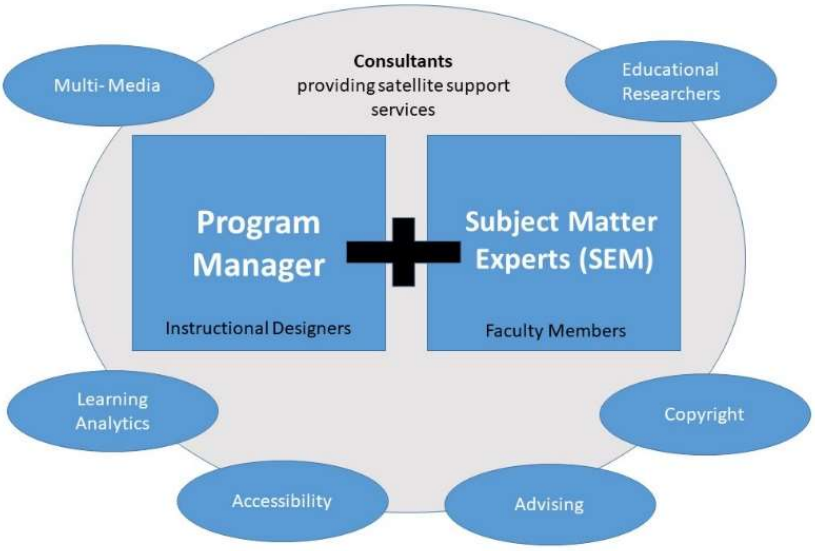
Moving Forward

Six of the 10 participants' from implementation support roles commented about plans for LA use and how to drive the innovation ahead. P1 spoke about overall future targets making "a more user-friendly system in terms of aligning it with the institution's needs." Specific target areas included a robust system for course evaluation and a student-facing data system. Both required strong policies and input from all stakeholders. P7 stated that "I think we're still in the phase of figuring out how to best use it [LA system]." Also, P10 spoke about a fellowship program "we're hoping to launch a grant process in the next year for a few faculties to have fellowship communication channels." P10 also explained that the target for data system improvements would move beyond the live course, "we are designing a new process for not using learning analytics simply in live instruction…use the analytics not to answer questions, but to pose?" The plans include stakeholders across disciplines and roles, bringing the stakeholders together, and possibly incorporated mass media, thus addressing a broader scope of needs and ideas for LA system use.

The implementation team's fellowship program plan continues an interpersonal format with small groups to connect with consultants for course design support. One stakeholder served as a project manager in these smaller teams and a faculty member and instructional designer to help develop courses. The faculty members served as subject matter experts. P10 described the group structure as a "satellite or a constellation of other support services with multimedia learning, analytics, educational resource, and copyright accessibility…where the instruction designer will pull us into consultations with the faculty throughout the design development course." See Figure 3 for how the support network functioned.

Figure 3

Diagram of the Description of Stakeholder Support Structure Network for Course Design Development Integrating LA Data



The theme of the continuous transition of LA implementation involves the initiation stage, refining through research, learning by doing, and moving forward. In the initiation stage, the decision to purchase a third-party system and implement it using a series of pilots across the fully online program set the stage for later implementation transitions. As the stakeholders worked to initiate and implement the system, literature on LA's topic provided insight into how other universities used LA. Also, stakeholders would collaborate with individuals from other universities to learn more. The implementation team sought feedback throughout the process and adjusted. Now looking to the future, the use of fellowships to bring various experts together to solve LA problems is part of the plan. The team also mentioned using mass media channels as part of the next transition stage in the implementation process.

Theme 5: Infrastructure, the Backbone of LA Data

All 10 participants talked about aspects of infrastructure. The primary users talked about confidence regarding the accuracy of the data with a few expectations for when changes occurred with student's schedules or advisor assignments. Primary users also noted glitches with report generation related to system maintenance. The implementation team members would talk about integration between the system and the rigid nature of the out-of-the-box solution. Four of the organizational documents contained information about testing and validating LA data reports. The testing and validating process directly related to the system's infrastructure. The infrastructure for the system integration and reports served as the backbone of the current system. The LA system, which was an LMS

add-on, served as a data warehouse. P1 explained the system was "a data warehouse that pulls in all of our student learning data from LMS." A report for the advisors in a one size fits all format with limited customization. Two advisors described the three types of reports.

One type of report was an "advisor at a glance," which contained login information, number of submissions, and grade data for all students. A different kind of report collected the login data and the final report with grade data. On occasion, the reports did not get sent due to a maintenance update or a change in the system's student degree or advisor assignment. P9 reported that "the thing about the [LA system], it's an all or nothing. And you can't customize it. You can't…narrow it down." Thus, the stakeholders worked to use the system within the given reports.

Issues related to the limited report customization and system design influence the user experience and security. One advisor provided detailed information about the process of searching for specific data for students. P8 explained,

> once you get into the report…you click into a student. To look more to do more of a deep dive, you can't back arrow. Go back to the previous page. You have to pull the whole report again…So that is really difficult. Takes a lot of time.

Stakeholders with I.T. expertise noted that even though the system required an annual license renewal, the system was stagnant. P5, said. "just that it [LA system] hasn't been updated in a while." In addition, the system does not have built-in access controls. P1 said, "lack of controls from the system itself…when we give access to a faculty member to a report, they have carte blanche access to the whole university," which creates

security issues. P1 explained the vendor requires additional payment for customizations, "But overall…[The LMS wants]. you to…pay them to go and do customizations." Therefore, in-house customizations of the system depended on the capabilities and resources of the institution.

The topic of infrastructure was prevalent in the literature (de Freitas et al., 2015; Ifenthaler, 2016). Stakeholders reported that the infrastructure was essential for data accuracy, data security, and interface for the person using the system. The stakeholders in this study reported benefits of having access to data; however, the system's constraints limited avenues to improvement or expanded use of the system.

Theme 6: Culture Determined Through Leadership

Culture and leadership influenced the attitude toward innovation. Understanding an institution's culture and building the LA program within the culture was addressed by the LTLA framework and the SHELIA framework (Tsai et al., 2018; West et al., 2016). In the LTLA framework, culture is under leadership and governance with the level of sponsorship, positioning in the institution. In contrast, the SHELIA framework included culture with the trust of data and openness to change under the internal capacity to effect change. In this study, the related to culture emerged as structural support for the innovation through subthemes of sponsorship level, positioning in the institution, and leadership.

Level of Sponsorship

The level of sponsorship for the LA innovation existed in a division that supported online learning at the institution. Evidence of sponsorship came from funding

for software, support, and personnel for the LA system. The LA innovation was synonymous with online education at this institution, as reported by all interview participants. P9 said, “there was some funding available to purchase [LA system] software, which is the plugin for…LMS to have those learning analytics reports.” P11 explained, “it is through the [division], so it provides all kinds of non-traditional education for the college-level courses.” Thus, the leadership of the division limits oversight to LA implementation for fully online programs. P9 explained the dynamics, “there’s interest in using those tools beyond the online education realm, across the institution. I mean, we’re always supportive of that,” However, “we stayed within our lane” based on the direction from the institution’s higher-level leadership.

Positioning in the Institution

The positioning of the LA stakeholders in the institution influences the process at the division and individual levels. The [online division] was a side unit at the institution created to support non-traditional education initiatives centered on online education opportunities. In the Initiative Proposal document for LA, D1 designated a small unit of four to six members within the online division to drive the implementation. One of the proposed constraints of the proposal was the inconsistent use of the LMS across campus. Therefore, the online division partnered with entirely online academic departments that used the LMS consistently. P1 described the partnership as the “programs, and the courses all belong to the academic department and the faculty members. And we’re here to support them and their students.” The positioning of being a support to the programs influenced the dynamics between the advisors and faculty.

Three primary users who were advisors reported that the faculty approved the level of interaction or communication advisors had with students. Advisors monitored the LA reports looking for opportunities to support student success but needed to confirm with faculty regarding interventions directly related to academic performance. P8 described the process for the position of faculty support,

> I might be reaching out to help with the student during the semester, and then they'll [faculty] tell me, like, here's all we want you to do with it … so I have some boundaries with that as well" Furthermore, the stakeholder said that interaction is contingent on what the faculty member wants, "we can't decide independently of the programs… because…it's their class…we're there just to support them and the student.

P7, who worked with academic programs, indicated faculty "aren't necessarily comfortable or accustomed to having other folks involved in the learning process." The dynamics between the advisor and faculty both contacting the students was a process that required continuous and responsive communication. Both the advisor and faculty have different positioning levels at the institution, which influenced the interaction necessary to support the student as a team. The advisor reviewed LA data information weekly, and the faculty directed the instruction, entered grades, and thus understood the student's performance.

All participants that were members of the implementation team commented on the positioning in the institution. P1 said, "it's like we're kind of trying to push from beneath, but there's not a lot of strong institutional priorities around it [LA]." P10 said, "the

priorities our team has with pushing some of these things forward to fit into a larger organizational context. And I think that sort of silos us a little bit." Therefore, the data show that the implementation team held a mid-level administration position in one division institution and functioned as a support option for faculty and students.

Decentralized Leadership

The stakeholders described the leadership as decentralized. P10 said that they "do have institutional movements and leadership that make decisions about, using the tool. But the practical reality of it is definitely decentralized." When P5 talked about ramping up any adoption, they said, "There's really no one who it falls on. It's several people's responsibility. Thus, the path to expanding the adoption was through disparate divisions and leaders. Another level of complexity with a decentralized leadership structure is that LA use does not work in an imposed manner, and it requires a team of experts. P7 noted that they were "surprised by the level of bureaucracy that I needed to front or navigate to implement it." As a result, the stakeholders viewed the LA implementation progress as slower due to decentralized decision-making. The culture and leadership affected the LA implementation.

The culture determined through the leadership at this institution for LA implementation is disparate and siloed. The level of sponsorship through software and personnel funding exists in a division supporting online learning programs. The midlevel positioning influences the interaction with other divisions. However, the online division's leadership to support other divisions by sharing information did not have oversight of the implementation of on-campus implementation. The positioning of the individual

stakeholders, advisors, and faculty requires a level of complexity for each to understand how to support students. Finally, decentralized leadership increases the complexity regarding the vision for expansion at the institution.

Theme 7: Stakeholder Actions Influenced by LA Data

The implementation team members and primary users reported increased visibility of learning activities, which influenced their respective roles. The purpose of LA stated in the Initiative Proposal document, D1, noted the expectation of developing faculty, advisor, and student reports associated with timely and effective interventions. Also, the data would provide meaningful measures of LMS utilization to the OIT stakeholders. Nine of the 10 participants reported that advisors could see student data to target student needs proactively. P6 described the triggers for advisors to act, "if a student doesn't login in 3 days, the advisor is notified through learning analytics…or...if they have a grade below a C in a given class." The advisors take an intervention action for either prompt. The advantage of increased visibility was explained by P8, "without this… data, we would be flying blind like we wouldn't know until a student fails a class and then we're doing a lot of cleanup." The use of LA data allowed a new perspective. P1 said, "the advisors had a certain level of insight, and they could see patterns across for an individual student across classes." Based on the insight gained from student activities' visibility, advisors worked with all instructors for one student and addressed student needs.

An instance occurred at the institution reported by four of the ten interviewees working with LA in different capacities. An advisor noticed a student who had a sudden

drop in grades across all courses. When the advisor intervened, they learned the student had lost their job, which created food insecurities. P9 said, “they [advisors] were able to catch earlier food insecurities. For students…disengaging from the course. That triggered the adviser to reach out sooner rather than later.” The result of the discovery, as reported by P9, “so that triggered a whole slew of support systems around for that student, not only to address those insecurities but to get them to get them back on track so that they can take continue their education.” The visibility of that student and action by the advisor influenced the level of support for that student.

After the first LA pilot, the institution transitioned from faculty as the primary users to advisors. P3 said, “I thought it would be…more useful for me…when I’m in the course. But it really wasn’t…I was able to go into the grade book and see student’s participation.” P1 corroborated the feedback, “Faculty, it wasn’t as useful to them, the reports. And I think the reason was that faculty are already pretty engaged. However, the feedback from advisors reported by P1, “the feedback that we received was that advisors totally loved it [LA data], felt it was really useful, those reports.” P3 said, “Now the advisors are taking a bigger role, and they are reaching out to students that they see that are not logging in.”. The first pilot of the LA system targeted faculty as primary users. The implementation team, faculty, and advisors realized the system served as a valuable tool for the advisors.

Even though advisors receive the weekly LA reports and drive students’ interventions, faculty involvement is crucial. All of the primary users who were advisors reported the essential relationship and engagement of faculty regarding the LA

implementation. P8 explained, “if the instructors aren’t invested…their grade books could be incorrect. And, you know, it could look like all the students are failing. And that would just be kind of useless.” The advising team’s approach is to partnerships with academic programs that agree to work with advisors using LA to support students. As explained by P6, “We have agreement from our program partners to actually reach out to those students. So we reach out to the students and offer support.” P8 added that "we can’t decide independently of the programs." Advisors reported that even with programmatic buy-in, the perspective of each faculty varies. P6 said, “some think it’s great something it’s an awesome system. And they like that my team does it. And then some find us a little odd and think that we’re a little too overbearing.” The faculty defined the advisor’s extent of interaction with students.

Beyond the LA targeted student support from advisors, faculty, and program administrators gain insight about course design. P3 explained how data supplied information about time students spend on different modules, “the purpose of looking at students….in the course…it grabs how much time students are actually in certain modules and courses.” P3 found that it “showed me that there was 1 week where there was so much work to complete that week…spending way too much time.” Based on this data, the instructor adjusted the course. P11 worked with an academic program to identify a bottleneck course and design an online version to increase enrollments. Online managers use LA data to work with faculty when they review their courses. P7 said, “we were really looking at it as another data point in improving student learning from a number of perspectives.” The primary user stakeholders use data at different frequencies

for different purposes. However, the LA data prompts action intended to improve the student experience.

The theme, stakeholder's actions influenced by LA data, captures the result of implementation efforts through communications prompted by data and dialogue about the information presented and how to use it. The use of data changed the student data's visibility for the advisors at a high level, which affects the interaction between faculty and advisors. The information also informs faculty and managers when they looked at course design.

Research Question Results

Research Question 1: Communication Channels

The first question focused on communication channels: how do stakeholders use different communication channels during LA implementation in a HEI using elearning options? Stakeholders described the interaction as occurring through one-on-one or small group meetings. The recruiting for pilots to use LA happened through personal contact from the implementation team or a colleague who had used the program previously. The stakeholders reported over 65 different instances of interpersonal heterophilous (cross-departmental) and homophilous (internal departmental) connections between primary users and implementation support members. Stakeholders described interactions through conversations, discussions, talking, sharing, partnerships, and correspondence. Therefore, the implementation team intentionally managed the approach of data use through interpersonal interaction among stakeholders. As a result, the stakeholders reported that

LA's adoption moved at a slower pace because of the heavy reliance on interpersonal communication channels.

Research Question 2: Domains of Dialogue

The research question asked how stakeholders engaged in LA domains of dialogue during implementation in a HEI using elearning options. The stakeholders reported talking with each other about the data reports provided by the LA system. Some of the advisors spoke about how they used the report, and others did not. However, the advisors talked with the faculty in the programs they supported to interact with the students. The advisors discussed technical issues related to the report generation or data accuracy. When an error occurred, advisors reported to the implementation team, who let the IT support know. The implementation team discussed literature and best practices acquired from published research and other institutions. They also talked about options to provide data that support course design or evaluation. Topics of governance and policy, as well as data use, occurred in stakeholder conversations. The stakeholders engage in dialogue about LA in a small group or one-to-one setting. The topics of the dialogue aligned with the issues outlined in the LTLA domains for LA implementation.

Summary

The design of this research study aimed to answer two research questions. First, how do stakeholders use different communication channels during LA implementation in a HEI using elearning options? Second, how do stakeholders engage in LA domains of dialogue during LA implementation in a higher educational institution using elearning options? The purpose of this qualitative case study was to explore how HEI stakeholders

from different departments that used elearning tools in one U.S. institution engaged in communication channels and dialogue occurring during the LA implementation process intended to improve learning and teaching. The themes found in this analysis were: stakeholders involved in LA implementation had multidisciplinary backgrounds and expertise, intentional implementation of LA, interpersonal approach to communication about LA, continuous transition related to LA implementation, infrastructure, the backbone of LA data, culture determined through leadership, and stakeholder's actions influenced by LA data.

This study identified how the stakeholders used communication channels and dialogue domains addressed during conversations regarding LA data use. The stakeholders discussed the need for experts with a variety of backgrounds to implement the LA system. The stakeholders involved used interpersonal communication channels to recruit, train, and collect feedback regarding LA data use and implementation. None of the stakeholders were aware of the mass media channels used for the LA implementation. Intentional implementation entered the conversation with stakeholders who were division and unit leaders. IT support professionals, data analysts, faculty, and academic advisors. The intentional implementation approach meant that ethical considerations regarding the use of LA data support student success rather than excluding students or punitive measures. Also, to avoid imposing the help of LA data. Involvement from IT stakeholders occurred initially; thus, the stakeholders reported confidence regarding the infrastructure. However, because of an outside vendor system add-on to the LMS, customization limitations existed. The leadership decisions for the LA innovation

determined positioning in the institution and level of sponsorship. At the study institution, leadership driving the implementation existed at the online and IT division levels. Division directors rank below the institutional executive level and above that of a department leader or individual stakeholder adopter. LA data increased the visibility for the advisors who were responsible for supporting student success across all courses. The LA data did not provide increased visibility of students or efficiencies for the faculty with the LA data report provided in the system's pilot uses. The discussion of LA touched-on domains from the LTLA framework occurred through interpersonal communication channels defined in the DOI framework.

In Chapter 5, I will share an expanded discussion of the results by interpreting findings and conclusions. Also, I included limitations of the study, recommendations for future research. Furthermore, I outlined the study's implications for positive social change for the findings and implications for the research method and practice in education.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this qualitative case study was to explore how HEI stakeholders from different departments that used elearning tools in one United States institution engaged in communication channels and dialogue during the LA implementation process intended to improve learning and teaching. I explored the communication channels and dialogue domains used during LA implementation at one HEI as a bounded case study in a naturalistic setting (see Merriam & Tisdell, 2015). This exploration helped expand knowledge about the LA implementation process because empirical evidence related to the topic was limited.

The key findings involved the approach to LA implementation, the transition from the innovation, how the system's culture influenced decisions regarding the innovation, and the utilization of LA data. An integral component to interpreting the findings was identifying the key stakeholders and how LA influenced their roles. The stakeholders had various backgrounds and expertise and included advisors, faculty, instructional designers, team managers, administrators, learning analysts, data analysts, and system administrators who either used the LA system or facilitated its use. Stakeholders who used the LA data to drive interventions to support student success (i.e., advisors and faculty) were labeled primary users of the LA system. Other stakeholders provided implementation support directly or indirectly for primary users, whom I labeled, implementation supporters.

The designation of primary users and implementation support team members were different from stakeholder groups described in the literature. Stakeholders defined by a

department appeared most often (Alamuddin et al., 2016; Arroway et al., 2016; Cox & Naylor, 2018; Parnell et al., 2018; West et al., 2016). Stakeholder role showed as another common designation (Alamuddin et al., 2016; Arroway et al., 2016; Avella et al., 2016; Gašević et al., 2015; Parnell et al., 2018; Tsai & Gasevic, 2017; Wei et al., 2019; West et al., 2016). Mavroudi et al. (2018) grouped stakeholders as main participants and main beneficiaries. While the stakeholder's department and role played a part in stakeholder involvement, it did not delineate stakeholders into participant or beneficiary groups in the current case study. All the stakeholders in the current case study served as participants in the LA system, and none identified as beneficiaries; instead stakeholders fit into groups of primary users and implementation support. The basis of the groups relied on their connection to LA, specifically in an implementation environment.

Three factors influenced how the implementation team communicated with the primary users and the topics of conversation. First, the stakeholders from both groups expressed awareness of tension created by the promise and peril of LA data use and wanted to ensure the intentional implementation of LA data. Thus, the implementation approach involved interpersonal communication in a series of pilot projects with online academic programs using advising services. Second, each pilot and expansion of LA use increased the knowledge and alignment with institutional needs; therefore, transitions occurred in the process and communication workflow facilitating LA data use. Third, stakeholders explained how the out-of-the-box system's infrastructure structure had limited customized data reports. The limitations of the system and the educational setting's culture influenced the implementation and unitization of LA data.

In this chapter, I detail the study findings and my interpretations, the limitations of the study, recommendations for further research, implications for society, and the method and practice related to the phenomenon of LA. The final section contains conclusions for the study. To make my interpretations, I used a conceptual framework comprised of the DOI theory and LTLA framework as a lens. The DOI theory (Rogers, 2003) involved communication channels connected with LA implementation progression. The LTLA framework (West et al., 2016) focuses on the dialogue and the content discussed among stakeholders related to its domains. Furthermore, the findings are discussed related to the literature review in Chapter 2.

Interpretation of the Findings

In this study, it became clear that stakeholders involved in the implementation of LA used interpersonal communication channels to introduce LA and provide training and feedback. The discussion topics or dialogue about LA had similar themes among stakeholders with distinct perceptions of LA's role and use. Furthermore, the evidence from the study confirms, disconfirms, and expands upon themes from the research literature. Finally, the findings contribute to existing knowledge on LA and educational technology implementation regarding communication channels and stakeholders' dialogue domains.

Communication Channels Used to Implement LA Data System

The findings show that stakeholders used interpersonal communication channels but not mass media channels. Each participant used language with detailed descriptions of interpersonal conversations to introduce, train, or provide feedback for LA at the

institution. Interpersonal communication occurs in a one-to-one or small group settings (Rogers, 2003). Stakeholders also noted the lack of mass media or broadcast communication channels at the institution for LA implementation. The strategic plan discussed by implementation innovation leaders involved a series of pilots with online academic programs to drive the adoption and focus on using the data for student success. Although the strategy organized innovation and controlled the language and use for student success, system-wide adoption findings suggest this will take several more years and may not be replicable for on-campus implementation.

Prior research about the communication of stakeholders during LA implementation described similar use of communication channels. Cox and Naylor (2018) used a small group of stakeholders comprised of academics, professional staff, and program directors who met monthly to discuss student progress and support student achievement regarding LA programs. Tsai and Gasevic (2017) found that collaboration during LA implementation closed the gap in stakeholder perceptions.

The study site institution did not utilize mass media to build awareness about the LA innovation. Furthermore, I did not find an example in another educational institution's literature using mass media to promote LA. As a result, faculty and staff at the study institution beyond the implementation pilot groups were unaware of the LA initiative. However, Arroway et al.'s (2016) findings suggested LA implementation occurred in fragmented groups in other institutions. I found that communication occurred among the stakeholders involved in the pilots but not beyond the pilot groups, creating pockets of implementation versus a system-wide adoption.

The DOI theory addresses innovation attributes and how communication channels influence adoption rate (Rogers, 2003). Attributes perceived by stakeholders in this study and those of studies from the literature regarding the LA innovation aligned with varied adoption rates for stakeholders in different roles. The DOI attributes of innovations, including relative advantage, compatibility, complexity, trialability, and observability, all affect the adoption rate (Rogers, 2003). The relative advantage attribute reflects how the stakeholder perceives that innovation's benefit surpasses the current process or practice. Stakeholders in the current study reported various levels of relative advantage. Compatibility attributes connection with stakeholders' perceptions of existing values, past experiences, and adopters' potential needs. The institution's culture and the perception of individual adopters influence the level of compatibility (West et al., 2016). Another innovation attribute, complexity, addresses the difficulty to use or understand the innovation (Rogers, 2003). LA's complexity level is generally high, impeding the adoption rate (Ferguson et al., 2016). Trialability is the degree that stakeholders are able to use the innovation on a trial basis. The LA innovation requires a team approach involving experts from different areas and infrastructure to support the system; therefore, trialability is low (Rienties et al., 2017; Slater et al., 2016). Another innovation attribute, observability of the innovation, relates to the visibility of results to others (Rogers, 2003). Since the effect of LA use requires data related to student success collected over time, at least a semester, course term, or more, observability takes time to develop (Ferguson et al., 2016; Saxena & Kasparian, 2019). In this study, the observability varied among stakeholders. The innovation attributes discussed in this paragraph come from the DOI

theory; however, the DOI innovation attributes intertwined with the LTLA conceptual framework regarding stakeholders' dialogue fit into other themes and are noted when relevant.

The findings related to DOI communication channels about how stakeholders used interpersonal communication channels involved introducing, training, and gathering feedback for LA implementation pilot programs. No use of mass media channels to increase awareness campus-wide or recruitment for pilot programs occurred. In the future, division leaders intend to develop teams around institutional problems that will benefit from using LA data to expand communication regarding the data.

Domains of Dialogue Regarding LA Implementation

Stakeholders reported topics aligned with the domains of the LTLA framework (see West et al., 2016). The domain topics include the institution's context, transitional institutional elements, LA infrastructure, transitional innovation elements, LA for retention, and intervention and reflection. The LTLA framework also includes recommended questions related to each domain. The study site institution did not use the LTLA framework; however, comparing the interview data to the framework questions added insights into the alignment of each domain. Participants demonstrated awareness of the institution's context through an explanation of the implementation background and process. However, the dialogue among stakeholders did not contain explicit connections to the institutional context. In the following subsections, I expand on the alignment between the dialogue domains and the implementation processes and conversations at the institution.

Institutional Context and Transitional Elements

This section focuses on two dialogue domains from the LTLA framework: institutional context and transitional elements. According to West et al. (2016), context is the guiding feature of analytics implementation and includes the policies and regulations related to the institution's location, size and structure, strategic positioning, student demographics and characteristics, and staff demographics and characteristics. The study site was a midsized research institution with a division devoted to fully online programs and educational innovations to support nontraditional students. Implementation team members explained connections between the institution's size, partnership with other institutions, policies related to privacy laws, and student demographics to the LA implementation.

Evidence from both the primary user stakeholders and LA innovation documentation showed that the LA system and intervention plan support students enrolled as fully online students. The student populations for fully online programs were mostly nontraditional students returning to school. The students often worked full-time jobs and had families. None of the participants mentioned the staff demographics or characteristics. The data showed the context topics existed as background knowledge rather than a part of the dialogue used to drive LA implementation. All the institutional context components influence LA implementation because the LA system needs to fit the institutional needs and available resources.

Innovations require transitions at the institutional, organizational level. Rogers (2003) outlined the stages of the innovation process for organizations. This institution's

LA projects reflect the second stage of DOI, which fits the organization's problem with the innovation (p. 420). West et al. (2016) addressed the institution's transitional elements as related to how the institution's culture promotes and challenges LA's advancement. The stakeholders in the current study did not directly discuss the institution's cultural aspects related to promotion or challenges; however, they did discuss the positioning of LA and the level of sponsorship associated with the strategic positioning of LA in the institution as well as and the sponsorship of LA as part of the institutional transition. West et al. noted that the level of sponsorship is usually academic or IT, which was true for the case study site.

Transitional elements of the institutional LA innovation included assigning the online division and OIT division as the strategic leaders for the LA implementation, which set positioning in the institution and level of sponsorship. An initial hire involved a dual role of instructional designer and data scientist. As the program matured, a need for additional experts and team members emerged, and the original data scientist left the institution. A new position of a research and innovation manager replaced the dual role of instructional designer and data scientist. At the same time, the study site created a learning analyst position occurred, which a person filled with a data science and instructional background. Prior research also identified the need to expand staffing to support LA implementation. Ifenthaler (2016) found that HEIs lacked staff and technology available for LA projects. Therefore, knowledgeable staffing is vital to technology innovation to fill the gaps that affect successful adoption.

Due to the level of sponsorship and positioning of the LA innovation institution, the online division had the autonomy to transition and strategized with IT to promote and address the LA implementation challenges. However, the transition to on-campus implementation will involve different stakeholders. Evidence of the strategic plan for the entire institution transition related to the LA implementation did not emerge from the data collected in this study.

LA Infrastructure

The institution had an established division to implement and support technology initiatives. IT developed an initial proposal and outlined the process to deploy and test the LA system's integration within the existing data systems. It is common for professionals from the IT discipline to partner in educational technology implementations (Adejo & Connolly, 2017; Alamuddin et al., 2016; Avella et al., 2016; Lester et al., 2017; Mavroudi et al., 2018). They also explored developing a system developed in-house and joining the PAR group to share databases as a midsize institution. However, they transitioned to an outside vendor for the LA system, which served as a data warehouse.

The dialogue domains regarding infrastructure aligned closely with LTLA's recommended topics. West et al. (2016) suggested stakeholders discuss the institution's expertise, the level of technical sophistication, and the reliability of the system. Stakeholders reported leadership decisions related to the expertise in the institution and level of technical sophistication. One implementation team member pointed out limitations of IT capabilities to develop a LA system in-house. However, the IT team supported minor customization of reports and maintenance issues for the vendor-

developed system. Dialogue related to the system's reliability generally showed a positive perception from stakeholders regarding some problems. A primary user reported a high level of confidence in the data accuracy. Two other primary users trusted the data but said problems after a few enrollment or advisor changes. On occasion system, maintenance affected report generation but not data accuracy. Prior research reported that stakeholders perceived infrastructure as integral to LA implementation. (Ifenthaler, 2016; Moscoso-Zea et al., 2016). Challenges to LA implementation stem from insufficient infrastructure (Arnold et al., 2014; Cope, & Kalantzis, 2016; de Freitas et al., 2015; Graham et al., 2013; Ifenthaler, 2016). The study site institution demonstrated a keen awareness of LA's infrastructure connection and the related capabilities or limitations.

Transitional LA Elements

The transitional elements for the innovation existed in the online division but not on an institutional level. West et al. (2016) noted dialogue surrounding LA implementation should include an institutional strategic plan and associated governance arrangements. The study site LA implementation showed three transitional stages for the division and online programs implementing LA: the initial stage, learning by doing, and moving forward. The OIT and online division leadership developed initial proposals, a data integration test, and budget planning in the initial stage. Also, the implementation team was staffed and trained. Implementing LA using a pilot with one fully online program was a strategy of learning by doing.

The stakeholders reported learning instances by doing or trial and error to figure out how to use the system and develop best practices. One of the best practices set early

in the pilot was to outline the communication in the workflow among advisors, faculty, and students. Another part of the learning process was to use feedback channels to share the LA system's needs and utilization of primary users to the implementation team. A formal report of the first pilot informed leadership for the online division and other LA utilization divisions. The stakeholders continued to increase LA data use and awareness through a series of pilots. Still, they did not have definite plans to change the strategy of using pilots to promote the LA innovation. The COVID-19 pandemic halted tentative plans to hold workshops, small data fluency training, and creating a community of practice as priorities shifted to adjust to moving the institution online.

The implementation path forward entered the conversation among stakeholders through informal channels. One of the lead implementation teams discussed plans to add professional development sessions and mass media promotions as a strategy. More specific plans involved developing a team of experts available to support faculty who wanted to use LA to redesign courses to improve teaching and learning. An online division leader noted that the LA innovation was gaining interest among the on-campus stakeholders. The online division would support the on-campus implementation, but the Center for Learning and Teaching would lead that effort with input from the OIT. Thus, the implementation leaders had ideas for expanding LA. However, they need backing from institutional leadership and other divisions to move forward.

LA Retention, Intervention, and Reflection

The goal of LA implementation centers on areas to improve student experience or success at some level. The schools in the original study for the LTLA framework

development focused on student retention (West et al., 2016). However, there are other goals for LA, including predictive analysis and informing pedagogy. The institution in this study looked at predictive analysis in the initial stage. However, the risk of excluding students shifted the efforts toward the early warning system as another option to improve retention. The early warning system worked through a manual review of LA data reports by advisors. Advisors contacted students that showed on the activity exception report. For example, if the student had not logged in for the first four days, the advisor attempted to communicate with the student. The advising team created a workflow document with communication workflow for advisors to contact students with scripts for intervention actions. In the first pilot, targeted faculty members for the retention intervention plan with advisors as a backup. The faculty determined that the LA data reports fit the advisor role for intervention better through reflection and feedback.

Advisors reported that the LA data reports' vision created a relative advantage (Rogers, 2003) for proactive intervention to increase student retention. The advisors noted immediate benefits from receiving access to LA data reports where the faculty reported duplication of information in the LA reports and LMS grade center. However, the faculty did note minimal benefit from reviewing the LA data to detect student activity patterns used to adjust course design from one term to the next. The first pilot report showed increased student retention for students in the fully online program participating in the pilot. Implementation team leaders found the data encouraging but could not attribute the improvement to the LA implementation alone as retention involved many complex factors. Thus, the advisors felt empowered to help the students through

interventions. The retention rate did improve. However, LA data were challenging to measure in the naturalistic setting.

Limitations of the Study

Four limitations are evident in this research study, based on the research method, nuances at the study site, an unforeseen outside factor, and my own bias as a research instrument. The first limitation relates to the nature of a qualitative case study approach because results have limited transferability beyond the study site. Also, the innovation of LA had dependencies on the context of the institution. Thus, LA projects tend to be unique to each institutional setting. Application of findings from this institutional setting to another depends upon relevant insights based on another institution's environment and needs.

The second limitation involved the nuances regarding the interpersonal approach used as an implementation strategy resulting in limited data only from those stakeholders who worked directly with the LA data system. Participants included stakeholders working with the implementation team and fully online program. Stakeholder participant was voluntary. Thus, the sample consisted of individuals interested in innovation in education and knew LA. Therefore, data may represent a more positive view than that of the general population.

A third limitation resulted from the COVID-19 pandemic, which necessitated changes to campus and personnel access. Constraints of recruiting options occurred because of limited personal contact and social distancing rules. Also, the potential participants incurred a heavy workload related to transitioning the entire institution to

online learning. Many recruited stakeholders rejected an invitation to participate due to their changing responsibilities.

The last limitation relates to my biases as a researcher. My personal experience working in the online education environment to promote student success without an LA data system made me recognize LA's value. I made an effort to reduce biases by taking notes during the interview, recording interviews, transcribing word for word, sharing interview summaries with participants, and keeping a reflexive journal throughout data collection and analysis. Each strategy helped me remain objective and neutral as I wrote results.

Recommendations

Recommendations for future studies expand upon this study's findings through surveys distributed to a randomly selected population of LA stakeholders, a focused research comparing predictive analytics results with LA data-driven interventions, and a study gaining insight into LA's student perspectives. A more extensive scope study using surveys to collect information from various stakeholders; faculty, students, advisors, institutional researchers, innovation and implementation specialists, senior management, and IT regarding the general knowledge and attitude toward LA would inform educational technologists about the status of the innovation and perception of stakeholders. Ferguson et al. (2016) stated that more research is a need in the areas of LA adoption and implementation. A broad survey study would provide direction for future studies.

A need for further research about the benefits of LA regarding retention or student success exists. In this study, stakeholders saw an improvement in retention but could not confirm a correlation with LA data use. Still, a gap exists between the possible benefit and current practice (Wei et al., 2019). An experimental study designed with a combination of predictive analytics and interventions prompted by LA data may reveal a correlation between student need and targeted intervention. A predictive analysis conducted for a group of students would be completed but not shared with the LA data report's primary user for interventions. An option to collect data for the type of interventions, ability to contact students, and frequency of interventions. At the end of the term, a comparison of the predictive analytics with the interventions triangulates the findings. The students' analysis predicted to have limited success or drop aligned with successful interventions would add to the knowledge regarding LA's effect on student success.

The recommended study follows a similar concept to the student performed by Cox and Naylor (2018) at La Trobe University. The number of successful intervention contacts makes with at-risk students in an experimental group. The academic performance tracked though final course grade increased for the students that had successful intervention contacts. This approach would compare student success and contact interventions with predictive analysis modeling.

Students are a critical topic in LA research studies and implementation plans; however, students are rarely directly involved in the LA system or process. Aljohani et al. (2018) conducted a study using a student-centered dashboard that showed positive

academic performance results for the students using the dashboard. West et al. (2016) recommended working toward more student-facing LA data options but cautioned that the task was deceptively simple. Student-facing data considerations include ethical governance of privacy and security, monitoring unintended consequences, and data use goals alignment with institutional goals. In the future, students will increasingly expect real-time feedback during learning with options for self-reflection on the learning process (Leitner et al., 2017). With that, a recommendation for future research needs to involve student-facing LA data options monitored closely through institutional aligned research studies.

Implications

LA can provide options to understand the learning that occurs online at a deeper level. Given the COVID-19 pandemic constraints, which shifted learning online, many students and teachers experienced online education for the first time, which increased the need for additional support and information. LA supplies options for efficient and effective support through feedback and alerts for stakeholders. Ethical use of student data provides an opportunity to support students and teachers working and learning remotely. Even with the increased need or LA, the innovation will not work if imposed. Thus, information from this study may inform others working to implement LA for online nontraditional student populations. Such as the online division in this study that served students who had returned to college to complete degrees, while working full-time jobs, and many with families. The student population is a component of the institutional context that guides LA implementation.

Positive Social Change

Use of LA for positive social change is possible when used to funnel additional support for needs detected by analyzing learning data. For example, an advisor notices a marked drop in a student's performance. Through an intervention contact prompted by a break in performance trends, the advisor learns the student's employment had recently changed and had food insecurities. As a result, the advisor can connect the student with community resources to alleviate food insecurities and resume focus on schoolwork.

Another example of using data for positive change can result from targeted prompts to remind students of drop dates. The emphasis of intervention for the prompts goes to students who have not logged in before the drop date. If students miss the dropdate even if they intended to drop, they still pay tuition. The process of getting reimbursed for tuition in this situation is time-consuming. In this study, advisors reported that they saved students time and money by reminding them of drop dates. The student does not have to experience the financial hardship of lost resources and can focus on completing other courses.

LA can support course design and pedagogical decisions. The options to influence course design are emergent stages as the LA data system supports a high level of interaction with course material. However, a faculty member in this study did learn the time students spent on specific modules and lessons. If the time spent on work by students exceeded the expected credit hour, the instructor adjusted the content and provided a better learning experience.

Finally, there is controversy related to the use of LA data. The data provided insights that were not available previously, and if used to exclude students from programs or school, then the data use is harmful. In conjunction with LA data, standard ethical policies and guidelines are critical to ensure positive social change occurs. Policy development surrounding student data use relevant to all stakeholders is essential for positive change regarding LA.

Implications for Method

I chose an exploratory case study because I wanted to know more about the communication channels and dialogue in a closed social system implementing the LA innovation. If I were to repeat the research, I would consider a comparative case design between two similar institutions. That would allow a comparison of approaches to LA implementation. Differences in strategy using communication or dialogue domains would inform the influence of context on the implementation process.

Another approach would be to use a survey to collect campus-wide data regarding the perception or use of LA data, adding to the LA implementation knowledge. Having a better understanding of the scope of implementation or stakeholder awareness of implementation could direct an exploratory case study like this one as a followup. The LA phenomenon was emergent; therefore, qualitative research will advance the knowledge of the phenomena.

Implications for Practice

The results confirm imposing LA data use on stakeholders does not work. With that in mind, institutions should articulate governance arrangements before implementing

LA. When all stakeholders are aware of the governance arrangements using various communication channels, interpersonal and mass media, they will be informed and have a larger picture of what LA can mean. LA leaders must anticipate the cultural shifts needed to support partnerships between stakeholders that may begin supporting students as a team rather than in isolation. An example of stakeholders' support includes implementing training for working as a team and more options for each primary user to submit feedback directly to the implementation team.

Conclusion

Higher education trends indicate increased data use to inform decisions (Dede, 2016; Klein et al., 2019). Amid the increased focus on data, institutions face changes with emergent technologies, diverse student populations, intense competition, and more significant accountability requirements (Klein et al., 2019; Lietner et al., 2017; Stearns, 2016). Ifenthaler (2016) noted that institutions are unprepared to meet the demands for data analysis. Furthermore, Tempelaar et al. (2015) reported that institutions do not have the capability to deliver personalized learning support by data. The institution in this case study made efforts toward intentionally using data to inform decisions and increase retention. The stakeholders' experience through communication channels and domains of dialogue adds to LA implementation knowledge. LA systems are complex and require a team of experts partnering with academic and subject matter experts to provide an equitable yet individualized learning experience for all students. Therefore, the need to understand the implementation process in terms of communication and dialogue is

critical for the LA innovation. The LA innovation is essential to improve students' learning experience of students leading into the future of change and uncertainty.

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Appendix A: Interview Protocol

Introduction

Hello, my name is Grace Jackson. I am a doctoral student in the field of education from Walden University. I am working on a dissertation, and my topic is exploring how stakeholders at a higher education institution from different departments use communication channels and engage in dialogue during the implementation process of student data programs intended to improve student learning outcomes. I have always had a passion for understanding how things work. My career as an educator fed that passion in various settings; now, my focus is on understanding the communication channels and domain dialogue among individuals at this institution during the implementation of the student data program or learning analytics system.

Thank you for taking the time to meet with me today. Your participation is voluntary, and you may decline to answer any question or end the interview at any time. Your participation is also confidential. I will use a participant ID for you and mask of the institution. I will not associate your name or the institution's name in the transcript used for data collection. I will be recording the interview to allow me to complete an accurate transcription of the interview. The deletion of the recording will occur when the transcript is complete and has been approved as accurate by you. All the details of your consent and related protection as a participant are outlined on the consent form shared before our meeting.

Do you have any questions about the consent form, the recording, the confidentiality, my contact, or other topics related to the interview before we begin?

I want to contact you if I have follow-up questions or need clarification regarding our conversation. You have my contact on the business card and may contact me as you wish.

Interview Questions

Background – Level Setting	Prompts for the initial question	Rational
1. Tell me about your role here at the University **2. What aspects of your role are related to learning analytics (LA)?**	What aspects of your role are related to student data? Tell me more about programs used to analyze student data	
Phenomenon of Interest		
3. **What is the name of the program used for learning analytics (LA)?**	If already named in an earlier question, then I will summarize and confirm the name of the LA program. If the interviewee cannot name the program. I will have the name listed in the policy	Once we establish the name of the LA program, I will use that name going forward in the interview.

		document gained before prompt the interviewee	Patton (2015) recommended learning the terminology familiar to the interviewee and using that terminology.
	Conceptual Framework		
4.	Take me back to the first time you heard about the *LA program*. **What were your thoughts?**	What other details about the circumstances around your introduction to LA at *this institution* can you share?	This will help me know the communication channels used to inform the interviewee about the innovation-relating to the Diffusion of Innovation DOI theory
5.	Think of recent conversations you have had with colleagues about the LA system. **Tell me about that conversation**?	Was the person you spoke within your department or a different department? If different, which department?	Related to DOI (Rogers 2003) and Let's Talk Learning Analytics (LTLA) framework (West et al., 2016).
6.	**What are your sources of information to learn about the LA system?**	Which sources, if any, did you find most useful?	DOI connection; this will help me understand the categories of adopters and their interactions
7.	**What option, if any, do you have available to provide feedback for the LA system?**	If the interviewee does not have a contact, ask who they would go to first if they wanted to provide feedback?	This will add insight into the flow of information in

			the context of the institution.
8.	Now let's do a short role-play. Suppose you want to provide feedback for the LA system. Address me as one of your contact for feedback**. What do you need me to know about the system?**		
9.	Before I go onto the next questions, I want to make sure we covered your view of the LA system. *I will provide a summary of what was covered.* **How do you think your colleagues would describe your position regarding the LA system?**	Would you be described as a proponent or a skeptic of the system?	This question will help me identify opinion leaders and adopter categories
	Conclusion		
10.	**As we wrap up our session today, let me know if there is anything related to communication about the LA system you would like to share.**		
11.	**What is the key idea you would like me to remember about our conversation?**		

I will email you a summary of our interview and my notes so you can verify your intended perspective of the topics is accurate. I can send you a file of the complete transcript upon request. You will receive the documents in your work email within two business days after the interview. May I contact you if I have questions while completing the transcript? Also, may I schedule a follow-up interview if I need to clarify any information discussed in the interview and answer any outstanding questions? I plan to use Email; however, let me know if you would prefer another form of contact. Also, here's my contact information if you have any questions (Give them a business card or refer to one if given earlier).

For reference:
Research Questions

RQ1-How do stakeholders use different communication channels during LA implementation in a HEI using elearning options?

RQ2-How do stakeholders engage in LA domains of dialogue during implementation in a HEI using elearning options?

Definition

Learning analytics: The collection of data from learning activities and student demographics that is analyzed using software with data visualization, aggregation, and real-time capabilities to promote student success (Avella, Kebritchi, Nunn, & Kanai, 2016; Lester, Klein, Rangwala, & Johri, 2017; Siemens & Gasevic, 2012).

Phenomenon of Interest

Learning Analytics Implementation

Appendix B: Adapted Publishing Permissions

Permission for Figure 1, p. 23. *S-Curve diagram depicting patterns of adopter rates overtime*

RE: Doctoral Candidate Request for Permissions to Use Material in Dissertation- Grace Jackson

SP **S&S Permissions <Permissions@simonandschuster.com>**
9/23/2019 2:16 PM

To: Grace Jackson

Dear Grace Jackson:

In reply to your request, you have our permission to use the figure as specified in your request from the book "**DIFFUSION OF INNOVATIONS, 5E**" by Everett M. Rogers in your Doctoral degree dissertation. New permission is required for all subsequent uses.

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Please re-apply to this department if your dissertation is later accepted for commercial publication and you wish to retain our material at which time there will be a fee.

Best wishes for the successful completion of your work.

Sincerely,

Laura Milunic
Assistant Permissions Manager

Permission for Figure 2, p.69 - *Example of a Student's Visual Form LA*

Re: Permission to reprint visual form graphic student example

M **McKenna,Kelly** [redacted]
9/27/2019 12:38 PM

To: Grace Jackson; Folkestad,James

Hello Grace,

Thank you for your inquiry. You are welcome to reprint the graph in your dissertation literature review, but this same RPA Graph (figure 3) is in our article in the Contemporary Educational Technology (open access) journal. So you will want to cite the article rather than the conference proceedings.

Journal:
http://www.cedtech.net/

Article:
http://www.cedtech.net/articles/103/1031.pdf

Best of luck as you finalize your dissertation.

Kelly McKenna, PhD (she, her, hers)
[redacted]

Appendix C: First Code System Using Precodes: Two Interviews

Code System	Memo	Frequency
Code System		190
RQ1- Communication Channels	How do stakeholders use different communication channels during learning analytics implementation in a higher education institution using eLearning options?	0
social system	Nature of the social system includes the norms - the openness to innovation is part of the norms. degree of interconnectedness level of cosmopolitiness (homophilous and heterophilous)	2
communication network	Interconnected individuals who are linked by patterned flows of information. Communication network analysis- identification of communication structure using relational data about communication flows. Interpersonal relationships are the unit of analysis. Communication structure can be complex even in small system. For example a system of 100 members can have 4, 950 network links. The formulas is N(N-1)/2. Network analysis is a method of research identifying communication structure in a system	0
Change agents	Influences clients innovation-decisions in a direction deemed desirable by change agency. Change agents use opinion leaders as their lieutenants. Must be careful not to use opinion leaders too often or the OL will be viewed as a change agent. Change agents 7 roles. 1. To develop a need for change 2. To establish, an information exchange relationship [credible, competent, trustworthy] 3. To diagnose problems [analyze problems to determine existing alternatives] 4. To create an intent to change in the client [motivate, innovation] 5. To translate intent into action [Interpersonal networks of influence] 6. To stabilize adoption and prevent discontinuance 7. To achieve a terminal relationship [develop self-renewing behavior]	3

opinion leadership	The degree to which an individual is able to influence other individuals' attitudes or overt behavior informally in a desired way with relative frequency. Not a function of the individual formal position or status in the system. opinion leadership is earned and maintained by the individuals technical competence, social accessibility, and conformity to system norms.	4
Adopter category	Classification of members of a social system based on innovativeness. 1. Innovators 2. Early adopters 3. Early majority 4. Late majority 5. laggards	0
Innovator - Venturesome	Look to understand the situation- immerse their selves Go beyond the obvious Interest in new ideas leads them out of local circle of peer networks into more cosmopolite social relationships understand and apply complex technical knowledge as needed cope with a high degree of uncertainty about innovation funding willing to accept set back if innovation is unsuccessful Innovator not always respected but play an important role in diffusion process: launching new idea into a system gatekeeping role in the flow of new ideas in a system	6
Early Adopter - Respect	Integrated part of local social system localities highest degree of opinion leaders (ones who others look for advice and information about innovation) considered "the person to check with" generally sought by 'change agents' -local missionary for speeding up the diffusion process Serve as role model for many other members of a social system Trigger the critical mass must make judicious innovation decisions decreases uncertainty about a new idea by adopting it, then conveying subjective evaluation of innovation to near peers through interpersonal networks	3

Early Majority - Deliberate	important link in diffusion process provide interconnectedness in systems interpersonal networks One of the most numerous adopter categories (1/3 of system members) innovation decision period is relatively longer than innovators and early adopters follow w/deliberate willingness in adopting innovations but seldom lead	1
Late Adopter - Skeptical	no attributes listed. The innovation has not hit critical mass with early adopters so probably no late adopters but i will create code just in case.	0
Laggard - Traditional	no attributes listed. The innovation has not hit critical mass with early adopters so probably no late adopters but i will create code just in case.	0
source	Individual or institution that originates the message	2
Communication Channels	Means by which a message gets from the source to the receiver interpersonal or mass media, localite or cosmopolite Timing - Mass media 1st - knowledge stage| Interpersonal - persuasion stage [content specific]	0
Interactive Communication	Internet	2
Interpersonal	Involve face-to-face exchange btw 2 or more individuals - more effective in forming and creating attitudes toward new idea	12
heterophilous	interpersonal communication among individuals who are different - in different departments for this study	9
homophilous	Interpersonal communication among individuals that are the same. Same department for this study	3
Mass Media	transmitting messages that enable 1 or few individuals to reach and audience of many - more effective in creating knowledge of innovations	4
RQ2 - Domains of dialogue	How do stakeholders engage in the LA domains of dialogue during implementation in a higher educational institution using eLearning options?	0

leadership	"Institutional Transitional Elements" Culture positioning of LA in institution level of sponsorship alignment with institutional strategy LTLA (West et al., 2016) centralized or distributed leadership, leadership's knowledge and information (de Freitas et al., 2015) Areas of support for stakeholder engagement (SHELIA project- 2018)	13
governance	Governance arrangements (West et al., 2016) Data aspects Transparency - data standards data ownership privacy (Scheffel et al., 2014) Rigorous view of ethics and adherence to highest standard of ethical procedures (deFreitas et al., 2015) Data, open or protected (Greller & Draschler, 2012)	5
Stakeholder System Interaction	Consideration of ethics Stakeholder questions (West et al., 2016) Cross over to DOI- Ease of use=Complexity Perceived usefulness= relative advantage, trialability, observability (Scheffel et al., 2014; West et al., 2016) actions taken from data analysis (deFreitas et al., 2015; Scheffel et al., 2014) Stakeholders mediate the potential of capacity through engagement and communication of goals and strategic vision (Colvin et al., 2015	20

stakeholder identity	"Identify key stakeholders" people are a critical ingredient in the early stages of LA LA Mediating dimensions (Colvin et al., 2015) primary users senior management team academic teams support staff external partners internal advocates required expertise (SHELIA framework dimensions- SHELIA project, 2018 Tsai et al., 2018) Institution Teachers Learners Others (Critical Dimensions of LA (Greller & Drachsler, 2012)	16
Evaluation	Endorsed processes and around actions driven by data Training, support, and time for stakeholders to use the system Modifications relevant to feedback of the system LTLA(West et al., 2016) Seek Stakeholder feedback (SHELIA- 2018) Conceptualizations of LA- Framing of the problem is more important than how the problem is solved. The underlying epistemological and ontological values shape the pathways for achieving a vision related to LA (Colvin et al., 2015)	38

Strategy	Strategic planning for initiative Governance arrangements for imitative (West et al., 2016) Develop engagement strategy (SHELIA- 2018) Wide use of implementation strategy Communication of disparate units a institution (Colvin et al., 2015) Objectives: awareness reflection motivation behavioral change (Scheffel et al., 20140 Objectives reflection predication (Greller & Draschler, 2012)	20
Infrastructure	Digital ability and integrity of data Integration (West et al., 2016) Existing framework (SHELIA-2018) Enterprise data warehouse (EDW) - Colvin et al., 2015 Commit to infrastructure for big data integration (de Freitas et al., 2015)	12

Context	Institutional Context Student demographics Staff demographics Size and structure Location Strategic positioning of the university (West et al., 2016) Identify drivers for implementation (SHELIA - 2018) Institutional Goals for LA (Colvin et al., 2015) Organizational aspects- organizational change, training of educational stakeholders, implementation, availability, (Scheffel et al., 2014) internal limitations and external constrains (Greller and Drachsler, 2012)	15

Appendix D: Final Themes With Sample Codes and Categories

Final Coding Sample for Themes				
643 total coded segments	**515 Codes**	**47 categories**		**7 Themes**
Segment	**Code**	**Category**	**explain codes (framework or perceived pattern)**	**Theme**
And so we have a very interesting collective of Ed tech or research, innovation, pedagogy experts to help support our [unit]	supporting unit	stakeholder expertise	The online unit has a multidisciplinary group of experts	Theme 1: Stakeholders Involved in LA Implementation had Multidisciplinary Backgrounds and Expertise
So I didn't come into this position knowing very much about the specifics and the nuances and the field of learning analytics. I came to my position from kind of a statistical background with the way it's employing statistics, data for quality improvement, program evaluation.	employing statistics	stakeholder expertise	The LA position was new in a new field	Theme 1: Stakeholders Involved in LA Implementation had Multidisciplinary Backgrounds and Expertise

I was there to, you know, bring the product on, connect to integrate it, tests the reports, make sure they were pulling accurate data.	bringing product on	stakeholder responsibilities	Technical support role described by the IT support person working with LA implementation	Theme 1: Stakeholders Involved in LA Implementation had Multidisciplinary Backgrounds and Expertise
And so every time we consult, I really try to focus on how can I support you and the practices you're doing. Sometimes that works and sometimes people are just, you know, what hands clean this is not for me. And we really try to respect that. And not force the issue	not forcing the issue	Not imposed	Support offered through consult if desired	Theme 2: Intentional Implementation of LA
I mean, there's always reasons why students are not able to progress. And if it's on our end as a school, as someone is providing a service and education environment, we should be doing our due diligence to look at that	doing due diligence	ethical considerations	Ethical use of data is a responsibility of the institution	Theme 2: Intentional Implementation of LA
But we wanted to be pretty intentional about the use of learning analytics in that we wanted it to focus on student success and retention. And so working strategically with online programs, we wanted to partner with those programs to	figuring out partner goals	Not imposed	Shows the cross over between interpersonal approach and intentional implementation	Theme 2: Intentional Implementation of LA

figure out what goals that they had in that realm and how we can look to use or leverage learning analytics to help their students succeed. So it was very much of a collaborative, customized kind of engagement in that collaboration.				
I think that it's been a growing conversation we have on our team about both the promise of learning analytics, the potentials, but also the limitations.	growing conversation	knowledge sharing	The language about communication channels for LA occurs via conversations	Theme 3: Interpersonal Approach to LA Communication
Up to this point, it has the word of mouth, you know, building relationships and networks way.	building relationships and networks	knowledge sharing	use of word of mouth, building relationships and networks	Theme 3: Interpersonal Approach to LA Communication
So my biggest source is the [LA] implementation Team at the university? And I when I was using it, I actually corresponded with them on probably an every few week timeframe.	corresponding with implementation team	Train and support primary user	Source of LA information is correspondence with the LA implementation team	Theme 3: Interpersonal Approach to LA Communication

So we are designing of a new process for not using learning analytics simply in live instruction. But also after a course is taught. How can we make learning analytics data, look at our instruction side more intentionally and use the analytics not to answer questions, but to pose?	posing questions to data	moving forward	Comments about potential uses for LA	Theme 4: Continuous Transitions of LA Implementation
And so we've been trying to work on my team in general, just on setting more programming in place up, like let's get like a faculty learning community together or let's get a grant proposal together, our fellowship and then have people like we set up the problem and then we invite people to come into that conversation.	collaborating through fellowship	moving forward	Use of fellowship to prompt conversations around data use and LA	Theme 4: Continuous Transitions of LA Implementation
And so the way in which we do that [leverage data for success], here's how we want to communicate that with our students. Here's how we want to communicate that with our faculty members. And then it becomes more institutional conversation at that point.	becoming an institutional conversation	moving forward	The expansion to campus-wide implementation is forecasted to occur as an institutional conversation	Theme 4: Continuous Transitions of LA Implementation

so the [LA system] products brings the data into a data warehouse where that reporting service can go through and visualize it any way you want to. And that's the part where we it's part of a bigger ecosystem	reporting service	data warehouse	Implementation support SH explains the infrastructure behind the LA system	Theme 5: Infrastructure, the Backbone of LA Data
Maintenance, it'll sometimes break that [report generation], which can be challenging	interrupting report generation	technical limitations and constraints	Technical issues with LA reports	Theme 5: Infrastructure, the Backbone of LA Data
Because there's a lot of things about the current infrastructure of [the LA system] that doesn't allow us to make customized reports for individual faculty or doesn't allow us to report on a way that is useful for faculty	limiting approach	technical limitations and constraints	Cannot customize the report for an individual faculty or make it more useful to faculty	Theme 5: Infrastructure, the Backbone of LA Data
Yeah, I think it really depends on what they [Faculty] would like us to do as far as reaching out, because we can't just have this, we can't decide independently of the programs. You know what how they want us to reach out to their students once they're in their classes, because it's really like the instructors there, it's their class. And so we're there just to support them and the student.	working as a team	positioning in institution	The faculty determine the scope of out reach done from the advising service using the LA data	Theme 6: Culture Determined through Leadership

So what that looks like could vary from program to program.				
So with that effort, we really wanted to also move forward in innovation. And so learning tech, learning analytics was one part of that. OER was another component of that, as well as your educational technologies and getting everything lined up.	lining up technologies	online synonymous with LA	LA in one component of online learning and initiatives	Theme 6: Culture Determined through Leadership
And for us, it's like we're kind of trying to push from beneath, but there's not a lot of strong institutional priorities around it [LA]	pushing from beneath	positioning in institution	An understanding of the dynamics and culture of the university and how the implementation team is positioned in the university	Theme 6: Culture Determined through Leadership

And again, sometimes that showed me that there was one week where there was so much work to complete that week that it was overwhelmingly showing me that we're spending way too much time. So then I went in and I did adjust and take away an assignment or made an assignment a little bit less intense to make sure that every week was an equal amount of time on the average	making pedagogy adjustments	benefits	A faculty primary user reviewed student data to determine how much time students were spending in each unit. If one unit showed an overwhelming level of effort and time from the student, the an adjustment was made to that unit.	Theme 7: Stakeholder's Actions Influenced by LA Data
But if we're tasked with retention, you know, helping students stay in classes and be successful. But we have no idea if they're logging in, if they're failing a class like we can't proactively reach out. We you know, without this. This data, we would be flying blind like we wouldn't know until a student fails a class and then we're doing a lot of cleanup, you know, trying to help the student recover after the fact	enabling proactive approach	relative advantage	Background of how it was before LA data was available to guide retention efforts	Theme 7: Stakeholder's Actions Influenced by LA Data

than, you know, being able to help. Be proactive and help them pass. You know, help them get through their class				
It's more informative for advisors than it is for faculty members, to be quite frank. And I think that might have a bit to do with the reports that are available. But also, you know, a lot of the information that faculty you need about student, where they're at in the courses right there in the grade book. So unless there's another lens which learning analytics can provide and then, you know, keeping up while teaching the course, sometimes a grade book is just an easier mechanism for that.	keeping up while teaching	status of adoption	Reflection of LA implementation status of adoption by a SH that support the implementation process	Theme 7: Stakeholder's Actions Influenced by LA Data

Appendix E: Data Security Statement From Third Party Transcription

Security at TRINT

At TRINT, we have always made our customers' data security and privacy a priority. Our automated transcription software handles very important and confidential audio and video files and produces equally important and confidential transcripts, which is why we always maintain the highest standard of security when handling these files.
In short, our security position is this: **no one sees your data but you**. To provide a more in-depth look at how TRINT deals with customer data, we've outlined some of our data security and privacy practices in detail below.

ISO 27001 Forms the Bedrock of our Security

The International Organization for Standardization (ISO) creates guidelines and specifications for the regulation of global standards. The ISO 27001 was created by the ISO to provide a global standard for an information security management system (ISMS). ISO 27001 requires the management team to implement three broad practices:

• Systematically examine the organization's information security risks, taking account of the threats, vulnerabilities and impacts
• Design and implement a coherent and comprehensive suite of information security controls and/or other forms of risk treatment (such as risk avoidance or risk transfer) to address those risks that are deemed unacceptable
• Adopt an overarching management process to ensure that the information security controls continue to meet the organization's information security needs on an ongoing basis

TRINT's security practices are currently aligned with ISO 27001, and we expect formal certification in the first half of 2019.

How we keep your data secure

a) Data transfer and storage

Trint uses HTTPS (using TLS 1.2) for secure data upload, export, and transfer. Data is encrypted at-rest using AES 256.
Physically, Trint stores your data in data centers owned and operated by Amazon Web Services. These data centers deliver the very highest levels of physical and infrastructure security; more information can be found here.
Usage and activity tracking and reporting

Trint does not presently generate usage reports for individual users, but usage and activity monitoring are available for Enterprise clients. These reports are available to Team plans upon request by contacting hello@trint.com.

b) Data retention and deletion

If you delete Trint from your account, they are not permanently removed but are hidden from view. We do this so that we can retrieve deleted files for you later upon request. Your Trint-related data (media files and associated transcripts) are permanently deleted if and when you request; we delete your Trint account. Users can request Trint permanently deletes files on demand by contacting support@trint.com.

c) Trint Employees

At Trint, we know that effective security begins with our employees, so we use market leaders in personnel and data security to protect against vulnerabilities and internal threats. Some of the tools and services we use:

- OnFido to perform background checks on employees
- 1Password to securely generate and manage passwords
- F-Secure to guard against malware
- CyberSmart to enforce our employee computer equipment hardening policy
- In addition, employees are required to use single-sign on and two-factor authentication wherever these are supported.

Third-Party APIs

Trint partners with third-party software providers to give the best possible customer experience. Before integrating with any company, Trint performs a review of their privacy protocols to ensure they have equally rigorous protection standards.

When agreeing to the Terms of Use upon joining Trint, a user is agreeing to the sharing of certain information with third-party APIs that are vital to Trint's functionality. Trint uses the following as part of delivering its service:

- Auth0 for authentication and delivery of single sign-on capability
- Transloadit for transcoding media files
- Filestack for file selection and uploading
- Stripe for billing and payment
- Various analytics services; see our Privacy Policy for more information

Billing and Payment Security

Billing and payment are processed through a PCI-DSS-certified third-party payment processor, Stripe, which uses high-level encryption to protect all payment details entered. Trint Support and other Trint personnel will not be able to view all billing information entered in the system. The following is visible to authorized Trint personnel:

- Account holder email
- Account subscription
- Account billing history
- Last 4 digits of card on file
- Address of card on file
- Invoices issued to the customer
- Any error codes produced by failed payments

If at any point you believe you have been wrongly charged, please reach out to our Support Team at support@trint.com.

Data backup and retention

Trint provides a backup and restore plan in the event of data center or system-wide events. Backups are performed 4 times per day. Trint retains backups for one year.

Business Continuity and Disaster Recovery

Trint implements a highly available and fault-tolerant service that can recover from events in a data center or other disaster.

The Trint service is hosted on AWS and architected using either clustered services or serverless implementations as relevant to the use case.

Trint maintains a business continuity and disaster recovery plan. In the event of a natural disaster, a combination of our backup strategy and infrastructure-as-code techniques would enable us to bring up a replacement environment in either a new AWS availability zone or region within a few hours.