

Data Literacy Perceptions and Experiences Among K-12 District Leaders

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Abstract

The problem addressed in this study is that K-12 district leaders face a deficiency in data literacy training, limiting their ability to effectively utilize learning analytics within their data-driven decision-making practices. The purpose of this qualitative case study was to explore how K-12 school district leaders leverage learning analytics tools and demonstrate data literacy competencies when planning and executing educational improvement initiatives. The theoretical frameworks for this study were the generic framework for learning analytics and the data literacy framework. A qualitative case study design was used. The target population for this qualitative case study was K-12 leaders serving at the central office level in a large, urban, public school district in Washington, District of Columbia. Semi-structured interviews were conducted with nine participants, and documents were collected. The data were codified, categorized, and analyzed inductively via NVivo software and manual review to compare, contrast, and synthesize perspectives and identify themes regarding participants' use of data. The results suggested that translating data into actionable strategies is central to how district leaders leverage learning analytics. Leaders also emphasized aligning data with strategic goals while navigating challenges such as limited infrastructure, competing priorities, and gaps in professional development. These findings contributed to practice by underscoring the need for organizational support and professional learning to enable sustainable, equity-driven data use.

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Section 1: Foundation

K-12 educators increasingly rely on data to inform critical decisions, guide budget development, support curricular choices, and bolster interactions with government agencies (Mandinach & Schildkamp, 2021). Learner analytics, a term that combines education and analytics, includes "the measurement, collection, analysis, and reporting of data about learners and their contexts, for understanding and optimizing learning and the environments in which it occurs" (Siemens, 2013, p. 1382). Learning analytics initially gained traction in higher education institutions, where centralized data systems and advanced technology infrastructure supported data collection and analysis, but continues to grow in popularity in K-12 settings (Aguerreberre et al., 2022).

The No Child Left Behind Act (2002) heightened accountability through standardized test data, increasing the emphasis on data-driven decision-making (DDDM) in education (Henderson & Corry, 2020). This legislative shift compelled educators to routinely collect and analyze data to evaluate student performance. K-12 educational institutions collect vast amounts of student data from various sources, including academic performance, attendance, and behavioral referrals, but face challenges when using these insights to inform decision-making. Data analytics can help K-12 organizations enhance student learning by providing concrete methods for collecting, analyzing, and acting on learner needs (de Sousa et al., 2021). K-12 leaders must consider several factors when making decisions, often encountering situations that require foundational data literacy skills to complete projects (Townsend & Snyder, 2022). Without the proper understanding and application of data literacy, district leaders may make decisions that misalign with the actual needs of students and schools (Isaacs, 2021).

Educational leaders employ these diverse data sources to drive DDDM practices, ensuring that decisions are informed, strategic, and impactful (Paolucci et al., 2024). The Professional Standards for Educational Leaders (2015) advocate the use of relevant data to set and monitor school goals. However, educational leaders need more guidance on which specific data sources to prioritize (Townesley & Snyder, 2022). This lack of clarity can hinder effective implementation and affect stakeholder confidence.

More research is needed to determine the most effective learning analytics practices within K-12 institutions (Paolucci et al., 2024). Temel-Aslan et al. (2024) highlighted that data literacy includes essential competencies such as data recognition, comparison, analysis, and communication. Few studies have identified the specific data literacy skills that K-12 leaders need for effective planning and execution, limiting researchers' understanding of leaders' data literacy competencies (Hegestedt et al., 2023). The aim of this study was to explore, from the perspective of K-12 district leaders, the competencies and strategies they believe are necessary to effectively interpret and apply data to support meaningful educational improvements, including how they identify gaps in their own knowledge or skills. With clear guidelines, leaders may be able to navigate the vast array of data, thereby improving their ability to produce positive, data-informed outcomes.

There is a critical need to clarify which competencies are essential for DDDM (Hegestedt et al., 2023). By identifying and strengthening these skills, K-12 leaders can make data-informed decisions that holistically address educational needs and positively impact student achievement. Schools with high data use for instructional and pedagogical decisions tend to see improved student achievement (Townesley & Snyder, 2022). Education experts worldwide have emphasized that using data holistically is crucial for monitoring academic progress, supporting student needs,

and making forward-thinking decisions (Dodman et al., 2023). For district leaders, strong foundational data literacy skills are essential to impacting school culture, academic achievement, and students' overall sense of belonging.

While extensive research exists on the data literacy needs of teachers and school administrators, such as principals, less is known about the specific competencies required by district leaders, such as chief academic officers, directors of assessment, and instructional superintendents who guide system-wide decision-making. K-12 district leaders should have higher levels of data literacy than teachers and principals, as their decision-making affects large student populations (Townsend & Snyder, 2022). District leaders' data literacy competencies can affect their ability to make effective decisions (Henderson & Corry, 2020). Leaders who lack strong data skills may struggle to interpret and apply data accurately, risking large-scale disruptions from misguided decisions (Hegestedt et al., 2023).

District leaders play a crucial role in shaping policy, allocating resources, and driving systemic change, yet many need more robust data literacy skills for practical student data analysis (Paolucci et al., 2024). This gap must be addressed to enhance their ability to lead data-informed decisions that address educational disparities. As Hegestedt et al. (2023) suggested, improving data literacy is essential for educational reform and should be part of a national initiative impacting local school development and broader educational policy. Despite advances, challenges remain in achieving a clear understanding and application of data literacy, due to discrepancies in its definition and implementation (Mandinach & Gummer, 2016). Additional research can standardize terminology, enabling educators to gain a consistent understanding of data literacy's essential components (Conn et al., 2022). By understanding how district leaders experience and navigate DDDM, the outcomes of this study can inform professional

development that builds essential skills and policy reforms that support data literacy initiatives at all levels.

Statement of the Problem

The problem addressed in this study was that K-12 district leaders face a deficiency in data literacy training, limiting their ability to effectively utilize learning analytics within their DDDM practices (Conn et al., 2022; Filderman et al., 2022; Henderson & Corry, 2020). Research has indicated that inadequate training hinders resource allocation and instructional planning, negatively impacting overall school district performance (Townsend & Snyder, 2022). Hegstedt et al. (2023) found that educational institutions collected vast amounts of data and required leaders to transform it into actionable insights that drive effective decision-making and support student success. However, data literacy remained underdeveloped, as its inclusion was often overlooked in educator preparation programs (Issacs, 2021). Despite the growing recognition of data literacy as a vital skill for educational leadership, many district leaders need more training and support to apply these skills effectively (Temel-Aslan et al., 2024).

Although learning analytics continues to evolve, inconsistencies in its definition and implementation limit educators' ability to fully grasp and apply data literacy competencies when planning educational improvement projects (Henderson & Corry, 2020). Consequently, decision-making processes often underutilize data, leading to suboptimal outcomes in resource allocation and instructional planning (Paolucci et al., 2024). Most research on data literacy in education primarily examines higher education or K-12 teachers, leaving the perceptions and experiences of K-12 district leaders underexplored (Henderson & Corry). The need to address this gap is clear, as improved data literacy can significantly enhance the effectiveness of DDDM practices and positively affect school and student outcomes (Henderson & Corry; Paolucci et al.).

Purpose of the Study

The purpose of this qualitative case study was to explore how K-12 school district leaders leverage learning analytics tools and demonstrate data literacy competencies when planning and executing educational improvement initiatives. By delving into the experiences of these leaders, the aim was to learn how district-level personnel translate learning analytics insights and leverage data literacy competencies to develop educational improvement initiatives.

Understanding these dynamics is vital, as district leaders are often responsible for decisions that affect a broad range of stakeholders, from government agencies to students, and impact the overall effectiveness of school operations. This study provided valuable insights into how district leaders currently engage with data, revealing both existing strengths and critical gaps in data literacy competencies. These findings informed the design of targeted professional development and data analytics strategies that directly address the skill deficiencies limiting effective data use in educational decision-making. The gap in district leaders' data literacy must be addressed, as many leaders rely on intuition or incomplete data to make decisions, leading to policies and programs that fail to effectively address educational challenges (Townsend & Snyder, 2022). This study aimed to fill that gap by offering insights into how district leaders engage with and integrate data literacy competencies into their decision-making processes.

Data collection included conducting semi-structured interviews and reviewing documents with approximately nine K-12 district leaders in roles such as superintendent, assistant superintendent, or professional staff member (e.g., directors of curriculum, special programs, staff development, or assessment), representing an urban, public school district in Washington, D.C. I used purposive sampling to select central office district leaders in Washington, D.C. for participation in this study. To ensure rigor and accuracy throughout data collection and analysis,

I employed member checking and triangulation methods. Thematic analysis was used to interpret the data and identify patterns across interviews and documents. The findings provide critical insights into improving educational practices and policies by examining how these leaders interpret and apply data to inform decision-making, particularly in resource allocation and instructional planning (Mandinach & Schildkamp, 2021). Additionally, this research has the potential to influence professional development initiatives, offering targeted recommendations to build district leaders' data literacy capacity (Hegestedt et al., 2023).

Research Questions

RQ1

How do leaders in an urban, public school district leverage learning analytics tools in their decision-making when planning educational improvement initiatives?

RQ2

What specific data literacy competencies do leaders in an urban, public school district demonstrate when planning and executing educational improvement initiatives?

Conceptual/Theoretical Framework

Driving meaningful improvements in education requires strong leadership and data literacy skills to critically analyze, interpret, and apply learning analytics insights (Siemens, 2013). I employed a dual-framework approach to explore how school district leaders leverage learning analytics and demonstrate data literacy competencies. Greller and Drachsler's generic framework for learning analytics (2012) and Gummer and Mandinach's data literacy framework (2015) collectively provided a robust foundation for examining both systemic and individual dimensions of data use in decision-making.

Greller and Drachsler (2012) defined six dimensions critical to the successful implementation of learning analytics: stakeholders, objectives, data, instruments, external constraints, and internal limitations. This framework emphasized a holistic understanding of the technical, ethical, and contextual elements influencing the adoption and application of analytics tools. In this study, the framework's emphasis on stakeholders helped identify district leaders as central actors in decision-making. The data dimension provided a lens to evaluate the types of data leaders use, while the external constraints focused on challenges such as privacy, ethical considerations, and systemic barriers. These dimensions directly align with RQ1, which explored how leaders use learning analytics to address the challenges they face.

Gummer and Mandinach (2015) defined data literacy for educators as “the ability to transform data into actionable knowledge and practices through collection, analysis, and interpretation” (p. 2). Their framework identified three critical domains: data use for teaching, content knowledge, and pedagogical content knowledge. It further outlined an iterative inquiry cycle consisting of six steps: identifying problems, framing questions, using data, transforming data into information, transforming information into decisions, and evaluating outcomes. This framework complements Greller and Drachsler's (2012) by focusing on the human competencies and skills needed for effective data use. For example, it highlights leaders' abilities to analyze, interpret, and apply data insights, addressing RQ2, which examined the data literacy competencies district leaders demonstrate.

Integrating these frameworks offered a comprehensive perspective on leadership decision-making and data literacy. Greller and Drachsler (2012) provided the structural context, emphasizing the systems, constraints, and stakeholders involved in data use. Meanwhile, Gummer and Mandinach (2015) focused on the cognitive and practical skills required for

effective decision-making. The iterative inquiry cycle described by Gummer and Mandinach can be mapped onto Greller and Drachsler's dimensions. Stakeholders interact with data and instruments to identify problems and frame questions. The transformation of data into decisions aligned with both the cognitive processes in Gummer and Mandinach's framework and the ethical and systemic considerations in Greller and Drachsler's. By combining these frameworks, the study captured both the structural and human dimensions of data use in K-12 school districts, offering a nuanced understanding of leadership decision-making and data literacy.

Definitions of Key Terms

The terms specific to and necessary to understand this study are as follows:

Data-driven decision-making (DDDM)

Data-driven decision-making is the process of analyzing data to develop teaching and learning insights that directly impact school improvement and student achievement (Issacs, 2021).

Data literacy

Data literacy refers to the ability to convert information into usable instructional knowledge and strategies by gathering, analyzing, and interpreting all types of data (Henderson & Corry, 2020).

Data literacy competency

Data literacy competency is an individual's data literacy skill level and how their interests connect to data-driven educational practices (Hegestedt et al., 2023).

Decision-making process

The decision-making process refers to authentically engaging stakeholders to make informed choices that shape school and district policies and practices (Bertrand et al., 2023).

Educational improvement initiatives

Educational improvement initiatives are targeted, evidence-based efforts designed to enhance the academic, social, emotional, and physical well-being of students and educators, with a focus on continuous planning, implementation, and refinement to achieve meaningful and lasting impact (Koh et al., 2023).

Educational planning

Educational planning is the process of prioritizing goals within an educational system and systematically allocating available human and material resources to achieve them (Gao et al., 2022). It plays a crucial role in guiding educators in designing curricula, delivering instruction, managing classrooms, and sustaining the overall functioning of schools.

Learner analytics

Learner analytics, a budding field in K-12 education, involves measuring, collecting, analyzing, interpreting, and reporting learner data to personalize the student experience and tailor learning environments to student needs (Siemens, 2013).

Learner analytics tools

Learner analytics tools refer to a wide array of digital software that educators can use to conduct educational data mining and learner analytics research (Romero & Ventura, 2020). These tools help educators gain insight into learners' progress, identify areas for improvement, and make data-driven decisions to enhance the learning experience.

School district leader

School district leader refers to a member of the district office (or central office) personnel, such as a superintendent, assistant superintendent, or professional staff member (e.g., directors of curriculum, special programs, staff development, or evaluation/assessment),

responsible for guiding and managing the policies, programs, and operations of schools within the district (Anderson et al., 2012).

Review of the Literature

The problem addressed in this study was that K-12 district leaders face a deficiency in data literacy training, limiting their ability to effectively utilize learning analytics within their DDDM practices (Conn et al., 2022; Filderman et al., 2022; Henderson & Corry, 2020). The purpose of this study was to explore how K-12 school district leaders leverage learning analytics tools and demonstrate data literacy competencies when planning and executing educational improvement initiatives. This study provided insights into how educational leaders in urban settings can strengthen their DDDM practices to improve student and school outcomes.

This literature review aims to establish a foundation for understanding the intersection of learner analytics, data literacy, and DDDM among educational leadership by critically analyzing and synthesizing relevant research. It also highlights the need for targeted professional development and systemic support that empowers district leaders to implement DDDM practices effectively.

This literature review is structured into five key sections. It begins with an overview of the academic databases used, the search strategies employed, and the inclusion criteria for selecting the literature. Following this, the themes addressed include (a) the use of learner analytics in K-12 education, (b) the data literacy competency of education leaders, (c) the challenges faced by leaders in leveraging data and analytics, and (d) DDDM for school improvement. The review concludes with a critical synthesis of the findings, identifying areas of convergence, divergence, and gaps in existing literature.

Literature Search Strategy

The strategies utilized to search for peer-reviewed literature supporting this study included accessing scholarly databases and academic libraries to ensure a comprehensive and rigorous review. Primary databases used in this process included ERIC (Education Resources Information Center), ProQuest Education Journals, JSTOR, and Google Scholar. These platforms provided access to a wide range of peer-reviewed articles, dissertations, and reports relevant to the study's focus on K-12 district leaders, data literacy, and DDDM practices. The Boolean search system was employed to refine results and identify relevant literature effectively. This approach involved entering combinations of keywords and phrases aligned with the study's focus, such as *K-12 district leaders*, *data literacy and K-12 district leaders*, *K-12 central office leaders*, *data-driven decision-making*, *data-based decision-making*, *K-12 learning analytics*, *K-12 data use*, *K-12 school improvement planning*, and *K-12 assessment literacy*.

The search focused primarily on studies conducted in the United States to maintain relevance to the target population and context. However, given that K-12 learning analytics is a new topic, the review included articles from international studies as well. The search prioritized peer-reviewed articles published between 2020 and 2025 to ensure the inclusion of the most current and relevant research. Articles published before 2020 were included selectively to provide historical context and foundational background information on learning analytics, data literacy, and DDDM in K-12 education. Despite these efforts, the search did not yield an overwhelming number of peer-reviewed articles specific to district leaders. This reflects the limited focus on this subgroup in existing literature, justifying the need for this study. The selected studies collectively highlight gaps in data literacy training for K-12 district leaders and underscore the importance of equipping them with the competencies to use learning analytics effectively in their decision-making. By synthesizing existing research, this literature review

establishes a foundational understanding of the intersection between data literacy and educational leadership.

Learning Analytics in K-12 Education

Learner analytics (LA), a transformative and rapidly advancing field in K-12 education, leverages data to enhance decision-making and improve educational outcomes. Defined as the measurement, collection, analysis, and reporting of data about learners and their contexts, LA optimizes learning environments and processes (Siemens, 2013). While LA is significantly implemented in higher education, its adoption in K-12 settings faces unique challenges, such as resource constraints and the need for tailored frameworks (Aguerreberre et al., 2022).

Nevertheless, LA holds substantial potential to revolutionize how district leaders, educators, and policymakers address systemic challenges in education, including achievement gaps and resource inequities.

The emergence of LA in K-12 education is rooted in the broader shift toward DDDM. Federal policies such as the No Child Left Behind Act (2001) and Every Student Succeeds Act (2015) laid the foundation for LA by mandating data collection and accountability for student outcomes (Lasater et al., 2021). These policies emphasize the use of disaggregated data to address disparities among student subgroups, reinforcing the role of analytics in improving equity. While early use of LA primarily focused on administrative tasks such as attendance tracking and academic performance monitoring (de Sousa et al., 2021), technological advancements have expanded its scope to include predictive analytics, early warning systems, and personalized learning interventions (Salas-Pilco & Yang, 2020). This evolution underscores a growing recognition of data's potential not only for compliance but also for fostering innovation and equity in education (Lasater et al., 2021).

Globally, research has highlighted LA's capacity to drive pedagogical innovation, enhance student outcomes, and inform system-level decision-making (Howard et al., 2022). LA provides real-time insights into student engagement and learning behaviors, enabling educators to tailor instruction to individual student needs and promote personalized learning experiences (Salas-Pilco & Yang, 2020). These tools empower educators and administrators to move beyond anecdotal decision-making, relying instead on robust data to design targeted interventions and allocate resources effectively (de Sousa et al., 2021). For example, LA systems can identify at-risk students by analyzing patterns in attendance, academic performance, and engagement, enabling timely interventions to mitigate potential dropouts (Howard et al., 2022). Real-time analytics can also provide educators with immediate feedback, fostering a responsive learning environment that supports student success (Ifenthaler et al., 2020).

At the systemic level, LA enhances district-wide decision-making by identifying performance trends, evaluating curricula, and uncovering systemic challenges (Anderson et al., 2012). Aggregated data insights enable district leaders to address issues across multiple schools, allocate resources strategically, and implement tailored support systems for historically marginalized student populations (Lasater et al., 2021). For example, district-wide analyses can reveal patterns of underperformance in specific schools, prompting targeted interventions to address shared challenges (Anderson et al.). However, the successful implementation of LA depends on leaders' data literacy skills, as their ability to interpret and act on analytics directly impacts its effectiveness (Henderson & Corry, 2021).

The relationship between LA and data literacy is critical in K-12 educational leadership, as both concepts work together to support DDDM. LA focuses on analyzing data to enhance educational outcomes, but its effectiveness depends heavily on the data literacy of educational

leaders. Knudson (2020) emphasized that data systems alone cannot improve outcomes; it is the leaders' ability to interpret and apply data insights that drives meaningful change. Similarly, Dexter et al. (2021) highlighted that while districts use analytics tools to guide decision-making, the lack of data literacy among leaders often limits their ability to leverage these tools effectively. Challenges in implementing learning analytics often arise due to trepidation or limited confidence in using data (Conn et al., 2021). Many leaders struggle with interpreting complex analytics, which hinders their ability to translate data into actionable strategies. Developing data literacy helps mitigate this hesitation by equipping leaders with the necessary skills to understand and utilize data effectively. Bhargava et al. (2021) suggested that fostering a culture of data literacy within schools can empower educators to trust and engage with analytics systems more confidently.

Despite its transformative potential, district leaders often rely on anecdotal or localized expertise when making decisions about educational products, highlighting the need for more systematic, data-informed approaches (Dexter et al., 2021). LA addresses this gap by providing evidence-based insights that guide decisions at both the school and district levels. However, effective use of LA requires educational leaders to establish trust and foster an improvement-oriented culture around data use (Jimerson et al., 2021). Leaders must also navigate the complex and interpretive nature of data analysis, ensuring that goals and applications align with the specific contexts and needs of their schools (Mandinach & Schildkamp, 2021).

The capacity of LA to drive equity remains a focal point in its implementation. Many district leaders view LA as a tool to identify and address disparities among student populations, enabling targeted support for historically underserved groups (Lasater et al., 2021). However, some caution against over-reliance on analytics, emphasizing the importance of contextual

understanding and the risks of data misinterpretation (Mandinach & Schildkamp, 2021). Ultimately, the effectiveness of LA depends on leaders' ability to interpret data critically and design interventions that are both evidence-based and context-specific (Henderson & Corry, 2021; Ifenthaler et al., 2020). LA represents a powerful mechanism for enhancing educational equity, fostering personalized learning, and driving systemic improvements in K-12 education. Its success, however, hinges on the development of strong data literacy skills among educational leaders and the establishment of a culture that prioritizes trust, collaboration, and thoughtful data use. By addressing these challenges, K-12 systems can harness LA to create more equitable and effective educational environments.

Data Literacy Competencies for Educational Leaders

Data literacy serves as a catalyst for maximizing the potential of LA, as leaders with strong data literacy competencies can critically analyze information and make informed decisions to improve educational outcomes. According to Dodman et al. (2021), data literacy enhances a leader's capacity to identify trends and implement targeted interventions, thus addressing educational challenges effectively. Similarly, Bhargava et al. (2020) highlighted the importance of "data theater" as a creative approach to foster educators' understanding of complex datasets, equipping them with the skills to interpret and apply analytics meaningfully (p. 95). Developing a data-driven culture in K-12 education requires leaders to have strong skills in interpreting and analyzing data, enabling them to make informed decisions that align with organizational goals (Gade, 2021).

Data literacy, a foundational concept for educational leaders, involves the ability to collect, analyze, interpret, and apply data to make informed decisions that drive improvement in teaching and learning (Doğan, 2023; Mandinach & Schildkamp, 2021). It requires leaders to go

beyond basic data comprehension, enabling them to draw meaningful insights and translate these into actionable strategies aligned with organizational goals (Gummer & Mandinach, 2015). In K-12 education, where data plays an increasingly significant role in accountability and improvement efforts, data literacy ensures leaders can navigate the complexities of diverse datasets and use them effectively to enhance student outcomes (Dodman et al., 2023). Data literacy competencies refer to the essential skills required to gather, interpret, and apply data effectively to make informed decisions (Hegestedt et al., 2023). While the definitions vary in the literature, these competencies frequently align around critical areas of practice necessary for leaders to engage with data systematically and strategically (Temel-Aslan et al., 2024). Educational leaders must not only interpret datasets but also evaluate their quality, ethical implications, and relevance to the decisions they inform (Doğan; Gummer & Mandinach).

The most discussed core data literacy competencies include data recognition, collection, cleaning, transformation, analysis, presentation, communication, quality evaluation, comparison, and ethical use (Gummer & Mandinach, 2015; Temel-Aslan et al., 2024). Together, these competencies form a framework that enables educational leaders to engage with data in a systematic and strategic way, ensuring its effective application to decision-making and improvement initiatives. Data recognition involves identifying different types of data—quantitative, qualitative, or mixed—and understanding their relevance within specific contexts. This competency is foundational, as it allows leaders to determine what the data represents, recognize patterns, track changes over time, and identify discrepancies that may signal deeper issues or opportunities for intervention (Temel-Aslan et al.). Without this skill, leaders may overlook critical insights or misinterpret key trends, undermining their ability to make informed decisions.

Data collection requires leaders to systematically gather accurate and relevant data aligned with their goals, whether through assessments, surveys, or observational records. Effective data collection is not merely about volume but about ensuring alignment with organizational priorities and educational contexts. When data collection processes are clearly tied to goals, it increases the likelihood that the resulting insights will be actionable and meaningful (Gummer & Mandinach, 2015). Leaders who excel in this area are better equipped to ensure that the data they gather serves as a reliable foundation for analysis and decision-making. Data cleaning ensures data integrity by addressing inconsistencies, errors, or missing values that can compromise analysis. This process not only eliminates inaccuracies but also enhances the overall trustworthiness of datasets. As Doğan (2023) emphasized, even minor errors in datasets can lead to misinterpretations, making this competency essential for maintaining the reliability of insights. Data cleaning also supports other competencies, such as quality evaluation, by creating a dataset that is accurate and ready for deeper scrutiny.

Data transformation refers to organizing and structuring raw data into usable formats. Leaders must be adept at processes such as aggregation, segmentation, and categorization, which allow them to focus on specific patterns or trends that drive actionable insights (Temel-Aslan et al., 2024). This skill is especially critical in K-12 education, where leaders often work with large, diverse datasets and need to synthesize information quickly to inform timely decisions. Data analysis enables leaders to apply statistical or qualitative techniques to interpret datasets and uncover meaningful patterns, relationships, and trends. This competency serves as the bridge between raw data and actionable insights, empowering leaders to make evidence-based decisions (Gummer & Mandinach, 2015). The ability to analyze data effectively also supports collaboration, as leaders can use their findings to advocate for change or resource allocation.

Data presentation involves translating complex findings into accessible formats for diverse stakeholders. Effective visualizations, reports, and narratives ensure that data insights are not only understood but also used to drive action. Henderson and Corry (2021) emphasized that strong presentation skills are particularly important for fostering buy-in among educators, policymakers, and community members, as clear and compelling presentations can inspire confidence and motivate collaboration. Data communication builds upon presentation by fostering dialogue around data findings. Leaders must not only present data but also contextualize it, addressing stakeholder questions and building consensus around data-informed strategies (Gummer & Mandinach, 2015). This competency highlights the importance of relational and interpersonal skills in leveraging data to drive systemic improvements.

Quality evaluation requires leaders to assess the reliability, validity, and relevance of the data they work with. This competency ensures that decisions are based on sound evidence, rather than flawed or biased datasets (Doğan, 2023). Leaders must also critically evaluate data sources and methodologies, ensuring that their use of data aligns with ethical and professional standards. Data comparison is critical for understanding trends, identifying gaps, and making informed policy adjustments. By juxtaposing different datasets, leaders can uncover discrepancies, validate findings, and identify areas where interventions are needed most (Temel-Aslan et al., 2024). For example, comparing academic performance data with behavioral trends can provide a more holistic understanding of student needs.

The ethical use of data is a cornerstone of data literacy because leaders must navigate privacy concerns, ensure compliance with regulations, and protect sensitive information such as student records (Filderman et al., 2022). Ethical data use also involves promoting equity and inclusivity, ensuring that data is not misused to perpetuate disparities but instead drives

interventions that address systemic inequities (Jimerson et al., 2020). This competency reinforces the moral responsibility of leaders to use data in ways that benefit all stakeholders and uphold the integrity of the educational system. These competencies highlight the interconnected nature of data literacy in K-12 educational leadership. Each competency builds upon and reinforces the others, creating a comprehensive framework that equips leaders to navigate the complexities of data use in K-12 education. Together, they enable leaders to transform data into actionable insights, fostering a culture of innovation, equity, and continuous improvement.

Globally, nations such as Rwanda, Australia, and those within the European Union recognize data literacy as a vital skill for the future (Bhargava et al., 2022). This global emphasis highlights the importance of equipping K-12 leaders with the skills to meaningfully engage with data in educational contexts. Data literacy skills go beyond academic metrics, requiring leaders to draw insights from a variety of sources, including assessment data, student records, behavioral trends, and social-emotional indicators (Conn et al., 2022). Educational leaders can integrate these diverse data types to make more comprehensive and informed instructional decisions that holistically address the needs of students (Dodman et al., 2023).

For K-12 leaders, the ability to interpret and act on data is not only a technical skill but also a critical tool for fostering equitable learning environments, ensuring resources are allocated effectively, and driving strategic improvements across schools and districts (Jimerson et al., 2020). Data-literate leaders can use analytics to uncover disparities, identify underserved student populations, and design targeted interventions to address these inequities. The Council of Chief State School Officers (CCSSO) emphasizes the importance of data literacy for administrators, recommending that they develop the ability to collect and utilize data to set goals, evaluate organizational effectiveness, and foster a culture of continuous learning (Henderson & Corry,

2021). Focusing on organizational learning ensures that data use extends beyond compliance and accountability, fostering innovation, collaboration, and sustainable progress within school systems.

The broader context highlights the critical need to address data literacy deficits. The United States workforce faces a shortage of 1.5 million managers and analysts equipped to interpret large datasets, make evidence-based decisions, and construct data-driven arguments (Schultheis & Kjølvik, 2020). The World Economic Forum's report, *Data Science in the New Economy* (2019), underscores the critical importance of data literacy and data science competencies for maintaining economic competitiveness, emphasizing that these skills are essential not only in IT roles but across industries, regions, and professions (Coners et al., 2025). Without these competencies, individuals may find themselves unable to participate fully in data-informed conversations, effectively silenced in key decision-making processes (Bhargava et al., 2022).

Professional development serves as a foundational element in building data-literate leadership, equipping educational leaders with the skills and confidence needed to navigate the complexities of data use effectively (Henderson & Corry, 2021; Knudson, 2020). Leaders who engage in structured professional learning develop the technical and strategic skills necessary to use data as a foundation for informed action. Dodman et al. (2021) asserted that professional development equips leaders to approach data with confidence, helping them identify trends, target interventions, and prioritize resources effectively. Educational leaders often struggle to build data literacy competencies due to the complexities of collecting, organizing, and analyzing diverse datasets within the dynamic school environment (Conn et al., 2021). These challenges can undermine their confidence and hinder their ability to make informed decisions. However,

researchers agree that professional development plays a pivotal role in addressing these difficulties and empowering leaders to navigate data-driven challenges effectively (Dodman, 2021).

Conn et al. (2022) highlighted that targeted training sessions and workshops equip leaders with essential skills to collect relevant data, clean, and organize datasets, and conduct meaningful analysis. Bhargava et al. (2020) pointed out that training models that integrate experiential learning, such as simulations or role-play scenarios, allow leaders to practice using data in complex, real-world situations. These approaches ensure leaders are prepared to apply their skills beyond theoretical discussions, directly impacting the policies and practices within their districts. Through hands-on practice in these environments, leaders not only enhance their technical abilities but also gain confidence in interpreting data and applying insights to drive decisions that address the unique needs of their schools.

Professional development fosters collaboration by training leaders to communicate data in ways that resonate with diverse audiences. Effective data communication requires not just presenting findings but also guiding stakeholders toward shared understandings of how the data informs strategic priorities. Conn et al. (2021) emphasized that when leaders clearly articulate the implications of data, they foster buy-in among educators and community members, creating alignment around initiatives that improve student success. Beyond individual skill-building, professional development has far-reaching implications for school district outcomes. Bhargava et al. (2020) highlighted that well-trained leaders embed data literacy into their district culture, making data-informed practices the norm. This cultural shift results in districts that actively monitor performance, adjust strategies based on evidence, and continuously refine their goals to

better serve students. Leaders who integrate data into every aspect of their work build systems that are not only adaptive but also equitable (Dodman et al., 2023).

Data literacy empowers individuals to advocate for themselves and their communities by enabling them to use data effectively, identify instances of misuse or misrepresentation, and critically evaluate arguments, fostering informed decision-making and independent thinking (Schultheis & Kjervik, 2020). Professional development builds a foundation for educational leaders to align data literacy with broader district goals, fostering innovation and addressing systemic challenges. By investing in rigorous and intentional professional learning opportunities, school districts ensure their leaders possess the tools to drive equitable and sustainable educational improvement.

Challenges in Leveraging LA and Data Literacy

District leaders must understand the technical and analytical aspects of data and possess the judgment and ethical awareness to ensure that data is used equitably and responsibly (Salas-Pilco & Yang, 2020). Education leaders have immense responsibility because their decisions directly impact students, families, and broader communities (Honig, 2012). Effective use of LA requires leaders to interpret data in ways that benefit all stakeholders, address systemic inequities, and support evidence-based improvement initiatives (Siemens, 2013). When leaders lack the necessary preparation or resources to handle data effectively, it can result in unintended consequences, such as the reinforcement of biases, misuse of information, or inequitable allocation of resources (Jimerson et al., 2020). Addressing implementation barriers is critical to ensuring LA and data literacy become powerful tools for positive, systemic change in education. Educational leaders encounter a range of challenges in effectively using LA and data literacy to support school improvement. Integrating LA into K-12 education has the potential to transform

decision-making processes, offering data-driven insights that can significantly improve teaching, learning, and school outcomes (Paolucci et al., 2024). However, the successful application of LA depends heavily on the data literacy competencies of educational leaders, particularly those in district leadership positions (Bowler & Shaw, 2024).

K-12 district leaders play a pivotal role in integrating LA into decision-making processes, but they frequently encounter barriers that limit their ability to use data effectively. Research identifies several key areas that must be addressed: (a) personal competency gaps in data literacy, (b) inequities in data access and infrastructure, (c) inconsistent vocabulary and unclear frameworks guiding data use, (d) ethical and security concerns, and (e) organizational barriers that hinder the widespread adoption of learning analytics. While some researchers attribute challenges primarily to a lack of training at the individual level, others argue that systemic limitations within districts create larger obstacles (Henderson & Corry, 2021; Townsley & Snyder, 2022).

District-level leaders are expected to incorporate LA into decision-making processes, yet many face personal competency gaps that hinder effective data use. Greller and Drachsler (2012) noted that LA involves more than just reviewing student achievement data—it requires integrating multiple data sources, from attendance records to engagement metrics and social-emotional indicators. Many district leaders struggle to interpret data effectively, limiting their ability to translate LA into actionable insights. Conn et al. (2022) highlighted that some educators feel uneasy when making data-driven decisions, fearing misinterpretation or a lack of understanding. Similarly, Dodman et al. (2023) emphasized that despite being a powerful tool for identifying inequities, data is often presented to educators devoid of critical training on how to

use it effectively. Without strong data literacy skills, educators may rely on surface-level interpretations that reinforce deficit-based thinking rather than drive meaningful change.

The literature diverges on whether this challenge stems primarily from inadequate training or broader systemic factors. Henderson and Corry (2021) suggested that professional development in data literacy must extend beyond assessment literacy to include competencies such as data visualization, trend analysis, and ethical considerations. In contrast, Townsley and Snyder (2022) argued that individual training alone is insufficient without a district-wide culture that prioritizes continuous learning and structured data use. These perspectives suggest that professional development should focus on technical skills and embed data literacy into broader district leadership frameworks.

Even when professional development opportunities exist, they often fail to provide district leaders with the necessary skills to integrate learning analytics effectively. Jimerson et al. (2020) argued that traditional training models tend to focus on compliance-based data use rather than fostering analytical thinking. This means administrators are trained to track assessment scores and compliance metrics rather than explore data trends, identify patterns, or critically analyze root causes of student performance disparities. Educators frequently assume that routine exposure to data equates to effective data use, but this assumption is flawed (Jimerson et al.). Without structured learning experiences in pre-service programs, many school leaders and administrators lack the foundational knowledge necessary to analyze data beyond standardized test scores. Greller and Drachsler (2012) emphasized that data literacy in education requires more than just technical proficiency; it demands the ability to critically evaluate data sources, recognize biases, and understand the limitations of analytics tools. District leaders who lack

these skills may misinterpret data, leading to flawed policy decisions and ineffective interventions.

K-12 school districts must develop strong data literacy skills and acquire the technological infrastructure and resources needed to implement learning analytics effectively. However, disparities in resource allocation and technological access create significant obstacles, particularly for underfunded schools, making it even more challenging to implement DDDM at scale (Aguerreberre, 2022). Access to essential technological infrastructure—including high-speed internet, cloud-based data storage, advanced learning management systems, and interoperable student information systems—remains an obstacle in leveraging LA within K-12 education (Salas-Pilco & Yang, 2020). Aguerreberre highlighted that disparities in resource availability across schools, particularly in terms of server capacity, secure data-sharing platforms, and real-time analytics dashboards, are influenced by the decentralized nature of the U.S. education system. These inequities result in limited access to LA tools for schools with lower socioeconomic status, hindering their ability to collect, integrate, and analyze data for informed decision-making. Such discrepancies are particularly evident between public and private institutions and among schools within the same geographic area, where wealthier districts are more likely to implement cutting-edge predictive analytics models and artificial intelligence driven intervention systems. Similarly, Salas-Pilco and Yang noted that wealthier districts often have access to sophisticated data management systems, while underfunded schools struggle with outdated technology and inadequate internet connectivity.

This disparity limits the ability of district leaders in low-resource areas to implement data-driven strategies effectively. While some researchers emphasize increasing funding for educational technology, others argue that equitable access requires more than financial

investment (Aguerreberre, 2022). Townsley and Snyder (2022) suggested that even when districts receive funding, poor implementation strategies and a lack of training prevent meaningful use of LA. These findings highlight the need for a comprehensive approach that combines financial investment with capacity-building initiatives, ensuring that technology is available and effectively integrated into decision-making processes.

Data literacy continues to gain recognition as an essential skill, but the absence of a standardized definition continues to create challenges for district leaders. A lack of clear frameworks and consistent terminology makes it difficult for educators to interpret and apply LA effectively, leading to fragmented implementation and missed opportunities for data-driven improvement (Henderson & Corry, 2021). Henderson and Corry highlighted that despite efforts to solidify the concept of data literacy, disagreements persist regarding its precise definition, resulting in inconsistent expectations in both pre-service training and professional development. The absence of shared vocabulary complicates the development of effective policies, staff training, and a coherent district-wide approach to data use. Clear policies play a critical role in ensuring consistency, yet many schools within the same district may adopt vastly different approaches. Although data literacy has evolved into a more defined concept, inconsistencies in its definitions create uncertainty about the core competencies needed for effective data use. Bowler and Shaw (2021) emphasized that data literacy can encompass a wide range of skills, from statistical competencies to more socio-technical and ethical dimensions. Training programs often reflect these inconsistencies, leaving district leaders struggling to establish clear expectations and ensure alignment across schools.

Due to the lack of structured methodologies for interpreting and applying data, LA in K-12 remains underdeveloped in comparison to higher education (Aguerreberre, 2022). Townsley

and Snyder (2022) reported that district leaders often struggle with determining which data sources to prioritize and how to integrate them into meaningful decision-making processes. A unified language and common frameworks must be developed to improve usage. Salas-Pilco and Yang (2020) suggested that district-wide frameworks can help create consistency in how data is collected, analyzed, and applied to drive improvements. Researchers disagree on the best approach to structuring these frameworks. Some advocate for centralized district-level policies to standardize data use, while others argue that flexibility is necessary to accommodate the unique needs of different schools (Henderson & Corry, 2021; Salas-Pilco & Yang, 2020). Establishing shared definitions and consistent guidelines can create a more cohesive and effective approach to DDDM. Collaboration among educational stakeholders—teachers, administrators, district leaders, and policymakers—serves as a key strategy in developing a unified understanding of data literacy, ensuring that LA supports meaningful improvements in teaching and learning outcomes (Henderson & Corry).

Growing reliance on LA introduces complex ethical and security challenges that district leaders must address proactively. Schools collect vast amounts of student data, including academic performance, behavioral patterns, and even biometric information, raising questions about privacy, consent, and data protection (Siemens, 2013). Siemens argued that while LA can enhance educational decision-making, educators must consider the ethical implications of data collection and analysis to prevent potential harm. Weak safeguards can lead to data misuse, reinforcing biases, violating student privacy, and contributing to inequitable practices.

Data security remains a critical concern as school districts increasingly depend on cloud-based platforms and third-party vendors to store and manage student information. Salas-Pilco and Yang (2020) highlighted that weak cybersecurity measures leave student data vulnerable to

breaches, unauthorized access, and harmful misuse by external entities. Many schools lack technical expertise or funding to implement robust security protocols, increasing the risk of cyberattacks that could expose sensitive student records. Townsley and Snyder (2022) further emphasized that districts often prioritize compliance with federal regulations, such as the Family Educational Rights and Privacy Act, but fail to develop proactive security strategies that safeguard data integrity.

Beyond security risks, ethical concerns surrounding the interpretation and application of LA also present challenges. Lasater et al. (2021) recommended managing predictive analytics closely to avoid perpetuating deficit thinking and disproportionately labeling students from marginalized backgrounds as at-risk. This labeling may lead to lower expectations, exclusion from advanced coursework, or biased disciplinary actions. A shift toward equity-focused data practices would ensure LA does not reinforce systemic inequities but rather serves as a tool for identifying and addressing gaps in educational opportunities (Dodman et al., 2023).

Some scholars advocate for stronger regulatory frameworks and ethical guidelines to govern the use of LA in K-12 education. Siemens (2013) suggested that transparency in data collection, stakeholder engagement, and ongoing ethical review processes can help mitigate risks associated with data misuse. However, researchers diverge on the level of oversight required. While some call for stricter federal regulations, others emphasize the need for district-level autonomy in developing ethical data policies that align with local needs (Salas-Pilco & Yang, 2020). District leaders must navigate these ethical and security challenges by establishing clear policies that balance DDDM with student privacy protections. Ethical guidelines, professional development on responsible data use, and investment in cybersecurity infrastructure are critical

steps in ensuring LA contributes to educational improvement without compromising student rights.

Even with strong data literacy competencies, robust technological infrastructure, and well-defined data-use frameworks, district leaders continue to face structural and cultural barriers that hinder the widespread adoption of learning analytics (Henderson & Corry, 2021). Resistance to change, limited administrative support, and inadequate staffing create obstacles that prevent data-driven practices from being effectively integrated into district operations (Townsley & Snyder, 2022). Systemic and structural barriers within school districts continue to hinder the full integration of LA into decision-making, despite growing recognition of its potential to improve educational outcomes. A culture of resistance within school districts often prevents the effective use of LA. Conn et al. (2022) emphasized that educators and administrators may distrust data-driven initiatives, particularly if they perceive them as tools for compliance rather than mechanisms for meaningful improvement. Skepticism about the accuracy and utility of data insights further complicates LA adoption and implementation, with some teachers and administrators reluctant to rely on analytics over their professional judgment. Dodman et al. (2023) argued that district leaders must actively develop a culture where data is seen as a collaborative tool for continuous improvement rather than a punitive mechanism. However, changing mindsets requires sustained professional development, leadership modeling, and alignment of data practices between the district office and schools.

Many school districts lack dedicated data teams or personnel with the expertise to manage and interpret learning analytics at scale (Townsley & Snyder, 2022). Without clear roles and responsibilities for data governance, school leaders struggle to implement analytics-based initiatives consistently. Additionally, competing priorities—such as standardized testing

demands, curriculum development, and equity initiatives—often overshadow efforts to enhance DDDM (Salas-Pilco & Yang, 2020). Budget constraints further limit LA implementation.

Although some districts receive funding for technology upgrades, financial resources are often insufficient to support long-term capacity building, including hiring data specialists, providing ongoing training, and integrating analytics tools with existing student information systems (Aguerreberre, 2022). Townsley and Snyder highlighted that even when districts invest in data platforms, the absence of sustained professional development results in underutilization of these tools. Educators may have access to data dashboards and predictive analytics tools, but they often lack the training needed to interpret and apply insights effectively.

Researchers diverge on whether organizational change should be led through top-down policy mandates or through grassroots efforts at the school level. Some argue that district-wide policies and accountability measures are necessary to drive data adoption, ensuring that all schools within a district follow consistent practices (Salas-Pilco & Yang, 2020). Others suggest that bottom-up approaches—where schools and teachers take ownership of data initiatives—are more effective in fostering engagement and long-term sustainability (Dodman et al., 2023). Both perspectives emphasize the need for leadership support, resource allocation, and strategic planning to overcome organizational barriers.

DDDM for School Improvement

DDDM is a systematic approach that involves collecting, analyzing, and applying data to inform decisions that improve student learning and organizational efficiency (Gummer & Mandinach, 2015). The concept evolved over several decades, reflecting broader trends in educational policy, technological advancements, and accountability measures. While the term DDDM is widely used today, it has been known by other names, including *data-informed*

decision-making, evidence-based decision-making, and data-based decision-making, each emphasizing different aspects of how data is utilized in school improvement efforts (Cui et al., 2023; Gummer & Mandinach). These variations in terminology highlight the ongoing debate over the role of quantitative versus qualitative data in educational decision-making, as well as the extent to which data should guide versus inform leadership and instructional choices (Donate-Beby et al., 2025). The increasing emphasis on DDDM in K-12 education stems from the need for more strategic and evidence-based approaches to school improvement. However, the effectiveness of DDDM hinges on the data literacy of educational leaders and the ability to align learning analytics with district priorities (Cui et al.; Donate-Beby et al.). While the benefits of using data to guide instructional and organizational decisions are widely acknowledged, challenges remain, particularly regarding the quality and interpretation of data, as well as the capacity of educators to use it effectively (Witte et al., 2025).

The foundations of DDDM emerged in the 1960s and 1970s, when early accountability movements pushed for more systematic evaluations of student performance and school effectiveness (Francis, 2020). However, the widespread adoption of DDDM accelerated in the 1990s and early 2000s as federal and state policies made standardized assessments and performance metrics central to school improvement strategies (Hegestedt, 2023). The No Child Left Behind Act (2001) solidified DDDM's role in K-12 education by mandating that schools use student achievement data to shape instruction, allocate resources, and meet accountability targets (Knudson, 2020). During this period, schools primarily collected and analyzed test scores and demographic data, often treating data use as a compliance-driven activity rather than a tool for holistic student learning and growth (Henderson & Corry, 2020).

By the 2010s, advances in technology and the rise of LA expanded DDDM beyond standardized testing (Witte et al., 2025). Digital assessments, student information systems, and real-time analytics now allow educators to track student progress more dynamically and personalize learning experiences (Francis, 2020). The increasing emphasis on DDDM in K-12 education is a response to growing demands for accountability, equitable student outcomes, and the effective allocation of resources in schools. Policymakers and educators recognize that traditional decision-making, which often relied on intuition or historical practices, may not adequately address the complexities of modern education systems (Gummer & Mandinach, 2015). Instead, DDDM provides a structured, evidence-based approach that allows school leaders to identify achievement gaps, tailor interventions to student needs, and monitor progress over time (Dodman, 2023).

Increased usage of digital learning platforms, student information systems, and assessment tools provides schools with access to vast amounts of data to inform instructional practices and administrative decisions (Francis, 2020). Schools and districts leverage various data sources, including student performance metrics, attendance records, behavioral indicators, and teacher effectiveness measures, to shape instructional strategies and policy decisions (Knudson, 2020). Moreover, state and federal policies continue to require schools to use data for performance evaluations in areas such as standardized testing, teacher effectiveness, and school accountability ratings (Hegestedt, 2023). These policy shifts have further institutionalized DDDM as a fundamental component of school improvement efforts. However, the effectiveness of DDDM depends on educators' ability to critically assess and contextualize the data they use. Studies indicate that many leaders lack sufficient data literacy training, which can lead to misinterpretation of data and ineffective decision-making (Cui et al., 2023; Donate-Beby et al.,

2025). Isaacs (2021) argued that the push for DDDM has resulted in educators being overwhelmed with data and underprepared to make sense of it in ways that enhance learning.

Despite these challenges, successful DDDM implementation shows positive outcomes in K-12 settings. Schools that use data to guide instructional decisions see improvements in student achievement, increased equity in resource allocation, and more targeted professional development for teachers (Dodman, 2023). Classroom-level data allows teachers to personalize learning experiences and adjust instruction based on students' needs (Witte et al., 2025). Additionally, when data is used at the district level, it enables policymakers to identify trends, allocate resources more effectively, and refine strategic initiatives (Knudson, 2020).

The role of data in school improvement planning is multifaceted, influencing curriculum design, resource distribution, and teacher support. Districts that embed DDDM into their continuous improvement cycles are better equipped to identify achievement gaps, evaluate the impact of interventions, and make informed policy decisions (Gade, 2023). Research highlights cases where districts successfully use data to guide resource allocation, identify struggling students, and implement targeted support programs (Knudson, 2020). Advocates argue that predictive analytics, when used responsibly, can provide early indicators of student disengagement and prompt timely interventions (Ifenthaler et al., 2021). A fundamental aspect of data-driven school improvement is the ability to differentiate between leading and lagging indicators. While lagging indicators—such as standardized test scores—provide retrospective insights, leading indicators—such as formative assessment data and early warning systems—allow for proactive intervention (Knudson, 2020). Schools that focus on a balanced approach incorporating both types of data are more successful in achieving sustained improvement.

Many schools struggle to fully integrate DDDM into their improvement plans due to a lack of coherence between data collection practices and instructional decision-making (Hegestedt, 2023). Some scholars argue that data is often used to enforce compliance with standardized assessments rather than to support holistic school improvement (Isaacs, 2021). The overemphasis on summative data, such as standardized test scores, has led to concerns that DDDM reinforces a culture of performativity rather than meaningful learning (Howard et al., 2022). Critics suggest that overreliance on quantitative data marginalizes qualitative insights that provide a fuller picture of student learning and school effectiveness (Ifenthaler et al., 2021). Standardized assessments, when used in isolation, can reinforce systemic biases rather than address them (Francis, 2020). To counteract these challenges, experts recommend fostering a culture of collaborative data use where educators engage in data dialogues to interpret findings and develop responsive action plans (Dodman, 2023).

Implementing DDDM can transform into school improvement planning if district leaders ensure data practices align with broader strategic goals. This requires a shift from data collection as an isolated function to data use as an integrated component of leadership and instructional planning (Gummer & Mandinach, 2015). Some key strategies to achieve this include developing a data-literate leadership culture, integrating data into decision-making structures, utilizing predictive and real-time analytics, and ensuring equitable and ethical data use.

Scholars contend that professional development programs focused on data literacy can significantly enhance educators' ability to leverage data for instructional improvement (Gummer & Mandinach, 2015). Research underscores the importance of embedding data literacy training into leadership development to ensure sustainability (Cui et al., 2023). Some districts successfully integrated LA dashboards and real-time data tracking into teacher training

programs, fostering a culture where data use becomes a routine part of pedagogical decision-making (Ifenthaler et al., 2021; Knudson, 2020). Schools that embed data use within their leadership and instructional teams see greater success in driving improvement for every student (Koh et al., 2023). This includes establishing data teams, integrating analytics into professional learning communities, and using collaborative inquiry models to assess and refine school initiatives (Knudson). Structured processes that link data insights and instructional planning result in more effective use of resources and improved student outcomes (Gade, 2023).

Although DDDM allows leaders to address educational disparities, it also raises concerns about data privacy, algorithmic bias, and ethical decision-making. Studies caution against the over-reliance on standardized metrics without considering contextual factors such as socioeconomic status and access to learning resources (Francis, 2020). Ethical frameworks and policies that prioritize student data privacy and equitable practices are essential for responsible data use (Donate-Beby et al., 2025). Despite broad support for DDDM as a strategy for school improvement, the literature reveals significant divergences in perspectives, particularly regarding the ethics, practicality, and impact of data use in educational settings. Scholars remain divided on the degree to which data should drive decision-making, the role of standardized testing, and the implications of predictive analytics in shaping educational equity and policy (Howard et al., 2022). The literature suggests that while DDDM has the potential to drive meaningful school improvement, its impact depends on how data is framed, interpreted, and acted upon. Thoughtful implementation, ongoing professional development, ethical safeguards, and an emphasis on equity are critical when determining whether leveraging data in K-12 settings fulfills its promise or exacerbates existing challenges.

Ethical Assurances

This study was conducted in accordance with all ethical standards required by National University. Prior to the initiation of any data collection, the study received approval from the University's Institutional Review Board. Since the study involves interviews with educational leaders and does not include vulnerable populations or sensitive topics beyond professional practices, the risk to participants was minimal. However, participants were fully informed of the purpose of the study, their rights as participants, and the voluntary nature of their participation through an informed consent process. They also had the right to withdraw at any time without penalty.

To protect participant confidentiality, all identifying information was removed from transcripts and replaced with pseudonyms. Audio recordings, transcripts, and research notes were stored on a password-protected external hard drive. Only the researcher had access to these materials. In accordance with IRB policy, all data will be securely stored for a period of three years following the completion of the study and then permanently destroyed.

The researcher served as the primary instrument for data collection and analysis in this qualitative case study. With prior professional experience as a district-level leader responsible for assessment and data strategy, the researcher acknowledged a level of familiarity with the study context and potential for implicit bias. To address this, reflexive journaling was used throughout the research process to monitor assumptions and maintain self-awareness. Member checking and peer debriefing were also employed to enhance credibility and reduce the influence of the researcher's positionality on data interpretation. These strategies are intended to support a trustworthy and transparent examination of how educational leaders engage with learning analytics tools and demonstrate data literacy competencies in their decision-making practices.

Summary

This study aimed to explore how K-12 school district leaders leverage LA and demonstrate data literacy competencies when planning and executing educational improvement initiatives. As DDDM becomes a cornerstone of K-12 leadership, district leaders face increasing pressure to translate complex datasets into meaningful strategies that advance equity and student achievement. While data literacy has gained prominence in educational discourse, research continues to emphasize a gap in preparation and practice among district leaders, many of whom lack formal training in transforming data into actionable insights. This gap is especially significant given that their decisions impact entire systems, resource allocation, and instructional outcomes.

The lack of adequate data literacy training among district leaders limits the effective use of learning analytics for informed decision-making. The study addressed this issue by examining the specific competencies district leaders use, how they navigate challenges in data use, and the broader organizational and policy implications. Grounded in the frameworks of Greller and Drachsler (2012) and Gummer and Mandinach (2015), the study employed a qualitative case study design that includes interviews and document review. These data sources provided a comprehensive understanding of how urban district leaders use data tools and insights to design and implement school improvement initiatives. This study aimed to strengthen the professional development landscape and support systemic efforts toward more data-literate, equity-focused leadership in K-12 education.

Section 2: Methodology and Design

The problem addressed in this study is that K-12 district leaders face a deficiency in data literacy training, limiting their ability to effectively utilize learning analytics within their DDDM practices (Conn et al., 2022; Filderman et al., 2022; Henderson & Corry, 2020). Therefore, the purpose of this qualitative case study was to explore how K-12 school district leaders leverage LA tools and demonstrate data literacy competencies when planning and executing educational improvement initiatives. I used semi-structured interviews and documents as the primary data sources for this research. The interviews and documents provided the opportunity to collect data, explore how K-12 district leaders engage with learning analytics tools, and examine their data literacy competencies in planning and executing educational improvement initiatives.

This section details the research method and design that will be applied. The main focus of this study was to gain a deeper understanding of how district leaders navigate DDDM processes and assess the extent to which data literacy deficiencies impact their ability to utilize learning analytics effectively. This section includes research design and method, population and sample, materials/instrumentation, data collection and analysis, assumptions, limitations, and delimitations.

Design and Method

Qualitative research, recognized for its adaptability and exploratory nature, enables researchers to gain in-depth insights into participants' perspectives without being confined by rigid frameworks (Bloomberg, 2023). This method prioritizes the collection of non-numerical data, such as interviews, observations, and document analysis, to gain insight into individuals' perspectives, experiences, and interpretations within a particular context (Susanto et al., 2024).

Qualitative research is a robust approach to understanding complex social phenomena through in-depth exploration and immersion in participants' experiences (Stake, 1978).

In contrast to the structured, hypothesis-driven approach of quantitative research, qualitative research prioritizes context and subjectivity, enabling a more nuanced understanding of human interactions (Bloomberg, 2023). This approach aligns with the study's objective of examining the challenges and enablers that influence K-12 district leaders' ability to leverage learning analytics and demonstrate data literacy competencies in decision-making. Since the research questions focused on subjective experiences and personal insights rather than predefined variables, a qualitative approach is the most suitable choice (Yin, 2015). This methodology offered a deeper understanding of district leaders' context, attitudes, and behaviors, providing insights that can inform strategies to enhance data literacy and improve decision-making practices (Ahmad et al., 2019).

A qualitative case study design was used to examine how K–12 district leaders in Washington, D.C., use LA and demonstrate data literacy competencies when planning and executing educational improvement initiatives; the case was bound by its focus on a single public school district, the perspectives of central office leaders, and practices occurring during the 2024–2025 academic year. A qualitative case study suited this research because it allowed for a deep exploration of the complex and subjective nature of data literacy experiences among K-12 district leaders (Yin, 1984). This method enabled a detailed examination of the contexts and conditions influencing how leaders incorporate data literacy into their decision-making. According to Yin (2015), case studies are particularly beneficial for answering "how" and "why" questions and are best suited for situations where the researcher has little control over events.

This approach allowed for a comprehensive understanding of how district leaders engage with learning analytics and demonstrate data literacy competencies.

Researcher-as-instrument, a concept primarily used in qualitative research, posits that the researcher is the primary data collection and analysis tool (Dean et al., 2018). As the primary instrument of data collection and analysis, I acknowledged potential biases and their influence on the study (Creswell & Poth, 2018). Given my experience in educational leadership and familiarity with data-driven decision-making, I recognized the importance of maintaining reflexivity by documenting personal assumptions, expectations, and interpretations throughout the research process.

Grounded theory and phenomenology were considered potential research designs but were not selected due to their differing methodological purposes. Grounded theory, primarily used to develop new theories based on patterns that emerge from the data, did not align with this study's objective of examining existing practices related to learning analytics and data literacy (Glaser & Strauss, 1967). Phenomenology emphasizes the exploration of individuals' lived experiences with a specific phenomenon, making it less suitable for this research, which focused on analyzing how K-12 district leaders apply learning analytics tools and demonstrate data literacy in decision-making rather than solely examining their subjective experiences (Moustakas, 1994). A case study approach was more appropriate because it enabled an in-depth exploration of these real-world practices within their specific educational contexts, making it invaluable for exploratory, explanatory, and descriptive research (Bloomberg, 2023).

Population and Sample

The target population for this qualitative study consisted of educational leaders serving at the central office level within a large, urban, public school district located in Washington, D.C.

These individuals included chiefs, deputy chiefs, directors, and program managers whose roles involve oversight of districtwide initiatives that involve teaching and learning, data and technology, and operations. The school district serves more than 50,000 students and employs over 8,000 staff members, with over 900 central office-level administrative staff members (National Center for Education Statistics, 2023). Leaders at the central office level are uniquely positioned to engage with learning analytics tools and make high-impact decisions related to district improvement initiatives (Stosich, 2020).

The selected district serves a diverse, predominantly urban student population. In the 2023–2024 school year, it enrolled 50,839 students across 117 schools. Approximately 44% of students identified as Black or African American, 36% as White, 12% as Hispanic or Latino, and 4% as Asian (National Center for Education Statistics, 2024). Additionally, 16% of students were English learners, 16% received special education services, and 45% were classified as at-risk due to factors such as homelessness, foster care placement, economic disadvantage, or academic underperformance.

Governed by a mayor-appointed chancellor and an elected state board of education, the school district operates under a centralized governance model. This structure facilitates cohesive policy implementation but can present challenges in maintaining consistent stakeholder engagement across schools. The school district has made significant investments in learning analytics tools to support data-driven decision-making across both central office and school leadership. These tools include interactive dashboards, predictive analytics platforms, and early warning systems that help identify at-risk students and monitor progress toward strategic priorities. While professional development in data literacy has been a districtwide focus,

variability remains in how confidently and consistently leaders apply data insights to guide planning and execution.

As an urban school district, it faces persistent challenges related to student mobility, resource limitations, and achievement disparities that differ from those in neighboring suburban districts. Nevertheless, the school district benefits from robust partnerships with universities, philanthropic organizations, and national reform initiatives, positioning it as a strategic site for the implementation and study of innovative, data-informed practices. This district offered a valuable lens for examining how high-needs, urban education systems operationalize learning analytics and cultivate data literacy among leaders. Its scale, diversity, and governance structure made it an instructive case for understanding the complexities and opportunities involved in leveraging data to drive educational improvement, which directly aligned with the purpose of this study.

This population was appropriate given the study's focus on how central office administrators leverage learning analytics and demonstrate data literacy competencies. These leaders shape district-wide practices and have direct influence over how data systems are integrated into improvement planning, school support, and instructional priorities (Honig et al., 2010). Central office leaders are well-positioned to address the research questions regarding data use due to their system-level oversight and decision-making authority (Coburn et al., 2009).

Approximately nine participants were selected using purposeful sampling to ensure the inclusion of individuals whose experiences and expertise were directly relevant to the study's objectives. The selection criteria included: (a) individuals currently serving in central office leadership positions (e.g., office chiefs, superintendents, directors), (b) individuals actively engaged in decision-making processes related to educational policies, programs, or practices, (c)

individuals with direct experience in implementing DDDM practices, and (d) individuals representing a range of data literacy competencies to capture diverse perspectives (Appendix C). A sample of this size was consistent with qualitative research standards and anticipated to achieve data saturation, the point at which no new themes or insights emerge from additional data collection (Chitac, 2022). This sampling approach was appropriate for qualitative research, as it allowed for the intentional selection of information-rich cases that can provide deep insight into the research questions (Martínez-Mesa et al., 2016).

Materials/Instrumentation

Approval was obtained from the Institutional Review Board to ensure the study meets ethical research standards. Data were collected using semi-structured interviews, supported by relevant, public documents that provide additional context or insight related to district practices. In qualitative research, semi-structured interviews are essential for capturing participants' perspectives in their own words, allowing for depth, nuance, and flexibility in exploring the research topic (Obery et al., 2021). Document analysis enhanced the richness of the data by providing contextual background and supporting triangulation, which strengthens the credibility and trustworthiness of the findings (Bloomberg, 2023).

Interviews

Semi-structured interviews were selected because they allow participants to share detailed insights based on their lived experiences, making them well-suited for exploring complex leadership practices. The semi-structured interview format also provided me with the opportunity to modify questions as needed and delve into emerging topics, facilitating a deeper exploration of the participants' experiences (McGrath et al., 2019). The study included nine semi-structured, open-ended interview questions designed to explore how central office leaders

engage with learning analytics and demonstrate data literacy competencies to make data-driven decisions. Questions were informed by existing literature and focused on participants' roles and responsibilities, the tools and support they use, and their experiences planning and implementing improvement initiatives using data. Each interview lasted less than 60 minutes and was conducted virtually. Upon completion, audio recordings were transcribed, and each participant received a copy of their transcript to review for accuracy. All recordings and transcripts were stored securely and will be maintained for a minimum of three years in accordance with ethical research guidelines.

Documents

Documents collected for this study included publicly available district-level materials that reference data use, leadership practices, or planning for educational improvement. These included strategic plans, performance reports, and other documents that reflect how the district communicates and enacts data-informed decision-making. Documents were gathered through systematic online searches of district websites, open-access government archives, and education-focused public repositories.

These documents provided contextual evidence to support and triangulate the interview findings. Specifically, the materials helped identify how district leaders represented their data use practices, what data literacy competencies are emphasized (or omitted) in official communications, and how data-driven decisions are framed in planning documents. This aligned directly with Research Question 2 (which explored competencies demonstrated or perceived by leaders). Document analysis also offered insight into whether systemic supports or barriers to data use are reflected in policy or reporting artifacts, thereby enhancing the depth and trustworthiness of the qualitative analysis.

Data Collection and Analysis

Approval was sought from the Institutional Review Board before data collection began. The Institutional Review Board application included all relevant documentation, including the interview protocol, informed consent form, participant recruitment materials, and data security plan. No data were collected until full Institutional Review Board approval was granted, ensuring the research study met ethical standards for protecting the rights, privacy, and well-being of participants. It also provided formal oversight to ensure that risks were minimized and informed consent was properly obtained.

Participants were recruited using purposive sampling, specifically targeting central office leaders within an urban school district in Washington, D.C., who were involved in the planning and implementation of educational improvement initiatives. Initial outreach was conducted via email through professional networks and district contacts. Each potential participant received an email that outlined the purpose of the study, including why their perspective was valuable, what participation involved, and how confidentiality would be maintained. It also included an invitation to participate, the estimated time commitment, and a copy of the informed consent form for their signature (Appendix A).

Participants were contacted via email to schedule a mutually convenient time for the virtual interview. The initial email included a brief overview of the study, the informed consent form, and a link to a scheduling tool via Calendly to select an available time slot. Once a date and time were confirmed, I emailed each participant a calendar invitation with a secure video conferencing link and a copy of the interview questions for their review in advance. A reminder email was sent 24 hours before the scheduled interview to confirm attendance and answer any final questions. (Appendix B).

Semi-structured Interviews

Data were collected through semi-structured interviews with 9 central office leaders via Zoom. Each interview lasted approximately 60 minutes and was audio-recorded with consent. The interviews followed a semi-structured format, allowing for a consistent set of core questions aligned with the research focus while also providing flexibility to explore participant experiences in greater depth. Interview questions aligned with the study's two research questions, which explored how school district leaders leverage learning analytics tools in their decision-making when planning educational improvement initiatives, and what specific data literacy competencies they demonstrate during the planning and execution of these initiatives. Follow-up and probing questions were used as needed to clarify responses, encourage elaboration, and capture the nuances of each participant's perspective. The audio recordings were transcribed following each interview to ensure accuracy and to allow for early immersion in the data. Transcripts were shared with participants for member checking, providing an opportunity to confirm the accuracy of their responses and make any necessary clarifications. This process enhanced the credibility of the findings and supported a collaborative approach to data validation.

Documents

In addition to interviews, I reviewed publicly accessible district documents, such as strategic plans, data reports, and city council meeting presentations, to supplement and triangulate the interview data. These documents were identified through targeted searches on the district's official website, city government portals, and public archives. Each document was reviewed using a structured document analysis protocol adapted from Bowen (2009), which includes examining the content for references to data use, learning analytics, decision-making processes, and leadership practices related to educational improvement. I applied thematic

coding aligned with the study's research questions to identify patterns, language, and artifacts that illustrate how district leaders engage with data in their planning and implementation work. Relevant excerpts were organized into a document analysis matrix, noting the source, date, intended audience, and any emerging themes or contradictions in relation to the interview findings. These materials were analyzed concurrently with interview transcripts to support triangulation and enhance the credibility and depth of the findings. All data were stored securely in password-protected files that only I can access.

Data Analysis

Qualitative data analysis focuses on interpreting meanings, patterns, and themes within rich, descriptive data. This process is often inductive, with researchers examining transcripts, field notes, or visual data to identify emerging themes and insights that reflect participants' perspectives and experiences (Creswell & Poth, 2018). Thematic analysis is a flexible method suitable for identifying, analyzing, and reporting patterns (themes) within data (Bloomberg, 2023). The step-by-step process includes becoming familiar with data, coding, searching for themes, reviewing, defining, naming, and writing up findings. This approach allows for theoretical flexibility, making it particularly effective for exploring perspectives and experiences without requiring adherence to a specific theoretical framework. Clarke and Braun (2013) emphasized that thematic analysis is not a linear process but rather a recursive one, allowing researchers to move back and forth as they refine and analyze themes.

Qualitative data analysis in this study focused on interpreting patterns, meanings, and themes derived from both interview and document data. The process followed Braun and Clarke's (2013) six-phase approach to thematic analysis, a flexible and recursive method that enables researchers to identify, analyze, and report patterns across a dataset without the

constraints of a specific theoretical framework. The first phase, familiarization, involved transcribing interview recordings, digitizing handwritten notes, and thoroughly reviewing all collected data, including strategic plans, performance reports, and city council documents (Bloomberg, 2023). These documents were read multiple times alongside interview transcripts to develop a deep understanding of the context in which participants operate and to begin identifying early patterns related to data use and decision-making.

In the coding phase, all data, including interviews and documents, were uploaded into NVivo qualitative analysis software for consistent coding and management. Open coding was used to identify and label relevant excerpts across both data sources (Bloomberg, 2023). This included language used in documents to describe data use, leadership actions, or references to learning analytics tools. Codes emerging from both sources were reviewed for alignment and divergence. Axial coding was applied to explore relationships among codes and to group them into broader categories and subcategories (Creswell & Poth, 2018). For documents, this involved examining how data-informed decision-making is communicated through policies, plans, and public-facing reports, and how this aligns with or differs from what participants describe in interviews.

The next phases included searching for themes, reviewing themes, and defining and naming themes. During these steps, codes from both interviews and documents were organized into overarching themes. These themes reflected patterns in how district leaders engage with data, the competencies they emphasize or lack, and the organizational conditions that support or constrain data-driven practices. The themes were refined through iterative comparison and linked explicitly to the study's research questions and relevant literature (Bloomberg, 2023). In the writing-up phase, findings were presented through rich narrative descriptions that synthesize

evidence from both interviews and documents. Direct participant quotes and illustrative excerpts from district documents were used to support each theme, highlighting areas of alignment or divergence between reported practices and institutional artifacts.

This study incorporated several methodological strategies to ensure analytic rigor and trustworthiness of the findings. Member checking was conducted by inviting participants to review their interview transcripts for accuracy and clarity. Triangulation involved comparing themes across interviews and documents, providing a more nuanced and credible understanding of district-level data use (Bloomberg, 2023). A reflexive journal was maintained throughout the process to document analytic decisions and reflect on potential researcher bias. Additional strategies, including peer debriefing and thick descriptions, further supported the credibility and transparency of the findings.

Assumptions

This study was conducted under several key assumptions. It was assumed that participants provided honest and thoughtful responses based on their professional experiences, which is reasonable given their leadership roles and involvement in data-driven decision-making. It was also assumed that participants had a working knowledge of data literacy and learning analytics tools, as these are core components of their responsibilities. Additionally, it was assumed that participants' insights were shaped by their district context, aligning with the interpretivist nature of qualitative research. Finally, it was assumed that interviews and document analysis would yield sufficient depth and richness to support a credible thematic analysis.

Limitations

This study had several potential limitations. First, as a single-district case study, findings were not generalizable, though a rich description supported transferability. Second, researcher

bias may have influenced interpretation; maintaining a reflexive journal helped mitigate this risk. Third, participants may have offered socially desirable responses due to their leadership roles, which was addressed through confidentiality and member checking. Lastly, reliance on self-reported data may have limited accuracy, but triangulation with document analysis helped validate and enrich the findings.

Delimitations

This study included several delimitations, which were intentional boundaries set to narrow the scope of the research (Bloomberg, 2023). It focused on a single K-12 public school district and included only central office leaders involved in planning and implementing educational improvement initiatives. While this allowed for in-depth exploration of district-level data use, it limited the range of perspectives and may not have reflected the practices or experiences of leaders in other districts. The use of qualitative methods, including semi-structured interviews and document analysis, supported a deep understanding of participant experiences but did not aim for generalizability. The sample size was small, which is appropriate for a qualitative case study, but it further limited the breadth of perspectives captured. Additionally, the study was restricted to interviews and document review, excluding other data sources such as observations or surveys that could have provided additional context or validation.

Summary

This qualitative case study examined how K–12 district leaders leverage learning analytics tools and demonstrate data literacy competencies when planning and implementing educational improvement initiatives. The study focused on one urban public school district in Washington, D.C., using semi-structured interviews and document analysis as primary data

sources. Central office leaders were purposefully selected based on their involvement in district-level decision-making.

Interviews were conducted virtually, recorded, transcribed by the researcher, and verified through member checking. Publicly available documents supplemented interview data to support triangulation. Braun and Clarke's (2013) six-phase thematic analysis guided coding and theme development using NVivo software. Reflexivity was maintained through journaling to mitigate bias.

The study was based on the assumption that participants responded honestly and had relevant experience with data use. Limitations included limited generalizability, small sample size, and reliance on self-reported data. Delimitations included the focus on one district, exclusion of school-based staff, and use of only interviews and document analysis. These choices aligned with the study's purpose and supported an in-depth exploration of district leadership practices.

Section 3: Findings, Implications, and Recommendations

The problem addressed in this study was that K-12 district leaders face a deficiency in data literacy training, limiting their ability to effectively utilize LA within their DDDM practices (Conn et al., 2022; Filderman et al., 2022; Henderson & Corry, 2020). This qualitative case study focused on how K-12 school district leaders leverage learning analytics tools and demonstrate data literacy competencies when planning and executing educational improvement initiatives. This section of the study outlines the findings, implications, and recommendations. The findings section includes an overall description of the study and an analysis of the data organized by the research question. Responses from the K-12 district leaders, obtained through one-to-one Zoom interviews consisting of 11 open-ended questions and a review of publicly available documents, are discussed. Furthermore, the findings address the four criteria that ensure the trustworthiness of the data: credibility, transferability, dependability, and confirmability.

This study had several limitations. First, the population sample was limited to a single school district in Washington, D.C. While this focus provided an in-depth understanding of how district leaders perceive and apply data literacy competencies, it also restricted the breadth of perspectives. Districts across the United States vary in governance, demographics, resources, and priorities, and as a result, the findings may not fully capture the diversity of practices, challenges, or decision-making approaches that exist in other regions. This limitation reduced the generalizability of the study, though thick description was provided to support transferability to similar contexts.

A second limitation stems from my prior role as a district leader in the same school district, which introduced the possibility of researcher bias. My professional background and existing relationships with participants may have influenced their willingness to participate or the

nature of their responses, as some may have been inclined to provide socially desirable answers or less willing to share critical perspectives given my familiarity with district operations. To mitigate this risk, I implemented strategies to enhance trustworthiness, including reflexive journaling, the use of a standardized interview protocol, and member checking to confirm the accuracy of transcripts and interpretations.

Closely related is the limitation of socially desirable responses. Because participants held leadership roles within the district, they may have chosen to emphasize positive aspects of their experiences or align their answers with district priorities rather than sharing candid critiques. This tendency could have narrowed the range of perspectives captured in the data. To reduce this risk, confidentiality was assured, and participants were given the opportunity to review their transcripts, which helped encourage honest and open responses. Lastly, reliance on self-reported data presents an additional limitation, as participants' accounts are shaped by memory, interpretation, and personal perspective. To strengthen the accuracy and credibility of the findings, interview data were triangulated with publicly available documents, which provided corroborating evidence and helped enrich the study's conclusions.

Findings

Trustworthiness of the Data

Establishing the trustworthiness of the data was a critical part of the data collection process in this study. Trustworthiness reflects the clarity of the research design and procedures, along with the credibility and usefulness of the study's findings and implications (Bloomberg, 2023). Trustworthiness is essential in qualitative research to ensure that findings accurately and authentically reflect participants' experiences and perspectives (Guba, 1981). Qualitative

researchers strengthen the trustworthiness of their studies by applying three foundational principles: reflexivity, triangulation, and participant verification (Leko et al., 2021).

Reflexivity requires researchers to critically reflect on their position within the study, acknowledging potential bias and examining decisions in light of their ontology, epistemology, and axiology (Leko et al., 2021; Meyer, 2022). Triangulation strengthens interpretations by drawing on multiple data sources (Leko et al., 2021). Participant verification, or member checking, further supports credibility by allowing participants to review and confirm the accuracy of their data, such as interview transcripts (Bloomberg, 2023; Leko et al., 2021). The concept of trustworthiness is established through credibility, transferability, dependability, and confirmability, which together strengthen the overall rigor of qualitative inquiry (Guba, 1981).

Credibility

Credibility, defined as confidence in the truth of the research findings, is strengthened through strategies such as triangulation, member checking, prolonged engagement, and persistent observation (Bloomberg, 2023). Credibility was supported through triangulation of data sources, including semi-structured interviews and public document reviews. Member checking was also conducted, as participants were given the opportunity to review their interview transcripts to ensure accuracy and provide clarification when needed. In addition, the use of a standardized interview protocol helped maintain consistency across interviews.

Dependability

Dependability addresses the extent to which the research process is consistent and reliable, focusing on whether the study was conceptualized, conducted, analyzed, and reported without error. It emphasizes a logical, traceable, and well-documented process that allows the

findings to be considered repeatable (Bloomberg, 2023). Dependability was ensured by maintaining a clear and detailed description of the study's methodology and research design, including data collection procedures, coding methods, and theme development. An audit trail was created that documented decision-making, coding steps, and revisions to the codebook. This thorough documentation allows for the study to be replicated or evaluated by other researchers.

Confirmability

Confirmability refers to the extent to which research findings are shaped by participants rather than researcher bias, motivation, or interest (Bloomberg, 2023). Qualitative researchers recognize that remaining fully neutral is challenging, so confirmability is strengthened through strategies such as reflexivity, triangulation, and maintaining a detailed audit trail. Confirmability was established by implementing strategies to reduce researcher bias and ensure that findings were grounded in the participants' responses rather than personal assumptions. This included maintaining a reflexive journal throughout the study to document my positionality and reflect on potential biases. Data analysis was conducted systematically using NVivo software, which allowed for transparent organization of codes and themes. Member checking and the inclusion of direct participant quotations further supported that the interpretations accurately reflected the participants' perspectives.

Transferability

Transferability is the extent to which research findings apply to other contexts, enhancing external validity through detailed records and consistent journaling (Bloomberg, 2023). Transferability was enhanced by providing thick, rich descriptions of the research context, participants' roles, and the processes under study. Although the findings are limited to one

district, the detailed contextualization of the setting and participants allows readers to determine the applicability of the results to other districts or similar educational contexts.

This qualitative case study investigated how K-12 district leaders engage with data to inform educational improvement efforts. The study involved nine K-12 district leaders from a school district in Washington, DC. Supporting documents were collected from the school district website and the Office of the State Superintendent, all of which were in the public domain. After receiving authorization from the Institutional Review Board at National University (Appendix A), prospective participants were recruited through purposeful sampling and contacted by email (Appendix B). Nine participants responded to the recruitment email, met the study criteria, and received the consent form (Appendix C). Each participant was then emailed an individual Zoom link for their scheduled interview. The recruitment process resulted in nine participants who completed interviews. All interviews were conducted virtually using Zoom and transcribed through the platform. Data were collected through one-to-one Zoom interviews, which included 11 open-ended questions (Appendix D), and through the review of relevant documents. The participants were K-12 district leaders representing a range of experiences and educational backgrounds.

All participants met the eligibility criteria for this study. The nine participants included three males and six females. Regarding race and ethnicity, three identified as White, one as Hispanic, and five as Black or African American. Participants' professional experience in education ranged from 15 to 23 years. In terms of educational attainment, one participant held a bachelor's degree, several held master's degrees ($n = 7$), and one held a doctoral degree. Participants represented a variety of district-level leadership roles within the school district, including program management, assessment, curriculum, and instructional leadership.

Once data collection was completed, thematic analysis was employed to examine the interview transcripts and documents. Thematic analysis is a widely used qualitative method that involves identifying, analyzing, and reporting patterns, or themes, within a data set (Byrne, 2021). This approach provided a flexible framework for organizing and interpreting data, enabling the development of rich insights into district leaders' perceptions and practices. An inductive strategy was applied, allowing themes to emerge directly from the data rather than being predetermined by the researcher (Byrne, 2021; Campbell et al., 2021).

Inductive data analysis was conducted to examine individual cases and identify themes as they emerged across the data set (Moseley et al., 2021). The process began with a manual review of interview transcripts to generate initial codes, followed by systematic organization in NVivo. Transcripts were uploaded into the software, where codes were applied consistently, and participant memos were created to capture contextual details and reflections that supported interpretation. This iterative approach is aligned with Guest et al. (2012), who describe inductive analysis as beginning with raw data, codifying information, and then reviewing and analyzing it for recurring patterns and themes. Participant memos were particularly valuable for documenting nuances and maintaining an audit trail of analytic decisions. From this process, a comprehensive codebook was developed with emergent codes grounded directly in the data. The codebook included two overarching categories aligned to the research questions: learning analytics use and data literacy competencies, with a total of 49 codes distributed across these categories. These codes were then organized into broader themes to capture shared meanings and explain how district leaders engaged with data and demonstrated data literacy competencies. Thematic analysis provided a flexible framework for identifying, analyzing, and reporting patterns that offered deep insights into leaders' perceptions and practices (Byrne, 2021; Campbell et al.,

2021). Tables 1 and 2 show parent codes aligned with research questions 1 and 2. A mind map illustrating the research questions and their corresponding emergent codes is provided in Appendix E. Code frequency analyses for both research questions were conducted using NVivo, and paraphrased excerpts from interviews and documents were incorporated into the analysis to support the development of themes (see Table 3).

Table 1

RQ1 Code Frequency Analysis with NVivo Software

Research Question 1 Themes	Total codes
Use of Learning Analytics	48
Use of Assessment Data	47
Data Relevance Decisions	29
Impact on Improvement Planning	29
Types of Tools and Platforms	28
Stakeholder Engagement	11

Table 2

RQ2 Code Frequency Analysis with NVivo Software

Research Question 2 Themes	Total codes
Challenges in Using Data	46
Data Accuracy and Integrity	39
Confidence with Data	27
Professional Learning and Support	19
Key Data Skills	15
Skills and Supports Needed	12

Table 2

Themes

Themes
Theme 1: Translating Data into Actionable Strategies
Theme 2: Integrating Assessment Insights into Decision-Making

Theme 3: Barriers to Effective Data Application

Theme 4: Ensuring Validity and Reliability in Data Use

Research Question 1

Research question 1 was: How do leaders in an urban, public school district leverage learning analytics tools in their decision-making when planning educational improvement initiatives?

Theme 1: Translating Data into Actionable Strategies participants consistently described how learning analytics served as a bridge between raw information and strategic decision-making. The ability to translate data into actionable strategies was central to their practice, whether in guiding interventions, allocating resources, or justifying requests for additional support.

Participant 1 explained, “it’s led to a lot of conversation about intervention,” and further reflected that growth was the most meaningful metric, noting, “the most interesting thing to me is growth [...] are we talking about movement of kids? Are we talking about movement of averages? Are we talking about which kids?” This emphasis on growth illustrates how Participant 1 values analytics that capture longitudinal progress, not just static measures of proficiency.

Participant 7 highlighted the use of Power BI to connect multiple measures, such as i-Ready and free or reduced lunch eligibility, explaining, “what we use it for right now is determining where our limited resources go to the schools that request.” Participant 7 expanded on this by describing how access to student-level data supported planning:

Schools will have a better idea of preparing or knowing how many students, how many classes they need to develop, how many licenses they're going to need for various programs [...] they can be much better at predicting what they are going to need for those incoming populations than they ever have been before.

These comments demonstrate how Participant 7 leverages analytics for both immediate resourcing and long-term capacity planning.

Participant 8 described the cyclical, iterative nature of working with data: “what does that mean in terms of how we deploy our team to do some drilling down. What’s going on? What are the barriers? What can we help with? And so we will repeat that process.” Participant 8 further distinguished between “assessments of learning”, which serve as lagging indicators, and “assessments for learning”, which must be used more frequently to avoid what was described as “dead data.” This perspective illustrates how Participant 8 views analytics as part of a continuous improvement cycle requiring multiple forms of evidence.

Participant 4 emphasized the role of dashboards in making inequities visible: “the purpose of the dashboard was for us to look at indicators of exclusionary practices and then use them to decide which schools that we are going to support through the cluster support model.” Participant 4 explained that the dashboard expanded over time, adding disability categories, growth and proficiency gaps, and risk ratios tied to federal accountability measures. This infrastructure enabled Participant 4 to identify schools at risk of intervention and to proactively allocate support.

Participant 9 cautioned against misinterpretation, explaining, “not just focusing on one score as a determining factor of what this child’s educational future should be. So really, just understanding how data is a tool and not a period.” Participant 3 reinforced this by stating,

“data’s incomplete in some ways [...] data can be manipulated in several different ways,” while also affirming that “data is always a part of the conversation.” These reflections underscore awareness of both the power and the limitations of analytics.

Participant 2 highlighted the importance of analytics for advocacy, stating, “it gives us the opportunity to have something to fall back on. To justify why we are requesting more time, more financing, more access, equitable access to materials and other things.” Participant 2 also described reliance on national datasets, noting that “I feel comfortable with associating some levels of national data to student outcomes locally.” This demonstrates how Participant 2 used both local and national data to strengthen justification for resources and initiatives.

Participant 5 described the use of monthly reports from the learning management system to track course publication and student engagement. According to Participant 5, these analytics “led us to support the behavior of teachers which would trickle down in student experiences in online spaces.” Participant 5 further explained the value of analytics from Clever, where data on formative assessment app usage was reviewed to inform intervention strategies.

Participant 6 emphasized the breadth of available data: “we’re looking at DIBELS data, we’re looking at i-Ready data, we’re looking at NWEA data, we’re looking at Panorama, we’re looking at attendance.” At the same time, Participant 6 recognized challenges in applying data literacy across contexts, explaining:

I think applying data literacy to other people sometimes depends on approval and acceptance of. And so that, I think has been a little bit of a challenge in terms of like scheduling, or what is allowed to promote data literacy? Some of those. And that I would definitely say, that's a challenge. But working around that sometimes and making them

like professional learning communities where that's already been approved, doing that going that route data literacy in terms of like with the schools and so forth.

Participant 3 highlighted the connection between data and broader disciplinary strategies, explaining, “using the literacy data as an entry point to include social studies in the conversation has been kind of like the driver of the work.” Participant 3 further reflected that “almost every moment of data, or educational improvement initiatives [...] is based on data.” This statement reinforces the perception of analytics as foundational to decision-making.

One highly visible, strategic planning document outlines a multi-year framework that commits to using evidence and progress monitoring to refine strategies and close equity gaps. Another public document focuses on ninth grade transitions by requiring schools to review attendance, behavior, and course performance data multiple times a year to determine which students are on track and which require additional support. Together, these documents reflect the ways participants described translating data into actionable strategies, such as drilling into performance measures, redeploying resources, and justifying requests for support. They illustrate how the broader system institutionalizes the same practices participants identified, using analytics as a catalyst for equity-driven interventions and continuous improvement.

Theme 2: Integrating Assessment Insights into Decision-Making participants emphasized both the utility and the limitations of various assessment systems, underscoring the importance of using diagnostics, screeners, and summative measures in complementary ways. Across interviews, participants consistently reinforced that assessment insights must be connected to instructional and programmatic action in order to support meaningful improvement.

Participant 1 described the role of MAP assessments in generating dialogue, noting, “MAP [...] is new this year, and I think it’s led to a lot of interesting conversations.” Participant

1 added that these conversations included questions about diagnostic assessments and the limits of relying solely on a RIT score, stating, “the RIT score only takes us so far.” This reflection highlights how assessment data provides starting points for inquiry but requires deeper diagnostics to guide meaningful instructional responses. Participant 1 also stressed the importance of using DIBELS as an entry point while recognizing its limitations: “DIBELS is a place to start, and it is not a place to stop in terms of data collection for kids [...] it also shouldn’t be used to measure teacher efficacy.” Participant 4 and Participant 8 echoed this caution by emphasizing the necessity of diagnostic assessments beyond surface-level screeners. Participant 4 explained:

Then we realized, like, we can’t wait for CAPE [...] we need diagnostic data,” while Participant 8 added: a huge thing for us is like data literacy of knowing which data you get from which assessments, and I feel pretty well versed in the assessment landscape, and then the [...] landscape itself there, both on the central side, but also having administered them, coached teachers to administer them on the school side. And so I think, from direct experience, I feel really confident in knowing like which assessment piece of data is going to be the most helpful at this moment in time to see how things are going like that part feels pretty strong.

Together, these reflections illustrate agreement across participants that assessments must be used in layered and purposeful ways.

Participants also agreed that diagnostic and formative assessments were central to equity monitoring. Participant 4 explained how their team analyzed multiple assessment results, including DIBELS, i-Ready, NWEA MAP, CAPE, and MSAA, by race, ethnicity, gender, grade,

and language status to uncover gaps. Similarly, Participant 5 noted that increased participation in formative assessment applications could be linked to performance on summative assessments:

So, if there's an increase in participation on those apps, accessing those apps, whether it be intervention or formative, I think that there could be some relationship drawn to student outcomes in our summative assessments, which in DC is called CAPE.

These perspectives align with Participant 9's description of using world language assessment proficiency data to identify declining outcomes in Chinese programs, which then informed targeted professional learning. Across these examples, participants reinforced the idea that assessments provide visibility into equity gaps and can serve as catalysts for responsive interventions.

Several participants underscored the importance of connecting assessment insights to programmatic or instructional planning. Participant 7 shared,

The vertical alignment of assessments across grade levels, saying at grades 6 through 12 we use NWEA MAP and all of its associated programming like Read 180, and the code through HMH. To help us determine where our students are, what we will predict they will be doing on CAPE. But, more importantly, how we can connect them to correct programming and correct teaching methods.

Participant 7 emphasized that these assessments help predict student performance while also guiding programming decisions. Participant 6 added a longitudinal perspective, commenting:

Looking at the actual i-Ready data, looking at how students are performing, looking at the different trends. Seeing where we are as a district and then making those comparisons to like our NWEA data and seeing where there can fill in some gaps for students once

they leave 6th, 7th and 8th grade and get to 9th grade, like, their algebra I data and seeing how to improve some of those numbers.

These reflections demonstrate agreement among participants that assessment insights must be tied to forward-looking planning to ensure smoother transitions across grade levels.

Participants also consistently acknowledged challenges related to over-testing and assessment fatigue. Participant 7 stated, “we have too many assessments, too many overlapping assessments. They don’t mean anything. It collapses the meaning; they spend more time assessing than they do actually instructing.” Participant 1 similarly noted the limits of individual assessments, emphasizing that data tools have value but cannot be overextended to measure things like teacher efficacy. Participant 6 added that while data reviews are produced and shared widely, “that’s kind of where it stops,” underscoring concerns about whether insights are consistently carried through to action. This convergence reveals broad agreement that while assessments are indispensable, the sheer volume and inconsistent follow-through diminish their impact.

The document review resulted in a public-facing guide that provided families and educators with details about the full range of diagnostic and curriculum-based assessments used to monitor growth and guide interventions. Another highly visible, district planning document emphasized the need for a revised assessment strategy that ensures progress is measured accurately and interventions are applied appropriately. A third document focused on literacy improvement through an assessment-driven cycle designed to identify gaps early and provide targeted support. Together, these documents align with how participants described integrating assessment insights into decision-making by using multiple tools to spark inquiry, monitor

equity, and plan instruction, while also acknowledging the challenges of over-testing and the importance of applying assessment data in purposeful and actionable ways.

Research Question 2

Research question 2 was: What specific data literacy competencies do leaders in an urban, public school district demonstrate when planning and executing educational improvement initiatives?

Theme 1: Barriers to Effective Data Application participants described how personal opinions about data sources, fragmented communication structures, accountability gaps, and misalignment between goals and available data present significant challenges. Leaders also identified inequities in how data are distributed across content areas, which hindered their ability to use insights effectively.

Participants noted how personal preferences among senior leaders could create ripple effects that limited the broader application of assessment data. Participant 1 reflected, “I don’t know that I totally understand her opinion about that. But that opinion shapes how we look at and think about that assessment.” Participant 1 elaborated further,

The way that we are looking at them, all of them across is hard, because, like, I have a different stance than the person at the table next to me when we’re talking about how we’re doing as a district.

These comments reveal how conflicting opinions about assessments contribute to inconsistent interpretations of data, weakening efforts to establish shared meaning across the system. The problem of fragmentation was reinforced by Participant 4, who explained,

We are in our own little silos, trying to use the information to drive our individual improvement initiatives, whether they’re academic, operational, or strategic. But the

catch is, to be strategic we can't be in silos and to be strategic and not be in silos we have to aggregate around something other than celebrating [...] growth.

Participant 6 added, "I think in in many spaces, the work stops because it may stop with a certain team, you know, and that does cause some challenges." These reflections illustrate how limited communication, and siloed practices prevent leaders from fully leveraging collective data insights.

A lack of accountability was also described as a barrier to effective application.

Participant 4 observed that school leaders are not held accountable for those gaps, while

Participant 2 further elaborated:

So it is sometimes very difficult to try to hold schools and administrators accountable for things that are either just best practices or written in stone as a necessity. When they are also not, for lack of better words, held accountable for that information, or for that success of that.

These statements highlight how the absence of clear accountability structures undermines the ability of leaders to act on data findings in a consistent way.

Misalignment between goals and available data was another challenge raised by participants. Participant 5 shared:

I think one piece of the limitations I felt in collecting and using that data had to do with the fact that the goal itself was very convoluted and in the right in the how they wrote the goal meant we had to collect a lot of data points to find the one answer to the goal, and I felt limited.

This perspective illustrated how poorly designed goals complicate the ability to measure progress, making data less actionable in planning processes.

Participants also reflected inequities in data availability across content areas. Participant 3 described the challenge in social studies:

Advancing the work that we do on our team, and the work that should be done in social studies classrooms providing PD and telling that story of how the data connects to the work, even though it doesn't overtly make connections.

Participant 7 similarly explained the difficulty of making health and physical education data relevant to broader district goals, describing the ongoing struggle of “fighting for equity and health and physical education, regardless of the whole child perspective.” Participant 6 added that constraints on scaling data literacy across all teams led to a reliance on smaller, individual efforts rather than broad systemic changes. Participant 9 reinforced these concerns from the perspective of world languages, noting, “a lot of times data is pulled from areas that may not necessarily speak to world languages, or the two data sets don't really speak to each other.” These accounts demonstrate how content areas outside of math and literacy often lacked the robust data systems needed to inform improvement planning.

None of the district documents reviewed directly address the barriers participants described related to accountability gaps, misaligned goals, siloed communication, or unequal access to data across subject areas. While the documents outline systems for assessment use, research approval, and program implementation, they primarily present intended strategies and structures rather than acknowledging or confronting the organizational and cultural barriers that complicate effective data application. As a result, the participant perspectives on this theme highlight challenges that are not explicitly reflected or remedied in the available district-level documents.

Theme 2: Ensuring Validity and Reliability in Data Use. Participants described a multi-layered process that relied on cross-checking, test cases, peer verification, district business rules, and an awareness of the limitations of data. These practices underscore the extent to which leaders understood that data are powerful but also imperfect, requiring deliberate action to maintain validity and reliability.

Participants emphasized the importance of checking and re-checking their work to identify errors and inconsistencies. Participant 4 explained, “I rely on my colleagues, but I also use it like I do test cases, and I do a lot of them. We have a lot of dirty data. And we find problems.” Participant 1 echoed this point, describing how errors were a recurring challenge:

I find stuff all, I find errors in my own stuff all the time . . . at least like going back and checking. And does that make sense? And does that add to a hundred? And if it doesn't, why not?

Participant 9 added a similar observation, stating that “looking for errors in the data, because that does happen,” is a routine part of the work. Participant 5 reinforced this culture of constant verification: “one thing that we have been very good about is going back to cross reference things,” emphasizing that triangulation across sources was a key method of ensuring accuracy.

Other participants described how they leaned on established routines or peer support to confirm reliability. Participant 6 shared,

I just recently had a few issues with like data integrity. Usually, I will find the data, I will pull the data, I always check it again with our stakeholders to make sure that the data is clean data going back.

Participant 3 reflected on the technical side of this process, explaining that “in terms of making sure things are accurate when you bring together district data platforms [...] just practicing, practicing for the opportunity to troubleshoot and test drive” was essential to identifying inconsistencies before finalizing results. Similarly, Participant 2 explained how data validity checks required additional work when discrepancies arose, describing how “we noticed that there was some skewed data around students’ engagement and lifetime activities versus the traditional activities.” These accounts illustrate that ensuring validity and reliability is both technical and relational, requiring collaboration and iterative review.

District-level business rules were also viewed as essential in standardizing calculations and ensuring agreement across teams. Participant 8 explained, “on the front end, like we just went through this process making sure we’re all in agreement and alignment across teams when we create our business rules is something that’s super important.” Participant 1 pointed to the complexity of this work, stating, “there’s also all this like business rules, and who gets included and who gets excluded and who’s exempt and who’s not exempt.” Participant 1 elaborated further by describing disagreements that emerged around student exemptions, noting:

There’s a misunderstanding about who’s exempt in a lot of cases. And we’re really trying to make sure that we are actually assessing every kid, and that we’re really valuing the growth and the movement for every kid.

These reflections highlight how leaders worked to clarify technical definitions and align processes across the district to avoid misinterpretation or uneven application of data.

For many leaders, reliability meant repeatedly justifying numbers until they could be defended with confidence. Participant 7 explained,

I go back and I justify every decision that I make, and if I can't justify those decisions, then I need to redo it. I redo all the numbers, and if I don't get the same numbers, I redo them a 3rd time.

Participant 3 similarly described the importance of troubleshooting through practice to confirm accuracy. Participant 1 acknowledged how personal processes like pulling data into personal spreadsheets sometimes introduced error, which reinforced the need for rigorous review: "I pull everything into my own spreadsheet, and sometimes I worry that that introduces error." Participant 5 also described aligning school-level reports against centralized sources to "ensure the source of truth." Collectively, these reflections illustrate how leaders demonstrate persistence and rigor when ensuring validity and reliability, even when it required time-consuming repetition.

Finally, participants consistently emphasized that data needed to be interpreted carefully, without overstating its meaning. Participant 9 explained, "there's a lot of data that is connected, but not causal [...] making sure that I shut down narratives." Participant 3 added, "you know, if you're trying to put out a certain narrative, you can always find data to match their narrative," and emphasized the responsibility of leaders to prevent misleading stories.

Participant 7 shared,

This balance between qualitative and quantitative perspectives, noting that the qualitative data tells a story that is supported by the quantitative data [...] and that the quantitative data is as much as we can possibly make it an accurate and reliable representation of where the student actually is.

Participant 2 spoke to the same concern from a different angle, pointing out how "it's complex trying to get educators to respond with good data and not just emotional data." These

reflections highlight that ensuring validity is not only about accuracy in calculation but also about resisting the misuse of data to serve predetermined narratives.

Several of the reviewed public documents support this theme by outlining systems and expectations for accuracy, consistency, and appropriate interpretation of data. The assessment guidance describes how diagnostic and curriculum-based measures are administered multiple times a year to track growth, which reinforces participants' emphasis on repeated checks and cross-referencing to confirm accuracy. Policy guidance around research and data sharing also reflects this concern, requiring providers to return student-level results in timely, accurate, and clear formats to ensure that official analyses are reliable. In addition, planning documents stress the need for consistent rules and aligned measures when reporting progress, which parallels participants' descriptions of developing business rules to ensure uniformity across teams. Collectively, these documents demonstrate the district's structural commitment to ensuring validity and reliability in data use, aligning with the practical strategies participants described, such as cross-checking, test cases, and shutting down misleading interpretations.

Evaluation of the Outcomes

This section details the evaluation of the research findings, including extant research and the applied conceptual framework. The two research questions that directed the study were further described utilizing four themes that emerged from data analysis of participants' responses. The findings were evaluated by comparing the emergent themes with existing literature and theoretical frameworks to examine areas of consistency, divergence, and contribution. The four emergent themes were: (1) Translating Data into Actionable Strategies, (2) Integrating Assessment Insights into Decision-Making, (3) Barriers to Effective Data Application, and (4) Ensuring Validity and Reliability in Data Use.

Research Question 1

How do leaders in an urban, public school district leverage learning analytics tools in their decision-making when planning educational improvement initiatives? The themes related to Research Question 1 are represented in Table 4: (1) Translating Data into Actionable Strategies, (2) Integrating Assessment Insights into Decision-Making

Table 3

Research Question 1: Themes

Theme 1: Translating Data into Actionable Strategies

Theme 2: Integrating Assessment Insights into Decision-Making

Theme 1: Translating Data into Actionable Strategies. Eight of the nine participants described ways they translated analytics into strategies, such as linking findings to goals, identifying inequities, and justifying requests for resources. Six participants emphasized drilling down into the data and redeploying resources, while five highlighted the role of dashboards and reporting tools in increasing data visibility. These repeated references were combined to form the theme Translating Data into Actionable Strategies.

The data indicated that participants actively translated analytics into decisions through cycles of drilling into data, redeploying resources, and using evidence to justify requests. This reflects Gummer and Mandinach's (2015) data literacy framework, which emphasizes interpreting and transforming data into actionable steps, and Greller and Drachsler's (2012) model that highlights the connection between data, stakeholders, and objectives. Prior research has similarly documented the use of learning analytics to shape intervention strategies and guide leadership decision-making (Paolucci et al., 2024; Mandinach & Schildkamp, 2020). A unique

contribution of this study is the finding that leaders relied on analytics not only as a technical decision-making aid but also as a political tool to advocate for equitable resources, extending the scope of prior research. This outcome is supported by the literature review, particularly studies that recognize the strategic and organizational dimensions of data-driven decision-making.

Theme 2: Integrating Assessment Insights into Decision-Making. All nine participants discussed their use of assessments such as DIBELS, i-Ready, NWEA MAP, CAPE, and MSAA to inform instructional decisions and improvement planning. Seven participants highlighted the need to balance diagnostic, formative, and summative measures, while five participants raised concerns about over-testing or misalignment between assessments and district goals. These responses were combined to form the theme Integrating Assessment Insights into Decision-Making.

Participants described implementing diagnostic, formative, and summative assessments in complementary ways, while also raising concerns about over-testing and misalignment with goals. This finding resonates with the literature documenting both the promise and the challenges of assessment use (Townsend & Snyder, 2022; Dodman et al., 2023). Lasater et al. (2020) emphasized the equity potential of disaggregating assessment data, which was evident in participants' accounts of using results to monitor disparities across subgroups. The findings also reinforce the need for assessment literacy, as leaders demonstrated judgment in selecting the most meaningful data (Mandinach & Gummer, 2016). A contribution of this study is the evidence of layered assessment literacy, where leaders distinguished between diagnostic, formative, and summative uses in a way that extended prior models. This outcome is supported by the literature review, although the persistent concerns about over-testing suggest gaps between policy intentions and practice.

Research Question 2

What specific data literacy competencies do leaders in an urban, public school district demonstrate when planning and executing educational improvement initiatives? The two themes that emerged from research question 2 can be viewed in Table 5: (1) Barriers to Effective Data Application, and (2) Ensuring Validity and Reliability in Data Use

Table 4

Research question 2: Themes

Theme 1: Barriers to Effective Data Application
Theme 2: Ensuring Validity and Reliability in Data Use

Theme 1: Barriers to Effective Data Application. All nine participants described barriers to effective data use. Seven participants identified organizational challenges such as siloed communication, lack of accountability, and conflicting opinions, while five described inequities in data access across content areas. These responses were combined to form the theme Barriers to Effective Data Application.

Analysis of participant data revealed that conflicting preferences among senior leaders, misalignment of goals, and lack of accountability structures undermined the ability to use data effectively. These findings align with Henderson and Corry's (2020) work that organizational barriers such as siloed practices limit the adoption of evidence-based decision-making. Isaacs (2021) similarly observed that district systems often privilege core content areas like ELA and math with robust data, while areas such as social studies or the arts remain underserved, mirroring participants' reports of inequitable access.

This theme also reflects Gummer and Mandinach's (2015) argument that data literacy is not only about individual technical skill but also about the organizational culture in which those skills are applied. Participants highlighted that even when individual leaders possessed strong competencies, systemic silos or leadership preferences often blocked meaningful application. This finding diverges from the literature that emphasizes professional development as the main remedy (Mandinach & Schildkamp, 2020). Instead, the study suggests that district-level cultural and structural barriers, such as weak accountability mechanisms and fragmented communication, play a more decisive role in limiting application. Thus, this outcome is partially supported by the literature. While the barriers identified are consistent with prior research, this study extends the conversation by foregrounding structural and cultural dynamics within district leadership contexts, an area underrepresented in current research.

Theme 2: Ensuring Validity and Reliability in Data Use. Eight of the nine participants described practices to ensure data validity and reliability. Seven participants emphasized strategies such as cross-referencing, test cases, and peer verification, while five stressed the importance of developing business rules and avoiding causal misinterpretation. These insights were combined to form the theme Ensuring Validity and Reliability in Data Use.

The findings demonstrate that leaders invested significant effort in verifying the accuracy of data, using test cases, peer feedback, and repeated calculations. These practices confirm competencies described in Gummer and Mandinach's (2015) framework, particularly data evaluation and interpretation, and resonate with Temel-Aslan et al.'s (2024) findings that cross-checking and validation are critical to educational data literacy. Participant references to business

rules also align with Greller and Drachsler's (2012) structural model of learning analytics, which emphasizes defining clear parameters for data inclusion and exclusion to ensure consistency.

The emphasis participants placed on resisting misleading narratives extends the literature by underscoring the ethical dimensions of data literacy. While prior research acknowledges that data can be misinterpreted or politicized (Mandinach & Gummer, 2016; Datnow & Park, 2019), the findings contribute by showing how district leaders actively shut down causal misinterpretations and challenged colleagues' attempts to overstate conclusions. This finding highlights the interpretive and ethical dimension of data literacy, showing that competencies include not just technical accuracy but also the judgment to prevent misuse. This outcome is strongly supported by the literature review. Participants' strategies for ensuring validity and reliability confirm existing frameworks and extend them by explicitly addressing the cultural work of resisting misinterpretation, which represents an important contribution to understanding data literacy at the district leadership level.

Implications and Recommendations for Practice

The study employed a dual-framework approach, drawing on Greller and Drachsler's (2012) generic framework for learning analytics and Gummer and Mandinach's (2015) data literacy framework, to examine how district leaders leverage learning analytics and demonstrate data literacy competencies. Together, these frameworks offered a comprehensive lens for analyzing both systemic and individual dimensions of data use. Greller and Drachsler's (2012) model highlighted the contextual elements that shape leaders' practices, including stakeholder roles, data types, analytic tools, and systemic constraints, while Gummer and Mandinach's (2015) framework emphasized the iterative inquiry cycle, and the competencies required to transform data into actionable decisions. Revisiting these frameworks in light of the results

underscores the need to strengthen leaders' individual data literacy competencies while also addressing systemic conditions that enable more effective integration of learning analytics into educational decision-making.

Research Question 1

How do leaders in an urban, public school district leverage learning analytics tools in their decision-making when planning educational improvement initiatives?

Research question 1 was designed to uncover not only the types of learning analytics tools district leaders employ, but also the ways in which these tools shape their approaches to planning, monitoring, and refining educational improvement initiatives. In evaluating participant responses, they described using a range of analytic tools to monitor student performance, track program effectiveness, and guide resource allocation, while also noting challenges such as data accessibility, tool limitations, and competing organizational priorities.

Theme 1: Translating Data into Actionable Strategies. Findings from this study imply that district leaders regularly engaged with diverse data sources and analytic tools in response to stakeholder needs, yet they encountered persistent organizational and cultural barriers that limited the consistent application of the full inquiry cycle.

The data suggest that district leaders see value in moving from reviewing data to creating strategies that drive change. This theme represents the process of turning information into concrete actions that shape programs, instruction, and resource decisions. In this study, eight of the nine participants described the importance of translating data into actionable strategies. Gummer and Mandinach's (2015) Data Literacy Framework highlights the step of transforming data into decisions as central to effective data use. Greller and Drachsler's (2012) framework also emphasized aligning data with stakeholder needs, underscoring that data must serve as a

foundation for decision-making. Yet, most existing research concentrates on teachers or principals rather than district-level leaders, leaving a gap in understanding how central office leaders carry out this process.

Knudson (2020) argued that data systems alone do not improve student outcomes, but progress occurs when leaders embed data within cultures of problem-solving and actionable planning. These findings align with this study, where participants described the need for not just data access but the structures and practices that allow data to be applied meaningfully. Dexter et al. (2021) found that district leaders often relied on limited forms of evidence, such as usage data or teacher feedback, when adopting educational technologies. Those limitations constrained their ability to connect data to sustained improvement efforts (Dexter et al., 2021). This study echoes those findings, as participants emphasized similar limitations but also revealed a desire to build stronger processes that move data toward long-term strategies. Together, these studies illustrate that leaders must be equipped with both technical tools and organizational conditions that allow data to be transformed into strategies with measurable impact.

In sum, these findings suggest that district leaders require targeted support to strengthen their capacity to move from data review to actionable strategy development. From my perspective, this theme underscores the need for leadership preparation and professional learning that go beyond data interpretation, ensuring leaders are equipped to design and implement strategies that translate evidence into measurable improvement.

Theme 2: Integrating Assessment Insights into Decision-Making. These results suggest that district leaders view assessment data as a critical input for shaping improvement initiatives. This theme represents how leaders take insights from assessments and incorporate them into broader planning, instructional decisions, and accountability structures. In this study,

seven of the nine participants mentioned integrating assessment insights into their decision-making processes.

The literature underscores the importance of linking assessment results to educational improvement. Gummer and Mandinach's (2015) data literacy framework emphasizes that using data for decision-making requires not only interpreting results but also aligning them with instructional goals. Greller and Drachsler's (2012) generic framework highlights the objectives and stakeholder dimensions that guide how data are used in context, reinforcing the connection between assessment evidence and leadership decisions. However, most prior research has focused on classroom teachers or school-level actors, leaving less attention to how district leaders interpret and apply assessment results at the system level.

Conn et al. (2022) found that school and district personnel expect educators to use multiple forms of academic and non-academic data to inform instruction, stressing that teacher effectiveness depends on the ability to interpret assessment information and apply it appropriately. This aligns with this study, where district leaders emphasized the challenge of making sense of diverse assessment data while ensuring their validity for decision-making. Similarly, Dodman et al. (2023) demonstrated that engaging educators in equity-focused professional development around data use enhanced their ability to question assumptions and interpret assessment data critically. This relates closely to the present study, where participants not only discussed the use of assessment results but also acknowledged the importance of interpreting them with accuracy and equity in mind. The literature suggests that effective integration of assessment insights requires both technical data skills and a critical lens that accounts for context and validity.

In sum, this study's findings imply that district leaders need ongoing support to strengthen their ability to interpret assessment results, ensure their validity, and apply them meaningfully in planning and improvement efforts. From my perspective, this theme highlights that leaders must not only have access to assessment data but also the training and structures that help them use these insights responsibly to guide sustainable change.

Research Question 2

What specific data literacy competencies do leaders in an urban, public school district demonstrate when planning and executing educational improvement initiatives?

Research question 2 was designed to examine how district leaders put data literacy into practice by demonstrating the knowledge, skills, and dispositions necessary to turn information into meaningful action. Participants described competencies in framing problems of practice, interpreting data, and applying evidence to guide decisions, which reflected strengths in foundational data use. They mostly described barriers to data application, including limited analytic expertise, fragmented systems, and competing organizational priorities that made it difficult to leverage evidence. Participants also emphasized the importance of ensuring validity, noting the need to verify data accuracy, contextualize findings, and build trust in the information before using it to guide decisions.

Theme 1: Barriers to Effective Data Application. These results suggest that barriers to effective data application emerged as a stronger theme than participants' discussions of their own data literacy skills. All nine participants expressed confidence in demonstrating foundational data literacy skills such as framing problems of practice, interpreting student performance data, and applying evidence to guide decisions. However, despite this confidence, every participant also described frustrations with barriers that limited their ability to grow these skills beyond the

foundational level. This theme represents the challenges leaders encounter with data use, including issues of limited analytic expertise, fragmented systems, and organizational pressures that prevent data from being fully leveraged. These barriers included limited, high-level analytic expertise, fragmented systems, and organizational pressures that made it difficult to fully apply data in sustained and meaningful ways.

Gummer and Mandinach's (2015) Data Literacy Framework emphasizes that transforming information into actionable decisions requires both knowledge and dispositions, yet many leaders struggle with consistent application across contexts. Greller and Drachsler's (2012) framework highlight external constraints and internal limitations as factors that directly shape how stakeholders are able to use data. Despite these frameworks, most of the existing research has focused on teacher- or school-level barriers, leaving little attention to how district leaders experience and navigate these challenges.

The findings suggest that without stronger preparation and ongoing support, leaders and educators alike are constrained in their ability to fully apply data in practice. Henderson and Corry (2021) found that while data literacy is gaining importance, training programs for both teachers and leaders often emphasize assessment literacy at the expense of broader data literacy skills, creating gaps in preparation and authentic application. This relates to the present study, where district leaders acknowledged that inadequate training and limited professional learning opportunities restricted their ability to apply data beyond surface-level use. Similarly, Conn et al. (2022) reported that educators frequently felt uncertain or overwhelmed when interpreting complex data sets, and that gaps in preparation hindered their ability to draw meaningful conclusions. These findings parallel the experiences of district leaders in this study, who described difficulties navigating multiple data sources and translating them into decisions.

In sum, this study's findings imply that addressing barriers to effective data application requires targeted professional development, clearer organizational support, and stronger integration of data literacy training at the leadership level. This theme highlights that while district leaders are committed to using data, systemic challenges and preparation gaps limit their effectiveness, underscoring the need for intentional strategies that bridge those barriers.

Theme 2: Ensuring Validity and Reliability in Data Use. The findings suggest that district leaders placed strong emphasis on the need for data to be valid and reliable before using it to inform educational decisions. This theme represents participants' concern with verifying accuracy, contextualizing results, and building trust in data as a foundation for instructional and organizational strategies. In this study, all nine participants spoke about the importance of ensuring validity when working with data, making it one of the most consistently discussed priorities across interviews.

Gummer and Mandinach's (2015) Data Literacy Framework identifies evaluating outcomes as a core step in the inquiry cycle, highlighting that data use requires not only collection and analysis but also verification of accuracy and quality. Greller and Drachsler's (2012) generic framework highlights external constraints such as ethical concerns and data quality, which shape whether information can be responsibly applied. However, most prior research has concentrated on classroom teachers' attention to assessment validity, leaving relatively little scholarship on how district leaders ensure reliability across larger systems and multiple data sources.

Knudson (2020) emphasized that valid and reliable data are essential for continuous improvement, noting that without trustworthy evidence, systems risk making superficial or misguided decisions. This finding aligns with the experiences of district leaders in this study,

who described the need for accuracy checks before committing resources or strategies. Conn et al. (2022) reported that educators often felt uncertain when interpreting complex data sets, raising concerns about whether their conclusions were valid. This parallels the frustrations of district leaders in this study, who acknowledged similar difficulties in ensuring that data interpretations reflected the realities of their schools and communities. The results of the study indicate that ensuring validity is not only a technical process but also an organizational challenge that requires training, structures, and support.

In sum, this study's findings imply that ensuring validity and reliability in data use should be a central focus of leadership practice. This theme underscores the importance of equipping district leaders with both the skills and system-level supports to evaluate the quality of their evidence so that decisions rest on trustworthy and contextually sound information. Through this qualitative case study, I examined the perspectives of district leaders in a large urban public school system regarding how they leverage learning analytics tools and demonstrate data literacy competencies when planning educational improvement initiatives. Through the analysis of the identified themes for the two research questions, I found that strengthening leaders' capacity to translate data into actionable strategies, integrating assessment insights into decision-making, addressing barriers to effective data application, and ensuring validity and reliability in data use are critical areas of focus. A review of the study findings led to three recommendations for application to practice.

First, based on research question one, I recommend that districts provide targeted professional learning for leaders on using learning analytics to build actionable strategies. Participant responses revealed that while leaders regularly accessed and reviewed data from dashboards, assessments, and monitoring systems, they often struggled to move beyond

reviewing information toward developing sustained strategies. Several participants described frustration with processes that ended at analysis without clear structures for turning insights into long-term initiatives. Professional learning that emphasizes decision-making grounded in evidence, paired with opportunities to practice applying data to program and instructional planning, can help address this gap. By focusing on building leaders' ability to translate data into strategies, districts will better position leaders to use analytics as a driver of school improvement rather than as an isolated reporting tool.

Second, based on research question one, I recommend that districts embed assessment insights into leadership decision-making processes. Participant responses showed that leaders relied on assessment results to monitor student progress and identify areas of need, but they also expressed frustration with the sheer number of assessments, the difficulty of triangulating data across multiple sources, and the challenge of determining which data points should carry the most weight. These barriers made it harder to consistently use assessment evidence as the basis for planning and improvement efforts. Establishing protocols, such as structured data review meetings and decision-making frameworks that help leaders prioritize and synthesize evidence, can address these challenges. Embedding these practices into leadership routines will allow K-12 district leaders to more effectively use assessment insights as a foundation for resource allocation, instructional planning, and system-wide improvement.

Third, based on research question two, I recommend that districts develop professional learning opportunities that strengthen participants' advanced data literacy competencies. All nine participants expressed confidence in foundational skills such as framing problems of practice, interpreting student performance data, and applying evidence to guide decisions. Yet they also described barriers that limited growth, including limited analytic expertise and fragmented

systems that constrained deeper analysis. Participants identified a need for support in evaluating outcomes, synthesizing multiple data sources, and collaborating across departments. Professional learning that targets these advanced competencies will help K-12 leaders move beyond basic data use and make more comprehensive, evidence-based decisions that improve instructional quality and organizational effectiveness.

Recommendations for Future Research

Three recommendations emerge from the research. Various considerations for future research are proposed, and opportunities are included for other researchers to build upon this study and expand on it, given its limitations. This study, along with others, suggests that district leaders play an important role in how data literacy and learning analytics are applied to educational improvement (Dodman et al., 2023; Henderson & Corry, 2021; Townsley & Snyder, 2022). However, little is known about the processes by which leaders expand their skills beyond foundational competencies or the organizational structures that support them in doing so. I did a case study. As such, I did not develop a theory.

First, I recommend expanding on this study by using grounded theory to examine how district leaders develop advanced data literacy competencies within organizational contexts. Dodman et al. (2023) showed that professional development focused on equity can shape how educators interpret and apply data, but it is not clear how district leaders move from these experiences to designing organizational practices that make data use more effective and sustainable. A grounded theory study would help develop a theory of how leaders build on training and internalize practices that strengthen their data use. Such a study could also explain the stages through which leaders advance from foundational skills to more complex forms of analysis and application, offering a clearer view of the developmental process. This type of

theory-building is important because existing research has noted that most data literacy studies focus on classroom teachers rather than central office leaders, leaving a gap in understanding system-level practice (Schultheis & Kjelvik, 2020).

Second, I used interviews and document review to explore participants' perspectives on data literacy and learning analytics. Future research could use phenomenology to capture the lived experiences of district leaders as they navigate barriers such as fragmented systems, competing priorities, and ethical concerns. Henderson and Corry (2021) found that preparation programs often emphasize assessment literacy at the expense of broader data literacy skills, which leaves leaders underprepared for real-world challenges. A phenomenological study would add insight into how leaders describe and assign meaning to these challenges in their daily work.

Third, I gathered data from nine participants in a single urban district. As such, the transferability of the findings was limited. Future researchers could conduct a multiple case study across several districts with varied sizes, resources, and contexts to examine whether the barriers and priorities identified in this study are consistent across systems. Townsley and Snyder (2022) emphasized that district leaders' decisions about data use are shaped by organizational standards and local policies. Expanding the scope to include suburban and rural districts, or states with different policy environments, would provide broader insight into how context shapes leaders' use of learning analytics and data literacy competencies.

Conclusions

This study was designed to explore the perspectives of district leaders in one large urban public school system regarding how they use learning analytics tools and demonstrate data literacy competencies when planning and carrying out educational improvement initiatives. Research on data use in K-12 education has often focused on teachers and principals, leaving less

attention on district leaders who make system-wide decisions (Conn et al., 2022; Schultheis & Kjølvik, 2020). This problem is important because district leaders shape resource allocation, program adoption, and policies that affect schools and students. If district leaders are not supported in building advanced data literacy competencies, improvement initiatives risk being guided by incomplete or unreliable evidence (Gummer & Mandinach, 2015; Greller & Drachler, 2012). This study was conducted to gather information about how district leaders apply data in their work, what competencies they demonstrate, and what barriers influence their ability to use data effectively.

The limitations of this study included reduced transferability because of the small sample size and the focus on one district. Even so, the case study design allowed for the collection of detailed qualitative data about participants' knowledge, beliefs, and experiences related to data use in decision-making. Analysis showed that participants were confident in foundational skills such as framing problems of practice, interpreting student performance data, and applying evidence to decisions. At the same time, they identified barriers that limited growth beyond these basic skills, including limited analytic expertise, fragmented systems, and challenges ensuring validity across multiple data sources. Four themes emerged from the findings: translating data into actionable strategies, integrating assessment insights into decision-making, barriers to effective data application, and ensuring validity and reliability in data use. These themes pointed to both strengths and gaps in participants' data practices and provided direction for how districts can better support their leaders.

Conducting this research was important because the findings provide insight into how district leaders use and experience data, and where they need support. The results indicate that building leadership capacity requires more than data access. Leaders also need training,

structures, and safeguards that allow them to apply data with accuracy and confidence. These findings align with prior research that emphasizes the need for valid and reliable data in decision-making (Knudson, 2020; Townsley & Snyder, 2022) and add new evidence by centering district leaders as the focus of analysis. The study contributes to the literature by offering qualitative data on how leaders describe their own competencies, the barriers they face, and the conditions that would help them move beyond foundational skills. These findings point to the importance of creating professional learning opportunities, organizational supports, and system processes that allow leaders to use data in deeper and more effective ways. While prior studies have highlighted the need for stronger data use in education (Conn et al., 2022; Gummer & Mandinach, 2015; Henderson & Corry, 2021), few have focused on the district level. The findings from this study extend current frameworks by showing how the structural and human dimensions of data use intersect in practice and by identifying areas where leadership development should be prioritized.

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Appendices

Appendix A

IRB Approval Letter



9388 Lightwave Ave.
San Diego, CA 92123
irb@nu.edu

Notice of Exemption

July 8, 2025

To: Tolulola Odukoya

Project Title: Data Literacy Perceptions and Experiences Among K-12 District Leaders

NU IRB Number: IRB-FY24-25-1092

Determination: Exempt from further review 45 CFR 46.101 Category 2(ii). Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met:

Any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation; or

Status: Active - Research activities may begin as of July 8, 2025

Dear Tolulola Odukoya:

The study referenced above has been reviewed by the National University IRB. The IRB has determined

about:blank

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8/28/25, 4:48 PM

IRB-FY24-25-1092 - Initial: Exempt from Further Review - Tolulola Odukoya - Outlook

your research is exempt from further review under 45 CFR 46.104, which means you will not need to renew your study and may begin your study effective immediately. However, if you find the need to change your study in any way, you will need to submit a modification to the IRB prior to implementing the changes. This will allow the IRB to determine whether or not the study still meets exemption criteria.

Please review your Post Approval Responsibilities here: [Approved Documents Guidelines](#)

For any questions regarding your protocol, please reach out to the IRB at irb@nu.edu.

Sincerely,

Dr. Joseph Marron, IRB Chair

Dr. Brianne Mongeon, Director, HRPP & IRB

Jenessa Eberhardt, Associate Director, HRPP & IRB

Appendix B

Invitation to Prospective Participants (Email)

I hope this message finds you well! I'm reaching out to invite you to participate in my doctoral research study, which explores how district leaders in DCPS perceive and apply data literacy competencies when using learning analytics to plan and implement educational improvement initiatives. As someone I've worked with and deeply respect, your insights would be incredibly valuable to this study.

I am recruiting individuals who meet all the following criteria:

- Are age 18 or older.
- Are currently employed full-time at the central office or district leadership level at District of Columbia Public Schools.
- Hold a district-level leadership position with the title of Program Manager or higher (e.g., office chiefs, superintendents, curriculum directors).
- Are actively involved in decision-making processes related to educational policies, programs, or practices.
- Have experience or involvement in implementing Data-Driven Decision-Making (DDDM) practices.
- Use data literacy skills or experiences to make decisions that impact district stakeholders (students, teachers, principals, etc.).

If you choose to participate, you will be asked to complete the following research activities:

1. Participate in a one-on-one interview conducted virtually over Zoom, which will last approximately 45-60 minutes.

2. Review your interview transcript via email for approximately 10-15 minutes to confirm accuracy.

During the interview, you will be asked questions about:

- Your professional role and responsibilities
- Your use of data and learning analytics in decision-making
- Your perceptions and experiences related to data literacy competencies
- Challenges experienced when using data for educational improvement
- Demographic information, including role title, years of experience, and educational background

If you're open to participating, just reply to this email or text/call me at 210-323-5098. I'd love to schedule a time that works for you.

Thank you so much for considering it. I truly value your perspective and hope you'll join me in this important work.

Sincerely,

Lola Odukoya

Doctoral Candidate | K-12 Learning Analytics

National University

T.Odukoya3787@o365.ncu.edu

Appendix C

Letter of Consent

Introduction

My name is Lola Odukoya, and I am a doctoral student at National University (NU).

I'm asking you to take part in a research study about how school district leaders use their data literacy skills to make informed decisions. The name of this research is "Data Literacy Perceptions and Experiences Among K-12 District Leaders." I am seeking your consent to participate in this research. Please read this document to learn more about this research and determine if you want to participate. Your participation is completely voluntary, and I will address your questions or concerns at any point before or during the research.

Eligibility

You may participate in this research if you meet all the following criteria:

1. Are age 18 or older
2. Are currently employed full-time at the central office or district leadership level at District of Columbia Public Schools
3. Hold a district-level leadership position with the title of Program Manager or higher (e.g., office chiefs, superintendents, curriculum directors).
4. Are actively involved in decision-making processes related to educational policies, programs, or practices.
5. Have experience or involvement in implementing Data-Driven Decision-Making (DDDM) practices.
6. Use data literacy skills or experiences to make decisions that impact district stakeholders (students, teachers, principals, etc.).

I hope to include 10 people in this research.

Please read this form carefully and ask any questions you may have before agreeing to take part in the study. If you agree to be in this study, you will be asked to do the following activities:

1. Participate in a 1:1 online interview over Zoom or Google Meet for 60 minutes.
2. Review your interview transcript via email for 10-15 minutes.

During these activities, you will be asked questions about:

- Your name, age, gender, job title, years of experience, school district name, school district address, brief job description (1-2 sentences)
- Your experience analyzing data in relation to your job duties.
- Your experience using data to make decisions in relation to your job duties.

Risks

There are minimal foreseeable risks or discomforts associated with this research. You can still skip any question you do not wish to answer, skip any activity, or stop participating at any time.

Benefits

If you participate, there are no direct benefits to you. This research may increase the body of knowledge in the subject area of this research.

Recording: I would like to audio/video record your responses with Microsoft Teams during the interview and focus group. You can disable the video function of the online meeting platform at any time.

Confidentiality

I will keep the records of this study private and take reasonable measures to protect the security of all your personal information. In any report I make public, I will not include any information that will make it possible to identify you. Participant names, school district names, and specific job titles will not be used in the report. All data will remain secure, requiring a specific password

for access. Only the researcher and participant will have access to their specific data (for data review).

Participation in this study is completely voluntary. You may quit at any time.

Please ask any questions you have now. If you have questions later, you may contact me at tolulola@gmail.com or at 210-323-5098.

If you have any questions or concerns regarding your rights as a subject in this study, you may contact the Institutional Review Board (IRB) via email at irb@nu.edu

Appendix D

Semi-Structured Interview Questions

1. Can you walk me through a recent example where learning analytics data directly influenced the planning or design of an educational improvement initiative in your district? (RQ1)
2. What types of learning analytics tools or platforms does your district currently use, and how are they typically integrated into planning processes? (RQ1)
3. How do you and your team determine which data from analytics tools are most relevant when setting goals for improvement? (RQ1)
4. In what ways has access to learning analytics influenced how your district approaches improvement initiatives—whether academic, operational, or strategic? (RQ1)
5. How does your interpretation of learning analytics data impact how you engage with stakeholders—such as school leaders, instructional staff, or families—and influencing their satisfaction with district improvement efforts? (RQ1)
6. Which parts of working with learning analytics data do you feel most confident about, and how does that confidence influence your planning and decision-making? (RQ2)
7. What specific data skills or knowledge do you rely on most when analyzing student performance or school improvement trends? (RQ2)
8. How do you ensure data accuracy and integrity when analyzing or presenting findings from learning analytics? (RQ2)
9. Can you describe any professional learning or support systems in place that help district leaders like yourself build data literacy skills? (RQ2)

10. What challenges have you faced in applying your data literacy skills to complex decision-making scenarios, and how did you navigate them? (RQ2)
11. Looking back on a recent educational improvement initiative you were involved in, were there any moments when you felt limited in your ability to use data effectively? If so, what additional skills or supports do you think would have helped you make better use of the data? (RQ2)

Appendix E

Research Question Parent Codes Mind Map

