Blended Professional Development:

Toward a Data-Informed Model of Instruction

by

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A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Education

Approved April 2017 by the
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ARIZONA STATE UNIVERSITY

May 2017

ABSTRACT

Data and the use of data to make educational decisions have attained new-found prominence in K-12 education following the inception of high-stakes testing and subsequent linking of teacher evaluations and teacher-performance pay to students' outcomes on standardized assessments. Although the research literature suggested students' academic performance benefits were derived from employing data-informed decision making (DIDM), many educators have not felt efficacious about implementing and using DIDM practices. Additionally, the literature suggested a five-factor model of teachers' efficacy and anxiety with respect to using DIDM practices: (a) identification of relevant information, (b) interpretation of relevant information, (c) application of interpretations of data to their classroom practices, (d) requisite technological skills, and (e) comfort with data and statistics.

This action research study was designed to augment a program of support focused on DIDM, which was being offered at a K-8 charter school in Arizona. It sought to better understand the relation between participation in professional development (PD) modules and teachers' self-efficacy for using DIDM practices. It provided an online PD component, in which 19 kindergarten through 8th-grade teachers worked through three self-guided online learning modules, focused sequentially on (a) identification of relevant student data, (b) interpretation of relevant student data, and (c) application of interpretations of data to classroom practices. Each module concluded with an in-person reflection session, in which teachers shared artifacts they developed based on the modules, discussed challenges, shared solutions, and considered applications to their classrooms.

Results of quantitative data from pre- and post-intervention assessments, suggested the intervention positively influenced participants' self-efficacy for (a) identifying and (b) interpreting relevant student data. Qualitative results from eight semi-structured interviews conducted at the conclusion of the intervention indicated that teachers, regardless of previous experience using data, viewed DIDM favorably and were more able to find and draw conclusions from their data than they were prior to the intervention. The quantitative and qualitative data exhibited complementarity pointing to the same conclusions. The discussion focused on explaining how the intervention influenced participants' self-efficacy for using DIDM practices, anxiety around using DIDM practices, and use of DIDM practices.

DEDICATION

I dedicate this work to several people who have always guided and inspired to work toward achieving my goals:

To my parents, Kris and Tim Nelson: You gave me everything I could have ever needed to be successful.

To my brothers, Nathan and Matt Nelson: you two set a high bar, against which I have always measured myself.

To my partner, John Houghton: From the day I expressed interest in this program to the day I finished it, you have unfailingly loved and supported me throughout.

I love you all.

ACKNOWLEDGMENTS

I could not have made it to this point without the unwavering support of my committee chair, Dr. Ray Buss, who fielded countless phone calls, emails, and in-person meetings requests from me throughout the process of designing, executing, and writing about this study. Dr. Buss always had an anecdote to share, and every conversation with him left me feeling more capable and efficacious than I had been before. His dedication to his students through the entire process is all I could have hoped for, and more, from my chair. Thank you, Dr. Buss!

I would also like to extend my gratitude to Dr. Deb Preach. When I was seeking a second committee member, no fewer than five people independently recommended her with gusto. Several people said of Dr. Preach, "Of all my professors at ASU, she holds you to the highest standard." They were right! Your personal experience with the Leadership and Innovation program, coupled with your expertise as a researcher and practitioner, has brought a level of intellectual rigor to the committee that I so much value. Thank you, Dr. Preach!

I am also extremely grateful to the person on my committee who knows my work best, Dr. James Buchanan. When our paths first crossed, a year before I even began my doctoral work, I would have never imagined that, four years later, you'd be serving on my dissertation committee. I am humbled to have had your perspective and experience to guide me. Thank you, Dr. Buchanan!

When Dr. Buss suggested that I invite a fourth person to my committee, I did not know that I would be gaining a content expert as prolific as Dr. Craig Mertler. I quickly discovered this fact as I searched for literature on my topic and Dr. Mertler's name came

up, repeatedly. I am lucky of have a fourth committee member of Dr. Mertler's caliber. Additionally, Dr. Mertler has been instrumental in the growth and development of the Ed.D for Leadership and Innovation program at Arizona State University, which has been such a formative experience for me. Thank you Dr. Mertler!

To my cohort: in our first summer class together, I shared several quotes I found meaningful, when I read them through the lens of this program. *The journey of a thousand miles begins with a single step*. What once felt daunting was made manageable and, dare I say, enjoyable, because you have all been along, every *step* of the way. As we all finish this program, it is not just the letters, Ed. D., that we take away from this program; it is also the connections we have developed with one another, the inside jokes, the late nights, the frustrations, the vicarious excitement, and the friendships that have made this program into a foundational experience. *The journey was the reward.*

My participation in this Ed. D. program was possible, in part, due to a close partnership between Teach For America and Arizona State University. As an alumnus of Teach For America, I have been afforded so many amazing opportunities, like this one, that have supported my growth, both professionally and personally. I continue to be inspired by the work of Teach For America corps members and alumni in Phoenix, and around the country, who prove, daily, what is possible for all students.

My completion of this dissertation was fueled by my local Starbucks, where friendly baristas, free WiFi, and coffee refills made it an ideal place to get this thing done!

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CHAPTER 1

LARGER AND LOCAL CONTEXT OF THE PROBLEM

Larger Context

As Japan, Russia, and the countries of Europe dealt with massive devastation, destruction, and human loss resulting from World War II, the relatively intact United States built an education system that would eventually become the envy of the world. Further, as other countries were resettling millions of people, rebuilding entire economies and governments, and drawing up new geopolitical borders, Americans invested in infrastructure, suburban community development, and an educated population. The 1944 G.I. Bill provided millions of young servicemen with opportunities to buy new homes, start small businesses, and attend college. Under these new conditions, the economy boomed; Americans left the countryside in droves and moved into urban centers, where new and better-paying white-collar jobs could be found. As a result, the middle class emerged as a prominent feature in American society. Subsequently, American students thrived: female students were staying in school longer and were attaining more advanced degrees than they historically had, students, in greater numbers than ever, were completing high school and college, and, as a country, the population achieved universal literacy, among other indicators.

This chapter of my dissertation has been divided into two parts. In the first part, I have outlined the larger context of my work within the American education scheme. I have described the historical conditions that have contributed to the current reality of standardized testing in the United States, and I have detailed the resulting effects of this assessment-driven culture on school and teacher practices. In the second part, I have

described the local context for my study, where the research was conducted. I described my role in my professional setting, the program of support I implemented with schools, my problem of practice, and my research questions.

In the mid-twentieth century, the United States experienced tremendous economic and population growth: the gross domestic product increased, on average, by 13.5% annually between 1945 and 1960 and the population growth rate nearly doubled, relative to the preceding decade. During this same period, relative to other still-recovering or developing countries, American students were the best in the world for attainment of upper secondary and tertiary education, among other metrics. The United States' standing atop many of the world rankings solidified its position as the global-standard for education. Such statistical 'confirmatory' evidence played well into the newly redefined notion of 'American exceptionalism.' It entrenched and reinforced in the American psyche the belief that the US was fundamentally and qualitatively better than other countries, something that has been further examined later in this section.

In the years that followed, the US exerted military and economic influence to counter the Soviets' geopolitical threat to capitalism in Western Europe: the North Atlantic Treaty Organization (NATO) was formed and the Marshall Plan, which removed barriers to trade and gave monetary aid to Western European nations, was put into place. With this support, Western Europe rebuilt and many of these nations began their rise in the global education rankings. Later in the 20th century, similar improvements in educational results occurred in some Southeast Asian countries, after a period of rapid economic growth and development. During the 1970s, 1980s, and afterward, various countries caught up to and surpassed the US in terms of educational attainment. It was

not necessarily the case that the US was significantly regressing, but rather that stability and investments in previously war-torn, isolated, or otherwise unstable countries began to pay off. These other countries' improvements threatened the American educational 'dominance' that had been the norm for decades. How can a country reconcile mediocre results with the belief that they were an exceptional model to be emulated? This contradiction challenged a very integral facet of the nation's identity.

A 'Nation at Risk'

"Our once unchallenged preeminence in commerce, industry, science, and technological innovation is being overtaken by competitors throughout the world" exemplified the nature of the concerns (A Nation At Risk, 1983, p. 5). In response to increased foreign competition, the economic downturn of the late 1970s early 1980s, and the widely-held belief that the quality of education in the US was to blame, President Ronald Reagan and US Secretary of Education, T. H. Bell convened the National Commission on Excellence in Education (NCEE). Among the things this 18-member group were chartered to do were: assess the quality of teaching and learning at public and private institutions in the U.S., compare American schools with those of other industrialized nations, define the problems that must be overcome—and recommend solutions— in the pursuit of excellence in education.

When the final report was released in 1983, it focused on five main areas: content, standards and expectations, time, teaching, and leadership and fiscal support. Under each heading, the report made one broad, sweeping recommendation followed by subsequent implementation recommendations. Although many of those recommendations have contributed to the present state of public education, my discussion here is focused on only

those with the most salient implications for my work: standards and expectations. With respect to this area, the authors suggested, "schools, colleges, and universities adopt more rigorous and measurable standards, and higher expectations [for academic performance]…and that 4-year colleges and universities raise their requirements for admission" (p. 27). This was followed by an implementation recommendation that called for widespread use of standardized assessments in America's Schools:

> Standardized tests of achievement (not to be confused with aptitude tests) should be administered at major transition points from one level of schooling to another and particularly from high school to college or work. The purposes of these tests would be to: (a) certify the student's credentials; (b) identify the need for remedial intervention; and (c) identify the opportunity for advanced or accelerated work. The tests should be administered as part of a nationwide (but not Federal) system of State and local standardized tests. This system should include other diagnostic procedures that assist teachers and students to evaluate student progress. (p. 28)

Standardized assessments were nothing new. Prior to *A Nation At Risk*, standardized assessments existed in many forms such as college and graduate school entrance exams, professional certifications and designations, licensure exams, Advanced Placement tests, psychological tests, and others. Yet, this report's explicit call for an increase in these types of assessments proved to be the clarion call that state legislators needed to develop content standards and, subsequently, standardized assessments.

No Child Left Behind

In the 18 years that followed the publication of *A Nation At Risk*, many states independently adopted content standards, under no legal mandate to do so. That all

changed, however, with the passage of the sweeping 2001 federal legislation, *No Child Left Behind* (NCLB), which, among other things, required all states to develop academic content standards and to assess their students in reading and mathematics annually, between third and eighth grade, and once in high school. The data collected through the states' various assessments were required to, as part of NCLB, be disaggregated for students in specific sub-groups, including racial minorities, low-income, and for those classified as students with special needs. Along with the newly required assessments came new mandates about students' academic performance; NCLB required that all students must meet or exceed the state standards by the end of the 2013-2014 school year, and imposed penalties on those not progressing toward that goal. This marked the beginning of a new era of assessment and accountability in public K-12 education in the United States.

Race to the Top

Although NCLB had the effect of standardizing the content taught in schools at the state level, there were vast discrepancies *between* the states regarding their expectations of students. With the threat of penalties for not making progress toward NCLB goals, some states adopted less rigorous standards and assessments, effectively setting a lower requirement of student achievement, relative to other states. This remained the norm until 2009, when, in the midst of an economic recession, President Obama offered federal stimulus dollars from the American Reinvestment and Recovery Act to states by way of the Race to the Top grant. Along with the money, however, came the stipulation that states adopt certain education reforms. These initiatives included adopting more rigorous academic standards, higher quality assessments, and

performance-based evaluations for teachers and principals, among other things. These initiatives were meant to bring parity between different states' educational systems and raise the bar for all students in the country. Although these efforts have helped reshape public K-12 education in the Arizona, there were several requirements that had specific implications for my work and this action research project, most notably, the advent of the relatively new Arizona College and Career Readiness Standards (Common Core Standards) and the use of student data in teacher evaluations. The confluence of these factors has made it more important than ever for educators to have a clear sense of their students' academic abilities.

Data-Informed Instruction

The innovation implemented for this project centered on the idea of data-informed decision making (DIDM). I have adapted Dunn, Airola, Lo, and Garrison's (2013) definition of DIDM: the use of student and class data to identify patterns of performance that reveal students' academic strengths and weaknesses relative to established learning goals, and the planning of instructional practices to support academic success for all students. A report from the US Department of Education (2009) stated:

> The collection, analysis and use of educational data are central to the improvement of student outcomes envisioned by *No Child Left Behind* (*NCLB*). The use of data in educational decision making is expected to span all layers of the education system—from the federal to the state, district, school and classroom levels. (p. vii)

It was from this foundation that DIDM practices have grown to play an important role in public K-12 education. Schools have regularly assessed their students using formative

tests aligned to the standards to obtain data that indicated likely student performance on the state assessment, gaps in students' understanding, and readiness for new content. However, a report prepared for the US Department of Education suggested that, despite the call for increased use of DIDM practices, teachers were still struggling to adequately implement these strategies into their work (Means, Chen, DeBarger, & Padilla, 2011). Further, teachers reported they needed additional professional development in the areas of identifying relevant data, interpreting the information, adjusting instruction in response to student data, and using and navigating the data and assessment user interface (Means, et al., 2011).

Local Context

My employer, a local education non-profit, served as an umbrella organization for several other nonprofits, including a school support nonprofit and a school starter nonprofit. Each of the organizations worked individually to advance one collective mission: improve the quality and state of education in Arizona. In concert, the organizations worked toward this goal through three major avenues: (a) advocating at the state legislature for increased levels of funding and improved measures of accountability for Arizona's public schools; (b) supporting aspiring leaders to open high-quality schools; and (c) providing support for existing schools seeking to improve their operations and students' academic performance. The last of the aforementioned avenues has been where the majority of my work occurred. I supported a portfolio of 11 public district and charter schools in Arizona as they implemented our signature system of support, the Quality Schools Program (QSP).

The Quality Schools Program, an initiative of my organization, offered a three-year series of job-embedded professional development and intensive on-site coaching for K-12 teachers and leaders. The goal of the program was to help schools build, refine, and sustain systematic approaches to curriculum, assessment, instruction, and professional development. We supported our schools' efforts through professional development (PD) focused on data-informed decision making, classroom observations and feedback for teachers and school leaders, assistance with the breakdown and analysis of school- and student-level data, and on-going leadership support. Over the course of the three years, the QSP's goal was to assist schools in attaining a level of skill proficiency so they could implement the practices, without our support.

Nevertheless, our experience taught us that changing, sometimes long-held, professional practices was a difficult process. For this reason, we required schools to apply for admission into our program, which helped us assess their readiness to undertake this new initiative. Before being accepted, we conducted a site visit to the campus, met with the teachers, leaders, and other stakeholders, and completed a needs analysis. Only after we completed these tasks did we make the decision to grant admission into the program.

Once accepted into the QSP, schools worked with their assigned trainer to develop an implementation plan for the first year, which included creating an aligned assessment and professional development calendar that allowed for the regular collection and analysis of student data. This was foundational to the program: schools must regularly assess their students and respond to that information in a timely manner to see

improvements in their students' academic results. The plan also detailed the dates and topics of the professional development and on-site coaching sessions.

In a school's first year of participation in the program, they received five professional development sessions and 12 coaching sessions. In each of the subsequent two years, the number of coaching sessions remained constant, whereas the number of PD sessions decreased by one each year. This gradual release of responsibility approach was meant to ease schools into the work and help schools develop the capacity to sustain the change. Although much of the content for the PD and coaching was pre-determined in the first year of participation in the QSP, schools had freedom in the second and third years to select topics from other areas of need. Their content in the first year however, focused mainly on the use of school-, classroom-, and student-level data and using that information to inform their practice.

This was not fast work; schools contracted with us knowing that it would take three years to fully implement data-informed practices. Rather than waiting until the end of our partnership to evaluate our own programmatic effectiveness, we reviewed our metrics quarterly to ensure we were providing quality service to our schools. These quarterly evaluations included an evaluation of schools' scores on an internally-created implementation and fidelity rubric, as well as overall school performance on benchmark assessments. At the end of each school year, we also evaluated our programmatic success through a review of our schools' performance on the state accountability model.

The dialogue around standardized tests has centered on the high-stakes nature for students, that was to say, the requirement that students pass the required examination to graduate from high school, for example. Although there still was one high-stakes

assessment (Civics) for students in Arizona, the data-informed approach to teaching had grown in popularity, as accountability for schools and teachers increasingly shifted toward using students' outcomes on standardized content assessments.

In Arizona, every public school was given an A-F letter grade by the Arizona Department of Education (ADE), based on their students' performance on the state assessments, Arizona's Instrument to Measure the Standards (AIMS) and Arizona's Measurement of Educational Readiness to Inform Teaching (AzMERIT). This letter grade was meant to communicate the quality of education provided at the school. The ADE's accountability model included three components: the proficiency of all students tested in reading (P_R) and mathematics (P_M), the growth of all students tested in reading and mathematics from the previous year ($G_{ALL\text{-}R}$ and $G_{ALL\text{-}M}$), and the growth of the lowest performing quartile of students in reading and math, relative to the previous academic year, ($G_{B25\text{-}R}$ and $G_{B25\text{-}M}$). Their formula, $[.50(P_R+P_M)+.25(G_{ALL\text{-}R}+G_{ALL\text{-}M})+.25(G_{B25\text{-}R}+G_{B25\text{-}M})]$ resulted in a score between 0-200; scores 140+ were labeled as, 'A-Rated'; 120-140 were labeled as, 'B-Rated'; 100-120 as, 'C-Rated'; and scores below 100 were labeled as, "D-Rated." A school could only be labeled as, "F-Rated," if it scored fewer than 100 points for three consecutive years. This state-provided data provided valuable insights about the improvement of our schools.

Although we worked with district schools, the majority of our clients were public charter schools. It was for this reason that, in our development of the QSP, we worked closely with the charter-authorizing body, the Arizona State Board for Charter Schools (ASBCS), to ensure that the support we provided schools directly helped them meet the ASBCS' accountability framework.

Charter schools, unlike their district counterparts, had an additional layer of accountability that came from the ASBCS. Their accountability model, similar to the ADE's, used students' growth and proficiency on the state assessment, but further disaggregated the data to explore the performance of various subgroups of students, including those students classified as Free and Reduced Lunch, English Language Learners, and Special Education. Information about the performance of these groups has been provided in Figure 1. In our PD sessions, we specifically called teacher and leaders' attention to the performance of these students on benchmarks so that they addressed and supported these students' unique needs throughout the year.

Poor student performance on standardized assessments had significant implications for a school, including, losing the right to operate, as well as a reduction in student population and operating budget. When a school was consistently underperforming, it led to, in extreme cases, a state takeover, revocation of a school's charter, or non-renewal. Further, Arizona was an open-enrollment state, which meant students' school options were not limited by geographic boundaries; if a school was not producing quality academic results, parents could move their students to a different school. When a student opted to attend a different school, the funding followed that student to her new school, which placed budgetary challenges on the initial school. The QSP's intentional work with schools to improve their academics filled several critical areas of need: it helped schools fulfill their mission of providing the best possible

education to their students, as well as making it a place that parents chose to send their children.

		2012 Traditional K-12 School (7 to 12)			2013 Traditional K-12 School (7 to 12)			2014 Traditional K-12 School (7 to 12)		
1. Growth		Measure	Points Assigned	Weight	Measure	Points Assigned	Weight	Measure	Points Assigned	Weight
1a. SGP	Math	69	100	10	69	100	10	56	75	10
	Reading	63	75	10	68	100	10	65	75	10
1b. SGP Bottom 25%	Math	64	75	10	61	75	10	55	75	10
	Reading	65.5	75	10	78	100	10	68	100	10
2. Proficiency		Measure	Points Assigned	Weight	Measure	Points Assigned	Weight	Measure	Points Assigned	Weight
2a. Percent Passing	Math	59 / 58.2	75	7.5	56.9 / 58.5	50	7.5	63.9 / 59.5	75	7.5
	Reading	68 / 76.9	50	7.5	72.2 / 78.2	50	7.5	78 / 79	50	7.5
2b. Composite School Comparison	Math	5.3	75	5	7	75	5	14.3	75	5
	Reading	-5.8	50	5	0.3	75	5	7.3	75	5
2c. Subgroup ELL	Math	44 / 45.2	50	2.5	28.6 / 43.6	50	2.5	33.3 / 37.5	50	2.5
	Reading	50 / 61.6	50	2.5	52.8 / 61.3	50	2.5	48.3 / 53.1	50	2.5
2c. Subgroup FRL	Math	59 / 47.8	75	2.5	56.9 / 49.3	75	2.5	63.9 / 49.7	75	2.5
	Reading	68 / 69.1	50	2.5	72.2 / 71.5	75	2.5	78 / 71.7	75	2.5
2c. Subgroup SPED	Math	19 / 13.9	75	2.5	5.9 / 13.3	50	2.5	26.3 / 13.9	75	2.5
	Reading	21 / 32.3	50	2.5	11.8 / 31.5	50	2.5	25 / 35.6	50	2.5
3. State Accountability		Measure	Points Assigned	Weight	Measure	Points Assigned	Weight	Measure	Points Assigned	Weight
3a. State Accountability		B	75	5	A	100	5	A	100	5
4. Graduation		Measure	Points Assigned	Weight	Measure	Points Assigned	Weight	Measure	Points Assigned	Weight
4a. Graduation		88	100	15	88	100	15	94	100	15
Overall Rating		Overall Rating			Overall Rating			Overall Rating		
Scoring for Overall Rating 89 or higher: Exceeds Standard <89, but > or = to 63: Meets Standard <63, but > or = to 39: Does Not Meet Standard Less than 39: Falls Far Below Standard		75.63		100	81.25		100	78.75		100

Figure 1. Sample of a Charter School's Performance Dashboard from the Arizona State Board for Charter Schools

Typically, charter schools' student enrollment counts were less than that of traditional district schools. The schools in my portfolio, for example, collectively served about 1,850 students. Due to the relatively small student population served, 168 students per campus, on average, none of my campuses employed a curriculum, data, or instructional coach to offer day-to-day support for classroom teachers. The QSP provided participating schools access to a trainer who can fulfill many of the same duties and

services of someone in those roles, except on a part-time basis; this was an additional need that the QSP filled for our partner campuses.

Although we measured our results by student outcomes, teachers were the primary beneficiaries of our work and they viewed our program with mixed opinions. Some have commented that a data-informed approach has 'removed creative freedom' from their job, others found the work to be exactly what they needed to succeed under Arizona's teacher evaluation framework. In 2011, the Arizona legislature passed Senate Bill 1040, which regulated teacher and principal evaluations. This law required schools to use data to comprise between 33% and 50% of a teacher's annual evaluation. Although the law did not explicitly require this, many schools tied bonus money to these evaluations. The data used for these evaluations, which most often came from pre- and post-tests, was the same data we had participating teachers interpret and analyze on a regular basis. Although many teachers lamented this evaluation practice, the QSP was meant to help them thrive during this era of testing and accountability.

Yet, despite the program's intentions to help teachers become informed consumers and users of class and student data, I noticed that, at many campuses, there have typically been two 'camps' of teachers that formed: those who embraced our data-informed approach to teaching and those who did not. Whereas this, in and of itself, was not remarkable, it had the potential to undermine a school's effective implementation of the Quality Schools Program; it threatened students' performance on standardized assessments, and, subsequently, the school's performance on their state accountability framework. Further, it represented a potentially ineffective use and allocation of school and trainer resources, specifically time and money.

Initial cycles of data collection, which included questionnaires and semi-structured interviews with teachers and leaders, revealed that, among those not implementing the QSP with fidelity, there were several factors worth noting. Although some teachers had philosophical disagreements with the program, a larger contingent of teachers who wanted to use the data, still lacked the skills and/or efficacy to do so despite their participation in PD and their use of coaching services. Among this group of teachers, many believed they were already using the data but, when pressed, could not provide specific examples of their use, nor describe the process of how to use student and class assessment data. It was this latter group of teachers lacking the skills and/or efficacy who informed the design of this study.

Purpose Of Study

The purpose of this action research study was to examine the effectiveness of an intervention designed to prepare K-12 teachers at a Year 1 QSP school to regularly and effectively use student assessment data, which will lead to more effective school-wide implementation of the Quality Schools Program. Informed by a review of relevant literature and scholarship, as well as initial cycles of data collection, I defined 'use of student assessment data' as (a) the ability to identify relevant assessment information, (b) the ability to interpret relevant assessment information, (c) the ability to apply interpretations to their classroom practices, and (d) the ability to use the requisite technology for the process. Further, I assessed teachers' self-efficacy regarding their ability to successfully carry out the process. To support teachers' use of student assessment data, this action research study featured an innovation that blended traditional professional development activities from the Quality Schools Program, with online pre-

work modules focused on building teachers' capacity in one of the aforementioned four areas. Using a concurrent mixed methods research design, both quantitative and qualitative data were collected simultaneously.

Research Questions

To better understand the complex factors influencing teachers' use and efficacy for using student assessment data, I framed this research using the following research questions:

1. How and to what extent do blended professional development modules on Data-Informed Decision Making influence K-12 teachers' senses of efficacy for DIDM-practices?
2. How and to what extent do blended professional development modules on Data-Informed Decision Making influence K-12 teachers' apprehension regarding the use of DIDM-practices?
3. How do blended professional development modules on Data-Informed Decision Making influence teachers' use of student assessment data among K-12 teachers?

CHAPTER 2

THEORETICAL PERSPECTIVES AND RESEARCH GUIDING THE PROJECT

In chapter 1, I situated the problem of practice and my study within the larger context of 21st century American education issues. I described my study's roots and connections to the publication of *A Nation At Risk* (1983), as well as the federal *No Child Left Behind* legislation, both of which paved the way for the culture of testing that exists in Arizona's public schools. Further, I provided the reader with an overview of my local context, as a facilitator of professional development and classroom coaching at a local Phoenix non-profit. In this role, I worked with a group of schools around the state of Arizona to implement a program of support focused on preparing teachers to use data-informed decision making practices. Additionally, I outlined my problem of practice that, despite professional development on the topic, teachers struggled to implement the recommended changes, due to skill deficiency or low self-efficacy around their own abilities. Finally, I provided three research questions that served as the focus of this dissertation. In this chapter, I have described the theoretical perspectives and research guiding this study.

In my research journal, I periodically reflected on the process of doing action research, being a doctoral student, and working on my dissertation. I wanted to start this chapter by sharing a brief story from my journal that framed the importance of this chapter in the scheme of action research.

> *(September 27th, 2015): I sit, as is typical, on an early Sunday afternoon in a coffee shop in Central Phoenix. The music is too loud, the crowd too large. I put*

on my headphones, turn on some white noise, and the rest of the room fades out of my consciousness. I log on to MyASU, access the library feature, and start a concerted search for new literature to inform me and my work. I type in a few indiscriminate search terms and get more than 3,000 peer reviewed journals and articles. I click one link, then another. I've opened about a half dozen articles. I read the abstracts, check the reference list, and get new ideas of studies to search. Click leads to click, study unto study. Before I know it, I've opened or downloaded more than a hundred articles. Feeling overwhelmed by the sheer volume of literature, I shut everything down and go home.

I talk to my partner about my frustrations. "That seems stupid. Why do you need so much other research?" he asks. I don't have an answer that makes sense to me or to him. I tell him that I need to do something to keep my mind, hands, and body occupied. We go for a hike. From the top of the mountain we can see tens of miles in every direction. We talk about what we can see in the distance. And it dawns on me. "Imagine," I said, "there is a target just beyond the horizon. I don't know where it is, or really, even, what it is, but I know it's there. My research—and all research—is like shooting an arrow, trying to hit that location-unknown target. But I don't know if I need to shoot 304° northwest or 116° east-southeast. I also don't know which way, or how strong the wind is blowing. I need others' research to help me aim my arrow. I need previous cycles of action research to calibrate my bow. I need my chapter 2 to help me find and hit my target."

It did not matter whether my metaphor made any sense to him; it made sense to me. It gave me renewed clarity and focus about the purpose of and intent of this section of my dissertation. With that in mind, over the course of this chapter, I have presented selected, relevant literature and scholarship, as it pertained to my study, as well as a discussion on the implications for my work. I have provided an overview of data-informed decision making (DIDM) and its ideal use, discussed the framework of self-efficacy, and explained different perspectives as to why the current use of data-informed decision making was not ideal. Finally, I have discussed related research on DIDM and professional development for DIDM, described previous cycles of action research, and proposed a solution to optimize teachers' use of data-informed decision making.

Defining Data-Informed Decision Making, How It Functions, and Its Importance

Data-informed decision making was not a new concept. At its very root, it was "The collection, examination, analysis, interpretation, and application of data to inform instructional, administrative, policy, and other decisions and practice" (Mandinach & Jackson, 2012, p.22). Nor was the idea of data-informed decision making unique to education. In disciplines other than education, data were used to make decisions for many years. Consider, for a moment, the following medical example: a doctor might order some routine bloodwork for a patient. When she sees that the patient's cholesterol level is too high, she might first recommend a change in diet and exercise and bring the patient back six months later for further testing. At that time, she may order an additional round of bloodwork and, if necessary, prescribe a statin drug, then subsequently monitor the patient's cholesterol levels. Even in education, teachers and schools used data to inform their practice, regardless of whether or not they would have called it such (Mandinach &

Jackson, 2012). Yet, unlike the use of data in other contexts and disciplines, it was important that, before continuing, I defined the construct in question, with respect to its role in education.

Even on the terminology itself, researchers varied slightly in how they refer to the same idea. Some called it "data driven decision making" (also "data-driven decision making" and "data driven instruction"), others referred to it as, as I have heretofore and have continued to going forward, "data-informed decision making" (or "data informed decision making" and "data informed instruction") (Dunn, Airola, Lo, & Garrison, 2013, 2014; Mandinach & Jackson, 2012; Means, Chen, DeBarger, & Padilla, 2011; Slavin, Cheung, Holmes, Madden, & Chamberlin, 2011). With specific respect to the literature on my topic, I did not encounter any researchers who specifically addressed the distinction between being 'data-driven' and being 'data-informed.' I also noted that, across articles, researchers seem to use the two terms interchangeably. However, I found it necessary to articulate and justify my use of 'data-informed,' as opposed to 'data-driven.' As previously stated, with respect to my topic, this discussion was not included, so I searched other education resources to understand the differences between the two phrases. In my search for others' comments on this question, I encountered articles on both sides, why one should be data-driven or data-informed, and not the other. The term 'data-driven' implied that the data being used is the only source that guides a decision. However, what I found to be the most compelling argument, and what informs my use of 'data-informed,' was the position that data collection is (virtually) always incomplete (Chen, 2012; Kanter, 2013; Maycotte, 2015). Despite people's best efforts to fully understand or capture data, there was always missing information. Therefore, to make

decisions, based solely on incomplete data, was imprudent. Instead, the authors argued one should "use data *extensively* [emphasis added] to inform [one's] strategic decision-making… but don't let data completely overrule your human instincts and experience," as 'data-driven' implied that one should (Maycotte, 2015). Proponents of 'data-informed' contended that 'informed' describes "agile, responsive, and intelligent [organizations] that are better able to succeed in a rapidly changing environment… Data-informed cultures are not slaves to their data" (Kanter, 2013, p. 1). The scholarly use of the both terms, yet the exclusion of this discussion from almost every scholarly article, book, or journal, implied that many researchers seem to be casual about interchanging the two terms. Google Analytics on the search terms, 'data driven decision making' and 'data informed decision making' (DIDM) suggested the former was more commonly searched, by a 38:1 margin (Google Analytics, 2016). However, despite its commonplace use, for the reasons outlined above, I have continued to use and advocate for data-*informed* decision making.

Knowing the difference between the two terms yielded only a partial understanding; defining 'data-informed decision making' was also necessary. Although there was no objective denotative meaning of DIDM, there were various working definitions, with minor differences between them. Some researchers have defined it as a process through which data were collected, interpreted, and disseminated to inform and guide district and school reform efforts (Salvin, et al., 2011). Others claimed it was,

> Obtaining timely, useful information, trying to understand the 'root causes' behind the numbers, and designing interventions targeted to the specific areas most likely to be inhibiting success. The idea is both to focus resources and

efforts most efficiently where they will make the biggest difference. (Slavin et al., 2011, p. 4)

Jandris (2001) described DIDM as an integral component of the continuous improvement process, informed by both qualitative and quantitative data from a variety of sources at different levels. Marsh, Pane, and Hamilton (2006) suggested data-informed decision making occurred when educators systematically collected and analyzed various data sets to guide decisions intended to improve the success of students and, subsequently, schools. However, none of these aforementioned definitions adequately captured what it meant to use data informed decision making as well as Dunn et al. (2013), who argued that data-informed decision making referred to the "systematic collection of many forms of data … the identification of patterns of performance that unveil students' strengths and weaknesses relative to … learning goals … and the selection and planning of instructional strategies and interventions to facilitate student achievement of learning goals" (Dunn et al., 2013, p. 87). This definition was the one most closely aligned with the goals and mission of the Quality Schools Program, and therefore served as the operational definition of data-informed decision making for the study.

Given this understanding of data-informed decision making, it was important to know about the process through which educators use it. Thus, I have provided several different perspectives and, hesitantly, protocols, grounded in literature, as well as the 'ideal' use of the DIDM for an educator in the Quality Schools Program. I intentionally selected the word 'hesitantly' because there are many academics who felt that being data-informed cannot be reduced to a protocol, but rather was best considered a mindset that

DIDM users must adopt, embody, and embrace, if they truly want to utilize it (Mandinach & Jackson, 2012; Schmoker, 1996). Madinach and Jackson maintained, "it is a lifelong commitment to a philosophical and holistic transformation toward continuous improvement" (p. 19). The suggestion that data-informed decision making should be considered as a way of life, however, did not preclude other authors, researchers, and practitioners from providing a cyclical process that closely mirrored the ideas of "continuous improvement," and that DIDM must be on-going (Bambrick-Santoyo, 2010; Means et al., 2011).

The model of data-informed instruction used by schools participating in the Quality Schools Program was modeled, largely, after the one put forth in *Driven by Data* (2010). In that book, the model of DIDM proposed was cyclical in nature, and included three main components: assessment, analysis, and action (Bambrick-Santoyo, 2010). These three aforementioned broad categories were further described and supplemented by other publications.

After the passage and enactment of the *No Child Left Behind* (2001) law, the US Department of Education explored and published, with increased focus, frequency and intensity, reports emphasizing the power of DIDM. They, too, stressed the importance of the continuous improvement model and cyclical nature of using data to inform decisions. The circular design of the model indicated there was no definite starting or ending point in the process; each of the arrows, which represented the key components of a data-informed model, led to another (Figure 2).

Figure 2. Continuous Improvement Model of Data-Informed Decision Making (Means et al., 2011)

To help the reader better conceptualize the steps in the process, I have provided examples from a classroom teacher. Starting with the 'Plan' portion of this model, an educator used her existing practices to prepare for a lesson, or unit, or other predetermined length of time; this plan may have included lesson plans, differentiation plans, or unit plans, among others. The teacher then 'Implemented,' or executed this plan with her or his students. In order to be "data-informed" the teacher collected data, which happened in the 'Assess' phase; the teacher collected some form of evidence or artifact that as accurately as possible reflected the current understanding of her students. This could have been a portfolio of work, an essay, a quiz or test, or other standardized form of assessment, among other options. The assessment that the teacher collected provided insight and information about the extent of the students' grasp or mastery of the content. The teacher then reviewed and 'Analyzed the data,' in ways that "relate outcome to

processes" and actionable information (Means, et al., 2011, p. 19). This was done by looking for trends through sub-group, whole class, or individual student analysis (Means, et al. 2011; Bambrick-Santoyo, 2010). The final step, before the cycle began again, was for the teacher to 'Reflect' on her analysis of the data, interpret the findings, and identify areas to refine, enhance, or otherwise improve her program or instruction. In the interpretation of her students' data, a teacher considered current classroom instructional and pedagogical practices which might be changed to obtain a more desirable outcome, if necessary (Means, et al., 2011). The teacher returned in the cycle to the 'Plan' stage, wherein she used the insight gleaned to make a new plan of action.

Teachers in the Quality Schools Program expected to see the previously described cycles of DIDM enacted and implemented in several different ways. Though the premise of the Quality Schools Program was that the data-informed model should permeate all of a teacher's work, the most relevant example was the process we had teachers execute after each quarterly benchmark assessment: six-week instructional plans. Through our professional development sessions, we provided teachers with the time, space, and support necessary to analyze and reflect on their students' data, as well as the guidance to plan their instruction for the upcoming weeks. In these plans, teachers embedded standards to reteach to their students as they continued to plan for new content. Although we did not provide teachers with additional time to teach standards for a second or third time, we helped them to be intentional and strategic about which standards to prioritize and how to integrate them into their new content.

With an understanding of DIDM, what it looked like for teachers, and its use in the Quality Schools Program, the following review addresses why this process was

important for schools and teachers. The shift toward using data in schools was accelerated after the passage of the 2001 Federal *No Child Left Behind* policy, which closely linked student and school academic achievement with funding and accountability (NCLB, 2001). Mertler (2009) argued that assessment, one of the most important elements of a classroom teacher's job, was elevated in importance with the passage of NCLB. Datnow, Park, and Wohlstetter (2007) declared, "[s]ince the effectiveness of schools is being measured by performance indicators, it is not surprising that educators are now using data for improvement" (p. 10).

With the new requirements in place, schools began investing in data systems that enabled them to view student, class, school (and district) performance through a variety of lenses, including socioeconomic indicators, race, gender, language proficiency, special needs status, and so on (Gallagher, Means, & Padilla, 2008; Slavin & Cheung, 2011). These lenses allowed teachers to gain a better understanding of students in these various groups' objective or relative performance on assessments. Schools and teachers used the data to glean information helpful for "narrowing the achievement gap, improve teacher quality, improve curriculum development, share best practices, communicate [results] more effectively with key stakeholders, and motivate students and increase parental involvement" (Messelt, 2004). Although there were other effects of DIDM, the Quality Schools Program, most frequently, encouraged teachers and leaders to use data to inform instructional decisions to improve student proficiency and growth in mathematics, reading, and science.

Many studies demonstrated the correlation between the effective use of DIDM and improved student—and school—performance (Bambrick-Santoyo, 2010; Earl &

Katz, 2006; Means, et al., 2011; Peterson, 2007; Wohlstetter, Datnow, & Park, 2008). Carlson, Borman, and Robinson (2011) found that, relative to control groups, schools and teachers that implemented data-informed practices saw statistically significant improvements in students' mathematics proficiency. Their study utilized a quarterly benchmarking system, much like the ones schools and teachers in the Quality Schools Program utilized.

The 'Johns Hopkins Center for Data Driven Reform' produced reports that further investigated the effects of using a data-informed model. They found that when schools effectively utilized data-informed practices (with fidelity) in conjunction with benchmark assessments that were highly correlated to the state achievement test, $r >$. 80, that schools achieved statistically significant improvements in mathematics and reading proficiency (Bianco, 2010; Carlson, Borman, & Robinson, 2011; Datnow, Park, & Wohlstetter, 2007; Slavin & Cheung, 2011). Anderson (2003), who conducted a meta-analysis of key studies on DIDM, came to the following conclusion:

> Successful districts in the current era of standards, standardized testing, and demands for evidence of the quality of performance, invest considerable human, financial and technical resources in developing their capacity to assess the performance of students, teachers and schools, and to utilize these assessments to inform decision making about needs and strategies for improvement, and progress toward goals at the classroom, school, and district levels. (p. 9)

The need for using data to inform instruction is well documented in literature, as well as in my own personal practice in the classroom as a middle school science and

mathematics teacher. In 2010, after graduating from college, I moved to Phoenix for a teaching opportunity through Teach For America. As part of the program, I regularly assessed and tracked my students' mastery on the state standards. I used that information to determine which students needed additional supports, which students could benefit from enrichment, and on which standards additional support would give my students the best chance to succeed on their end of year state assessment (AIMS). After my first year, my students improved their performance on the state test by 41-percentage points, the largest year-over-year gain on the state test of any school in the state. After two years, my middle school science program was one of only 29 programs in Arizona to be labeled as 'Higher Performing' by the National Center for Educational Achievement, based on student growth (ABEC). Although there were a number of factors that contributed to this result, I credited much of the growth and improvement that my students demonstrated to using their achievement data to inform what I did in my classroom. However, simply implementing the DIDM practices did not ensure that students, teachers, or schools experienced success. Teachers must have believed in their own abilities to carry out the process. In the following section, a theory that was relevant to this action research project was reviewed along with relevant literature.

One theory that provided a framework for understanding and exploring the relation between professional development and teachers' beliefs, perceptions, and implementation of data-informed decision making practices was Bandura's (1977, 1997) self-efficacy framework.

Self-Efficacy Framework

A theory with implications for my area of inquiry was the self-efficacy framework. In this perspective, Bandura (1977, 1986, 1988, 1993, 1997) posited that individuals' beliefs about their own abilities to produce a desired effect, outcome, or result, played a substantial role in their behaviors and actions. Bandura (1977) first proposed this framework in his seminal work, *Self-efficacy: Toward a unifying theory of behavioral change*. Bandura (1977, 1986, 1997) suggested perceptions of their own abilities, or sense of efficacy, determined how much effort individuals expended, how they responded to obstacles and adverse experiences, and the duration or longevity of their actions.

Sense of self-efficacy was shown to influence many areas of people's lives, whether individuals were aware of it or not. For example, individuals who thought poorly of their athletic abilities were likely to be less willing to engage in activities that required physical participation, than would, say, those who thought highly of their abilities. Further, individuals' self-efficacy was shown to play an important role in how people viewed and responded to setbacks and obstacles. A feature of those with higher levels of self-efficacy was that they tied their successes to their efforts, and their failures to a lack of it; meaning failures were not reflective of any innate talent or fixed ability, rather they were linked to something that was under their control, which resulted in people being more willing to try again, and exert more effort.

Bandura (1977, 1986, 1997) asserted that self-efficacy was influenced by a combination of four main factors: (a) participation in mastery experiences, (b) exposure to vicarious experiences provided by social models, (c) social persuasion, and (d) changing how one perceives and interprets the situation, affect coaching. Participating in

experiences related to the four factors was critical for those seeking to enhance their efficacy in a given situation. Among those who desired to increase their efficacy, they likely had opportunities to experience success early in the development of a new skill or knowledge, which ensured they had the confidence to continue when the situation became more complex and challenging. Further, having an external model who demonstrated the knowledge or skill in action provided learners with a vision, toward which they could strive. The final two factors, which encompassed encouragement and affective coaching, provided individuals with the motivation they needed to stay focused and remain optimistic when facing obstacles.

Self-efficacy theory was shown to be important in school settings, both on an individual basis in teachers (Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998) and on a collective basis because efficacy of the staff can influence the outcomes for students (Goddard, Hoy, & Hoy, 2007). Teachers who, collectively, judged themselves as talented educators, capable of getting their students to improve academically infused the whole school culture with a positive atmosphere focused on student growth and achievement (Goddard et al., 2007). Further, the authors argued that efficacious teachers motivated their students to enhance their cognitive processes to develop increased levels of efficacy. Whereas teachers who generally had doubts about their abilities to improve their own or their students' performance, contributed to an environment of academic futility, where learning and growing was not a priority for students or teachers **(**Goddard, et al.**).**

Self-efficacy theory has far reaching implications for researchers seeking to better understand teachers' perceptions about the use of data, to inform their practice. For example, Dunn et al, (2013) examined the relation between DIDM efficacy and anxiety

using an inventory to measure these two variables. Previous research suggested teachers possessing a strong sense of efficacy, regarding their pedagogy, were better able to cope with the difficulties posed by a new strategy, like DIDM, for example (Dunn et al., 2013; 2014). Further, prior research suggested there was a negative relation between teacher efficacy and self-reported levels of stress, and positive relations between efficacy and sustained use of classroom innovation, learner centeredness, and perseverance with respect to obstacles (Dunn et al. 2013).

The literature suggested self-efficacy, when referring to teachers' use of DIDM, was influenced by five main factors: teachers' ability to (a) identify relevant data, (b) analyze and interpret relevant data, (c) apply relevant interpretations to their instruction, (d) use the technology and interface necessary to interact with the data, and (e) teacher's anxiety or apprehension around the use of data and statistics (Dunn et al., 2013). The researchers assessed the five different constructs that contributed to teachers' self-efficacy for implementing DIDM using a 22-item, 5-point Likert scale with answers, ranging from 1 = *strongly disagree* to 5 = *strongly agree*. Findings suggested the inventory for Data- 'Driven' Decision Making Efficacy and Anxiety(3D-MEA) could be used to assess teacher efficacy and anxiety for using data-informed practices. Additionally, the research results suggested that the majority of teachers entered into the process of DIDM with low efficacy scores, underprepared to apply DIDM, and anxious about the process (Dunn, et al. 2013).

Ross and Bruce (2007) conducted a study to examine the effects of professional development (PD) on teachers' self-efficacy beliefs. In their study, the researchers addressed three research questions, all of which sought to measure the effect of a PD

series on teachers' reported self-efficacy. Ross and Bruce (2007) worked with sixth-grade mathematics teachers, all from the same district, with random assignment into one of two groups, treatment and control. The treatment group received the PD in the first semester of the school year, whereas the control group did not. The PD was designed to ensure that it explicitly provided opportunities to improve teachers' efficacy through all four experiences posited by Bandura to increase efficacy: mastery experiences, vicarious experiences provided by social models, social persuasion, and affective coaching. Using a Likert scale survey in a pre- and post-PD assessment format as their main source of data, the researchers concluded their professional development positively influenced the teachers' senses of self-efficacy.

Related Literature on PD and DIDM

Although the literature on PD to develop DIDM practices in teachers was limited, three relevant studies were found. In the first study, Staman, Visscher and Luyten (2013) examined how PD influenced teachers' attitudes, knowledge, and skills for the use of DIDM. In their PD model, teachers looked at their students' assessment results, analyzed causes of underperformance, drew up instructional plans for their students, and set measureable and attainable goals. Teachers participated in PD sessions seven times over the course of a school year. Results from the study indicated that "the training activities had a positive effect on school staff's [DIDM]-knowledge and skills" (p. 89). With respect to teachers' attitudes toward DIDM practices, the results of the study indicated participants (n = 171) began the study with positive attitudes, but still reported a positive change in their attitudes. The researchers concluded "indicate therefore that solid professional development activities can fulfil this [DIDM]-prerequisite [correct analysis

of data]" (p. 89). Staman, et al. further contended that it was essential that participants use their students' own data, not a sample dataset.

In a second study, Schifter, Natarajan, Ketelhut, and Kirchgessner (2014) implemented a profession development model with science teachers (n = 12) over the course of two years. The researchers engaged the teachers' students with an activity that yielded usable student assessment data. They provided professional development sessions that engaged the teachers on "ways to view, analyze, synthesize, and make meaning from the data collected through the project" (p. 428). The researchers created a "dashboard" of class and individual student assessment information, which kept all of the data in one easily accessible location. Two distinct professional development sessions were held to support teachers' use of data: technical how-to sessions focused on navigating the technology and sessions designed to assist with the interpretation of student and class data. In the latter sessions, the teachers worked collaboratively in small groups to create lesson plans based on their analyses. The teachers also utilized their peers as on-going support systems. Outcomes from the study indicated there were "two essential components…high quality PD and ongoing support, as demonstrated through this project" (p. 428-429).

Wayman and Jimerson (2012) conducted a third study to understand teachers' need for data-related professional development, with respect to the skills required for data analysis and how teachers should receive learning on data-related topics. The researchers collected qualitative data from K-12 teachers (n = 110) in three districts in Texas. Data were collected through focus groups, interviews, document analysis, and observations (Wayman and Jimerson). Using qualitative data analysis techniques, grounded and axial

coding, the researchers found that, to be effective at using data, teachers needed skills in six areas: "(1) asking the right questions; (2) integrating data use with curriculum, instruction, and assessment; (3) analyzing and interpreting data; (4) linking data to classroom practice; (5) computer [technology] skills; and (6) collaborating around data" (p. 28). Further analysis revealed that relevant professional development for teachers, focusing on the adoption and use of DIDM practices, must be: "(1) contextual; (2) coherent; (3) active; (4) credible; (5) timely; (6) resourced; and (7) followed-up" (p. 30). They researchers also concluded that the quality professional development in this area should also include active learning strategies to engage adults in cognitively difficult work. The researchers recommended four qualities for developers of PD on DIDM practices, (a) that "data-related professional learning be purposefully included within each stage of a cycle of data-informed inquiry" (p. 32), (b) professional learning should be coherent and enable them to build skills and knowledge in a cumulative fashion, (c) include regular opportunities for collaboration, and (d) embed professional learning on data-related topics into all other teacher learning activities.

Previous Cycles of Action Research

I worked in my professional role for five years. Over this time, I saw some schools implement the program with fidelity and others less so. Nevertheless, there appeared to be one constant between the struggling and the successful schools: there were individuals at each who had difficulty utilizing the tenets of DIDM. This outcome was due, in part, to the fact that utilizing data required a lot of different skills, beyond simply looking at and analyzing data. One convincing explanation connected the challenges of implementation to the many different skills necessary in implementing data-informed

practices. For example, researchers suggested, "… for a teacher to successfully use data to change student outcomes, he or she must be technologically, statistically, and pedagogically savvy" (Dunn et al., 2013, p. 222). Thus, a deficiency in any of these areas could have an effect on teachers' abilities to implement DIDM practices and strategies with fidelity.

In previous iterations of action research, I conducted semi-structured interviews with six teachers who were in the Quality Schools Program. One theme that emerged from these interviews was a discomfort with the process of DIDM. Some of the teachers identified their own weaknesses for interpreting the statistics provided by the benchmarking system; others cited a knowledge gap with respect to turning their interpretations into actionable instructional changes; and a final group discussed a deficiency of their own skills for using and navigating the user interface of the data system. In previous cycles of action research, I also administered an adapted version of Dunn et al.'s (2013) questionnaire (n = 27). The changes were not substantive in nature; inserting the name of the particular testing system, for example. I prepared the data and used SPSS to calculate Cronbach's alpha score for each of the aforementioned five constructs on the questionnaire. The reliability analysis revealed that, in general, the items had high alpha scores, and therefore, high reliability, suggesting that the items grouped together on the questionnaire consistently measured the same construct (Cronbach, 1951). Scores ranged from α=.80 to α=.95 on the five different constructs. See Table 1. The SPSS output also included the alpha score for each construct if individual items were deleted. The analysis revealed that any improvement resulting from the removal of a particular item made reliability only marginally better. Further, my

analysis revealed estimates of reliability that were close to those presented by the authors of the instrument. See Table 1. Initial results from the questionnaire suggested teachers who participated in the survey had generally low efficacy for using DIDM.

Table 1: Internal Reliability and Consistency Estimates of the Factors Influencing the Use of Data-Informed Practices from an Initial Cycle of Action Research

Construct	Within Factor items	Coefficient Alpha Estimate of Reliability	Coefficient Alpha Estimate of Reliability in Literature
Anxiety about data-informed instructional practices	Items 16, 17, 18, 19, 20	α=.95	α=.88
Comfort with data identification	Items 1, 2, 3	α=.90	α=.84
Comfort with data interpretation	Items 7, 8, 9	α=.80	α=.81
Comfort with data application	Items 10, 11, 12, 13, 14, 15	α=.81	α=.92
Efficacy with technology	Items 4, 5, 6	α=.86	α=.91

Professional Development Model

Drawing on the previously discussed topics and literature, for this action research project, I investigated three research questions:

1. How and to what extent do blended professional development modules on Data-Informed Decision Making influence K-12 teachers' senses of efficacy for

DIDM-practices?

2. How and to what extent do blended professional development modules on Data-Informed Decision Making influence K-12 teachers' apprehension regarding the use of DIDM-practices?
3. How do blended professional development modules on Data-Informed Decision Making influence teachers' use of student assessment data among K-12 teachers?

To address these three questions, I implemented a professional development innovation with a school in its first year of the Quality Schools Program that blends online and in-person components, designed to improve teachers' self-efficacy for using DIDM. Participants engaged with three modules, two to three weeks in length, meant to improve, sequentially, their abilities to (a) access/identify relevant data, (b) analyze and interpret relevant data, and (c) apply relevant interpretations to their instruction. Throughout the three modules and nine weeks of the innovation, the use of technology for DIDM was infused. Dunn et al. (2013) suggested teachers' apprehension and anxiety around data-informed practices were negatively correlated to the other four (identification, interpretation, application, technology) factors. The three modules with which teachers engaged were also intended to reduce the participants' apprehension and anxiety for using a data-informed approach. It was necessary to reduce teachers' apprehension and anxiety, as previous literature has suggested anxiety "can have a profound impact on their [teachers] ability to function adaptively" (Hartly and Phelps, 2012, p 116).

To be consistent with my employer's approach to PD, I was limited in the design of my PD modules. My organization followed the PD structure outlined by Bambrick-Santoyo (2010), which was called the "live the learning approach" (p. 156). This model was established with four components: activity, reflection, framing, and applying. The modules in my innovation followed this structure. According to Bambrick-Santoyo (2010), activities included things like, case studies, movie clips, role plays, games, simulations, and modeling, screen casts, among others. These activities, must, however, be aligned to the objectives of the module and provide participants a way to meaningfully engage with the content in question. The reflection component of the PD design allowed participants to draw conclusions from the activities. The framing provided participants with the "formal vocabulary of the associated principles … so that participants share one common language" (p. 159). Participants had ample time to apply the information in simulated and real world experiences.

In this chapter, I outlined the main theories and research that guided and influenced my work. From this literature base, I defined DIDM and contrasted it with data-*driven* decision making. I provided information about the continuous improvement cycle of DIDM, as well as its practical applications for classroom teachers. Further, I discussed the relevant literature supporting the need for and value of DIDM in K-12 schools. From this, I discussed the theoretical framework that guided my work, self-efficacy, first proposed by Albert Bandura, and subsequently, and most notably, applied to education by Tschannen-Moran, Woolfolk Hoy, and Hoy (1998). Using self-efficacy as a framework, I reviewed several pieces of literature that connected the ideas of DIDM and self-efficacy, which suggested a five factor model that influenced teachers' efficacy,

with respect to DIDM, teachers' ability to (a) access/identify relevant assessment data,(b) analyze and interpret relevant assessment data, (c) apply relevant interpretations to their instruction, (d) ability to use the technology and interface necessary to interact with the data, and (e) teacher's anxiety or apprehension related to the use of data and statistics (Dunn et al., 2013). Finally, I discussed a PD model that guided the development of the modules for my innovation. In the next chapter, I have outlined the mixed-methods approach I used to develop and execute my innovation.

CHAPTER 3

METHOD

In my role as the lead trainer with my organization, I was responsible for implementing a program of support with a portfolio of schools around the state of Arizona. The initiative, the Quality Schools Program, sought to equip school leaders and teachers with the knowledge and skills necessary to implement data-informed decision making (DIDM). I provided professional development to assist teachers in using students' results from formative and benchmark assessments to make instructional and pedagogical decisions to better prepare students to learn course content and to perform well on the state's measure of student achievement, the AzMERIT and AIMS tests. This program was offered over a three-year period to participating schools. Results from initial rounds of action research showed teachers must have extended exposure to the program and protocol before they began to feel efficacious in their implementation. Even after participation in the whole program, some teachers still expressed apprehension and anxiety around the process of using student- and class-level data to make instructional decisions. Thus, the problem became clear. Despite the fact that schools invested a substantial amount of money to provide this support program to their staff members, some of the teachers still struggled to implement the program with fidelity, in part because they did not believe themselves to be capable of successful use of the practice. From this starting point, I developed the following research questions:

1. How and to what extent do blended professional development modules on Data-Informed Decision Making influence K-12 teachers' senses of efficacy for DIDM-practices?

2. How and to what extent do blended professional development modules on Data-Informed Decision Making influence K-12 teachers' apprehension regarding the use of DIDM-practices?
3. How do blended professional development modules on Data-Informed Decision Making influence teachers' use of student assessment data among K-12 teachers?

Research Design

To investigate these research questions, I utilized a concurrent mixed methods design. Although quantitative and qualitative methodologies were commonly thought to be on opposite ends of the methodological spectrum, when used in tandem, the two provided more information about a topic than either could individually (Plano Clark & Creswell, 2010). Together, the two methodologies provided a deeper, more complex understanding of the data, including the complementarity between the participants' questionnaire and interview results. By using triangulation, the themes consistent in the data were examined more closely.

Setting

The implementation of the Quality Schools Program spanned three school years, yet data obtained through initial rounds of action research have suggested that it was not until teachers had extended exposure to the process before they began to feel efficacious in their use of data to inform instruction. To help teachers gain a sense of self-efficacy earlier in the course of the program, this study occurred at one school in its first year of participation and implementation of the Quality Schools Program and it employed a new method of PD delivery. My portfolio of schools included campuses that are

geographically dispersed, with campuses located in Kingman, Maricopa, Casa Grande, Lake Havasu City, Tucson, Queen Creek, Gilbert, Phoenix, and Mesa. Because I needed to be available to visit the campus frequently during the course of data collection, I invited one first year campus within 60 miles of Phoenix to participate and, therefore utilized a sample of convenience. The campus was a pubic charter school and served students in kindergarten through eighth grade. The school served primarily a low-income population (Free and Reduced Lunch >75%).

The school had a unique weekly schedule. Teachers were required to be on campus five days a week, however students were only present four days per week. This structure meant that teachers had every Friday available for professional development, including completion of the online modules (and artifacts), attendance and participation in in-person sessions, and to engage in other activities associated with the intervention (questionnaires, interviews, etc.). This weekly schedule was uncommon among other partner schools.

Participants

The participants in this study were mathematics, reading, and science teachers working with students in kindergarten through eighth grade from the aforementioned school. At the onset, 35 people were invited to participate in this study, though participation was not mandatory, nor did it affect their standing in the program. Per Arizona statutory teaching requirements, all participants had, at a minimum, a four-year degree. Participants' teaching experience ranged from those currently in their first year of teaching to others with more than 30 years of experience. The participants were both male and female from different racial backgrounds.

Intervention

The literature suggested a five-factor model to explain participants' DIDM efficacy: (a) ability to identify relevant data, (b) ability to interpret relevant data, (c) ability to apply, (d) ability to use technologic tools, and (e) anxiety or apprehension about the process (Dunn, et al., 2013). From this foundation, the following intervention occurred over the course of nine weeks at the school's campus.

The nine weeks were split into three, two- to three-week long mini-interventions, and contained one- to two- online professional development modules and one in-person professional development session. Each three-week mini-intervention period focused on one of the five factors, in order: identifying relevant data during Weeks 1-2, interpreting relevant data during Weeks 4-5, and applying relevant data during Weeks 7-9. Additionally, the fourth factor (technology use) was infused throughout each of the three mini-interventions.

During the first week of each of modules one and two, participants asynchronously engaged in an online webinar that guided them through a task pertaining to topic. Prior to attending the in-person session during the second week, the participants completed an artifact. The artifact was unique in each of the three modules, but included questions that had the participants reflect on their learning. After the first module, identifying relevant data, participants produced a written description of several selected reports available to them using their students' assessment results, as well as written responses to several reflection questions: (1a) What information did you find most useful? (1b) Why? (2a) What information did you find least useful? (2b) Why? (3) What barriers or challenges did you encounter, with respect to this session? and (4) What

insights did you gain from this session? After the second module, interpreting relevant data, participants produced written interpretations of their students' assessment data, as well as responses to the following questions: (1) In your own words, explain what your students' scale score means. (2) What is something you still do not understand about scale scores? (3) List three standards on which your students struggled the most. (3a) Why did you select these standards? (4) List three standards on which your students struggled the least. (4a) Why did you select these standards?

The structure of third module, however, was modified to account for the increased skill demand of the topic, applying relevant student data to make changes in their classroom. This module lasted three weeks and had two online elements, and one in-person session. After the third module, participants produced written descriptions of how they could apply their interpretations to their instruction and pedagogy, as well as written responses to the following reflection questions: (1) What is an intervention group? (2) Considering your students' needs, list the students you could place in an intervention group. (2a) Why did you select these students? How are they grouped? (3) What is one strategy you can use to reteach the content differently? (4) How will you know if your intervention was successful? At the end of each module, participants brought their completed artifact from the prior week to an in-person session, where they received a brief review of the content from the module and had time to review their artifact with the researcher and their colleagues. Figure 2, below, presents a graphic representation of the intervention.

Over the course of the nine weeks, participants received the intervention, which focused on improving the three skill factors related to participants' senses of efficacy for

using DIDM. Technology, however, rather than being a stand-alone module, was infused throughout each of the other modules. The literature contended that the fifth factor, anxiety, was negatively correlated with the four other factors. Thus, it was anticipated that as participants became more comfortable with the other four factors, their anxiety about the DIDM process would decrease. Rather than having a stand-alone module that focuses solely on anxiety and apprehension, many of the underlying factors were addressed in the other modules.

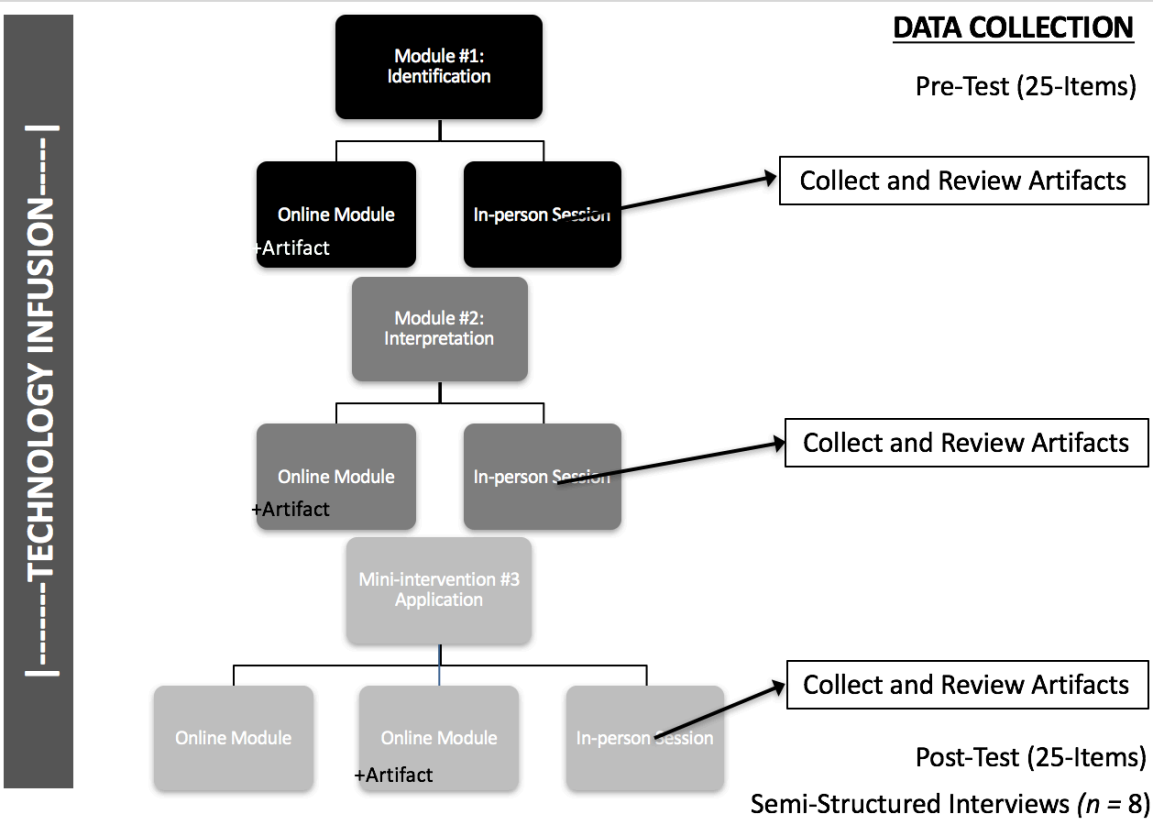

Figure 3. Diagram of the Intervention, Including *n* and Sequence of Data Collection

Instruments and Data Sources

To gauge the effectiveness of this intervention, I collected data at several different times throughout the course of the intervention. Before participants began the intervention, they completed a 25-item, six-point Likert scale pre-intervention

questionnaire, Appendix A, which quantitatively assessed their overall efficacy with DIDM practices. This instrument was piloted in previous cycles of action research and was adapted from Dunn et al. (2013). At the conclusion of the intervention, participants completed the same 25-item, six-point Likert scale post-intervention questionnaire. This allowed for a measurement of any changes in the participants' senses of efficacy for DIDM practices. Because the study was a concurrent mixed-methods study, at the conclusion of the intervention, eight participants were invited to participate in a semi-structured interview, which lasted about 25 minutes, on average. The protocol for the interviews sought to better understand how the intervention influenced teachers' senses of self-efficacy for using DIDM, Appendix B. In this interview, participants were asked to share their thoughts and opinions about using the DIDM practices that were explicitly discussed throughout the intervention. I invited teachers to participate in the interviews based on their level of engagement with the intervention, whether positive or negative; this included factors like completion of artifacts, verbosity during in-person sessions, and a willingness to be interviewed. These factors informed who was invited to participate in a one-on-one, semi-structured interviews.

Collecting Data

Various forms of data were collected to measure the effectiveness of the intervention, including both quantitative and qualitative data. Research questions 1 and 2, required quantitative data, which was collected at the beginning and end of the intervention in the form of a Likert-scale item questionnaire. Research questions 1 and 2, and 3 are mixed-method and, therefore, also required qualitative data. This will be

gathered through semi-structured interviews with participants (n = 8) at the conclusion of the intervention.

Data Analysis Procedures

Quantitative results. Using SPSS statistical analysis software, I investigated and analyzed participants' responses to constructs, including calculating the mean and standard deviation of participants' responses. I also conducted a paired-samples *t*-test to analyze the difference in means to test for changes in scores from pre- to post-intervention assessments.

Qualitative results. Using Strauss and Corbin's (1990) grounded theory approach, I analyzed the teachers' comments in the interview transcripts. I read the transcripts through several times from start to finish. I used open coding to attach initial codes, as I reviewed the transcripts. I subsequently gathered those comments into larger categories called theme-related concepts, and finally into emerging themes. I read through the deconstructed, thematic data and began to make assertions about my research questions, based on the participants' responses. Subsequently, I presented the assertions, themes, theme-related concepts and support these interpretations with quotes from respondents.

Timeline

The timeline provided in Table 2 outlined the sequence of events, as they occurred in the 2016-2017 school year.

Table 2
Timeline and Actions of the Study During 2016-17 School Year

Timeframe	*Actions*
Week of October 17th	Administration of pre-intervention questionnaire to teachers
Week of October 24th	Module #1 online component (identifying data) + Artifact
Week of October 31st	Module #1 concludes with in-person PD session and collection of artifacts
Week of November 7th	Module #2 online component (interpreting data) + Artifact
Week of November 14th	Module #2 concludes with in-person PD session and collection of artifacts
Week of November 28th	Module #3 online component (applying data) begins
Week of December 5rd	Module #3 online component + Artifact
Week of December 12th	Module #3 concludes with in-person PD session and collection of artifacts
Week of December 19th	Administration of post-intervention questionnaire to teachers
Week of January 9th	Administration of semi-structured interviews with eight participants
January	Transcription of semi-structured interviews Cleaning questionnaire Data
January/February	Coding of qualitative data Statistical analysis of quantitative data

CHAPTER 4

DATA ANALYSIS AND RESULTS

This chapter begins with a review of the data collection process and analysis procedures. Subsequently, the results from the study have been presented in the two sections of this chapter. The first section included analyses and results for the quantitative data. The second section contained the results of the qualitative data analysis. In that section, assertions were presented, which were supported by themes, theme-related components, as well as direct quotes from participants.

Data Collection and Analysis Procedures

Quantitative data were collected two times for this study: once before the intervention began and once more at the conclusion of the study. The quantitative data included the responses of 19 participants who completed both the pre- and post-intervention Likert scale questionnaire measuring teachers' self-efficacy, as it pertains to using data to inform their classroom instruction. The questionnaire assessed five constructs of data-informed self-efficacy, including educators' abilities to (a) identify relevant student and class data, (b) interpret relevant student and class data, (c) apply [interpretations] of relevant student and class data to their instruction, (c) use technology to interface with the student and class data, and (e) comfort with data (in general) and statistics. The questionnaire was administered using Google Forms and took participants between 4.5 and 14 minutes to complete.

The quantitative data were analyzed in several different ways. First, the pre- and post-intervention reliabilities of the five constructs were individually computed using Cronbach's alpha analysis. Following this analysis, a multivariate repeated measures

analysis of variance (MANOVA) was conducted for the participants' responses on the pre- and post-intervention questionnaire to better understand any changes in the responses. Then individual, follow-up ANOVAs were performed for each of the dependent variables.

At the conclusion of the intervention, qualitative data were collected through semi-structured interviews with eight participants and their written responses to various prompts over the course of the intervention. The audio of the semi-structured interviews was recorded, transcribed, and sent to participants to ensure transcripts were accurate (Creswell and Miller, 2000). When confirmation was received from those interviewed, the transcripts were entered into HyperRESEARCH and analyzed using Corbin and Strauss' (1998) constant comparative method. Following this methodology, the transcripts were coded using initial open codes, which included key words and phrases evoked when participants responded to questions. The initial codes were grouped into larger theme-related components, which were later gathered into broader themes. Assertions were developed then supported with direct participant quotes.

Results

Quantitative Results

The quantitative results have been presented in two sections. These sections addressed, in turn, reliability statistics and the multivariate, repeated measures analysis of variance (MANOVA) for participants' scores on the five constructs assessed on the pre- and post-intervention questionnaire.

Reliability of the constructs on teachers' self-efficacy for using data. The questionnaire administered to gauge participants' self-efficacy for using data in the

classroom measured five different constructs, including educators' abilities to: (a) identify relevant student and class data, (b) interpret relevant student and class data, (c) apply [interpretations] of relevant student and class data to their instruction, (d) use technology to interface with the student and class data, and (e) comfort with data (in general) and statistics. The items used to assess each of the five constructs on the pre- and post-intervention questionnaire have been presented in Appendix A. Participants responded to the six-point Likert-scale items with one of the following: Strongly Disagree, Disagree, Slightly Disagree, Slightly Agree, Agree, Strongly Agree, which were subsequently translated into numeric values of 1, 2, 3, 4, 5, and 6, respectively. The items were grouped together by the construct it assessed. SPSS was used to compute Cronbach's α for each construct on the pre- and post-intervention subscales to determine the reliability of the construct. The reliability coefficients, in every case, were greater than α = .70. See Table 3. The reliability coefficients all indicated an acceptable level of reliability. In no cases would removing an item from a construct result in a higher Cronbach's α coefficient.

Table 3. Cronbach's reliability coefficient for constructs on pre- and post-intervention questionnaires

	Identify	*Technology*	*Interpret*	*Apply*	*Anxiety*
Pre-intervention	.92	.96	.83	.97	.87
Post-intervention	.91	.94	.78	.74	.80

Repeated measures analysis of variance. Following the reliability analyses, a multivariate, repeated measures analysis of variance (MANOVA) was conducted to determine whether there were differences in the pre- and post-intervention scores for identifying data, using technology with data, interpreting data, applying data for classroom use, and anxiety in using data. The test was significant, multivariate $F(5, 14) = 4.77$, $p < .01$, with a very large within-subjects effect size (Olejnik & Algina, 2000), partial $\eta^2 = .63$. Subsequently, individual follow-up repeated measures ANOVAs were conducted for each of the dependent variables. The effect for identifying data was significant, $F(1, 18) = 25.23$, $p < .001$, with a very large within-subjects effect, $\eta^2 = .58$. Thus, pre- and post-intervention scores differed significantly for identifying data. By comparison, the effect for using technology was not significant, $F(1, 18) = 1.22$, $p < .29$. The effect for interpreting data was significant, $F(1, 18) = 10.58$, $p < .005$, with a very large within-subjects effect, $\eta^2 = .37$, which indicated pre- and post-intervention scores differed significantly. Again, by comparison, the effect for applying data for classroom use was not significant, $F(1, 18) = 2.76$, $p < .12$. Similarly, the effect for anxiety in using data was not significant, $F(1, 18) = 2.72$, $p < .12$. Pre- and post-intervention mean scores and standard deviations are presented in Table 4. See Table 4. Notice the gains for identifying data and interpreting data are over 1 point and approximately 0.75 of a point; whereas gains on the other three constructs were about 0.25 of a point.

Results from Qualitative Data

In this section, the results from the qualitative data have been presented. Table 5 shows the emergent themes, theme-related components, and assertions that were evident

in the qualitative data. Subsequently, each theme is discussed, and direct participant quotes are provided to support the assertion.

Table 4. *Pre- and Post-test Means and Standard Deviations for Five Constructs*

Construct	Pre-Intervention Scores		Post-Intervention Scores	
Identifying Data	4.19	(1.36)*	5.33	(1.07)
Using Technology	3.70	(1.37)	3.94	(1.39)
Interpreting Data	4.37	(0.81)	5.09	(0.91)
Applying Data to Classroom Use	4.18	(1.06)	4.45	(0.87)
Anxiety in Using Data	4.00	(1.04)	4.19	(0.92)

*--Note: Standard deviations are in parentheses.

Table 5. *Themes, Theme-Related Components, and Assertions evident in Qualitative Data*

Theme	Theme-Related Components	Assertions
Context Factors	Teacher Context Factors 1. Teachers had a variety of life and professional experiences that led them to the teaching profession. 2. Teachers' experiences and interests influenced their self-efficacy for using and talking about data. School Context Factors 3. The unique aspects of the school, including the staff, culture, and students' needs and motivation influenced teachers' perceptions on using data in their classrooms.	There are a variety of contextual factors that teachers take into account as they consider their own professional learning about data and its application to their teaching practices.

Innovation	Innovation Application 4. Teachers generally had favorable views of using data, regardless of previous experiences with this process. 5. Teachers saw the value in data-informed decision making.	Despite their previous experiences using student data, teachers viewed DIDM positively and as valuable for them and their students.
Changes in Using Data	Intervention-influenced Changes in Using Data 6. Teachers gained new knowledge about students' data. 7. Teachers expressed confidence in some elements of data-informed decision making. 8. There were several obstacles that teachers faced when using data.	Despite technological challenges, after the innovation, teachers were more able to find and draw conclusions from their data than they were before the intervention.
Evaluating the Intervention	9. Teachers recommended changes to the intervention to improve its effectiveness.	Although teachers generally liked the intervention, they also recommended improvements to make it more effective.

Context factors. *Assertion 1- There are a variety of contextual factors that teachers take into account as they consider their own professional learning about data and its application to their teaching practices.* After the intervention was implemented and completed, eight participants were interviewed. These interviews provided insights as to the various factors that teachers weigh as they consider the value added to their practice by new professional learning, in this case, about data-informed decision making. This assertion was supported by three theme-related components: (a) teachers had a variety of life and professional experiences that led them to the teaching profession; (b)

teachers' experiences and interests influenced their self-efficacy for using and talking about data; and (c) the unique aspects of the school, including the staff, culture, and students' needs and motivation influenced teachers' perceptions on using data in their classrooms.

Teachers' routes and influences into the profession. As people responded to the interview questions, each discussed, at length, their decision to enter the education profession and become teachers. To be faithful to their comments, I have included this theme related component. Of the eight participants who were interviewed, only two went into their undergraduate program intending to become educators; two switched to education majors while in college; the other four all took alternative routes into the profession later in life. Among the two who went to college having already decided on education, they spoke of a formative experience that solidified their intent. Nina, for example, described the value of a class she took in high school, saying,

> I took this class, it was like a child-study course in high school and in my junior and senior year, every day for like two or three hours, I got to go into an elementary classroom and help the teacher, sometimes with administrative tasks, sometimes helping the students, which was really cool. I think I just fell in love with it [education] then.

Another participant, Mae, said that she knew from the beginning she wanted to become a teacher and followed the traditional route, "four years to receive BA in education, a semester of student teaching and state tests of professional development and elementary education to get my Arizona certification."

Of those who switched their major to education, some experience or incident precipitated the change. Billie, who initially began studying nursing, succinctly described finding out that nursing was not the right profession for her,

> Well, I was in California and my original major was nursing at Santa Anna College. I was always good at math, but when I hit human anatomy class and they told me we had to dissect a dead cat and a human body later in the year I said, 'nope' this is not what I want to do!

Lauryn, on the other hand, chose to switch into education because of external financial pressures,

> I thought about going into educational psychology after college…then, it dawned on me, in order to be a psychologist, I would have to attend a lot more school, which meant more time and more money. At the time, I didn't have the resources I needed to do that, so I ended up majoring in education.

Among the teachers who took non-traditional routes into the profession, a variety of non-education industries were represented, including, warehouse management, aesthetician, park manager, test scorer, urban planning and development, and nurse's aide. All eight participants, however, were encouraged to go into the profession by friends, family, or colleagues. Tracy confirmed this when she said, "my friend said to me, 'you're a smart person, why don't you look into teaching?' I thought about it and… I like kids so… I went back and got my master's in education." Another teacher, Ella**,** corroborated this idea, when she said,

> At the time, I was working at Pearson, scoring tests. My coworker's spouse was a principal at a local school. One day at work he said, 'Why don't you try education? You'd be a great teacher! You should go apply at my wife's school. She's desperately looking for teachers. Even though you're not certified, you can get an emergency certification.' So, I thought I'd try it out, and I did.

Teachers' experiences influenced perceptions of data. Of the teachers I interviewed, they belonged to one of two groups: (a) those who had previous experience using data or (b) those who did not have prior experience using data. Among those teachers I interviewed in group (a), they all entered into the innovation with primarily negative, preconceived ideas and beliefs about data-informed decision making. The teachers in group (b) belonged to one of two subsets: those new to the profession and those with prior teaching experience with other schools that did not use data. Teachers in group (b), as one might expect, did not have the same preconceived notions about using data in their classroom as their counterparts in the other group. In fact, given that they had little or no previous experience in using student data, they had very little to say about it, with only one teacher making the comparison between her time at a previous school and her current school.

Ella, who used data at a previous campus, expressed her prior frustrations with data. More than anyone else, she had a self-identified negative, initial perception of using data. She articulated,

> I've always been data-driven to a degree, but I think I kind of got turned off to it [data]. At my previous school, because all they did was inundate

> us with data … Data, data, data, data, data, data, data, data, data, data! Data was everything! They beat us over the head with it ... I said to myself I don't want to be data-oriented anymore! It sucks! It's time-consuming! And it doesn't do any good.

Another teacher also shared his previous and ineffectual experiences using data. Louis stated,

> When I was a fledgling teacher in Illinois, they presented data also, but it seemed a little confusing at the time. I got what data was expecting [*sic*] to do for us, [extended pause] but, you know, it just seemed unwieldy for me … It didn't seem like it was easily accessible or easily understood.

He later went on to say, "…it was confusing to me before when data has been presented to me at other schools, where I wasn't getting it and I wasn't sure what was going on or why we were doing it."

During my interview with Tracy, she expressed skepticism of the validity of standardized assessments. She talked about her experience with data and assessment at another school, when I noticed an interesting vocal inflection, which I subsequently asked her about.

> [Tracy]: I will tell you, the last school I worked at had Galileo [an assessment tool] and they beat a dead horse. We went in for data analysis all of the time, and there was a room … *The data room* … and everything was pink and yellow and green and that's it. Then we divided kids up into single questions on the test, and we had five second grade classrooms and each teacher would do a reteach of that specific standard, and so we had

different kids every single day … it was just, *ugh*, a horrible mess! It was overkill!

[Andrew]: I noticed that when you said, 'data room' your voice changed… how did you think about and perceive the data room?

[Tracy]: It was just a really frustrating place. We would spend all this time looking at data, but we'd never address whether the assessment actually worked … if a kid just guesses on the test … they're going to get a 25%. There was no evidence as to whether or not they actually got it or if they were guessing … at least among the lower students … I think the validity of the test for lower students is nonexistent. How do I know they actually got it or if they're just guessing?

Other teachers, who were new to using the data-informed model, did not share the same preconceived ideas about data use. Diana, who previously worked at a private school, stated, "I came from 12 years of no data. Ever. So, this year has been a learning experience for me!" Another teacher, Nina, had not even heard of the widely-used assessment tool, Galileo. She said, "It's interesting because I had never heard of Galileo before … I had only worked with AimsWeb, which ... is like … I don't know … it's whatever. It doesn't really give much information."

Campus-specific factors influenced perception of data. Teachers shared that factors unique to their school, whether class setup and design or students' abilities and/or motivations, influenced the extent to which they used data. One other notable aspect of this school was that their classes were intentionally ability-leveled and grouped; thus, in grades with multiple classes or sections, the classes were designated as, some

combination of, “high,” “medium,” and “low.” This setup lent itself to different uses of data. Ella, for example, who taught middle school, implicitly made the point that having a “low” class encouraged the use of data. She stated,

> My strategic math class is designed to go back through the math standards the students aren’t getting … ones that they should get by this point in the year. It’s either something they’ve learned previously this year, or they should know from the year before. As we discover those points by looking at the data, we discover those points that not just some students don’t get, but that a lot of students don’t get.

Nina shared that her daily schedule made it difficult to incorporate re-teaching of previous standards into her routine. She said,

> My biggest thing is trying to find that extra little bit of time to squeeze it [re-teaching] in … Our schedule is very weird, we have, science, then Spanish or art … So, there’s two electives back to back, so there is only a 20-minute block between PE and lunch and we usually do our math re-teach there. We try to squeeze it into those 20 minutes whenever we can.

Other teachers, including Diana, echoed that sentiment. She said, “I want more time in the day. Like, I would really like more time [allotted] to be able to dig deeper into and use the data.”

Another factor unique to the school was their weekly schedule. Students were required to be on campus only four days per week, with an optional tutoring class on Fridays. Some teachers saw this as a benefit, because it provided them more time to plan, look at data, learn new techniques; whereas others saw it as limiting their ability to teach

their students the vast amount of content they needed to cover. Diana, for example, said "…but I only have four days a week with my students to do it [re-teach]." Louis, however, commented that he liked the Friday tutoring model, because it helped to keep parents apprised on their students' performance as he noted when he said,

> For example, if the students have a significant decrease in their performance, we invite them to attend Friday school; it's not mandatory, it's up to their parents, but usually when we can show the parents the data, they're very willing to send their kids for extra help.

The teacher, Tracy, who mentioned the dissonance she experienced using data, spoke of another factor unique to the school, students' abilities, as a hindrance to using and seeing positive results from data. She commented,

> The kids who really need to be paying attention to these [re-teaches] are the ones least likely to be engaged with them … the ones who are most proficient are the ones that are the most engaged … so it's difficult to try to get the kids who are struggling with the standard to feel successful … and those are the kids that we're trying the hardest to reach.

Other teachers commented on student abilities, in some cases sharing specific standards on which their students' performance was weak (or strong), when they discussed data. Several other teachers mentioned other student-specific factors, like motivation, as they talked about data. Lauryn, when talking about a higher performing student said the strategies she used in response to the data "pertain more so to building up his work ethic, to stick with it, regardless of whether or not he's thrilled about it. It's more of a life skill that I'm trying to teach him." A second-grade teacher, Mae, even

mentioned the role of data in helping her students set goals, "the data has also helped scholars gain a greater understanding of their own personal goals and hold themselves more accountable!"

Taken together, teacher experiences and background, their route into the profession, and unique school and student factors all played a formative role in shaping how teachers thought about and perceived using data to inform their work in their classrooms.

Innovation. *Assertion 2 – Despite their previous experiences using student data, teachers viewed DIDM positively and as valuable for them and their students.* Comments that teachers made during their interviews created a second theme: innovation. These were statements that pertained specifically to the work that we had done together about using data over the course of the intervention. This assertion is supported by two theme-related components: (a) following the intervention, teachers generally had a favorable view of using data, regardless of previous experiences with the process and (b) teachers saw the value of data-informed decision making.

Teachers viewed using data favorably. Over the course of my interviews with teachers, all who had used data previously shared that they had negative experiences, which were outlined in the theme, context factors, above. Nevertheless, regardless of any preconceived notions of using data, every teacher interviewed, whether through comparisons to the past or through first impressions based on their experiences with the innovation, spoke of using data in a favorable manner.

When discussing data, seven of the eight teachers frequently used words with positive connotations, or that conveyed a sense of efficiency and enhanced instruction. In

the quotes that follow, I have *italicized* the words I associate with having positive view of data. Ella, for example, explicitly said, "Especially for teaching strategic math I find it [data] *incredibly helpful*." She later added, "I can say with *more confidence*, I know [students] get it." Mae commented, "the data is [*sic*] there to *help* me." Nina shared, "I can *pinpoint exactly* what they [students] need!" Diana noted, "It's crucial. Critical. [Data] drives my instruction, definitely. It really is *affirmation* for me." Billie keyed in on data making her more efficient, "I can *quickly* and *easily* tell who is still struggling with the [standard]." Louis revealed that data gives him a way to, "*attack* things that students don't know." The word attack, as it is used here, communicates a sort of strength and aggressive ability to overcome an obstacle. Lauryn stated, "Me, my students, and their parents *are all on the same page* and *we all know* what we need to focus on, which *really helps* when we want to make a plan." Tracy was the only exception of all the teachers interviewed. She made it very clear that she was not fond of using data, as I outlined in the previous theme. The closest she came to saying something positive about using student data was when she observed the two following thoughts, "[Data] has allowed me to see… I've got a few kids in the child study process, and it has helped me decide where to go with those kids," and "I think [data] *would be great*, in theory, to use for the intervention piece of teaching." She, however, stopped short of offering anything that could be construed as a positive endorsement of data. In both statements, she added a qualifier, "in theory," or a limiter, "a few kids," to constrain her comments.

Data have value for teachers and students. The second theme-related component associated with assertion number two was the idea that teachers viewed data as valuable for themselves and for the outcomes of their students. I struggled to code the quotes

included in this theme-related component immediately preceding this one, as they, in some cases, convey a sense of value. However, I defined 'value' here as anything that conveys a sense of importance.

Ella commented, "Using data to support the students who come above grade level is one area that a lot of teachers seem to be missing … they see the deficiencies, but not those who are excelling." By specifically calling to attention a skill or practice that teachers are missing, Ella is suggesting that they should have it, which means it has a certain degree of importance. Nina suggested that she wanted her leadership to hold her and her colleagues accountable for using data more regularly. She said,

> It would help if we were held more accountable to this … for example, this is due here, that due there. Everyone would hate me if they knew I said this, but like, I could start doing it for myself, but if we had to make a test every week to assess what we've done … but to be held accountable, to be asked to see your results each week, to ensure we're making progress would be great.

Another teacher, Diana, added, that the data were undeniable, saying,

> It's become more concrete and more undeniable. I'm able to see where the students are needing more help. I realize it's only one aspect or dimension of their learning, of the whole picture of their education, but it is undeniable. That's truly what it is. And it drives what I'm going to do next. And next. And next. Obviously, we have an area where we have to go, in that I have to continue with my curriculum map, but there are other things I need help with and I'm not able to identify those unless I have the

> data to support me. So here is why they're not getting where they need to go … So let's go back and get a few more things to help build them up where they need to be. It's kind of like we need to take a step back in order to take a step forward.

Even Tracy, the teacher who was the most reluctant about using data, said, "It's not that I think [data] isn't important… I get why it's valuable I really do." Her statement, when simplified, would imply that she does, in fact, see data as something that could be helpful in her classroom.

In sum, the teachers interviewed described the innovation in positive terms and articulated the value of data to their practice. Despite teachers' previous uses of data, most of which were negative and ineffective, they shared that their participation had given them a new perspective and filled in gaps in their understanding and knowledge of DIDM practices.

Changes in using data. *Assertion 3 – Despite technological challenges, after the innovation, teachers were more able to find and draw conclusions from their data than they were before the intervention.* This assertion was made based on comments that fell into three theme-related components: (a) teachers gained new knowledge about student data; (b) teachers expressed confidence in some elements of data-informed decision making; and (c) there were several obstacles that teachers faced when using data.

New learning about student data. Teachers gained new knowledge, familiarity, and/or awareness about student data. Those with previous experience using data often shared their new learning through comparisons to other experiences. Take, for example,

Ella, who shared the following contrast between her previous interactions with data, and her sentiments after the intervention,

> At my other school I happened to use it [data] a lot because I taught [English language arts], and I had to give 10 formative assessments a semester. It was dreadful. I had to sit there and do all the curriculum planning and choose all of the questions. I literally wrote every formative assessment. I went to district office and sat with the curriculum director. But I don't think I actually learned how to use it [data] as a teacher until you came in and explained it.

When pressed on what made the difference between her current situation and her previous negative experience, she shared,

> The academic coaches didn't go through and explain it to us. They gave us all these millions of reports and said 'here, use them.' They didn't tell us what the reports really meant or *how* to use them, just that we *had* to use them… I really liked the delivery and presentation [of the innovation]. I liked that I could pause [the online module] and take my own time to explore it in as much depth as I wanted to, before continuing on to the next section.

She also claimed, "…And that's what I've learned here [from the innovation]… I've learned to delve into that information from the reports."

Louis, like Ella, framed his new learning through the lens of previous experiences when he offered,

> What I've noticed in your seminars and modules is that I understand the pedagogy of why the data work, why the data is [*sic*] working, and how the information coming out of the analysis is helpful to us teachers because of its pinpoint targeting … It was confusing to me before when data had been presented to me at other schools, where I wasn't getting it and it wasn't sure what was going on or why it was happening … now, I really get why we use it and how it benefits our scholars.

Mae, on the other hand, added the following broad, but encouraging statement, "I have learned not to fear data." Her colleague, Nina, echoed that same sentiment,

> I'm more comfortable with data now … I mean, it's like kind of scary at first, because there are so many different reports and so many different ways you can use it and interpret it, but like, through our trainings and through the modules we've done so far, I know which aspects to focus my time and attention on so I'm not so overwhelmed by the amount of it [data]. The things you've taught us have made it a lot easier and I'm a lot more comfortable with it now.

Confidence in using certain elements of data. Of the five elements that comprised data-informed decision making process in this study, teachers expressed newly found confidence in their abilities to identify and interpret data. Lauryn, for example, suggested that the innovation helped her make sense of, or interpret, numbers she had previously viewed as "arbitrary" when she suggested,

> I like that your sessions took the time to explain them to me, because before, I didn't really know what they meant, they were just random

numbers … a lot of teachers don't look at them, or talk about them because they perceive them as random arbitrary numbers. But they're not! They do mean something!

After the innovation, another teacher, Mae, was better able to interpret her students' data. She said, "I think the thing I've taken away most from working with you is how to glean insights and take-aways from it [the data]!" Ella shared an insight, unique to her students, that she found in her data, she said, "my entire sixth grade struggles with divisibility rules … it's something that they didn't understand. I was able to identify that through my test." She continued, "I've discovered through the data, that there are some students who really need way more help in this area [math] than we give them." However, when Diana looked at her students' data, she arrived at an alternative conclusion, she commented, "When I looked at my data, I noticed that even my high performing students struggled [with inferencing]." Billie also gave an example of how she identified and interpreted her students' data, stating, "…to identify what standards my scholars have not yet mastered. That way, it helps me to see, what I need to re-teach them, and what part of the standards they were struggling with." Lauryn stated that she found value and meaning in a particular report, "I really like looking at the developmental level score. It gives me a better sense of my students than a raw score."

Obstacles when using data. The teachers interviewed articulated several challenges they encountered that made it difficult to use a data-informed model for instruction. Many teachers struggled to efficiently navigate the interface of the assessment tool. Ella, for example, experienced difficulties finding the particular reports she sought as noted when she said,

> Part of it is remembering how to get to each of the things that want to see. It's like, 'okay what were the steps to get to this?' Because, you know, Galileo changes frequently, it seems. And each update moves things around. And, it's not the most user-friendly platform. I'll look for something and it's not there, or, not where it was last time, and that's very frustrating.

She continued, "Another sticking point then is getting something into a printable report that I can share with a scholar or parent." Nina, too, experienced the same challenge, stating, "Sometimes I don't know where to go or I forget where to go to find a test or find a particular report." Tracy also articulated a similar sentiment, saying, "I have a hard time navigating the website and finding the report I want … I can usually figure it out, but the website isn't as user-friendly as I would like."

Mae, on the other hand, veiled her feelings of being overwhelmed by the sheer volume of information with a compliment. She said, "The Galileo site has a lot to offer and little by little we are becoming more and more familiar with it." Diana also voiced her thoughts in a similar fashion, when she said,

> I would really like more time to be able to dig deeper into the [*sic*] so many things that exist within Galileo, but I just don't have the ability to say, 'let me just look into this a bit more,' because it would take up too much time.

However, navigating the interface of the assessment tool was not the only obstacle that teachers articulated during their interviews. A second challenge they expressed pertained to applying their data to their classroom, and making changes to their

instruction as a result of their analyses. Nina, for example, expressed her difficulty finding new ways to teach something a second, third, or fourth time,

> But another, bigger thing is finding new ways to teach it [the content]… like for us, you know that we've been working on measurement so much. I feel like I've tried so many different ways. So, when the data tells me they're still weak in that area, I don't necessarily know any more new ways to teach it. We're still struggling with measurement, and I use it every single day in my morning meeting and little things like that. So, trying to find new [ways of teaching it] is probably the hardest, most challenging thing. It feels like ugh, I've already done that. What else can I do?

Diana, a veteran teacher, also shared her struggle to try and find new ways of conducting content instruction during re-teaching. She said, "I've been doing this a long time, 13 years, and I need more time with you, my co-teachers, and my administration, to help me find appropriate resources for re-teaching my students." In response to the question, 'with what do you still need more help?' Lauryn said, "Finding new ways to teach it [the content]." Tracy added, "Applying it [data] in my classroom and making it fit with the curriculum are the two hardest things to do."

Billie, too, suggested that applying her interpretations of students' data to her classroom was difficult. She shared,

> More on strategies of how to hit the standards of the students and didn't do well on … like I know they're weak in a particular area, but now, 'what do I do with it?' The application part … less looking at the data and more

talking about how to do something with it. What can we do with it? What can we implement in the classroom?

Taken together, the data suggested that participation in the innovation resulted in changes in teachers' use of data. Participants' suggested that they gained new knowledge about DIDM and student data, for example, how to interpret a scale score. Teachers expressed improved confidence in some elements of DIDM, including identifying and interpreting relevant student data. Despite these positive changes, however, there were still obstacles that teachers faced when using data, primarily applying changes to their classroom practice, and navigating the technological data interface.

Evaluating the intervention. *Assertion 4 – Although teachers generally liked the intervention, they also recommended improvements to make it more effective.* By most accounts, the innovation was well received by teachers. However, with an eye toward the future, the teachers I interviewed recommended changes for future uses of the intervention. This assertion has a one-to-one correspondence with the theme-related component, teachers recommended changes to the intervention to improve its effectiveness. Several interview participants, when thinking about the in-person sessions portion of the intervention, would have preferred they be more grade-level specific. Ella**,** a middle school teacher, stated,

> It might be nice to have the middle school specific sessions, because our kids do interact differently with the test than other kids … We do use our data differently. Also, we are able to share a lot more with the kids, because they can understand what they need to do. That is something that

might be helpful, how would you use this as a middle school teacher, versus as an elementary school teacher?

Nina, an K-2 teacher, added, “I think maybe it would be nice if the in-person sessions were more geared toward a specific audience, like if we did one for K-3 and a separate one for [grades] 4-8 because we have different questions.”

Three of the participants, Ella, Nina, and Louis, added that they would like to do data analysis at more frequent intervals. They, respectively, said, “we made this six-week plan, but now that that one is done, we don’t have one to use any more,” “but it would be helpful if we had to do this [data analysis work] on a weekly or biweekly basis” and “Maybe what would be helpful would be to look at four lessons or a week at a time to figure out how to supplement, rather than looking at six weeks at a time.”

A final change that a teacher recommended, which is in the same vein of doing data analysis more frequently, is the longevity of support they received as they attempted to implement data-informed decision making. Ella best articulated this matter when she suggested,

> I think we need to have continued follow-up and support for a couple of years, not just through the end of this year. So that teachers can really embrace it and get it really solidified, so any new teachers who come in, come in to a culture where this is the norm. Because one year of it is fine, but if we have that couple of years of accountability and follow-up and really engrain it into our school, and get better at it each year, and fine-tune it. By the third year, we really will see it as habit and how to think through the process and make it a normal part of our routine. One of the

> problems I've seen with professional development is, "THE LATEST AND GREATEST THING HAS COME OUT" [emphasis hers] and we spend the year learning about it, but then after that year, there's no follow-up, and so you don't use it. You don't. A new teacher comes and they know nothing about it, because it's not a part of the school's culture or practice. We forget it if we don't use it and follow up on it the next year, and the next. And I think that's absolutely key to help teachers hone their skills.

In sum, teachers appreciated the intervention, but they also offered suggestions to improve its use and deployment in the future. Their primary concern was that the in-person sessions did not allow for in-depth discussions and analysis of data application to the specific context of their grade level, as teachers from all grades attended and participated. They suggested holding sessions specifically for different grade-bands, e.g. Kindergarten-2nd, 3rd-5th, and 6th-8th grade. A secondary concern shared by several participants was that data analysis and follow-up sessions should occur on a more regular basis. A final recommended change was to extend the longevity of the intervention, across two, or more, years. They suggested that this ensure that DIDM practices become engrained into the culture of the school.

This section focused on the complementarity between the quantitative and qualitative data collected through this intervention, a statistical analysis of participants' responses to a 6-point Likert scale pre- and posttest questionnaire, and results from semi-structured interviews with eight participants. The next

section will connect the results of this study to previous literature, and include discussions on this study's limitations, implications for practice, implications for future research, as well as personal lessons learned.

CHAPTER 5

DISCUSSION

When I began this action research endeavor, I sought to help teachers improve their self-efficacy and confidence, as it pertains to using student assessment data to inform their classroom instruction. The participant teachers were all in their first year of a three-year program, which focuses on professional development on data-informed decision making. The intervention includes online professional development modules and in-person sessions designed to support teachers in five key areas: (a) their ability to identify relevant student data, (b) their ability to interpret relevant student data, (c) their ability to apply the data and make changes to their classroom instruction, (d) their ability to use the technology necessary to interface with the data, and (e) their comfort with statistics. This study, then, is designed to better understand how, and to what extent, the intervention influences teachers' senses of self-efficacy, their apprehension using data-informed practices, and their actual use of student assessment data. In this section of my dissertation, I will address these research questions as I provide some thoughts on complementarity between the quantitative and qualitative data, an explanation of my findings, limitations, implications for practice, implications for future research, and personal lessons learned.

Complementarity and Integration of Quantitative and Qualitative Data

In mixed-methods research, both quantitative and qualitative data are collected. These two types of research are often viewed as distinct and mutually exclusive. However, Creswell and Plano Clark (2006) have advocated for a strong integration of the two methodologies. They contend, rather, that quantitative and qualitative data can be

used to explore complementarity or, ways in which qualitative data is consistent with qualitative data so that both types of data point to the same conclusions. Moreover, they also advocate that qualitative data can be used to better explain and understand quantitative data, and vice versa. Results from this study suggest that complementarity exists between three facets of teacher efficacy for using data-informed decision making: (a) teachers' abilities to identify relevant student data and (b) their abilities to interpret relevant student data. These two elements also had the highest means on both the pretest and posttest. Further complementarity is found between (c) the quantitative and qualitative data on teachers' abilities to apply, i.e., their abilities to make data-informed changes using relevant data.

Results from post-intervention surveys suggest participants were able to identify relevant student data increases, with a 1.14 difference in means from the pre- to post-intervention assessment. This finding is bolstered by the qualitative data collected through interviews with participants at the conclusion of the intervention. The qualitative data further develop the idea that teachers are more confident in their abilities to identify relevant student data. Teachers explain that, following the intervention, students' data takes on new meanings, becomes more concrete, and less "arbitrary" and abstract. These themes are reflected in the theme, *Changes In Using Data*.

There is also complementarity between the quantitative and qualitative data for participants' abilities to interpret relevant student data. From the pre- to the post-intervention assessment, there is a 0.72 increase in teachers' mean response. Participants corroborate this through their interviews, either through confidently sharing specific

interpretations of their students' data, or through comments suggesting that they can now "glean insights" from looking at the student assessment data.

Complementarity looks a bit different, as it pertains to teachers' abilities to apply relevant data. In this case, there is no significant change in teachers' mean response to the construct assessing their ability to apply relevant data. The observed minimal change to this element is buttressed by participants' comments in their interviews, in which many cited 'applying' the data as one of their chief and on-going obstacles to make data-informed changes to their classroom instruction. Nevertheless, it is clear the two types of data point to the same conclusion—this is an area that requires further improvement.

When viewed together, quantitative and qualitative data are consistent and help to better explain the other. The qualitative comments add a dimension of understanding not afforded just through an analysis of numerical results.

Discussion of Findings

Schools', and therefore, teachers' participation with my organization's program to use assessment data to inform instruction is three years in length. Therefore, this intervention is designed to more quickly facilitate teachers' development of self-efficacy for using DIDM -practices. The research seeks to better understand the relation between participation in the intervention and K-12 teachers' senses of efficacy, apprehension, and use of DIDM practices. As such, the discussion of findings will be presented in three corresponding sections: (a) intervention influence on self-efficacy; (b) intervention influence on apprehension; and (c) intervention influence on use of data. Connections to literature, theoretical frameworks, and perspectives will be included in each section to help explain the outcomes.

Intervention influence on self-efficacy. When schools contract with my organization and sign up for the Quality Schools Program, they commit to three years of on-going professional development, job-embedded implementation coaching, and other support meant to assist in the adoption of DIDM practices. This change can be difficult for teachers who, in many cases have had negative previous experiences using data or who have never used data as we suggest they do. Both cases can lead to low levels of teacher efficacy for using data to inform their classroom practices.

Findings from this mixed-methods research suggest that participation in this intervention significantly and positively influenced two of the five factors that comprise self-efficacy for using DIDM practices, as well as slightly positive, but statistically non-significant, effects on the other three factors. Overall, participants' mean responses are lower when moving from 'identify" to "interpret" to "apply." The quantitative data suggest teachers' abilities to identify, interpret, and apply (make data-informed changes) relevant student data exist in a hierarchical fashion, moving from easier to more complex, respectively. Further, the data suggest that the intervention positively influences the two, relatively, easier and lower level skills— "identify" and "interpret." Considering the design of the intervention, this observation is supported by Bandura's (1977, 1986, 1997) notion that self-efficacy is influenced by, among other things, participating in mastery experiences.

Over the duration of this intervention, participants have numerous opportunities to experience success in identifying and interpreting relevant student data. Whether through the online modules, in which participants could pause the video, or through the in-person sessions in which participants could work to collectively make sense of the information,

opportunities to participate in "mastery" types of experiences occurred during intervention-related activities. However, mastery, as it pertained to "applying," was less clear, as those experiences would have to occur in the participants' classrooms with their students, outside of the structured intervention-related activities. Given that the only way to have a mastery experience applying relevant student data is *in situ*, there are fewer affordances for participants' attempts and successes. This adds a level of complexity for researchers when planning an intervention designed to influence participants' application or use of a skill. Previous research studies that focus on the role of professional development in preparing teachers for DIDM, found similar results. For example, Staman, et al. (2013) found that solid PD can fulfill the requisite skill of interpreting data. However, they, too, concluded, that training teachers to apply data, "proves to be quite complicated" (p. 89).

A fourth element of DIDM efficacy, use of technology to access the data, also proved to be more challenging to influence. Results from the pre- and post-intervention assessment suggest that, of the five elements that comprise DIDM efficacy, participants are the least confident in their ability to use technology. Given that the mean responses were lower on this construct than any other, the data indicate use of technology to access data, more than anything else, is an inhibiting factor, preventing teachers from feeling efficacious for using DIDM practices.

Although the data indicate the innovation significantly influenced two factors that comprise efficacy for DIDM, identifying and interpreting relevant student data, confidence in technology and application remained statistically unchanged. The fifth factor of efficacy for DIDM will be discussed in the next section.

Intervention influence on apprehension. The fifth factor related to efficacy for DIDM is teachers' underlying apprehension or anxiety around statistics and using DIDM practices. Data suggest the innovation has mixed results on this factor. Quantitatively, there is no evidence to suggest that intervention had any effect on teachers' underlying apprehension, as the difference of means was not statistically significant. Nevertheless, the qualitative data suggest the innovation has some positive influence on participants' apprehension levels.

During the interviews, many of the participants spoke of their previous experiences using DIDM practices in negative ways; expressing senses of dread, agitation, exhaustion, and resentment, which are associated with higher levels of apprehension or anxiety (Bandura, 1988). However, when participants discuss DIDM after the innovation, they indicate they better understand and are able to use DIDM. Further, when participants share their current views of DIDM, they suggest they have more positive associations with it than they previously had. One teacher even comments, "I have learned not to fear data." Despite no significant change in participants' quantitative responses, these qualitative results are encouraging as apprehension, even in modest amounts, can limit the extent to which teachers adopt new learning (Dunn et al., 2013).

The minimal observed change in the quantitative data for anxiety could be due to the items on the questionnaire. The questions that assessed the anxiety construct are, in some cases, difficult to address through the intervention. For example, one item on the questionnaire is "I am comfortable with statistics." Although this item may be effective for measuring general comfort with statistics, it is too general to be influenced by the

innovation. Further, the innovation modules focus on identifying and interpreting data, and only use very simplistic statistical measures, for example, the percentage of students who demonstrate mastery on a particular standard, or raw scores. These basic measures are likely too superficial to even instantiate the concept of "statistics" in the minds of participants. Another item on the questionnaire asks participants to rate the extent to which they agree that they are "comfortable interpreting students' state-level standardized assessment results." This particular item, although necessary to gauge a participants' general apprehension with DIDM, fell outside of the scope of the intervention. In the intervention modules, participants examine only their students' results on benchmark and formative assessments; not scores on state-wide assessments.

Despite the mixed results observed in quantitative and qualitative data, this is a necessary construct to include on the questionnaire, given the relation between apprehension and participants' actual implementation of new learning as suggested in the literature (Dunn et al., 2013). The questions could, perhaps, be reworked to better assess anxiety in a way more appropriate to the kinds of information provided in the innovation.

Intervention influence on use of data. The main goal of this school, which was participating in the three-year, Quality Schools Program is to equip teachers and leaders with the knowledge and skills necessary to *effectively use* data to inform their decision making. Results from this innovation strongly indicate that participants are using their students' assessment data in various ways, primarily to identify students' weaknesses on particular academic standards and, ostensibly, provide their students with additional instruction on that standard. This is evident in participants' comments during the interviews.

Every teacher interviewed, without exception, mentions at least one standard on which they are providing some level of remediation. However, only one teacher interviewed discusses using the data to identify and provide enrichment opportunities to students at higher academic levels. This deficit-based use of student data is, in one way, surprising and, in another way, unsurprising. The innovation modules are intentionally designed to provide examples using student data for re-teaching material for standards that show low scores and enriching in areas of student strength. In this way, it is surprising that only one teacher explicitly describes using data for this purpose. On the other hand, considering the pressure that many teachers feel to get good student assessment results, it is not surprising that teachers are primarily using the data to bolster relatively weaker areas.

Two paragraphs above, the words ‘effectively use’ are italicized. The data strongly suggest participants are using their students’ assessment data, however, it is less clear how effective their use has been. One teacher, for example, describes having used so many strategies to re-teach a standard that she exhausts her toolkit of pedagogical techniques. Other teachers speak about their broad use of data, suggesting they are re-teaching “informational text,” a domain of the English Language Arts standards that encompasses 10 individual standards, each requiring numerous other knowledge bases and skills. Using data in this manner lacks the drilled-down, narrow focus that the modules are seeking to impart. Although the participants’ commitment to using data is admirable, it is unclear whether using it in such a way will yield the desired improvement in students’ academic performance.

Limitations

In this study, like all studies, there are external variables or factors that may have had some bearing on the outcomes of the innovation. These are factors that reduce the confidence in results, as they present threats to validity and reliability of the data collected. In this section, three such limitations will be discussed: the experimenter effect, the novelty effect, and participant selection biases.

The first limitation worth noting is the experimenter effect. This threat to validity occurs when participants are motivated to perform differently, in most cases at higher levels, due to the influence of the researcher (Smith & Glass, 1987). Even though the host school is only in its first year of participation with my organization, by the time the intervention began, I had already established rapport and, in many cases, positive relationships with the teachers. These relationships, while essential for recruiting participants, may have had an unintentional effect on the outcomes of the intervention. For example, on one visit to the school, unrelated to the innovation, three participants asked me about the progress of my dissertation, and concluded with an encouraging remark, like "I'm so excited for you," "We're all cheering for you," or "You got this!" If they're "cheering" for me, it might be possible that they would respond to items on a questionnaire or in an interview in a way that they think will be most helpful to me. This limitation is difficult to avoid in action research because the researcher plays such a central role in the study.

A second limitation to this study is the novelty effect. This threat to validity occurs when the treatment is new and is therefore, perhaps, more exciting and engaging and produces a change, simply by virtue of its newness (Slack & Draugalis, 2001). None

of the interviewed teachers report having previously participated in online professional development. Given that online professional learning is still uncommon, at least among interviewed participants, they may have completed modules and artifacts with greater efficacy than if the intervention design were more typical, or if the online component is no longer novel.

A final limitation is selection bias, or the process used to recruit participants. This threat to validity occurs when participants are selected in nonrandom ways, which can skew the data. For this intervention, invitations are extended to all K-8 content teachers, which makes more than 30 teachers eligible for inclusion in this study. However, because participation in the study is not mandatory, teachers opted-in. Teachers who willingly take on more work, responsibilities, and time commitments might be the type of people who are open to and seek out new learning opportunities. Further, they might be more likely than the general teaching population to attempt to use new strategies in their classroom.

Despite these limitations, this action research still has value and meaning, which will be explicated in the following sections: implications for practice, implications for future research, and personal lessons learned.

Implications for Practice

The results and outcomes from this intervention have already, and will continue to, inform and shape my professional work. One of the goals of this intervention is to prepare teachers to look at data, interpret it, and apply it to their classrooms; I would be remiss if I, too, fail to practice the same strategies I seek to impart through this intervention. Through my analysis of the quantitative and qualitative data, I realize

several things: (a) all teachers have different experiences connecting data to their teaching craft and, therefore, they have different entry points, (b) in an increasingly technology-integrated society, interpersonal relationships and communication are still essential, and (c) providing mastery opportunities for applying data will be important. In this section, each of these ideas will be discussed.

When I interviewed eight of the participants, I learned about their previous experiences, if any, linking data and instruction. Some teachers have very negative histories using data, whereas others claim no previous experience with the process. The point, however, is that I had not engaged them to better understand their conceptions about DIDM to better support their individual needs. All teachers, regardless of their knowledge, skills, or dispositions about DIDM, begin our program at the same entry point.

Reflecting on the interview comments, it makes no sense to engage someone like Tracy, who is openly hostile toward DIDM, in same way as Ella, who is very receptive to and appreciative of student data, in the same way as Nina, who is very new to teaching. A participant like Tracy, whose primary issue is with the assessment, may be more receptive to using data-informed decision making to respond to student needs as they arise in the moment. Someone like Ella, likely could efficaciously begin with support applying the data to make instructional changes. New teachers, like Nina, might need to start with support simply identifying relevant student information, as this intervention did.

Herein lies the implication for my practice: there can no "one-size-fits all" approach to prepare teachers for DIDM, or any initiative meant to support teachers of

varying skills, abilities, and experiences. As teachers are asked to differentiate their instruction for students, based on their needs, so too professional development providers should differentiate PD for teachers. The online module component provides a model that could support differentiation of PD content; teachers could assess themselves and identify their starting point, or they could be assigned to a particular entry point at which to begin the new learning. It is likely, however, that the former option would yield better results because it gives teachers some degree of control and agency over their own learning. Regardless of the method employed, we need to do a better job meeting teachers at a level that is reflective of and reflexive to their abilities.

As my organization scales its programs of support for schools, we explore various options to expand our reach and advance our mission. Among these options is providing more distance learning (online) options for teachers. Herein lies a second implication for my practice: interpersonal relationships and communication are essential in sense-making. If teachers have questions, they need someone they trust, someone with whom they have a relationship and established rapport, to whom they can reach out for support. For participants in this study, the '*person'* to whom they turn for support, is actually multiple people: their colleagues and fellow innovation participants. Their interpersonal relationships prove to be valuable during the in-person sessions; when a teacher asks a question, primarily the other teachers help them "troubleshoot," they share strategies and ideas to help the questioner find applications to their practice. If my organization continues to pursue an expanded online presence for professional development, it is important that we ensure structures are in place, and utilized, to facilitate sense-making and troubleshooting of new learning.

As I wrote in the Discussion of Findings section previously, the data suggest that participants significantly improved their comfort and confidence to identify and interpret relevant student data; changing their comfort and confidence to apply relevant student data, however, proves to be more elusive. Previously, I suggested that 'participating in mastery experiences' may be a missing, but necessary element to improve teachers' efficacy for using DIDM.

A third implication for practice is to revisit and revise our program design to ensure that teachers have multiple, and more regular, opportunities to experience mastery applying changes to their instruction, before we expect them to feel efficacious about applying benchmark assessment data to their classrooms. This might mean having teachers use smaller, more manageable pieces of data, in-the-moment checks for understanding for example. This is something the teacher could roleplay with colleagues, observe masterful models and videos, and could attempt in a much lower-stakes environment. Eventually, this would lead to end-of-lesson assessments, exit tickets, that the teacher could use to assess student understanding before she or he decides what to do on the following day.

Implications for Future Research

Results from this study suggest two primary areas for further investigation: the influence of this innovation on participants' knowledge and skills of DIDM practices and longitudinal results on participants' efficacy for applying data to their classrooms. This section will include a discussion of each of these implications for future research.

As I write my results and discussion chapters, I frequently find myself wanting to suggest the intervention has, in some way, influenced participants' knowledge and

abilities to use DIDM. However, I keep having to restrain myself and practice precise language. This study does not measure any changes to participants' knowledge or skills, as they pertained to DIDM. Instead, this study measures the elements of participants' self-efficacy for using DIDM practices, or, their comfort and confidence in their own abilities to use DIDM practices. These two ideas are distinct, and must be kept so. But it is in this exercise in restraint that I find my first implication for future research. In future iterations of this research, I will include a research question to address through what mechanism(s) and to what extent participation in the innovation influences participants' actual knowledge of and ability to correctly use DIDM practices. This would likely include adding a pre- and post-intervention assessment of their content knowledge of DIDM. This future iteration would also likely include a rubric on which participants' abilities to correctly use the DIDM practices could be scored and compared from the beginning of the treatment to the end. I wrote in the Discussion of Findings about my skepticism that teachers are effectively using DIDM; the implication for future research I describe above would help to resolve my skepticism, one way or the other.

At the conclusion of the intervention, I find that teachers' confidence and comfort applying data to their classroom has not changed. However, the intervention is only nine weeks; such a short duration may inhibit improvements in this area. Therefore, a second implication for future research includes the collection and analysis of longitudinal data, over a longer period of participation in the intervention. I want to better understand the relationship between the longevity of teachers' participation in semi-self-paced, hybrid professional development modules focused on DIDM and any resulting influence on their efficacies for applying data to their classrooms. A future iteration of this intervention

might include additional time and resources, including online modules and in-person sessions, designed and dedicated to supporting participants' ability to apply relevant student assessment data to the classroom.

Personal Lessons Learned

The lessons I have learned are a result of two main features of this doctoral program, the course work and this action research project. Yet, despite these two formative endeavors, there is a single unifying theme to which each of my lessons learned can be tied. In this section, I will explore several such lessons through the lens of becoming a scholarly and influential practitioner.

One of my most profound lessons learned is the importance of having a very focused problem to investigate through action research. When I look back on previous cycles of research throughout this doctoral program, the first thing I notice is how broadly my problem statement and, consequently, my research questions were written. For example, in my first cycle, the problem I keyed in on was teacher isolation. From here, I wrote the following purpose statement: "The purpose of my action research is to implement virtual PLCs to increase teacher collaboration and increase teacher pedagogical knowledge among geographically isolated K-12 teachers in Arizona charter schools." I intended to increase teachers' collaboration and pedagogical knowledge, two very vast and complex factors. Through subsequent research, interviews with teachers and school leaders, and discussions with colleagues, I further interrogated other problems of practice and winnowed it down to a narrower problem of practice: teachers' efficacy for using DIDM. There were times in planning and preparing for the intervention, as well as when writing my Results and Discussion sections, that I felt my current focus was still

too broad. It may have been advantageous, both from a research perspective, as well as a logistical management perspective, to focus solely on one element of teacher efficacy, for example, application. This would have allowed me to hone and focus my modules and tailor them to just one of the comprising elements of teacher efficacy for using DIDM. This lesson of focus connects back to the idea of being an influential practitioner. Rather than trying to shallowly influence all five elements of teacher efficacy, an intentional emphasis on just the application may have produced deeper and, perhaps, more meaningful results for teachers' practice.

A second lesson I learned, with far-reaching consequences is the importance of using scholarly literature to inform my work. I began my current professional role when I was quite young. The teachers with whom I worked would frequently make comments like, "I have been teaching longer than you've been alive." Maybe it was intentional, perhaps not, but it always felt like it had the effect of undermining my legitimacy and the work I was asking them to do. Since beginning this doctoral program, however, I have been afforded a new degree of cordiality and respect. I attribute this to several things, chief among them, however, openly sharing about my new learnings, and the literature-based rationale for the information I presented to them. For example, I have found myself connecting situations and experiences to something I have read or discussed, as part of this program. I frequently say to colleagues and teachers, "have you read ____ article? I read it for one of my classes and I think you might find it really helpful as you think about …" My intent behind this is not to remind or inform them that I am pursuing my doctorate, but rather because I truly believe they will find the content as genuinely

interesting and applicable to their work as I did. Facilitating these scholarly literature connections have, undoubtedly, changed others' perceptions of me.

The very same teachers who underhandedly criticized my inexperience, now say with a sincerity and interest, "Andrew! How's your doctorate coming along? I can't imagine how hard you must be working!" or "That must be an amazing experience! I bet you're learning so much!" In a sense, they are right; I have learned a great deal about training and preparing teachers to use DIDM, but so too have the teachers learned, as I apply new learnings and principles to my work with them. Using literature, not just reading it, but truly using it to inform how I work with teachers has added an element of scholarship to my practice that I have come to value.

Conclusion

Schools are, in increasing numbers, turning to DIDM as strategy to improve their students' academic results. To aid their teachers in this process, they use professional development as a strategy to impart the necessary knowledge and skills. However, as technology becomes more advanced, so too do the methods used to assess and measure students' learning and mastery of academic content. These increasingly personalized results require teachers with more discerning and advanced data analysis skills. For tens of thousands of teachers across the country who are not trained in those skills, this shift means that they must learn new skills and feel efficacious in their application of these skills to their practice. If this is to happen, additional training and/or professional development will be necessary to prepare currently practicing teachers to thrive under changing conditions. But the idea of feeling efficacious is frequently overlooked by professional development providers, despite previous research suggesting that teachers'

self-efficacy is associated with a willingness to make attempts at implementation. As such, this study utilizes a novel approach to professional development to aid in the development of teachers' efficacy for using DIDM practices, by providing online learning modules, which are subsequently supported with in-person sessions. Taken together, results from this study indicate that supporting teachers' efficacy for using DIDM is not a straightforward proposition.

Bandura (1977, 1986, 1997) proposes that efficacy is influenced by four main factors: (a) participating in mastery experiences, (b) being exposed to vicarious experiences provided by social models, (c) social persuasion, and (d) changing how one perceives and interprets the situation (affect coaching). Despite three of these factors integration into the design and development of the modules of this innovation, significant changes are only observed on teachers' abilities to identify relevant student data and their abilities to interpret relevant student data. Both qualitative and quantitative data suggest that influencing teachers' efficacy for applying data to their classroom is more challenging, and requires additional time, resources, and strategies beyond the scope of this study.

When I began this action research project, my hope is that engaging teachers electronically in new learning, would remove some of the commonly stated obstacles to adoption and implementation of the PD content. Although teachers generally like engaging with the modules on their own time and at their own speed, the data suggest that the innovation only had an influence on two of the five intended factors comprising efficacy for DIDM practices. Regardless of PD format or structure, and whether online or in person, teachers enter into professional development with a host of previous

experiences that influence their readiness to adopt and employ their new learning. With this in mind, professional development content should be differentiated to allow for multiple entry points based on the needs of the participants.

REFERENCES

AZ Higher Performing Schools Recognition - ABEC - Arizona Business and Education Coalition. (n.d.). Retrieved from http://www.azbec.org/pages/AZHigherPerformingSchoolsRecognition/

Anderson, S. (2003). *The school district role in educational change: A review of the literature*. Ontario: International Centre for Educational Change, Ontario Institute of Studies in Education.

Bambrick-Santoyo, P. (2010). *Driven by data: A practical guide to improve instruction*. San Francisco, CA: Jossey-Bass.

Bambrick-Santoyo, P., & Peiser, B. M. (2012). *Leverage leadership: A practical guide to building exceptional schools*. San Francisco, CA: Jossey-Bass.

Bandura, A. (1977). *Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review*, *84*, 191–215.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1988). Self-efficacy conception of anxiety. *Anxiety Research*, *1*, 77–98.

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist*, *28*(2), 117–148.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York, NY: W. H. Freeman.

Bianco, S. D. (2010). Improving student outcomes: Data-driven instruction and fidelity of implementation in a response to intervention (RTI) model. *Teaching Exceptional Children Plus*, *6*(5), n5.

Bernhardt, V. L. (2009). Data use: Data-driven decision making takes a big-picture view of the needs of teachers and students. *Journal of Staff Development*, *30*(1), 24–27.

Bettesworth, L. R., Alonzo, J., & Duesbery, L. (2008). Swimming in the depths: Educators' ongoing effective use of data to guide decision making. In T. J. Kowalski & T. J. Lasley (Eds.), *Handbook on data-based decision making in education* (pp. 286–303). New York: Routledge.

Bruce, C. D., Esmonde, I., Ross, J., Dookie, L., & Beatty, R. (2010). The effects of sustained classroom-embedded teacher professional learning on teacher efficacy and related student achievement. *Teaching and Teacher Education*, *26*(8), 1598–

1608.

Carlson, D., Borman, G., & Robinson, M. (2011). A multistate district-level cluster randomized trial of the impact of data-driven reform on reading and mathematics achievement. *Educational Evaluation and Policy Analysis*, *33*(3), 378–398.

Chen, A. (2012). *Know the difference between data-informed and versus data-driven*. Retrieved March 2016, from http://andrewchen.co/know-the-difference-between-data-informed-and-versus-data-driven/

Creswell, J. W., & Miller, D. L. (2000). Determining Validity in Qualitative Inquiry. *Theory Into Practice*, *39*(3), 124-130. doi:10.1207/s15430421tip3903_2

Corbin, J. M., & Strauss, A. L. (1998). *Basics of qualitative research: techniques and procedures for developing grounded theory*. Los Angeles, CA: SAGE.

Creswell, J. W. (2008). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Creswell, J. W., & Plano Clark, V. (2017). *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage Publications Inc.

Cronbach, L. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 297-334.

Datnow, A., Park, V., & Wohlstetter, P. (2007). *Achieving with data: How high-performing school systems use data to improve instruction for elementary students*. Center for Educational Governance. 1-84. Retrieved March 16, 2016.

Dunn, K. E., Airola, D. T., Lo, W. J., & Garrison, M. (2013). What teachers think about what they can do with data: Development and validation of the data driven decision-making efficacy and anxiety inventory. *Contemporary Educational Psychology*, *38*(1), 87-98.

Dunn, K. E., Airola, D. T., Lo, W., & Garrison, M. (2013). Becoming Data Driven: The Influence of Teachers' Sense of Efficacy on Concerns Related to Data-Driven Decision Making. *The Journal of Experimental Education*, *81*(2), 222-241. doi:10.1080/00220973.2012.699899

Evans, A. (2009). No Child Left Behind and the quest for educational equality: The role of teachers' collective sense of efficacy. *Leadership and Policy in Schools*, *8*, 64–91.

Earl, L., & Katz, S. (2006). *Leading schools in a data rich world*. Thousand Oaks, CA: Corwin Press.

Gardner, D. P. (1983). *A Nation At Risk: The Imperative For Educational Reform. An Open Letter to the American People*. A Report to the Nation and the Secretary of Education.

Google Analytics (2016). "'*Data Informed Decision Making' Versus 'Data Driven Decision Makin*g.'" Retrieved from google.com/analytics.

Hartley, C. A., & Phelps, E. A. (2012). Anxiety and decision-making. *Biological Psychiatry*, *72*(2), 113-118.

Jandris, T. P. (2001). *Essentials for principals: Data-driven decision making*. Alexandria, VA: National Association of Elementary School Principals.

Jick, T. (1979). Mixing Qualitative and Quantitative Methods: Triangulation in Action. *Administrative Science Quarterly, 24*(4), 602-611. doi:10.2307/2392366

Kanter, B. (2013). *Why Data Informed VS Data Driven*? Retrieved from http://www.Tracykanter.org/data-informed/

Learner, D. K., & Timberlake, L. M. (1995). *Teachers with limited computer knowledge: Variables affecting use and hints to increase use*. Retrieved from ERIC, database (ED384595).

Mandinach, E. B., & Jackson, S. S. (2012). *Transforming teaching and learning through data-driven decision making*. Thousand Oaks, CA: Corwin Press.

Marsh, J. A., Pane, J. F., & Hamilton, L. S. (2006). *Making sense of data-driven decision making in education*. Santa Monica, CA: RAND Corporation.

Maycotte, H. O. (2015). Be data-informed, not data-driven, for now. Retrieved from http://www.forbes.com/sites/homaycotte/2015/01/13/data-informed-not-data-driven-for-now/

Means, B., Chen, E., DeBarger, A., & Padilla, C. (2011). *Teachers' ability to use data to inform instruction*: *Challenges and supports*. Washington, D.C: U.S. Department of Education Office of Planning, Evaluation and Policy Development. <http:// www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CCEQ Fj AA&url=http%3A%2F%2Fwww2.ed.gov%2Frschstat%2Feval%2Fdata-to-inform-instruction%2Freport.doc&ei=fXSFUMXnIMfKqAHQi4CQDw&usg=AFQjCNF ct0 dzWDiTqxJXR5YC5W9AEkO5Og>.

Mertler, C. A. (2009). Teachers' assessment knowledge and their perceptions of the impact of classroom assessment professional development. *Improving Schools*,

12(2), 101-113. doi:10.1177/1365480209105575

Messelt, J. (2004). *Data-driven decision making: A powerful tool for school improvement* [White paper]. <https://www.erdc.k12.mn.us/promo/sage/images/Analytics_WhitePaper.pdf>.

No Child Left Behind Act of 2001 (2002). Pub. L. No. 107-110, § 115, Stat. 1425 (2002).

Olejnik, S., & Algina, J. (2000). Measures of effect size for comparative studies: Applications, interpretations, and limitations. *Contemporary Educational Psychology*, *25*, 241-286.

Plano Clark, V. L., & Creswell, J. W. (2010). *Understanding research: A consumer's guide*. San Francisco, CA: Merrill.

Peterson, J.L. (2007). Learning facts: The brave new world of data-informed instruction. *Education Next*, *1*, 36–42.

Schifter, C. C., Natarajan, U., Ketelhut, D. J., & Kirchgessner, A. (2014). Data-Driven Decision Making: Facilitating Teacher Use of Student Data to Inform Classroom Instruction. *Contemporary Issues in Technology and Teacher Education*, 14(4), 419-432.

Schmoker, M. J. 1996. *Results: The key to continuous school improvement*. Alexandria, Va.: Association for Supervision and Curriculum Development.

Slack, M. K., & Draugalis, J. R. (2001). Establishing the internal and external validity of experimental studies. *American Journal of Health System Pharmacy*, *58*(22), 2173-2184.

Shapley, K. S., Benner, A. D., Pieper, A. M., & Way, P. J. (2003, April). *Integrating technology into teacher education: Navigating the complexity of institutional change*. Paper presented at the annual meeting of the American Educational Research Association, Chicago, Illinois.

Shaughnessy, M. F. (2004). An interview with Anita Woolfolk: The educational psychology of teacher efficacy. *Educational Psychology Review*, *16*(2), 153–176.

Smith, M. L. & Glass, G. V. (1987). Experimental studies. In *Research and Evaluation in Education and the Social Science*s, pp. 124-157, Needham Heights, MA: Allyn and Bacon.

Staman, L., Visscher, A. J., & Luyten, H. (2014). The effects of professional development on the attitudes, knowledge and skills for data-driven decision making. *Studies in Educational Evaluation*, *42*, 79-90.

Straub, E. T. (2009). Understanding technology adoption: Theory and future directions for informal learning. *Review of Educational Research*, *79*(2), 625–649.

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, Calif.: Sage Publications.

Tschannen-Moran, M., & Hoy, A. W. (2001). *Teacher efficacy: Capturing an elusive construct. Teaching and Teacher Education*, *17*, 783–805.

Tschannen-Moran, M., Hoy, A. W., & Hoy, W. K. (1998). Teacher-efficacy: Its meaning and measure. *Review of Educational Research*, *68*, 202–248.

U.S. Department of Education, Office of Planning, Evaluation and Policy Development (2008). Teac*hers' use of student data systems to improve instruction: 2005 to 2007*. Washington, DC: Author.

U.S. Department of Education, Office of Planning, Evaluation and Policy Development (2010). *Teachers' ability to use data to inform instruction: Challenges and supports*. Washington, DC: Author.

Wayman, J. C. (2005). Involving teachers in data-driven decision-making: Using computer data systems to support teacher inquiry and reflection. *Journal of Education for Students Placed At Risk*, *10*(3), 295–308.

Wayman, J. C., & Cho, V. (2008). Preparing educators to effectively use student data systems. In T. J. Kowalski & T. J. Lasley (Eds.), *Handbook on data-based decision-making in education* (pp. 89–104). New York, NY: Routledge.

Wayman, J. C., & Jimerson, J. B. (2014). Teacher needs for data-related professional learning. *Studies in Educational Evaluation*, *42*, 25-34.

APPENDIX A

PRE- AND POSTTEST SURVEY INSTRUMENT QUESTIONNAIRE OF TEACHERS' EFFICACY AND APPREHENSION USING DIDM

ITEM	RESPONSE					
	SA	A	Sl A	Sl D	D	SD
1. I am confident in my ability to access assessment results for my students	6	5	4	3	2	1
2. I am confident that I know what types of data or reports I need to assess group performance	6	5	4	3	2	1
3. I am confident that I know what types of data or reports I need to assess student performance	6	5	4	3	2	1
4. I am confident I can use the tools provided by my school/network/district's data technology system to retrieve charts, tables or graphs for analysis	6	5	4	3	2	1
5. I am confident I can use the tools provided by my school/network/district's data technology system to filter students into different groups for analysis	6	5	4	3	2	1
6. I am confident that I can use my school/network/district's data analysis technology to access standard reports	6	5	4	3	2	1
7. I am confident in my ability to understand assessment reports	6	5	4	3	2	1
8. I am confident in my ability to interpret student performance from a scaled score	6	5	4	3	2	1
9. I am confident in my ability to interpret subtest or strand scores to determine student strengths and weaknesses in a content area	6	5	4	3	2	1
10. I am confident that I can use data to identify students with special learning needs	6	5	4	3	2	1

11. I am confident that I can use data to identify gaps in student understanding of curricular concepts	6	5	4	3	2	1
12. I am confident that I can use assessment data to provide targeted feedback to students about their performance or progress	6	5	4	3	2	1
13. I am confident I can use assessment data to identify gaps in my instructional curriculum	6	5	4	3	2	1
14. I am confident that I can use data to group students with similar learning needs for instruction	6	5	4	3	2	1
15. I am confident in my ability to use data to guide my selection of targeted interventions for gaps in student understanding	6	5	4	3	2	1
16. I am comfortable with statistics	6	5	4	3	2	1
17. I am comfortable interpreting students' state level standardized assessments	6	5	4	3	2	1
18. I am confident that I will feel or look competent when it comes to data driven informed-making	6	5	4	3	2	1
19. I am comfortable using my school/network/district's data retrieval technology [Galileo]	6	5	4	3	2	1
20. I am comfortable connecting data analysis to my instructional practice	6	5	4	3	2	1
21. In what year were you born?	_____					
22. What is your gender?	Male			Female		

23. What is the highest degree that you have successfully completed and attained?	_____
24. How many combined years of teaching experience do you have?	_____
25. What is your ethnicity?	_____

APPENDIX B

PROTOCOL FOR SEMI-STRUCTURED INTERVIEW AND QUESTIONS

Introduction: My name is Andrew Nelson, I am a graduate student at Arizona State University, where I am getting my doctorate in Educational Leadership and Innovation. I am conducting this interview to better understand what teachers think about their own ability to use the process of data-informed decision making to make changes in their classrooms. The questions I will ask will be both professional and personal in nature. You have the option to refuse to answer any questions, or stop the interview at any time. I am meeting with [person name] on [day] at [time]. You've agreed to do this interview with me and you are aware that this interview is being recorded. [Participant Responds]. After the interview, I will type up a transcript and send it to you. You can review, redact, or change anything in the transcript. Are you still willing to participate? [Participant Responds].

Interview Question	Justification - How does it help me answer my Research Questions?
Tell me about your training to become a teacher.	The type of training a teacher had might be insightful; those who, at one time, were student teachers could be more open to the coaching process. It also opens up the conversation with an easy question.
Tell me about your experience with online professional development and/or online learning, in general.	The main component of the intervention is blended professional development. This question will help me better understand the teachers' conceptualization of online PD.
Tell me about your experience with the online/in-person modules we've been working on for the last 2 ½ months.	After understanding how the teacher conceptualizes online learning/PD, this question will help me understand teachers' experience with the online modules of my innovation, in particular.
What, if anything, did you like about them [the PD model]?	In the spirit of action research, this question will help with future cycles of my innovation
What, if anything, did you dislike about them [the PD model]?	In the spirit of action research, this question will help with future cycles of my innovation
What do you see as the role of data in your classroom?	This question will help me assess the extent to which a teacher has internalized the cycle of DIDM and/or the continuous improvement model of DIDM
Tell me about a time you made a change in your classroom and it was successful/unsuccessful.	One of the theories my intervention relies on is self-efficacy; this question will provide insight as to how teachers process successes and/or failures.
Can you provide an example as to how you have used data in your classroom?	This question will provide insight as to teachers' use of data
What changes have you implemented as a result of the support you've received?	This question will help me understand how teachers apply the knowledge/skills gained through the PD they received in their classroom
Have these modules changed your perception about using DIDM? If so, how?	This question will provide insight as to how the PD has influenced teachers' conceptualization of using the DIDM practices.

Is there anything else you would like to add that I haven't covered?	This question will allow the participants the opportunity to share anything they find relevant that my questions have not covered.

APPENDIX C

LETTER OF CONSENT

Dear Possible Participants:

My name is Andrew Nelson and I am a graduate student in the Ed.D. program of the Mary Lou Fulton Teachers College at Arizona State University. I am working under the direction of Dr. Ray Buss, associate professor in the Teachers College at ASU. As part of the program requirements, I am conducting an action research study to examine the factors that influence teachers' use of student data.

I am inviting your participation, which will include responding to a survey about your comfort and confidence accessing, identifying, and using student data. Further, participation in this study will include several learning modules, both online and in-person, geared toward improving teachers' abilities to use this information. I anticipate that the survey will take about 8-11 minutes for you to complete on two occasions, at the beginning and conclusion of the study. You have the right not to answer any question, and to stop your participation in the survey at any time.

Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, there will be no penalty to you or your school. The benefits to participation for you and others are that revisions will be made to the Quality Schools Program. Thus, there is potential to enhance the training that your school and other staff receive. There are no foreseeable risks or discomforts resulting from your participation.

Your responses will be confidential. You will use a unique identifier, one that is easy for you to remember, but one that no one else will know. The unique identifier will be the first three letters of your mother's name and the last four digits of your phone number. For example, Mar0789, would represent the first three letters of Mary and 0789 are the last four digits of your phone number. As a result, your responses will be confidential. This identifier will be used to match your initial set of responses to your later responses. You will not be identified in any way. Results of this study may be used in dissertations, reports, presentations, or publications but your name will not be known. Moreover, results from the survey will be reported in the aggregate only.

Additionally, I will ask eight of you to participate in individual interviews, which will last about 20-30 minutes each. The interviews will be at the conclusion of the project.

By signing below, I agree to participate in the project.

Signature _____ Printed Name _____ Date _____

Thank you,

Andrew Nelson, Doctoral Student
Ray Buss, Associate Professor

If you have any questions concerning the research study, please contact the research team: Andrew Nelson (320) 291-9197 or Dr. Ray Buss (602) 543-6343. If you have any questions about your rights as a participant in this research, or if you feel you have been placed at risk, you can contact Dr. Ray Buss at (602) 543-6343 or the Chair of the Human Subjects Institutional

APPENDIX D

INSTITUTIONAL REVIEW BOARD LETTER OF APPROVAL

ASU Knowledge Enterprise Development

EXEMPTION GRANTED

Ray Buss
Division of Educational Leadership and Innovation - West
602/543-6343
RAY.BUSS@asu.edu

Dear Ray Buss:

On 9/29/2016 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Blended Professional Development: Toward a Data-Informed Model
Investigator:	Ray Buss
IRB ID:	STUDY00004782
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• Interview Questions and Protocol, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Recruitment and Consent Form, Category: Consent Form; • Survey, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • IRB Protocol, Category: IRB Protocol;

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 9/29/2016.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,