Data Analysis Discussions: From Hesitancy to Thirst

by

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ABSTRACT

A core reform area of President Obama's Race to the Top (RTT) framework, the Statewide Longitudinal Data Systems (SLDS) program, offered funding to states for the development of their own data systems. As a result, Arizona received funding to build a longitudinal student data system. However the targeted audience—teachers—needed training to move from a state of 'data rich but information poor' to one of developing actionable knowledge.

In this mixed methods action research study, six teachers from three schools participated in job-embedded data-informed decision making (DIDM) and root cause analysis (RCA) professional development to improve their abilities to employ DIDM and RCA strategies to determine root causes for student achievement gaps. This study was based on the theories of situated learning, specifically the concept of communities of practice (CoP), change theory, and the Concerns-Based Adoption Model (CBAM). Because teachers comprise most of the workforce in a district, it is important to encourage them to shift from working in isolation to effectively implement and sustain changes in practice. To address this concern, an online wiki provided an avenue for participants to interact, reflect, and share experiences across schools as they engaged in the application of new learning.

The results from this ten-week study indicated an increase in participant readiness levels to: (a) use and manage data sources, (b) apply strategies, and (c) collaborate with others to solve problems of practice. Results also showed that participants engaged in collaborative conversation using the online wiki when they wanted to share concerns or gain further information to make decisions. The online collaboration results indicated

higher levels of online discussion occurred when participants were attempting to solve a problem of practice during the learning process.

Overall, participants (a) used collaborative strategies to seek, create, and/or utilize multiple sources of data, not just student learning data, (b) worked through implementation challenges when making changes in practice, and (c) sought further types of data collection to inform their decisions about root causes. Implications from this study warrant further investigation into the use of an online CoP as an avenue for increasing teacher collaboration across schools.

DEDICATION

There aren't enough words to express the gratitude I have for my entire family. Each one influenced me in some way that led me to who I am today. I am a conglomerate of their love, encouragement, and support throughout my lifetime. Success with this utmost difficult journey would not have been possible without each and every one of them.

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I would like to thank Dr. Ann Ewbank for helping me realize that I could pursue my passion for finding root causes to student achievement gaps through action research. She was the spark that ignited this three-year journey into data analysis discussions with teachers during one of my initial doctoral courses. Her willingness to share her personal experiences through this difficult journey, along with her belief in me that I could accomplish it too, inspired me to keep moving forward.

As I moved further along in my doctoral coursework, I had the privilege of working with Dr. Ray Buss. His expertise with data analysis and action research helped me understand how to narrow my focus so I could fully understand the implications involved in sustaining a change initiative in my local context. His guidance in helping me share my ideas more succinctly as well as his kindness in providing support after class and during office hours to keep me on the right track is truly appreciated.

During the final semesters of my doctoral dissertation work, I began working with Dr. Scott Marley as my committee chair. He helped me learn more about strengths and limitations with action research and the value of purposeful data collection. I was like a "kid in a candy store" when it came to data collection instruments and he helped me realize that my participants would experience fatigue if I selected too many instruments for my study. I truly appreciated his feedback and advice as he guided me through the final stages of writing this dissertation.

There are many people in my local workplace who willingly gave up time to support my doctoral journey. Especially the teachers who participated in all of my action research cycles over the last three years. Thank you for giving up your precious time to

help me learn the best way to meet your needs as you strive to close student achievement gaps. I am so grateful for all of the skills and knowledge that I have gleaned from this three-year journey and am ready to conduct more action research in my local workplace to continue to improve current practices.

Last, but definitely not least, I want to acknowledge my classmates and LSC members. Without the diversity of knowledge and support shared in our classes, formal and informal meetings, and our Facebook CoP, this journey would have been much more difficult. I appreciate each and every one of you and am so proud to be a member of this group of highly intelligent and caring people…GR8 Expectations ROCKS!

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Things get done only if the data we gather can inform and inspire those in a position to make [a] difference.
~ Mike Schmoker

Introduction

Since 1965, the federal government has gradually increased its involvement in holding states accountable for addressing educational inequalities and closing student achievement gaps. When the No Child Left Behind Act of 2001 (NCLB) increased emphasis on standardized testing, by mandating that all students reach proficiency by 2014, states and public school districts realized a different urgency—the need to gather and analyze more frequent indicators to increase student proficiency outcomes on state assessments (Arizona Department of Education, 2015; Bernhardt, 2004; U.S. Department of Education, 2011). In 2009, the inception of President Obama's Race to the Top (RTT) framework intensified this impetus for utilizing data to drive school improvement (U.S. Department of Education, 2011). A core reform area of RTT, the Statewide Longitudinal Data Systems (SLDS) program, offered funding to participating states for the development of longitudinal student data systems. The targeted audience, teachers in participating states, needed training to proficiently analyze detailed assessment results to enable individualized instructional planning for students (Baker, 2002; Bernhardt, 2004; Levine & Marcus, 2007; Love, 2009; Mandinach, 2012).

In response to RTT, the Arizona Legislature enacted A.R.S. §15-249 in 2010 to develop the Arizona Education Learning and Accountability System (AELAS: Arizona Department of Education, 2015). The development of Arizona's interactive dashboard (AZDash), a component of AELAS, would save Arizona schools time and money through the provision of online access to longitudinal student data for planning and

individual student intervention. However, the missing link remained. Arizona teachers needed training to move from the state of 'data rich but information poor' to one of developing actionable knowledge to improve instruction (Bernhardt, 2004; Love, 2009; Mandinach, 2012). "Teachers are often handed reams of data or a computer program that slices and dices data every which way and are directed to use those data to improve instruction—but little happens" (Love, 2009, p. 60). According to Love, educators needed to learn how to construct meaning, make sense, and engage in meaningful dialogue about the data to increase their abilities to use it to improve instruction.

Arizona also adopted more rigorous College and Career Ready Standards (AZCCRS) in 2010 that obligated teachers to prepare their students to reach higher proficiency levels. These AZCCRS benchmarks required all Arizona students to show readiness for college or a career of their choice by demonstrating depth of content knowledge and problem-solving abilities on open-ended problems (Arizona Department of Education, 2015). The state of Arizona ranked school and student performance based upon data from these state assessments, however, these assessments did not explain why a student failed to perform. To meet these higher level data demands, teachers needed a comprehensive data-informed decision making (DIDM) and root cause analysis (RCA) process to aid in the identification of root causes for student achievement gaps and the selection of appropriate interventions (Bernhardt, 2004; Levine & Marcus, 2007; Love, 2009; Mandinach, 2012). In the fall of 2015, I implemented the RCA Challenge at the classroom level to address this problem. This innovation provided teachers with 10 weeks of job-embedded DIDM and RCA face-to-face professional development segments once

per week coupled with daily access to an online wiki for interacting with others to share experiences as they applied their learning.

Local Context

My mixed methods action research study took place in the Tumbleweed School District (TSD); a large urban school district in Arizona serving Phoenix, Glendale, Peoria, Anthem, New River, Cave Creek, and unincorporated areas of Maricopa County. Over 35,000 students attended TSD's sixteen K-6 elementary, thirteen K-8, three middle, and five high schools. Thirteen schools received Title I funding: nine K-6 elementary, one K-8, two middle, and one high school. Fourteen preschool sites and five Head Start sites offered early childhood education. The student population consisted of the following ethnic groups: 79% Caucasian, 14% Hispanic, 1% American Indian, 3% African American, and 3% Asian/Pacific Islander.

In 2006, TSD started addressing data analysis needs to meet the federal and state mandates for accountability. They hired outside vendors to deliver DIDM and RCA training to each school's Campus Improvement Team (CIT). To operationalize these efforts, the district defined DIDM in the educational setting as using data analysis to inform decision makers about possibilities for closing student achievement gaps (Picciano, 2006). To gauge student achievement progress throughout the school year, the district solicited teams of teachers to create quarterly benchmark assessments aligned to the Arizona standards in reading and mathematics. All teachers received explicit instruction for maintaining adherence to the adopted reading and mathematics textbooks and the administration guidelines for the quarterly benchmark assessments. TSD expected each school CIT team to implement the DIDM and RCA training and all

teachers to adhere to expectations for the benchmark assessments, selected research-based intervention strategy, and adopted textbooks to improve student achievement results.

The expectations for each school CIT included choosing an area of focus in reading or mathematics based upon the Arizona state assessment results, identifying causes for gaps in student achievement, and selecting a research-based strategy to target the identified gap. The RCA process entailed using DIDM strategies to find the basic cause or origin of problems associated with school-wide student gaps in learning on state assessments. Schools used the quarterly benchmark assessments to track student achievement progress and determine the effectiveness of their selected strategy. The goal was student success, however, the results showed otherwise. District-aggregated state assessment results from 2007 through 2014 showed a 15% decline in the number of students scoring greater than 75% in reading and a 21% decline in the number of students scoring greater than 75% in mathematics. These trends indicated schools struggled to identify and remediate causes for student achievement gaps.

Three criteria needed to be monitored to ensure the original professional development received in 2006 had an influence on student performance: (a) integrity—personal values of the teachers and their effect on learning; (b) efficacy—personal pursuits of effective practices; and (c) diligence—application of the learning (Reeves, 2000). The district did not have a systematic process in place to monitor and sustain the learning from the original training. This was also evident when schools requested assistance with DIDM and RCA during the 2012-2013 school year. To determine whether the original DIDM and RCA training reached the classroom level, I randomly

surveyed eight teachers in the district. Seven of the teachers reported they did not receive training, did not have a comprehensive data analysis process in place to determine root causes at their school, and did not systematically implement and track recommendations as a result of a root cause analysis process. Training at the classroom level did not appear to be a component of the original DIDM and RCA professional development.

The initial version of the RCA Challenge stemmed from the first school CIT's request for DIDM and RCA training in the summer of 2013. I designed this innovation as a six-hour face-to-face training session to help the school leadership team of teachers gather and examine multiple types of data, look for trends, find gaps, and determine root causes for student achievement gaps. This team worked with multiple types of their own school's data to implement data analysis strategies to identify school-wide root causes to student achievement gaps. I noticed hesitancy among the teachers to engage in the data analysis tasks. In addition, they needed extensive one-on-one support.

At the conclusion of that initial training session, I developed a pre- and post-assessment fast-feedback tool called a consensogram for use in future leadership team sessions to determine participants' perceived readiness levels to use multiple types of data and a RCA process. Like a histogram, the consensogram presented an immediate visual to describe the aggregation of individual responses. During the next five cycles of the RCA Challenge, each leadership team participant placed a red circle-shaped sticker on a large publicly displayed consensogram chart to indicate readiness levels to use DIDM and RCA strategies before engaging in the training session. When I analyzed the 69 responses received from all five subsequent training sessions, I noted 75% of the leadership team participants indicated they were not ready to analyze multiple sources of

data to determine root causes. I also noted 10% were ready to analyze at the classroom level, 9% were ready to analyze at the school-wide level, and 6% were ready to lead a session and help others. I invited 28 certified staff members from one of our Title I schools to complete a six-point Likert scale survey to determine teachers' interest in helping others with DIDM practices. The analysis of this survey indicated that 85% of the respondents showed some level of hesitancy to help others with DIDM practices. Taken together, my personal observations and survey data indicated teachers were not ready to employ a comprehensive data study to determine root causes of student achievement gaps and were hesitant to help others with DIDM practices.

Purpose of Study and Research Questions

The purpose of this mixed methods action research study was to explore the influence of the RCA Challenge on teachers' abilities to apply DIDM and RCA strategies to determine root causes of student achievement gaps. I initiated and revised this innovation during three semesters of action research with six different leadership teams in TSD. In the fall of 2015, I implemented the seventh iteration of the RCA Challenge at the classroom level. Six teachers from three different school sites in the district received one weekly training segment during their teacher planning time for 10 weeks. The added component of an online communication tool offered ample opportunities for teachers to collaborate across schools, reflect on their own practices, and improve/sustain their

learning received during the training. In this cycle of action research, I explored answers to the following research questions:

RQ1: How and to what extent did the RCA Challenge influence participants' perceived and demonstrated readiness levels to engage themselves and/or others in a root cause analysis process?

RQ2: How and to what extent did participating in the RCA Challenge influence participants' commitment and follow-through in making the self-reported changes stated in their weekly plus/delta feedback tool?

RQ3: How and to what extent did the participants engage in collaborative conversation using the online communication tool?

Literature Review

The previous section of this dissertation described how the influence of federal and state mandates created an urgency for training teachers to effectively make use of data to inform instruction to close student achievement gaps. This pressure on TSD's teachers to increase student achievement led to the creation of the RCA Challenge, a DIDM and RCA professional development innovation, based upon theory, research, and findings from my previous action research cycles. In this section I provide information about how my innovation and ideas are grounded in theory and research. This cycle of action research was based on the theories of situated learning, specifically the concept of communities of practice (CoP), change theory, and the Concerns-Based Adoption Model (CBAM). Supporting research studies supplied information to identify and apply best practices for professional development, develop a collaborative RCA tool, and build an online CoP.

Theory

Five practical considerations used with respect to professional development training and the application of new learning encompassed: (a) shifting teachers from working in isolation to engaging in dialogue with others; (b) building working relationships; (c) sharing ideas, concerns, and classroom practices throughout a learning experience to solve problems of practice; (d) sustaining the learning from professional development training sessions; and (e) attending to teachers' individualized needs as they implemented new learning. CoP offered a framework for teachers to dialogue, build working relationships, and learn from each other as they interacted, reflected, and shared experiences to solve problems of practice. The CBAM supplied the knowledge and skills needed to monitor and select appropriate interventions for teachers' personal concerns and levels of use when initiating and sustaining new learning. The following two sections review findings from the theoretical frameworks that informed this innovation.

Communities of Practice. Wenger (1999a) and Booth and Kellogg (2015) reported that CoP are popular avenues among educators for enhancing professional development and providing ongoing support. In this context, CoP were defined as "groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" (Wenger, McDermott, & Snyder, 2002, p. 4). A combination of three distinct characteristics distinguish CoP from other types of communities—domain, community, and practice (Wenger, 2011). The domain signifies the identity of the group defined by their shared interests. A group of practitioners, identified as the community, build relationships around their mutual interests as they learn, innovate, and solve problems of

practice. Participants in CoP meet regularly over an extended period of time and develop shared resources through their creativity and desire to improve their shared practice. This collective passion and commitment for learning and improvement of practice makes CoP a desirable avenue for introducing, improving, and sustaining learning (Booth & Kellogg, 2015; Wenger, 1999a).

Passion, commitment, and identification promote membership longevity in CoP. As CoP evolve over time, older members leave and new members join the group (Lave & Wenger, 1991). Lave and Wenger (1991) identified new members of existing CoP as peripheral participants. As new members increase their level of participation and contribution to the group, they gradually become full participants. Lave and Wenger also suggested the theory of situated learning presents a framework for peripheral participants to cross boundaries between CoP to mutually reach a common purpose. For example, if a trainer from outside the community presents the same professional development to several different school communities, he or she could cross the boundaries of established CoP. The trainer could then mutually involve multiple CoP in the development of an online collaborative where they could share learning and solve problems of practice across time and space. In this scenario, the trainer could originally be viewed as an expert or master in online CoP, while participants take on the roles of apprentices (Lave & Wenger, 1991). However, if the trainer is a district coach from within the community and takes on the role of a learner in the improvement of practice within the online CoP, then the trainer could eventually become accepted as a member through increased participation and contribution to the group.

Because teachers make up the biggest portion of the workforce in a district, it is important to encourage them to move away from working in isolation in their classrooms. They need regular opportunities to dialogue to substantially influence instruction and reflective processes (Booth & Kellogg, 2015; DuFour, DuFour, & Eaker, 2005; DuFour & Eaker, 1998; Lave & Wenger, 1991; Schmoker, 2006). Through CoP, teachers may become less isolated as they share in new learning, help each other solve problems of practice, and foster new ideas (Booth & Kellogg, 2015; Lave & Wenger, 1991; Wenger et al., 2002). Teachers are usually given an allotted amount of time to spend planning instruction for their students within the parameters of the school day. To promote more frequent interaction between teachers within the school site, Hausman and Goldring (2001) suggested school leaders could schedule teacher planning periods at common times.

Four paradigms may govern or influence common planning periods—a direct mandate from the school leader to participate in a structured weekly meeting, a job-embedded professional development opportunity conducted in short weekly segments, a natural occurrence of teachers deciding to meet regularly on their own accord, or teachers continuing to work in isolation. Wenger, White, and Smith (2009) advocated the use of technology as a viable avenue for teachers to interact with each other across physical space and time through online environments created specifically for sharing information, insight, and advice to solve problems of practice. Any of the above collaborative structures could lead to the development of CoP where teachers openly share ideas and concerns about their classroom practices (DuFour et al., 2005; DuFour & Eaker, 1998; Lave & Wenger, 1991). For instance, if job-embedded professional development

occurred during one weekly planning period, teachers may be open to accepting the opportunity to join online CoP where they could voluntarily interact with other teachers in their district who are receiving the same learning opportunity.

Change Theory and the CBAM. Change requires time for extended follow-up or coaching with an evaluation occurring at the end of the identified length of time (Hall & Hord, 2011). According to Hall and Hord's (2011) CBAM model, a change leader introducing a change initiative must manage ongoing training and engage in progress monitoring to gauge effectiveness, differentiate the levels of support to meet individual teachers' needs, and make necessary improvements. For example, one kind of support system may ensure time for teachers to work together as they apply new strategies to successfully accomplish a change initiative. Change leaders also must select interventions to meet teachers' individualized needs which could include a sense of loss for what was comfortable, not believing that the change will create improvement, and/or limited understanding of the change initiative. Everyone involved in the change process is part of the team that influences the success of the change initiative. "An entire organization does not change until each member has changed" (Hall & Hord, 2011, p. 9). The conversations about successes and challenges during the change process should occur among all members of the team.

Frequently, change leaders "tend to be preoccupied with the innovation and its use" (Hall & Hord, 2011, p. 11). The CBAM supplies research-based tools and knowledge to help change leaders identify and address the personal side of change during the implementation of an innovation (Hall & Hord, 2011). Understanding and addressing each teacher's personal concerns about the change initiative as well as levels of use is

imperative, because both perspectives allow the change facilitator to provide teachers with personalized "one-on-one coaching sessions, more relevant workshops, and strategic plans" (Hall & Hord, 2011, p. 68). These strategies facilitate the implementation process, increase personalization, and help address teacher concerns about the change initiative. It is more beneficial for teachers to have "experiences in a sequence that parallels the[ir] developing concerns" (Hall & Hord, 2011, p. 70), because "successful change starts and ends at the individual level" (Hall & Hord, 2011, p. 9).

In particular, when teachers are asked to implement an innovation, they could exhibit various stages during the process. Hall and Hord (2011) suggested these stages included perceptions influencing the rate of implementation; they referred to them as stages of concern (SoC). Hall and Hord identified seven SoC. The stages were: (a) stage 0—unconcerned, (b) stage 1—informational, (c) stage 2—personal, (d) stage 3—management, (e) stage 4—consequence, (f) stage 5—collaboration, and (g) stage 6—refocusing. Importantly, the leader of the change initiative could facilitate an innovation by using the results of the SoC survey to target individualized interventions appropriate for meeting each teacher's individualized needs immediately at that point in time.

Teachers who implement an innovation may also demonstrate various behaviors with respect to their implementation of the innovation that Hall and Hord (2011) classified into eight levels of use (LoU). The LoU were: (a) stage 0—nonuse, (b) stage 1—orientation, (c) stage 2—preparation, (d) stage 3—mechanical use, (e) stage 4A—routine, (f) stage 4B—refinement, (g) stage 5—integration, (h) stage 6—renewal. Change leaders could quickly conduct a structured LoU branching interview (LoUBI) to determine what LoU a teacher is demonstrating at a certain point in time. The LoU

information gleaned from teachers is important because knowing how the innovation is actually being implemented could assist a change leader in selecting the appropriate individualized level of support to move each teacher along the continuum towards a higher LoU.

Related Prior Research

Four considerations used in relation to delivering DIDM and RCA professional development to teachers include: (a) effective on-the-job professional development practices, (b) collaborative DIDM and RCA strategies and tools, (c) length of time required to conduct a thorough analysis, and (d) teacher engagement in dialogue during the learning and application phases of learning. Teachers must be able to analyze multiple sources of their own classroom data to identify gaps in student achievement. The DIDM and RCA processes should encourage interaction of all teachers to allow for the contribution of multiple viewpoints. When seeking causes for identified achievement gaps, the RCA tool should promote a focus on the problem and collaborative decision making. In the following three sections, I review findings from the literature and prior action research cycles that informed the innovation.

Best practices for professional development. Administrators and teachers continue to shoulder the demands of various educational reforms along with the added responsibility of receiving and implementing the appropriate learning support (Andrews & Rothman, 2002; Bernhardt, 2004). Frequently, trainers provided quick training sessions that did not vary training methods or did not allow follow-up opportunities for participants to receive feedback when applying the learning in their own work settings. These types of training sessions often led to passive learning, lack of implementation, and

negative attitudes towards professional development (Gregson & Sturko, 2007). Therefore, effective forms of professional development needed to be identified and systematically examined within local contexts.

Hirsh (2009) proposed six essential criteria that led to effective professional development: (a) intensive, (b) ongoing, (c) connected to practice, (d) focused on important content, (e) linked to school initiatives, and (f) built strong working relationships. Unfortunately, this kind of "high-intensity, job-embedded collaborative learning that is most effective is not a common feature of professional development across most states, districts, and schools in the United States" (Hirsh, 2009, p. 3). Teachers were more likely to implement the learning when professional development opportunities provided ongoing assistance through coaching or study groups (Elmore, 2004; Fullan, 2007; Fulton, Davis, Dukes, Gussmerotti, & Lombard, 2009; Hirsh, 2009). Most teachers teach in isolation; they need professional development opportunities for learning through collaboration and sharing as they incorporate new practices aligned with school initiatives (Fulton et al., 2009; Hirsh, 2009; Lave & Wenger, 1991).

DIDM and RCA professional development. The focus of most professional development designed for teachers has encompassed academic content knowledge, leaving little time and focus for data analysis training (Hirsh, 2009). Research about effective RCA processes and DIDM in educational settings and improving student achievement has been sparse. I found two RCA studies that applied to educational settings. In the first study, Mingin (2006) employed a RCA process with a school district to move its staff away from using "hunches" to a more data-informed approach to determining causes for student achievement gaps. Mingin applied the five 'why' model to

help teachers break down data to determine plausible causes without having to delve into a complicated statistical analysis process. For example, teachers asked 'why' the identified problem existed to come up with possible causes. They continued to ask 'why' up to five times or more until they agreed upon a viable cause related to the problem. This process decreased opportunities for placing blame, because teachers focused on peeling away layers of symptoms in search of root causes. Once teachers discovered root causes they could begin the process of finding relations between the causes and developing a plan of action. This school study required an investment of more than 20 hours in training, however, it was not clear what the time requirements might be after the initial training process. The results indicated that participants in the study (a) developed a different understanding of the problem, (b) determined the difference between contributing changeable factors versus those beyond their control, and (c) conducted thorough investigations to determine root causes for student achievement gaps.

In a second study, Fulton et al. (2009) used the fishbone model with a team of teachers at an elementary school to brainstorm possible causes of why their school's fifth-grade students were not proficient in problem solving. The group of teachers drew a diagram that resembled the side view of a fish skeleton, hence the term fishbone model. Teachers used the head to list the problem (why students were not proficient in problem solving) and the rib bones to list all of the possible causes. They sorted the causes into six categories: (a) student-related, (b) instruction, (c) assessment, (d) curriculum, (e) equity, and (f) critical supports. A simple prioritizing strategy required each staff member to place a colored dot next to each of their most salient top four causes. The results indicated a student-related problem—students lacked perseverance. From that point,

members of the staff conducted further analysis by randomly administering an interview-type assessment to 40 students in grades three to five to further refine determination of the root cause. This deeper analysis led to an investigation into classroom instruction as a possible cause of students' inabilities to use a variety of strategies to solve problems. As a result of this final investigation, the staff learned that students needed exposure to higher-level questioning and consistent access to the core mathematics curriculum. In this school example described by Fulton et al. (2009), results showed that participants spent almost a year in the hands-on learning process to identify the root cause.

Prior action research cycles. During the 2013-2014 and 2014-2015 school years, I implemented and revised the RCA Challenge during six action research cycles. Requests for DIDM and RCA training during the 2012-2013 school year led to the development of the first cycle of the RCA Challenge. I created a consensogram after the first cycle to track participant readiness to engage in a root cause analysis process based upon my observations of teachers who hesitated to work with data. After the second cycle, the results from the participant plus/delta feedback tool indicated that the data analysis tasks must include the participants' actual data sets. I revised the plus/delta feedback tool to collect information about participants' planned changes to their own practice, tailored the data analysis tasks to include actual data sets, and divided the single six-hour training session into two three-hour training sessions. Cycle three plus/delta feedback results indicated that the participants felt overwhelmed by the amounts and types of school-wide data. During cycle four, I included more in-depth hands-on activities with individual types of data and data intersections to provide extra support in utilizing multiple types of data. Three two-hour block training sessions occurred during

cycle five to give participants time to collaborate with their school team between sessions to help alleviate the feeling of being overwhelmed by multiple sources of data and rushed for time to complete complex tasks. To create a more effective RCA tool, participants in cycle six used two different tools to determine which one best met their requirements for determining a root cause. Based upon participant feedback, I combined components from both tools to create a more collaborative RCA tool.

Applying Theory and Research to Practice

Based on Wenger et al.'s (2002) CoP framework, Hall & Hord's (2011) change theory, and Hirsh's (2009) criteria for effective professional development, it appeared trainers needed to develop high-intensity job-embedded professional development sessions that could allow teachers to move at a pace commensurate with their application of new learning. These tailored segments of learning could help prevent teachers from feeling overwhelmed when making a change in practice. Both situated learning and change theories supported the need for teachers to dialogue with each other about their implementation of new learning. For example, if a trainer provided training opportunities across multiple school sites, the use of online CoP could allow for communication among all participants as they strived to solve problems of practice and sustain their learning. Research results indicated teams of teachers who interacted and worked together in on-the-job training improved their practices of utilizing their own data sets and attained improved attitudes towards professional development (Gregson & Sturko, 2007; Hirsh, 2009; Lave & Wenger, 1991; Love, 2009). A high level of camaraderie among teachers in on-the-job training also helped them make the link between relevance of the training to content, practice, and school initiatives as they worked together to revisit, reuse, and

revise processes to improve their skills (Gregson & Sturko, 2007; Hirsh, 2009; Love, 2009).

Upon closer examination of the relationship between the master and apprentice as described by Lave and Wenger's (1991) situated learning theory, it resembled the relationship between trainers and teachers. This theory suggested teachers would look for guidance from the expert, the trainer. Because trainers cannot maintain indefinite ongoing assistance, inclusion of an online collaboration tool during and after the training time period could foster the development of online CoP where teachers could interact and learn from each other after the conclusion of the training period. This is consistent with Lave and Wenger's suggestion that "it is the relationship between apprentices that organize opportunities to learn—not the relationship between the master and the apprentices" (p. 35). Lave and Wenger's CoP framework indicated the trainer's initial role in established CoP as one of a peripheral participant, a new member to the group. However, if the trainer is a district coach within the district that continually maintained support, he or she could eventually become a member of the CoP through increased participation. Together, the teachers and the district coach, as full members of online CoP, could begin to make the culture of DIDM and RCA their own (Lave & Wenger, 1991).

Hall and Hord's (2011) change theory framework supported the use of SoC and LoU tools for monitoring teachers' feelings and concerns as they experienced change during the implementation of DIDM and RCA strategies learned in the training sessions. For example, using Hall and Hord's model, a teacher experiencing stage 3 management concerns must receive individualized assistance that offers multiple ways of accessing

information. This could include how-to tips or a frequently asked questions section on an online collaboration tool to target concerns relating to details and mechanics for managing resources and time (Hall & Hord, 2011). By comparison, if a teacher's LoU indicated stage 4 refinement, Hall and Hord suggest offering purposeful plans to conduct a face-to-face meeting or an online collaborative opportunity for discussing the effectiveness and influence of the innovation on student achievement.

Results from several studies supported the use of collaborative strategies during professional development. A combination of the RCA models proposed by Mingin (2006) and Fulton et al. (2009) increased usability, maintained focus on peeling away layers of symptoms in search of root causes, and promoted collaboration during the phase of finding relations between the causes to develop a plan of action. Teachers focused on the problem and remained accountable for collaboratively contributing to the problem solving process. Consistent with Hirsh's (2009) criteria for effective professional development and Lave and Wenger's (1991) CoP, collaborative structures promoted opportunities for teachers to cooperate and share as they solved problems of practice. Teachers could be more encouraged by collaborative strategies to seek, create, and/or utilize multiple sources of data, not just student learning data, to find root causes to student achievement gaps (Fulton et al., 2009; Love, 2009; Mingin, 2006). According to Bernhardt (2004), "[i]f [teachers are] only looking at student learning, [they are] missing 65% of the data" (p. 134). The desired result is to lead teachers to further types of data collection to refine the root cause (Bernhardt, 2004; Fulton et al., 2009; Love, 2009). The ultimate goal is to enable teachers to make instructional decisions as fluidly as they make

driving decisions based on their vehicle's dashboard. Dashboards have multiple measures ready to be considered and so should the more complex multifaceted world of learning.

The Present Study

The goal is to turn data into information,
and information into insight.
~ Carly Fiorina

In the previous section, I discussed the application of theory and research to practice to inform the development of an effective professional development model for teachers learning how to apply DIDM and RCA strategies to identify student achievement gaps. I described how theory supported moving teachers from working in isolation to engaging in CoP where they could share ideas, concerns, and classroom practices to solve problems of practice. A combination of both theory and research offered strategies trainers could use to help teachers build working relationships, sustain learning from professional development, and provide individualized interventions to teachers based upon their concerns about implementing the innovation. For example, the blending of the two RCA models described in the research provided teachers with more opportunities to collaborate during the discovery phases of root causes to student achievement gaps. In this section, I describe the innovation implemented in the current study.

Innovation

I provided DIDM and RCA professional development in the capacity of a trainer and coach to six teachers at three different school sites along with 24/7 access to an online CoP wiki. My positionality in this action research study began as one of a peripheral participant, a new member of a newly established online CoP (Lave &

Wenger, 1991). As I continued to build working relationships between the teachers and myself and dialogued about problems of practice, together we moved towards becoming full members of the online CoP, what Lave and Wenger referred to as insiders. The face-to-face 35-minute training/coaching sessions provided once per week during teacher planning times for 10 weeks allowed for a high intensity of support and small steps towards application of skills (Hall & Hord, 2011; Hirsh, 2009; Lave & Wenger, 1991). The 10 face-to-face sessions included explicit training in examining multiple types of data, looking for trends, finding gaps, and determining root causes for student achievement gaps (Bernhardt, 2004; Fulton et al., 2009; Love, 2009; Mingin, 2006). Teachers were encouraged to use their own grade level and classroom data to allow for immediate application of learning to classroom practice (Gregson & Sturko, 2007; Hirsh, 2009).

Participants used a one-question Likert scale visual data display, called a consensogram, to rank their perceived readiness level to engage themselves or others in the use of a root cause analysis process at the conclusion of each session. This quick visual along with information collected from the plus/delta feedback tool, online collaboration wiki, and my field notes allowed for weekly modification of instruction to meet the needs of the participants. These tools also sent a message to the participants that I valued their input about the innovation. Table 1 outlines the professional development topics delivered to participants.

Table 1

Professional Development Topics

Week	Topics Addressed
1	Introduction to root cause and systems thinking
2	Types of data
3	Perception, Multiple voices/viewpoints
4	Data intersection activity part 1: questions and types of data needed
5	Data intersection activity part II: participants' questions and types of data
6	Data processing activity, Trends and gaps, Root cause analysis examples
7	Perception checks, Brainstorming possible causes, Using fishbone
8	Categorizing causes from fishbone
9	Narrowing and choosing viable causes, Case studies
10	Communication strategies, Key requirements, Performance indicators, In-process measures

Methods

A review of the literature indicated that professional development for teachers must include high-intensity job-embedded sessions that allowed for education at a pace commensurate with application of new knowledge as well as opportunities to work together to revisit, reuse, and revise processes to improve and sustain the learning. Wenger et al.'s (2002) CoP framework, Hall and Hord's (2011) change theory, and Hirsh's (2009) criteria for effective professional development offered possible solutions that were explored using the action research methods described in this section. This study, the intervention, and the data collection instruments were approved by the

Institutional Review Board (IRB) and TSD. See Appendix A for a copy of the IRB approval letter.

Research Design

When analyzing existing processes and proposing changes for improvement in TSD, mixed methods action research was the best choice for this study. The action research methods complemented the expectations in the district's five-year strategic plan that is based on principles of systematic continuous improvement. As an action researcher, I was able to apply theory and research to practice and seek answers within my local workplace (Mills, 2007; Plano Clark & Creswell, 2010). Fine (2003) and McNiff and Whitehead (2006) suggest action researchers know the line of vision within their local workplace and can gather evidence to make informed decisions as they use action research, an iterative process, rather than using intuition. Working in tandem with the participants to make decisions and negotiate change promoted a deeper understanding for making improvements to the RCA Challenge. Bradbury-Huang (2010), McNiff and Whitehead (2006), and Waters-Adams (1994), assert that as change is negotiated, new ideas bloom leading to possibilities of creating more pertinent theories as the study of the living practice continues to evolve. Using the knowledge gained during this action research cycle, I reflected upon what was being done, what needed to be done to improve, and how it could improve the learning of everyone involved in the practice.

McNiff (2013), Plano Clark and Creswell (2010), and Riel (2010) claimed action research provides opportunities for researchers/practitioners to review current practice and reflect on processes to develop a new plan for moving forward. McNiff and Whitehead (2006) further characterized action research as a cyclical process that moves

in new directions at the completion of each cycle. I engaged in careful monitoring of the planned changes as they were put into practice (Waters-Adams, 2006). Observing, reflecting, acting, evaluating, modifying, and moving in new directions occurred in the six prior iterations of this innovation and continued to occur during this cycle. The nature of action research is messy and required me, as an action researcher, to reflect and collaborate among all of my participants (Waters-Adams, 2006). As I employed quantitative and qualitative methods of data collection to look at the research study from different perspectives, the outcomes led me to changes in future actions (Waters-Adams, 2006). Modifications to the original plan occurred during the study to meet the needs of each participant.

Setting and Participants

This mixed methods action research study took place at two preK-8 schools and one preK-6 school in TSD, a large urban school district in Arizona, where I worked as the Read 180 Curriculum, Instruction, and Assessment Specialist. I have described the school sites and participants in detail below.

Sites. I conducted this study with six teachers from three separate higher socio-economic A-rated schools: Sonoran View, Wake Forest, and Lark Bay. The schools are similar in student enrollment (approximately 1,000 students), ethnicity (89% Caucasian), special education (10%), English language learners (ELL) (3%), and federally funded lunches (10%). When looking at 2007-2014 state assessment trends for students scoring greater than 75%, Sonoran View declined from 78% to 65% in reading and 82% to 62% in mathematics; Willow Forest declined from 66% to 54% in reading and 72% to 60% in

mathematics; and Lark Bay declined from 79% to 56% in reading and 79% to 36% in mathematics (internal document).

Participants. To seek more in-depth information about the innovation results, I used convenience sampling to select participants (Ivankova, 2015). This means that the participants were available and willing to participate in the mixed methods action research study. Teachers in grades three through six at the selected school sites were invited to participate in the study. Nine Caucasian female teachers accepted the invitation, however, two teachers from each school completed the study: one special education teacher, one intervention teacher, three fourth grade teachers, and one sixth grade teacher. Two of the original nine teachers dropped out of the study to accept other teaching positions and one could only meet once a month. They ranged in age from 40 to 51 years with 8 to 28 years of experience in the field of education. Due to my position as the district's Read 180 Curriculum, Instruction, and Assessment Specialist and my prior positions as the district's Manager of Research and Data Analysis and elementary teacher, all participants readily accepted me as a trainer and coach. I did not serve in the capacity of an evaluator and participants perceived me as a viable resource to improve student achievement. I met with each of the six participants one-on-one in their classrooms for 35 minutes during their teacher preparation for ten weekly sessions. As a researcher and practitioner in this study, I provided the professional development and participated as a coach in the collaborative online CoP.

Instruments

During this iteration of mixed methods action research, I explored the influence that the RCA Challenge had on participants' perceived and demonstrated abilities to use

and/or engage others in DIDM and RCA strategies, changes in practice reported in their feedback, and level of online collaboration with peers. To glean in-depth information to aid in answering the research questions proposed in this study, I used both quantitative and qualitative instruments. An overview of the instruments is shown in Table 2. Following the table, I describe the instruments in detail.

Table 2

Data Collection Instruments

Measures	Description	Timeline
Stages of Concern Survey (Quantitative) RQ 1; Appendix B	Online 43-question survey adapted from Hall and Hord's (2011) SoCQ to determine participant concerns when adopting an innovation.	Completed before and after the study.
Data Analysis Performance Task (Quantitative) RQ 1; Appendix C	Eight-question open-ended assessment to determine participants' data analysis training experience and demonstrated readiness level to use multiple sources of data to determine root causes.	Completed during weeks 1 and 10 of the study.
Consensogram (Quantitative) RQ 1; Appendix D	One-question pre-/post-assessment tool containing five readiness levels to monitor and differentiate learning.	Completed at the end of each training session.
Plus/Delta Feedback Tool (Qualitative) RQ 1, 2; Appendix E	Four-question open-ended feedback tool for participant feedback during face-to-face training experiences.	Completed at the end of each training session.
Structured Interview (Quantitative) RQ 1; Appendix F	Structured interview tool adapted from Hall and Hord's (2011) LoUBI to determine participant's level of use.	Conducted after week 10.
Online Collaboration (Qualitative; Quantitative) RQ 1, 3; Appendix G	Online wiki to promote participants' reflection, collaboration, and strong working relationships.	Encouraged use at least once per week.
Researcher Field Notes (Qualitative) RQ 1, 2, 3; Appendix H	Hand-written notes to track ideas and thoughts about areas for further investigation, interpretation, or change.	Periodically as the occasion warranted.

SoC survey. This 43-question survey, shown in Appendix B, consists of eight demographic questions and 35 questions from Hall and Hord's (2011) SoCQ. The questions from Hall and Hord's SoCQ are used to measure seven constructs, known as SoC. Each question is rated on an eight-point Likert scale with 0 indicating *irrelevant*, 1 indicating *not true of me now* to 7 indicating *very true of me now*. The purpose for this survey was to glean demographic information and stages of participant concerns. In this context, concern refers to a feeling or thought that is heightened when thinking about using the innovation. Pre-assessment results provided information to select appropriate interventions to decrease participant concerns and move them through the SoC towards collaboration as they adopted and used the innovation. Post-assessment results indicated participant growth in readiness to use DIDM and RCA strategies.

Data analysis performance task. Participants completed the data analysis performance task, provided in Appendix C, both before and after the 10-week innovation. They answered open-ended questions about prior data analysis trainings, current data sets they analyzed or desired to use, and their approach to a data analysis scenario. A comparison of pre- and post-assessment results indicated participant growth in readiness to use DIDM and RCA strategies.

Consensogram. Participants used a one-question Likert scale visual data display, called a consensogram, to rank their perceived readiness level to engage themselves or others in the use of a root cause analysis process at the conclusion of each weekly training session. This one-question pre- and post-assessment fast-feedback tool, displayed in Appendix D, contained five readiness levels. Like a histogram, the consensogram provided an immediate visual of an aggregation of participants' perceived readiness

levels to use multiple types of data and a RCA process. I designed and pilot tested this tool during the fall 2013 semester and was able to revise and refine it during four subsequent action research cycles to meet the needs of the current action research cycle.

Plus/delta feedback. Collecting information from participants about what worked and did not work to improve a professional development session is a common practice in TSD. To improve the use of this tool for my study, I created a four-question open-ended feedback form for participant feedback during each face-to-face training experience. Participants could readily share perceptions about what helped them learn, changes needed to improve their learning, commitments to changes in practice, and new ideas gleaned from the training session. This tool, shown in Appendix E, allowed me to explore participants' perceptions of their learning in the trainings, follow-up on participant commitments or ideas that indicated possible changes to current practice, and make changes to the training sessions to meet participants' needs.

Structured interview. I adapted the structured interview from Hall and Hord's (2011) LoUBI consisting of six close-ended questions and fourteen decision points. The participants' responses guided the sequence and number of questions leading to the identification of the LoU stage at that particular point in time. The LoU stage for each participant allowed me to explore possible interventions to promote growth in participant LoU. The short structured LoUBI outlined in Appendix F also helped me determine changes in participants' readiness levels to engage in DIDM and RCA strategies.

Online collaboration. I built a wiki, an online collaborative website, for all participants to add and edit content, conduct online discussions, and upload media: http://dataanalysisdiscussions.pbworks.com. Participants were encouraged to use the

online collaboration tool described in Appendix G at least once per week after the second week of training to dialogue with other teachers involved in the RCA Challenge. This tool provided an opportunity for participants to collaborate, solve problems of practice, and sustain the learning received in the trainings. The ultimate goal was to nurture and build an online CoP where the teachers could continue to collaborate and learn together after the conclusion of the weekly training sessions.

Researcher field notes. To organize observations, reflections, or ideas that I had regarding the study, I compiled and organized researcher field notes in a chart as shown in Appendix H. I also incorporated notes about participant responses to three weekly questions regarding challenges, data usage, and concerns. These notes provided further insight into participant readiness levels to engage in DIDM and RCA strategies, training needs, improvements to the online collaboration tool, and information about improvements to future iterations of this action research study.

Procedures

I administered the 42-question survey shown in Appendix B to each participant using Survey Monkey before and after the ten-week study in the fall of 2015. Each participant received an assigned unique identifier code that was used on all data collection instruments that consisted of five random digits. The pre-survey data revealed age, education, current grade level, and years of teaching experience for each participant and also established a baseline of concerns regarding the innovation to help differentiate the learning experience for each participant. Based on the results from the pre-assessment survey, I selected interventions suggested by Hall and Hord (2011) to address each individual participant's most intense SoC. To monitor changes in SoC and intervention

needs, I recorded participants' responses to three quick questions at the conclusion of each weekly training session: What were your greatest challenges? Where are you in terms of data usage? and, What are your concerns?

The next step in this cycle involved coordinating dates and times to meet with each participant for ten one-on-one face-to-face job-embedded DIDM and RCA professional development training sessions. Training occurred once per week in each teacher's classroom during their individual planning periods. A timer was set for 35 minutes at the start of each session to ensure that teachers had ample time to pick up students at the end of their preparation period. Six identical slide presentations were used to facilitate the delivery of content to each teacher due to the various dates and time slots selected throughout the week for the six individual meetings. These one-on-one 35-minute sessions allowed me to provide a high level of training intensity and encourage small steps towards application before each subsequent session. The individualized training sessions emulated on-the-job training models as each teacher was encouraged to work with their own data sets to seek answers to student achievement gaps.

Participants completed a performance task at the beginning and end of this 10-week study to demonstrate changes in readiness levels to engage in data analysis tasks. They also reported any data analysis training received outside of this innovation. Further detailed information about this tool is available in Appendix C. To track changes in participants' perceived readiness levels to engage in DIDM and RCA, I used the consensogram shown in Appendix D at the end of each face-to-face training session. Participants also provided feedback using the plus/delta feedback tool shown in Appendix E on a weekly basis to help me determine if changes needed to be made to the

RCA Challenge innovation or if I needed to follow-up with any stated changes in their practice. The structured interview conducted at week 10 with each participant helped me determine changes in participant's readiness levels to engage in DIDM and RCA strategies. See Appendix F for more details about the interview and questions adapted from Hall and Hord's (2011) LoUBI.

The online collaboration tool, available 24 hours a day after week two, gave all participants the freedom to choose when to dialogue as they applied their learning. I built the wiki described in Appendix G for this study due to its ease of use and capabilities for uploading media. A weekly e-mail was sent to participants as a reminder to participate in the online wiki for the first four weeks after its inception. Participants could revisit, reuse, and revise processes as they worked together to improve their methods of analyzing multiple sources of classroom and grade level data sets to determine root causes. The six instruments along with my researcher field notes provided opportunities to monitor and adjust the innovation throughout the research cycle to meet the learning needs of participants and track their growth.

Analysis

Both quantitative (close ended responses) and qualitative (open ended without predetermined responses) instruments were selected to provide information to answer my research questions. This process of mixing methods allowed for breadth and depth of understanding and corroboration (Creswell, 2014; Ivankova, 2015). I analyzed the findings of each data source independently and then compared the results to develop a more in-depth understanding of how to improve my participants' abilities to use DIDM and RCA strategies (Creswell, 2014; Greene, 2007; Ivankova, 2015; Plano Clark &

Creswell, 2010). The analysis and comparison of the weekly consensogram, plus/delta feedback, online collaboration, and field notes allowed for changes to occur during the action research cycle. The pre- and post-results from the SoC survey, data analysis performance task, and structured interview provided opportunities for analyzing changes in participants' readiness levels to use DIDM and RCA strategies both before and after the study.

SoC survey. To analyze the SoC survey data, I studied the technical manuals to guide my use and interpretation of the results (George, Hall & Stiegelbauer, 2006; Hall, George & Rutherford, 1986). Authors Hall and Hord (2011) suggested producing individual and group profiles to identify concerns to select appropriate interventions. Concerns regarding the implementation of this innovation could include (a) stage 0—worries more about things other than this innovation, (b) stage 1—requires further information about this innovation, (c) stage 2—wants to know how their role will change when implementing this innovation, (d) stage 3—tries to manage time and resources while learning to use this innovation, (e) stage 4—wonders about this innovation's impact on their students, (f) stage 5—seeks collaboration with others who are using this innovation, and (g) stage 6—thinks about ways to improve or replace this innovation. Decision making must encompass the use of both individual and group profiles to prevent masking important individual differences when selecting individualized targeted interventions.

Hall and Hord's (2011) "Stages of Concern Quick Scoring Device" (p. 286) provided the information needed to create an Excel template that automated the process of averaging the raw scores for each of the seven constructs, converting the averages into

percentiles of intensity for each SoC, and plotting the percentiles in line graphs by participant and group. The pre-assessment line graphs visually revealed SoC with the highest level(s) of intensity to enable the selection of appropriate interventions suggested by Hall and Hord to facilitate participant progress. To gauge weekly progress, participants responded to three quick questions at the conclusion of each training session: What were your greatest challenges? Where are you in terms of data usage? and, What are your concerns? I recorded information about these responses in my researcher field notes and used them to make any needed changes in interventions to help move participants along the SoC continuum towards stage 5 collaboration. At the end of the study, the post-survey results were keyed into the Excel template to create line graphs plotted in two different colors allowing for visual analysis of the pre- and post-survey results. These results demonstrated participant and group growth from the beginning to the end of the study and also helped confirm participants' perceived readiness levels.

Hall et al. (1986) determined the internal consistency of their SoC survey items in several research studies using a Cronbach alpha analysis and reported that the alphas for each of the seven constructs ranged from 0.64 to 0.83—the construct of awareness being the only one below 0.70. I used SPSS statistical software to conduct a Cronbach alpha analysis on each of the seven constructs for my participants' pre- and post-assessment results. My pre-test results indicated alphas for each of the seven constructs ranging from .19 to .87—the constructs of informational, management, consequence, and collaboration being above .70. My post-test results indicated alphas for each of the seven constructs ranging from -.19 to .90—the constructs of personal and management being above .70. This type of analysis measured the internal consistency of survey items to see how

closely related the items were as a group. If the items have an alpha coefficient greater than .70 they are considered reliable—this means I should receive consistent results each time I administer and analyze the survey. This survey instrument can also be considered valid if the questions have a high (.70 or higher) internal reliability and relate to the construct being measured (Cronbach, 1951). The Cronbach alpha results for this study indicated that the reliability and validity of this survey instrument can vary among different study groups, pre- and post-administrations, and sample sizes.

Data analysis performance task. To determine the demonstrated level of using multiple sources of data to make instructional decisions, the current and other desired data sources listed by participants were compared by documenting the number and types of data used at the beginning of the study compared to the number and types of data used at the end of the study. Historical data analysis trainings and concurrent data trainings that could have influenced the results of this study were also documented. The data chart responses were listed and compared to look for changes in participants' opening thoughts, initial investigation points, decisions made, and other data sources requested.

Consensogram. The weekly data from the consensogram was coded by participant in an Excel table to observe individual growth in readiness. The pre-assessment results collected during the first training session were placed on a visual consensogram chart using round red circles with a corresponding number to each participant. The post-assessment results collected after the last training session were added to the visual using the same process with green circles. Posting all of the pre-assessment responses in one color and the post-assessment responses in another color

completed the aggregated analysis of this tool. This data provided information to help determine the effect of the RCA Challenge on participants' readiness levels.

Plus/delta feedback. All participants provided handwritten feedback in the form of words and phrases on this tool at the completion of each face-to-face session. Results were posted on the wiki every week to allow all participants to view and make comments. A three-column Excel chart facilitated the insertion of weekly content into one column leaving the second column open for notes and questions and the third column for coding. The four response sections were accumulated weekly in the Excel spreadsheet. During each weekly read through, I would read all four sections of the accumulated contents and write notes and questions. This allowed me to adapt subsequent face-to-face training sessions or provide further training needs through the online CoP to meet the needs of participants during the study.

When examining the plus/delta feedback, I kept in mind that it was from the participants' point of view (it contained perceptual data). A quick browse through allowed me to take notes about first impressions. Next, I began the descriptive coding process of rereading carefully line by line to label words and phrases for meaning. Qualitative researchers use codes to label and describe meaning of a selection of text or an image during analysis (Corbin & Strauss, 2008; Plano Clark & Creswell, 2010; Saldana, 2013; Strauss & Corbin, 1990). Coding is a significant step in analyzing and organizing textual data, however, it is not an exact science (Saldana, 2013). Once the descriptive codes were completed, I sorted the data by assigned code in Excel to begin categorizing occurrences. Saldana (2013) states that descriptive coding primarily leads to a categorized inventory. This inventory allowed me to look for prominent ideas versus

those that did not appear as frequently. Then I began to make sense of the textual data by examining the codes for overlap or redundancy. Saldana suggests using axial coding to determine the dominant codes from the less important ones to group and reduce the number of initial codes developed. These codes were then condensed into more broad themes by looking for commonalities among them (Plano Clark & Creswell, 2010; Saldana, 2013). The text from the feedback tool was separated out by two broad themes and then I read through the entire selection of chunks under each theme to garner a more in-depth analysis (Saldana, 2013).

Structured interview. To analyze the information collected from this interview, I used Hall and Hord's (2011) LoUBI format to determine individual and whole group LoU of the innovation. Since the interview process was based on decision making points, each interviewee response determined the next step in the interview process leading to a final ending point that indicated LoU. Transcriptions of participant responses during each interview were hand written in the left column of a two-column chart and the right column was used for my analysis of each participant's LoU. I shared the transcription and resulting LoU description with each participant immediately after completion for member checking to verify if my understanding represented what they shared in the interview (Stringer, 2007).

Online collaboration. Data from the online collaboration tool was placed into the left column of a three-column Excel spreadsheet. During the first reading, initial questions and notes were made in the second column along with tallies, number of participants who posted online, and the total word count for each participant. Ways to seek answers to questions were typed in bold text during the second reading. The use of a

line graph provided an avenue for visually analyzing weekly usage by participant and total word count. I used the third column for completing the same coding process used for the plus/delta feedback tool. The text from the online collaboration tool was separated out by three broad themes and then I read through the entire selection of chunks under each theme to glean a more in-depth analysis.

Researcher field notes. I sorted and typed all field notes into the first four columns of a computer chart on a weekly basis using the following categories: observational notes, theoretical notes, methodological notes, and analytical memos. To analyze my field notes, the fifth column was used to list questions or concepts that surfaced during the first reading. During the second reading, any new concepts or themes not already reported by another instrument were integrated into the analysis (Corbin & Strauss, 2008; Saldana, 2013; Strauss & Corbin, 1990).

Results

I engaged in this mixed methods action research study to explore the influence of the RCA Challenge on teachers' abilities to apply DIDM and RCA strategies to determine root causes of student achievement gaps. In this cycle of action research, I explored answers to the following research questions:

> RQ1: How and to what extent did the RCA Challenge influence participants' perceived and demonstrated readiness levels to engage themselves and/or others in a root cause analysis process?
>
> RQ2: How and to what extent did participating in the RCA Challenge influence participants' commitment and follow-through in making the self-reported changes stated in their weekly plus/delta feedback tool?

RQ3: How and to what extent did the participants engage in collaborative conversation using the online communication tool?

The results of this study are presented in the following two sections under the categories of quantitative and qualitative. The results for the quantitative data are presented in tables, figures, and descriptive text. For the qualitative data results, the overarching themes are presented with related components and supporting quotes.

Quantitative Data Results

The quantitative data sources included the collection of 12 SoC surveys, 12 data analysis performance tasks, 60 consensograms, 8 weeks of online collaboration, and 6 structured interviews.

SoC survey. The pre-assessment group results shown in Table 3 indicated the selection and implementation of Stage 1 interventions that only met the needs of participants 1 and 3. The most intense SoC from each participant's pre-survey profile indicated the selection and implementation of Stage 0, 1, 3, and 4 interventions to help facilitate each participant's progress towards stage 5, collaboration with others.

Table 3

Most Intense Stage(s) of Concern About Using DIDM and RCA Strategies.

N = 6	Stage Number*	
Participants	Pre-Stage(s)	Post-Stage(s)
1	1	0, 2
2	4	5
3	1	0, 5
4	0, 3	3
5	0	0, 5
6	0, 3	3, 5
Group	1	0, 5

*There are 7 SoC: 0—worries more about things other than this innovation; 1—requires further information about this innovation; 2—wants to know how their role will change when implementing this innovation; 3—tries to manage time and resources while learning to use this innovation; 4—wonders about this innovation's impact on their students; 5—seeks collaboration with others who are using this innovation; 6—thinks about ways to improve or replace this innovation.

The individual pre-assessment results show one participant with more intense stage 0 concerns, two participants with more intense stage 0 and stage 3 concerns, two participants with more intense stage 1 concerns, and one participant with more intense stage 4 concerns. The individual post-assessment results show one participant with more intense stage 0 and stage 2 concerns, two participants with more intense stage 0 and stage 5 concerns, one participant with more intense stage 3 and stage 5 concerns, one participant with more intense stage 3 concerns, and one participant with more intense stage 5 concerns. The overview of the individual and group pre- and post-assessment results in Table 3 and Figure 1 indicated all six participants experienced a shift in their SoC after participating in this study.

The group pre- and post-assessment SoC profile, shown in Figure 1, indicated a decrease in intensity for stages 1, 2, and 4; an increase in intensity for stages 0, 5, and 6; and no change in intensity for stage 3. The most intense SoC indicated by the post-survey group results are stages 0 and 5. The pre- and post-assessment results for Stage 5 showed a 28 percentile increase indicating the group became more concerned with helping or collaborating with others in their efforts to use DIDM and RCA strategies to improve student achievement after engaging in this study.

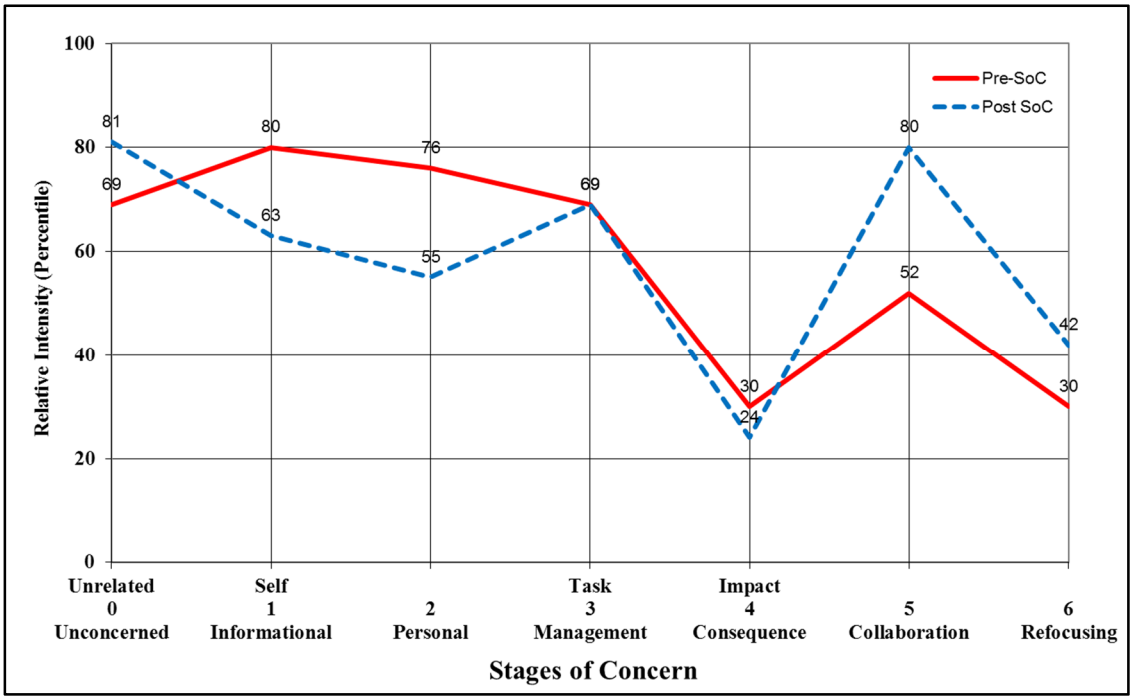

Figure 1. Relative intensity of pre- and post-stages of concern. (N = 6)

The post-assessment group results shown in Table 3 and Figure 1 illustrated how the group's SoC evolved over the time period of the study. The group analyses were averages of individual scores and provided an overall illustration of the most intense concerns of the group. Taken together, the individual and group post-survey results indicated stage 5 concerns were most prevalent and had the greatest increase in intensity.

Survey items for stage 5 reflect interest in knowing what others are doing, helping others, and/or coordinating efforts with others in the use of DIDM and RCA strategies to improve student achievement.

Data analysis performance task. Participants completed a pre- and post-assessment to track trainings received outside of this innovation, the number and types of data sources used when making instructional decisions, and knowledge used to complete a data analysis performance task. Three of the participants indicated they had no data analysis training prior to this innovation and the other three participants indicated receiving some data analysis training more than two years prior to this training. No participants received data analysis training in tandem with this study. The results displayed in Table 4 show that all six participants increased the number of data sources and types of data used to make instructional decisions after engaging in this study.

Table 4

Data Usage for Instructional Decisions by Source and Type

N = 6 Participants	Pre Sources	Post Sources	Pre Types*	Post Types*
1	4	7	1	2
2	6	11	1	4
3	3	6	1	2
4	8	12	3	4
5	4	12	3	4
6	11	12	3	4
Group	36	60	n/a	n/a

*Four types of data were discussed in the trainings: Perceptual, Demographic, Student Achievement, and School Processes.

The pre-assessment results from the data analysis scenario indicated that two of the participants could not make a decision based on the data chart without the provision of other data sources. The post-assessment results indicated that all six participants could not make a decision without the provision of other data sources.

Consensogram. The pre-assessment results shown in Figure 2 indicated five of the participants were not ready to analyze multiple sources of data to determine root causes and one participant was ready to analyze multiple sources of data at the classroom level to determine root causes. The post-assessment results indicated two of the participants were ready to analyze multiple sources of data at the classroom level to determine root causes and four participants were ready to analyze multiple sources of data at the school-wide level to determine root causes. Over the entire ten-week period, all participants reported a continuous progression towards the fifth readiness level as shown in Table 5.

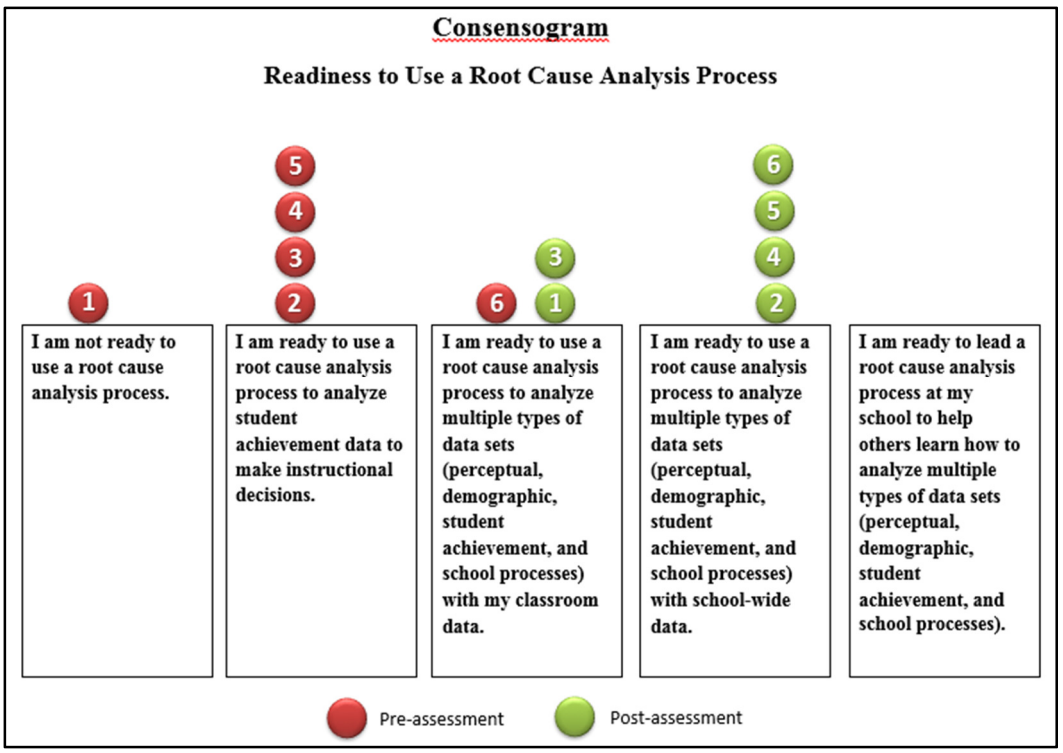

Figure 2. Participant readiness levels to use a root cause analysis process. (N = 6)

Table 5

*Weekly Participant Readiness Levels to Use a Root Cause Analysis Process**

N = 6	Weeks									
	1	2	3	4	5	6	7	8	9	10
Participant 1 Readiness	1	1	2	2	3	3	3	3	3	3
Participant 2 Readiness	2	2	3	3	3	4	4	4	4	4
Participant 3 Readiness	2	3	3	3	3	3	3	3	3	3
Participant 4 Readiness	2	3	3	3	4	4	4	4	4	4
Participant 5 Readiness	2	3	3	3	3	3	3	3	3	4
Participant 6 Readiness	3	3	3	3	4	4	4	4	4	4

*The five readiness levels are indicated by 1, 2, 3, 4, and 5.

Structured interview. The LoUBI was conducted at the end of the study to determine participants' active level of participation in using DIDM and RCA strategies. The results indicated that all six participants were at level three mechanical use. Hall and Hord describe level three as a focus on the short-term, day-to-day use of the innovation. This means that changes being made to the innovation are based on participant needs rather than the needs of others; the participants are focused on trying to master the tasks related to implementing DIDM and RCA strategies.

Online collaboration. Participants were encouraged to post at least once per week using the online wiki after week two of the study. The results shown in Figure 3 indicated that more content was posted during weeks three and five. After week five the amount of content posted began to decline with no conversation occurring during weeks nine and ten.

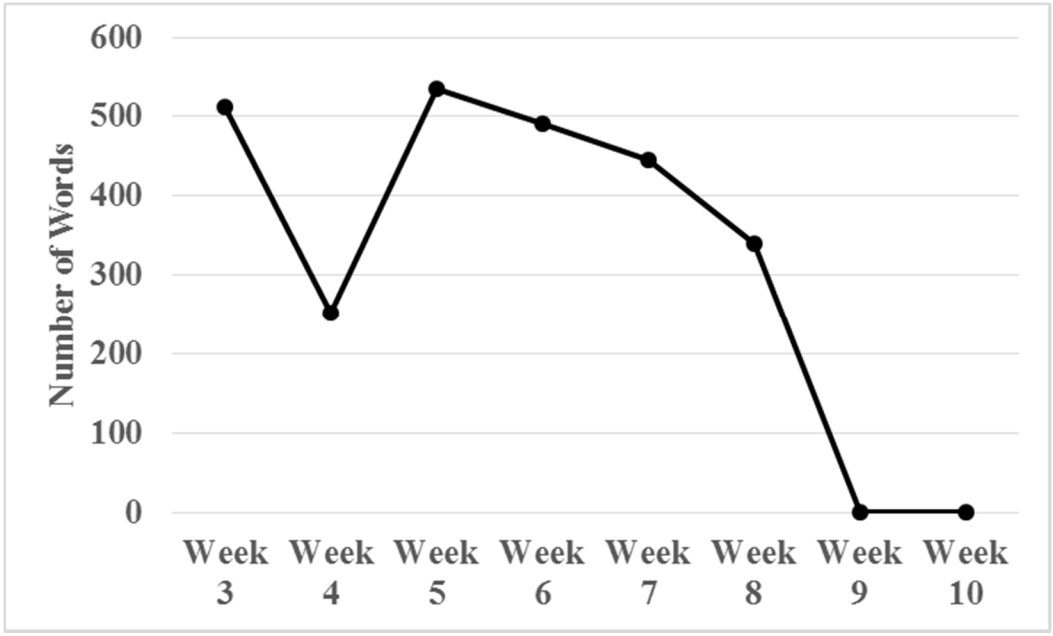

Figure 3. Participant participation by word count in online collaboration. (N = 6)

The number of participants participating in the weekly conversation varied from four to six during weeks three through eight with no participants posting during weeks nine and ten as shown in Figure 4.

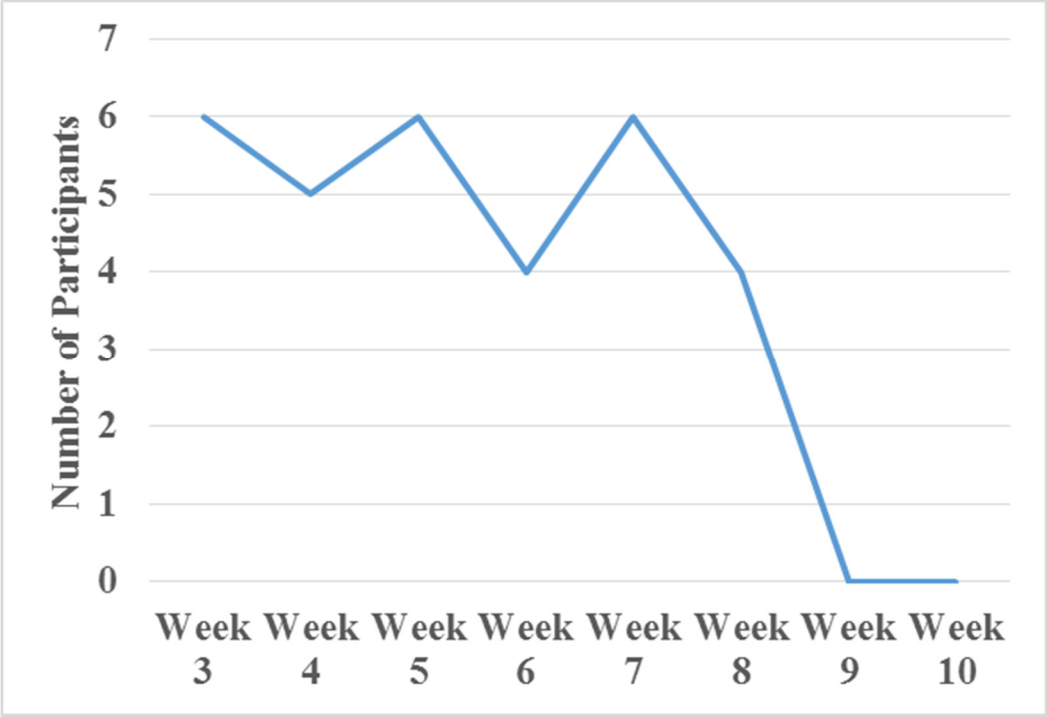

Figure 4. Participant participation in online collaboration. (N = 6)

Qualitative Data Results

The qualitative data sources included the collection of 60 plus/delta feedback forms, online collaboration postings, and researcher field notes.

Plus/delta feedback. Through the analysis of the plus/delta feedback, I noted that participants depicted the relevant aspects of the professional development sessions that they would implement in their own practice. Two overarching themes emerged indicating participants' desires to engage themselves and/or others in a root cause analysis process: skills use and resources.

Skills use. Participants indicated a commitment to use four skills learned during the sessions: (a) fishbone (see Appendix J code 01.SKU-MAP.01), (b) the five 'why' model (see Appendix I code 01.SKU-WHY.02), (c) categorization (see Appendix J code 01.SKU-CAT.03), and (d) data analysis (See Appendix J code 01.SKU-DAT.04). For the entire code sheet and codebook descriptions, please see Appendices I and J. The results shown in Table 6 provide examples of these codes.

Resources. Participants indicated a commitment to explore more resources for a more complete data analysis: (a) human resources (see Appendix J code 02.RES-VIE.01) and (b) data sources (see Appendix J code 02.RES-DAT.02). For the entire code sheet and codebook descriptions, please see Appendices I and J. The results shown in Table 6 provide examples of these codes.

Table 6

Overarching Themes, Subthemes, and Examples from Plus/Delta Feedback

Theme	Subtheme	Examples
Skills use	Fishbone	"Use the fishbone with students," "Try the fishbone method with my struggling students," "Fishbone activity," "ask students to fishbone issues," and "I'd like to do it with my kiddos," "Looking at one branch at a time -- I need to constantly remind myself to slow down"
	Five 'why' model	"Ask why more," "Asking more whys," "Look closely at the whys," "Looking more at why students struggle -- root cause of low scores," "After fishbone take one category and again and again ask why"
	Categorization	"Have kids categorize," "Have students do more categorizations," "Difficult to categorize, but helpful," "Thinking about categories for student issues with subject areas," "Putting categories to the whys"
	Data Analysis	"Think about all types of data before making a final question," "Gathering more data through school processes," "Look at more data before changing groups -- maybe a pair of students," "Look for trends in data," "Possibly use surveys," "Using Excel box and whiskers instead of averages with my students to reinforce our class goal setting and monitoring of their achievement"
Resources	Human Resources	"Having another perspective -- talking it out," "It is so helpful to have another set of eyes and another brain working on the things I'm trying to do with data," "Collaboration and communication to solve student issues," "Reflecting on other participants' data," "Working more with team to brainstorm," "I will work with 3 points of data to discuss with kids"
	Data Sources	"I am more aware of data and types of data, everywhere," "Narrowing where I want to work through root cause: rSkills, ind. students, distractions," "Look at my students' demographics data as well as classroom," "Possibly use surveys," "Looking at information that has effects on perceptions," "Looking at other areas that effect student learning that are outside of the norms"

Online collaboration. The analysis of the text produced three overarching themes of collaborative conversation: data management, student assessments, and collaboration.

Data management. One of the overarching themes was managing multiple data sources. Through the analysis of the text, I noted that participants depicted concerns (see Appendix L code 01.DMA-CON.01) and shared examples (see Appendix L code 01.DMA-EXA.02) of how to organize and manage data. For the entire code sheet and codebook descriptions, please see Appendices K and L. The results shown in Table 7 provide examples of these codes.

Student assessments. A second overarching theme was student assessments. Through the analysis of the text, participant conversations encompassed types of student assessments (see Appendix L code 02.SAS-TYP.01), frequency of administration (see Appendix L code 02.SAS-FRE.02), and student grouping (see Appendix L code 02.SAS-SGR.03). For the entire code sheet and codebook descriptions, please see Appendices K and L. The results shown in Table 7 provide examples of these codes.

Collaboration. A third overarching theme was collaboration. Through the analysis of the text, participant conversations included instances of collaborating with others (see Appendix L code 03.COL-OTH.01). For the entire code sheet and codebook descriptions, please see Appendices K and L. The results shown in Table 7 provide examples of these codes.

Table 7

Overarching Themes, Subthemes, and Examples from Online Collaboration Tool

Theme	Subtheme	Examples
Data Management	Concerns	"I think my biggest question is, how can I keep my data organized?" "I feel my data is all over the place, literally," "Data does get a little overwhelming for me…trying to keep it all organized is a challenge," "I am trying to narrow down my data," "Read 180 has so much data"
	Examples	"I am thinking of going back to the old fashion monitoring notebook I used years ago for my target group." "Data folders work great for students, but I want it in one place," "I use the paper/pencil method," "At our school we have Excel grids that use colors for the cut scores. This helps to get a quick look at how students are doing," "I work best hands on, so paper, pencil, color coding and folders work best for me"
Student Assessments	Types	"I use a classroom behavior management plan to handle most of the ADHD type behaviors in my class," "I find exit tickets to be wonderful sources of data," "Students have a chance to complete concept development with me, then homework at night," "In math I am using a number concept assessment," "I use exit tickets, sprints, IXL reports to make instructional decisions"
	Frequency	"We will not officially take the SRI again until the end of the year, but my low kids will have a chance to retake in Dec," "I have started using weekly quizzes," "I feel with Investigations I am not assessing the students often enough," "I have started using homework quizzes on Mondays, but like the idea of a daily spiral review as well," "I assess using WTW 3 times a year."
	Student Grouping	"I am planning to align my FLEX groups into SRI scores," "I have been using SRI data as well as their daily software data to align my FLEX groups," "I use exit tickets, sprints, and IXL reports to make small groups," "I can quickly pull those that need specific skills using a RAP worksheet," "I use writing samples and assessments to guide my small group instruction"
Collaboration	Others	"I'm really trying hard to use Box and Whisker plots with my data to discuss with the kids," "We had such a great discussion of how we can best make sure that all students are learning and we set a goal as a class," "I am in the process of scheduling a meeting with last year's teachers to see what they are/were doing that had such a positive influence," "I did not think data could be so exciting, but I can hardly wait to see each new plot to see if what we are doing is working or what we need to adjust"

Researcher field notes. The analysis of the weekly question responses recorded in the researcher field notes text produced two overarching themes of concern: lack of time and student needs.

Lack of time. One of the overarching themes was lack of time. Through the analysis of the text, I noted that participants depicted concerns (see Appendix N code 01.LOT-CON.01) about not having enough time to enter, analyze, and use data. For the entire code sheet and codebook descriptions, please see Appendices M and N. The results shown in Table 8 provide examples of these codes.

Student needs. A second overarching theme was meeting student needs. Through the analysis of the text, I noted that participants depicted concerns (see Appendix N code 02.SNE-CON.01) of how to meet the needs of all of their students. For the entire code sheet and codebook descriptions, please see Appendices M and N. The results shown in Table 8 provide examples of these codes.

Table 8

Overarching Themes, Subthemes, and Examples from Researcher Field Notes

Theme	Subtheme	Examples
Lack of Time	Concerns	"time for understanding," "time to evaluate," "time to get on the computer to respond to other teachers," "time during the holidays," "how do you get it all done?"
Student Needs	Concerns	"am I looking at everything I need to?" "finding the correct root cause," "will my strategies work?" "resources to help struggling students," "using the correct data to help students"

Discussion

People without information cannot act.
People with information cannot help but act.
~Ken Blanchard

The purpose of this study was to determine if a professional development model that included collaborative communication strategies through the support of an online community of practice was effective in helping teachers increase their ability to apply a data-informed decision making process to find root causes to student achievement gaps. In this case, classroom teachers needed to use the state-wide longitudinal student data system, AZDash, to make instructional decisions to improve student achievement on state assessments. When TSD provided all of its school CITs with DIDM and RCA training, they did not include the people closest to the problem—all of their classroom teachers. To address this gap, I conducted an action research cycle at the classroom level with six of TSD's teachers. The RCA Challenge, 10 weeks of job-embedded DIDM and RCA professional development, was implemented to improve teachers' abilities to apply a data-informed decision making process to find root causes to student achievement gaps.

Brief Summary of Findings

The findings from this study supported the use of Hirsh's (2009) criteria for effective professional development and Lave and Wenger's (1991) CoP. The job-embedded professional development along with collaborative opportunities to dialogue with others helped participants collaboratively work through some implementation challenges and apply some of their stated changes in practice, thus improving and sustaining the learning. Participants were also more encouraged by the use of collaborative strategies to seek, create, and/or utilize multiple sources of data, not just

student learning data (Fulton et al., 2009; Love, 2009; Mingin, 2006). A desired outcome, teachers seeking further types of data collection to inform their decisions about root causes, was also realized during this study (Bernhardt, 2004; Fulton et al., 2009; Love, 2009). In the following sections, I provide an indepth discussion of the study's results and share personal reflections. First, I discuss the complementarity and integration of the mixed methods results that provided comprehensive answers to the research questions. Second, I share how the results can be understood by relating them to chosen theories and practical applications from research. Third, I suggest that there are strengths and limitations of my study and reflect on the lessons I have learned during this cycle of action research as it applies to my local context and future research.

Complementarity and Integration of Quantitative and Qualitative Data

A concurrent mixed methods design was selected for the purposes of triangulation and complementarity (Ivankova, 2015). I implemented data collection instruments concurrently to measure the same phenomenon using two or more different methods allowing me to draw from strengths and minimize weaknesses (Greene, 2007; Ivankova, 2015; Plano Clark & Creswell, 2010). Mixing methods also allowed me to "tap into different facets or dimensions of the same complex phenomenon" (Greene, 2007, p. 101). In particular, gathering and integrating results from different methods deepened and broadened the interpretations and inferences from this study (Greene, 2007; Ivankova, 2015; Plano Clark & Creswell, 2010). A combination of seven different data collection

instruments were selected to provide information to discover comprehensive answers to the following research questions:

RQ1: How and to what extent did the RCA Challenge influence participants' perceived and demonstrated readiness levels to engage themselves and/or others in a root cause analysis process?

RQ2: How and to what extent did participating in the RCA Challenge influence participants' commitment and follow-through in making the self-reported changes stated in their weekly plus/delta feedback tool?

RQ3: How and to what extent did the participants engage in collaborative conversation using the online communication tool?

Research question 1. Based on the results from this study, the RCA Challenge did have an influence on participants' perceived and demonstrated readiness levels to engage themselves and/or others in a root cause analysis process. To address this first research question, I triangulated all of the quantitative and qualitative results from all seven data tools as each one gave a different perspective to help broaden and verify the understanding of the participants' readiness levels to use DIDM and RCA strategies. When analyzing participant readiness levels, I noted indicators showing: (a) an increase in the use and management of data sources, (b) application of strategies, and (c) a shift in concerns towards the desire to collaborate with others to solve problems of practice. The triangulation of consensogram and performance task results indicated that 100% of the participants experienced an increase in readiness to use multiple types of data to make instructional decisions to close student achievement gaps. Although the consensogram results represented participants' perceptions, the weekly results illustrated a continuous

progression in participant readiness levels. The performance task post-assessment results confirmed this increase in readiness when participants listed more sources and types of data needed for instructional decisions and also requested more explicit information to make a decision when presented with the data analysis scenario.

The concerns expressed by the participants in their SoC individual and group profile post-results provided further support for increased participant readiness levels. All participants experienced a shift in their SoC with management and collaboration being the most prevalent at the end of the study. When taken in tandem, both the SoC and LoU results indicated that participants were focused on task management—they were trying to master the tasks related to implementing DIDM and RCA strategies. These management concerns were further identified through online discussions between participants as they tried to collaboratively solve problems of practice: managing multiple sets of data, choosing types of student assessments, and determining frequency of administration.

The SoC group profile showed that management concerns remained constant and the collaboration concerns increased by 28 percentile points. These two concerns were also predominant in plus/delta feedback and field notes when participants shared concerns about needing more time to complete the data analysis tasks, seeking and choosing the correct data sources and/or types to meet student needs, and valuing conversations and multiple viewpoints when working with others to solve problems of practice. The expression of limited time to conduct a detailed analysis illustrated the participants' desire to delve deeper and find root causes for student achievement gaps. The need to pick and choose the correct sources to meet their students' needs showed that they were attempting to pursue multiple avenues for closing learning gaps, however, it

also demonstrated a struggle with mastery of tasks. The online conversation about problems participants experienced demonstrated that they were seeking relationships with others who were grappling with similar issues. Overall, the triangulation of these results indicated that the participants experienced an increase in their perceived and demonstrated readiness levels to engage themselves and/or others in a root cause analysis process to close student achievement gaps.

Research question 2. The second question in this study focused on the innovation's influence on participants' commitment and follow-through in making the self-reported changes stated in the weekly plus/delta feedback tool. Data collected in this study support the conclusion that participants who participated in the innovation were more likely to follow through with stated changes in practice. I used qualitative results from the weekly plus/delta feedback tool along with my field notes to document instances of participant follow-through. When analyzing the influence of the innovation on participants' changes in practice, I noted indicators demonstrating the use of new learning from the training that included: (a) data analysis tools and strategies; (b) data resources; and (c) collaboration strategies. Together, the results from the plus/delta feedback tool and researcher field notes showed that participants used the five 'why' model and fishbone method to dig deeper into root causes, shared and requested multiple types of data resources, and collaborated with others.

Many times new learning provided during the training sessions led to discussions about what they were currently working on that week. One example is when a participant wanted to move away from using averages to discuss academic progress with her students. She wanted to use box and whisker plots to have richer discussions with

students about where they were as a class in their quest for mastery of the skills. However, she did not have the technology background to develop a template to facilitate a weekly process. We worked together to solve this problem of practice through the use of my technology skills combined with her vision for the end result. Although it took a few weeks to refine the template, she persevered because we were solving the problem of practice together. She mentioned that collaboration is what kept her going; if left to her own accord she would have given up. She shared her thoughts about the process and its influence on her students:

> I'm really trying hard to use Box and Whisker plots with my data to discuss with the kids where we are at as a class in our quest for mastery of the skills. With Patti's help, I was able to create a way to use the Box and Whisker plots to analyze our data as a class. We had such a great discussion of how we can best make sure that all students are learning and we set a goal as a class to have our Interquartile Range be 10% or less. We're working on our differentiated learning groups and partners and discussing what a good mathematical problem solving partnership looks like. This PDSA conversation was so much richer than any we've had before. This allows me to have ongoing data discussions with the kids in each math class. We had a discussion about trying to make the interquartile range smaller each week—showing that more of us had learned the content. I think it encourages kids to work together and ensure everyone at their table is grasping the concept.

Another example is when one of the teachers expressed concern during a training session about why a student did not feel he belonged in her advanced math class. I suggested that she train the student to use the fishbone method to determine why he did not belong. This led her away from assumptions and into a deeper, more thorough investigation of this problem from another perspective. The approach of one-on-one collaboration and coaching during the training sessions helped provide participants with immediate application of newly learned skills to solve their current problems of practice.

The weekly sessions also prompted participants to have something ready to share or delve into when I arrived each week. We always started the sessions with professional development and then followed up with discussions about their current practice. Participants knew I had experience with data analysis from my prior position in the data analysis department and my years of teaching experience. I shared some of my classroom experiences with finding root causes for success as well as root causes for learning gaps during discussions about problems of practice. These types of discussions led to other data sources that could be used to glean more perspectives when seeking root causes. This was evident when one of the participants discovered a positive root cause when delving into the trends of the newly introduced historical reading inventory data:

> I am in the process of scheduling a meeting with last year's teachers to see what they are/were doing that had such a positive influence. We will implement and see if our grade level gets the same results. I did not think data could be so exciting, but I can hardly wait to see each new plot to see if what we are doing is working or what we need to adjust.

She met with her grade level team to share her learning. Her entire grade level team implemented this reading inventory as a progress-monitoring component for small group instruction. These results confirmed that the participants followed through with stated changes in practice and valued the process of seeking collaboration and multiple viewpoints to persevere when solving and improving problems of practice.

Research question 3. The final question addressed in this study focused on the level of participant engagement in collaborative conversation using the online wiki. The qualitative results from the online collaboration tool along with my field notes indicate that participants engaged in collaborative conversation using the online wiki when they wanted to share concerns or gain further information to make decisions. When analyzing

the level of participant engagement in using the online wiki, I noted indicators demonstrating collaborative conversations about: (a) data management; (b) student assessments; and (c) collaboration with others. The online collaboration text showed that higher levels of online collaboration occurred when they were trying to solve a problem of practice during the learning process. For instance, early on in the training participants sought assistance with managing multiple sources of data. Questions and strategies were discussed among participants as they worked together to help each other solve the problem of managing so many sources of data. This type of collaborative problem solving gave various perspectives allowing for individualized choosing of what would work for each participant.

The online conversation text demonstrated that the participants felt secure having discourse about their data management concerns openly and freely to solve this problem of practice. This was evident when participants explicitly stated examples of struggling as presented in these examples: "I think my biggest question is, how can I keep my data organized?" "I feel my data is all over the place, literally," "Data does get a little overwhelming for me…trying to keep it all organized is a challenge." When discussing student assessments and collaboration with others, participants expressed their interest in the types and frequency of assessment tools used to inform instruction and group students. Participants shared more examples rather than expressing concerns during these two collaborative conversations. For example, participants e-mailed each other and in some cases uploaded examples to assist others as they worked towards improving their current practices. I also shared examples of student attitude surveys for mathematics and reading during training sessions to encourage use of multiple viewpoints. These

conversations showed the participants were becoming more comfortable with seeking out collaborative efforts to gather ideas for using more than just student achievement data to inform their instructional decisions. Overall, the triangulation of these results indicated that the participants participated in online discussions when they needed to collaborate to solve a problem of practice.

Alignment to Theory and Research

The results from this study supported Hirsh's (2009) criteria for providing effective professional development as described in the literature review. I provided intensive weekly training and support during the school day that was ongoing for a ten-week period. Participants focused on the content and immediately applied it to their current practice during the study to meet school initiatives. The accountability of knowing they were meeting with me weekly led to more follow-through with commitments to changes in practice and discussions about their current data analysis tasks. Several studies supported results of an increased likelihood of implementing learning when professional development opportunities provided ongoing assistance and support (Elmore, 2004; Fullan, 2007; Fulton et al., 2009; Hirsh, 2009). However, consistent with Hirsh's research, this type of job-embedded collaborative learning is an uncommon feature of professional development. It is time intensive and would require more staff to individualize instruction across various grade levels in my large school district.

All of the participants in this study teach in isolation; they needed professional development opportunities for learning through collaboration and sharing as they incorporated the new practices (Fulton et al., 2009; Hirsh, 2009; Lave & Wenger, 1991).

Both situated learning and change theories supported the need for teachers to engage in dialogue while implementing new learning. Research also indicated teams of teachers who interacted and worked together in on-the-job training improved their practices of utilizing their own data sets and attained improved attitudes towards professional development (Gregson & Sturko, 2007; Hirsh, 2009; Lave & Wenger, 1991; Love, 2009). The use of the online CoP provided opportunities for participants to communicate across schools as they strived to solve problems of practice and sustain their learning, however, participants who requested to continue after the study ended sought collaboration with me rather than online collaboration with others from the study. Lave and Wenger's (1991) situated learning theory suggested teachers would look for guidance from the trainer. Because I could not maintain indefinite ongoing assistance, an online wiki was included in this study to foster the development of online CoP where teachers could interact and learn from each other after the conclusion of the training period. Lave and Wenger suggested that the relationship between the teachers would be what organized the opportunities to learn—not the relationship with the trainer. However, the teachers did not continue seeking relationships in the online CoP—they continued a collaborative relationship with me, the trainer.

During the first four weeks of online collaboration (weeks three through six), I sent out weekly e-mails to remind participants to post. When I noted the beginnings of rich conversations, I decided to stop the e-mail reminders to see if it would continue to flourish on its own with just verbal reminders during the rest of the training sessions. Weeks seven and eight still maintained the average of four to six participants, however, no participation occurred during weeks nine and ten of the study. All participants had a

week off for the Thanksgiving holiday; the first time they had a break from seeing me on a weekly basis. Upon returning from the break, the weekly meetings resumed and time became a more prevalent concern expressed during sessions as documented in the field notes.

The online wiki was an added task that participants posted to on their own time. The stronger commitment to the weekly training sessions was more evident as some of the participants mentioned they stayed on track better when they knew I was coming to meet with them. The last two weeks of the study occurred at the end of the first semester right up until the winter holiday break. Deadlines associated with end-of-the-year district assessments, end-of-the-quarter student grades, and personal preparations for family holiday plans may have impeded postings to the online wiki. Four of the participants requested to continue their work with me—one on a bi-weekly basis, one on a monthly basis, and two through e-mail communications and face-to-face as needed. No participants continued to use the online wiki as a discussion tool. This may be due to the need for more commonalities between the participants such as grade level standards and content to build stronger online relationships.

Hall and Hord's (2011) change theory framework supported the use of SoC and LoU tools for monitoring teachers' feelings and concerns as they experienced change during the implementation of DIDM and RCA strategies learned in the trainings. These tools proved to be valuable indicators to help me focus on participant concerns along with the implementation of the innovation. The use of the online CoP and my discussions with teachers during the training sessions helped move them through SoC and LoU much more quickly than if they were left to grapple with the learning on their own. This was

evident when the stage 3 management concerns were shared online about managing multiple types of data. They each received viable options from multiple viewpoints.

Overall, theory and research provided the knowledge and tools to build and study this action research cycle using collaborative structures that promoted opportunities for teachers to cooperate and share while solving problems of practice. The results of this study indicated participants were more encouraged by collaborative strategies to seek, create, and/or utilize multiple sources of data, not just student learning data, to find root causes to student achievement gaps (Bernhardt, 2004; Fulton et al., 2009; Love, 2009; Mingin, 2006).

Strengths and Limitations

Triangulation of both my qualitative and quantitative sources of data allowed me to look at my study using multiple methods (Creswell, 2014; Greene, 2007; Herr & Anderson, 2015). For instance, I looked at participants' perceived and demonstrated readiness levels with DIDM and RCA strategies from seven different points or angles (survey, performance task, consensogram, plus/delta feedback, structured interview, online dialogue, and field notes). The rationale for using a mixed methods design was to "increase the validity of construct and inquiry inferences by using methods with offsetting biases" (Greene, 2007, p. 100). When one methodology did not provide all the information required, the other provided answers from a different perspective. The mixed methods research strategy helped eliminate gaps in the information/data collected.

There were three strengths identified in this study. One strength of this action research study was that it sought to share and collaboratively build new knowledge to address the needs of the participants in the local setting (Herr & Anderson, 2015). As

teachers and I mutually engaged in the face-to-face training sessions and collaborated online, we created new knowledge about DIDM and RCA strategies. This helped establish process validity in this study since there were multiple opportunities for sharing ongoing reflection and problem solving among all participants during training sessions and online dialogue. Process validity also occurred when participants collaboratively engaged in solving problems that led to new questions, problems, or solutions. Publishing this study also created the potential availability of sharing this knowledge with others outside of our local context. Others may profit from the knowledge gained from this study also helping to establish process validity (Herr & Anderson, 2015).

To reduce limitations to process validity associated with the self-reporting data sources utilized in this study, triangulation of concurrent qualitative and quantitative methods provided multiple ways of confirming the self-reported responses. For example, when participants provided perceptions of their readiness levels to engage in DIDM and RCA on the consensogram, they also completed a performance task that could negate or verify their perceived readiness levels. During online collaboration with other participants, they also engaged in conversations that further verified readiness levels. When engaging in data analysis tasks during the face-to-face sessions, they asked for assistance or reported further needs in the plus/delta feedback tool indicating learning needs. This data was also compared to other readiness level indicators.

A second strength in this study was the establishment of democratic validity through participant interaction in face-to-face sessions and online discussions as they provided ongoing feedback for improvements to the innovation and shared in the decision-making process. For example, when participants brainstormed, categorized, and

prioritized causes for student achievement gaps they were using a collaborative approach. The building of new working relationships with other participants across schools provided another avenue of support with more opportunities to investigate problems and make improvements from multiple viewpoints which further supported the democratic validity of the study (Herr & Anderson, 2015). The plus/delta feedback tool also supported the democratic validity in this study through the contribution of multiple perspectives from all participants when suggesting changes for improvements in practice and the innovation as they mutually engaged to reach a common purpose (Herr & Anderson, 2015; Lave & Wenger, 1991).

Teachers, who were engaged as participants in this action research study, were exposed to opportunities to generate solutions and reframe problems throughout the action research cycle. Decisions that led to improvements in the innovation validated the third strength in this study, outcome validity, because these decisions were the result of generating new questions, problems, and solutions. Each time teachers successfully identified a root cause to a student achievement gap utilizing multiple sources of data, they were confirming the outcome validity of this study. This means that their collective actions resolved a problem that led to this study (Herr & Anderson, 2015). Using multiple sources of data to pinpoint a cause also supported outcome validity. For example, if more than one data source supported the selected root cause, this verified the quality of the data sources.

Although there were strengths demonstrated in this study, all studies possess limitations. In this study I identified two limitations. First, limitations to outcome validity occurred if teachers decided to attend trainings outside of this study that could have

influenced their abilities to use DIDM and RCA strategies. To minimize this limitation, I asked teachers to self-report any other training they received before and during this training using the data analysis performance task questions at the beginning and end of the study. Reporting out such valuable data aided in establishing further trustworthiness of the outcome data from this study. The second limitation to outcome validity occurred when teachers only looked at one type of data source without considering other alternatives or viewpoints, because they would only be implementing a single solution strategy. This could lead to an unsuccessful outcome for closing a student achievement gap. To diminish this limitation, participants were given opportunities to utilize multiple types of data to encourage the use of more than just student achievement data to identify achievement gaps. Largely, the mixed methods action research design strengthened this study, because it allowed for the collection of data points from multiple perspectives to help eliminate gaps in information.

Lessons Learned from Local Context to Inform Future Research Cycles

The fall 2015 implementation of the RCA Challenge allowed for further improvements and refinements to this study based upon information gleaned from my participants, classroom teachers who have the greatest influence on student achievement. In past iterations of this study, participants were teacher leaders who either coached or served on school leadership teams. My aspirations for this cycle included continued collaboration between participants from different schools through the added component of an online collaboration tool. The multiple viewpoints shared online during this study enhanced the learning as the teachers from the three different schools worked collaboratively to solve problems of practice. However, the online CoP activity

diminished towards the end of the study and did not continue after the study ended. The length of the study, my inexperience as a steward of the online community, and the lack of commonality among grade level standards and content may have contributed to the decline in online collaboration. I needed to facilitate the CoP emergence and growth in a manner that would entice participants to overcome time constraints to enable participation in the online discussions. I also believe the participants had more commonalities when first learning the skills leading to the earlier online discussions to solve problems of implementation and practice. Once they began delving deeper into their own classroom data, the participants became more individualized in their needs. The participants needed support from teachers at the same grade level grappling with similar state standards and content as they sought causes for student achievement gaps. This commonality could have encouraged more participation in the later stages of the study and sustained relationships afterwards.

The information garnered from the data collection instruments in this cycle is useful for informing future iterations of this study. For instance, in a future cycle, I would invite teachers from the same grade level to join the online CoP to determine if participants with more in common would spark more collaboration to increase the level of participation online. Being a better steward of the online CoP used in the innovation would be another avenue to pursue. This pursuit would require delving into further theories and research supporting effective strategies for engaging and sustaining participation in an online community. Some of the next steps after discovering root causes also occurred during this study leading to questions about the selection of appropriate interventions that would lead to closing the identified student gaps. The

stewardship of an online CoP would include managing the collaborative efforts of all members in building a repertoire of resources to assist in the selection of appropriate interventions coupled with online professional development components to aid users in adopting and utilizing the selected intervention.

Weekly segments were chosen for this study, however, participants who selected to voluntarily continue after the study have chosen as-needed, bi-weekly, and monthly meetings. In the next cycle, I would pursue meeting with participants face-to-face every two weeks for the first three sessions and then monthly for the last seven sessions of professional development. Professional development video segments would be posted on the online CoP in case a participant is absent for a session thus alleviating the rescheduling of missed trainings. This would also allow all participants to revisit any area where they need further remediation of the newly learned skills. Reminders and enticing new content could be added to the online CoP to encourage participants to seek out online collaboration between monthly sessions.

Conclusion

Unity is strength…when there is teamwork and collaboration, wonderful things can be achieved.
~ Mattie Stepanek

This study was based on the theories of situated learning, specifically the concept of CoP, change theory, and CBAM. As a change facilitator, these theories along with the use of Hall & Hord's (2011) change management tools allowed me to focus on individualized ongoing support needs and collaboration techniques that resulted in (a) participants seeking further types of data collection to inform their decisions about root causes; (b) collaboration and dialogue among all members in the study to help work

through implementation challenges; and (c) collaborative training strategies to help improve and sustain the learning. As I move forward in my role as an action researcher, I will continue to delve into theories and research as viable avenues of support when addressing problems in my local workplace. My passion for learning drives me to work hard to develop a broad spectrum of skills and perspectives so I can collaboratively lead stakeholders in overcoming barriers to student academic success.

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APPENDIX A

IRB LETTER OF APPROVAL

ASU Knowledge Enterprise Development

EXEMPTION GRANTED

Scott Marley
Division of Educational Leadership and Innovation - Tempe
-
Scott.Marley@asu.edu

Dear Scott Marley:

On 5/26/2015 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Data Analysis Discussions: From Hesitancy to Thirst
Investigator:	Scott Marley
IRB ID:	STUDY00002719
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• measures, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • HRP-503a-TEMPLATE_PROTOCOL_SocialBehavioralV02-10-15-2 (4) (2) (1).docx, Category: IRB Protocol; • Sierra Verde Approval 2.pdf, Category: Recruitment Materials; • HRP-502c-CONSENT_DOCUMENT.pdf, Category: Consent Form; • Las Brisas Approval 1.pdf, Category: Recruitment Materials; • West Wing Approval 1.pdf, Category: Recruitment Materials; • Sierra Verde Approval 1.pdf, Category: Recruitment Materials; • Las Brisas Approval 2.pdf, Category: Recruitment Materials; • West Wing Approval 2.pdf, Category: Recruitment Materials;

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 5/26/2015.

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

Sincerely,

IRB Administrator

cc: Patti Wann
Patti Wann
Ann Ewbank
Ray Buss

APPENDIX B

STAGES OF CONCERN SURVEY

Dear Educator,

Thank you for agreeing to participate in a study I am conducting as part of my Doctoral degree in the Mary Lou Fulton Teachers College at Arizona State University under the supervision of Dr. Scott Marley. I would like to provide you with more information about this project and what your involvement will entail as you take part.

The purpose of this study is to determine if a professional development model that includes collaborative communication strategies during and after implementation through the support of an online community of practice is effective in helping teachers increase their ability to apply a data-informed decision making process to find root causes to student achievement gaps.

Participation in this study is voluntary. Your first task will involve completing this initial survey that contains 7 demographic questions and 36 questions about the implementation of "data-informed decision making" in your classroom. It should take about 15 minutes to complete.

You may decline to answer any of the questions if you so wish. Further, you may decide to withdraw from this study at any time without any negative consequences by advising the researcher.

I am conducting this survey as part of a broader research project on data-informed decision making and root cause analysis processes in the K-12 setting. The findings of this study will be used to inform subsequent iterations of research on the topic of data-informed decision making and root cause analysis.

Your responses will be collected using the assigned code given to you in the accompanying e-mail. I will be the only person who will know your identity throughout this study. All information you provide is considered completely confidential. Your name will not appear in any thesis or report resulting from this study. Data collected during this study will be retained for three years in a password-protected file on the computer. Only researchers associated with this project will have access. There are no known or anticipated risks to you as a participant in this study.

I hope that the results of my study will be of benefit to those organizations directly involved in the study, other voluntary organizations not directly involved in the study, as well as to the broader research community.

I very much look forward to working with you and thank you in advance for your assistance in this project.

Your responses to the survey indicate your consent to participate.

You may stop participating in this study at any time and may skip any questions you choose.

If you have any questions regarding this study, or would like additional information, please contact me at 623-414-5457 or by e-mail at patti.wann@dvusd.org.

This survey was adapted from the Stages of Concern Questionnaire (SoCQ) survey by Hall and Hord (2011).

1. Please enter your unique identification code that was included in the e-mail.

2. What is the highest level of education you have completed?

3. What is your age?

4. How long have you been in the field of education?

5. What grade levels have you taught?

6. How long have you been in your current position?

7. How long have you been using data to help you make instructional decisions in your classroom?

   Please read the following statement carefully so you will know how to respond to each of the following questions.

   The survey questions you will be answering were developed from typical responses of school and college teachers who ranged from no knowledge at all about various programs to many years' experience using them. Therefore, many of the items on this questionnaire may appear to be of little relevance or irrelevant to you at this time. For the completely irrelevant items, please select "0" on the scale. Other items will represent those concerns you do have, in varying degrees of intensity, and should be marked higher on the scale. Please select "continue" below when you have finished reading this statement.

   Please respond to the items below in terms of your present concerns, or how you feel about your involvement in the data-informed decision making process you are using in your classroom.

   Rating 0 = irrelevant; Rating 1 or 2 = Not true of me now; Rating 3, 4 or 5 = Somewhat true of me now; Rating 6 or 7 = Very true of me now
   This survey does not hold to any definition of the innovation so please think of it in terms of your own perception of what it involves. Phrases such as "this approach" and "the new system" all refer to the same innovation. Remember to respond to each item in terms of your present concerns about your involvement or potential involvement with the innovation.

   Thank you for taking the time to complete this task.

8. I am concerned about students' attitudes toward the innovation.

9. I now know of some other approaches that might work better.
10. I am more concerned about another innovation.
11. I am concerned about not having enough time to organize myself each day.
12. I would like to help other faculty in their use of the innovation.
13. I have very limited knowledge of the innovation.
14. I would like to know the effect of reorganization on my professional status.
15. I am concerned about conflict between my interests and my responsibilities.
16. I am concerned about revising my use of the innovation.
17. I would like to develop working relationships with both our faculty and outside faculty using this innovation.
18. I am concerned about how the innovation affects students.
19. I am not concerned about the innovation at this time.
20. I would like to know who will make the decisions in the new system.
21. I would like to discuss the possibility of using the innovation.
22. I would like to know what resources are available if we decide to adopt the innovation.
23. I am concerned about my inability to manage all that the innovation requires.
24. I would like to know how my teaching or administration is supposed to change.
25. I would like to familiarize other departments or persons with the progress of this new approach.
26. I am concerned about evaluating my impact on students.
27. I would like to revise the innovation's approach.
28. I am preoccupied with things other than the innovation.

29. I would like to modify our use of the innovation based on the experiences of our students.
30. I spend little time thinking about the innovation.
31. I would like to excite my students about their part in this approach.
32. I am concerned about time spent working with nonacademic problems related to the innovation.
33. I would like to know what the use of the innovation will require in the immediate future.
34. I would like to coordinate my efforts with others to maximize the innovation's effects.
35. I would like to have more information on time and energy commitments required by the innovation.
36. I would like to know what other faculty are doing in this area.
37. Currently, other priorities prevent me from focusing my attention on the innovation.
38. I would like to determine how to supplement, enhance, or replace the innovation.
39. I would like to use feedback from students to change the program.
40. I would like to know how my role will change when I am using the innovation.
41. Coordination of tasks and people is taking too much of my time.
42. I would like to know how the innovation is better than what we have now.

APPENDIX C

DATA ANALYSIS PERFORMANCE TASK

Please list all of the sources of data you currently use to make instructional decisions.

Please list other sources of data you would like to be able to access to make instructional decisions.

Have you received any data analysis trainings in the past? What were these trainings? If so, how long ago?

Have you received any root cause analysis trainings in the past? If so, how long ago?

Using this data chart:

My District's Long-Term Suspensions For the 2012-2013 School Year		
Offenses	Number	Percent
Drugs	125	80%
Alcohol	6	4%
Weapon	18	12%
Fighting/Assault	5	3%
Theft	1	1%
Sexual Offense	1	1%
TOTAL	156	100%

What are your initial thoughts?

What would you investigate first? Why?

Can you make any decisions based upon this data chart? Why or why not?

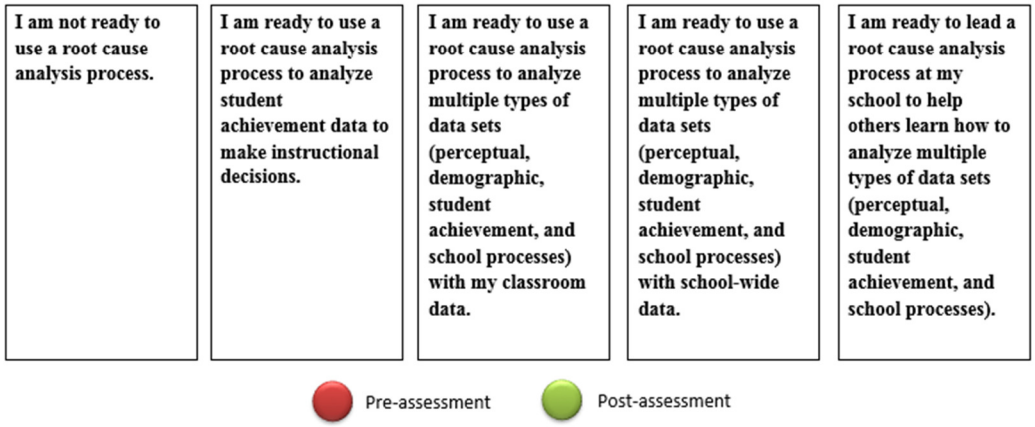
Do you need any other data sources to help you make a decision using this data chart?
Why or why not?

APPENDIX D

CONSENSOGRAM

Consensogram

Readiness to Use a Root Cause Analysis Process



APPENDIX E

PLUS/DELTA FEEDBACK TOOL

Please Provide Feedback

Written: Use this feedback form throughout the session today to record:

+ The aspects of the training session that worked for you.

△ The things you will change in your practice.

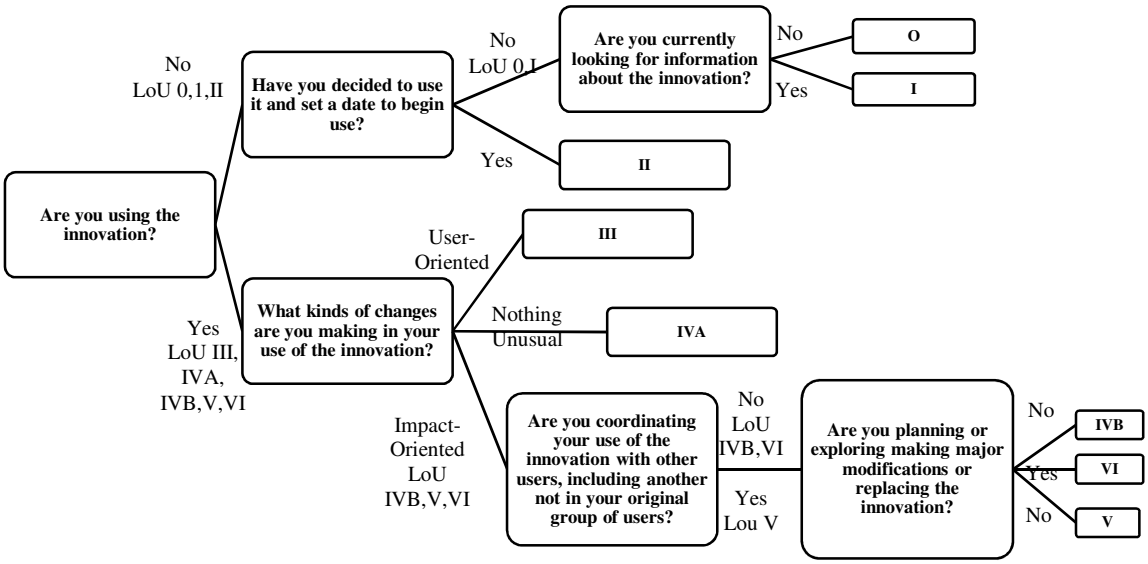
△ The things you would change about the training session.

? Questions that you still have or things we didn't get to today.

! Ideas, ah-has, innovations.

APPENDIX F

STRUCTURED INTERVIEW

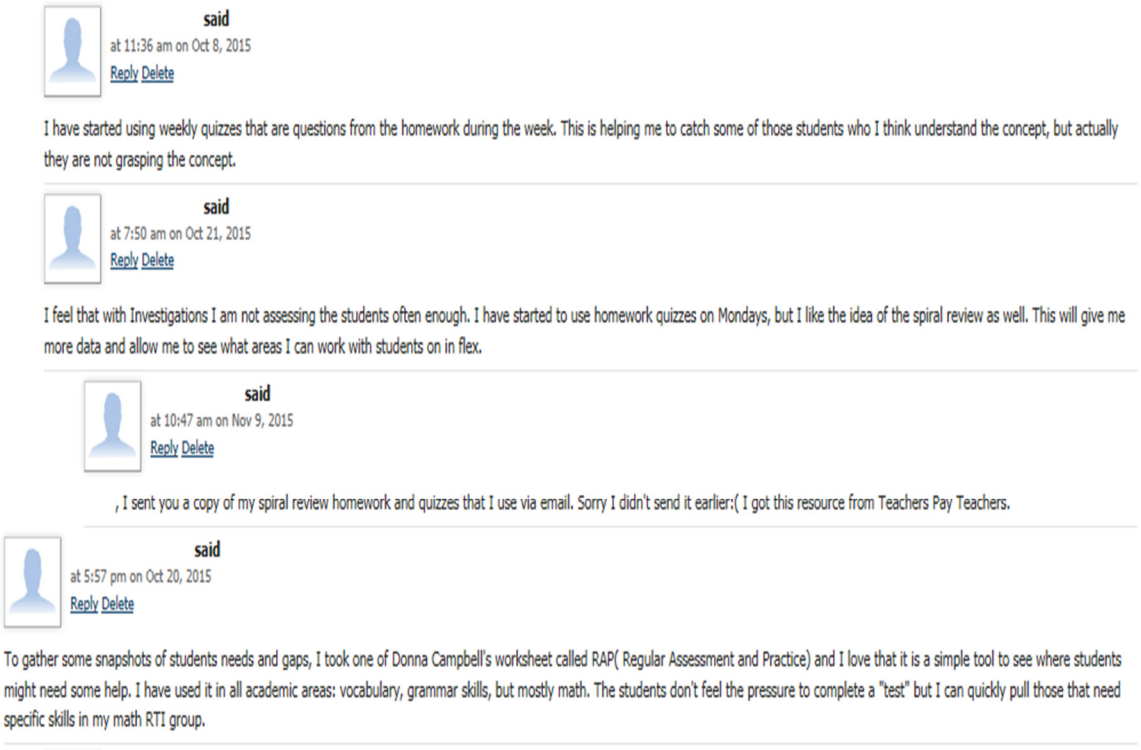


Source: LoU has been described and presented in many publications. An important resource for obtaining more detailed information about LoU is Hall, Dirksen, and George (2000) (Hall & Hord, 2011).

APPENDIX G

ONLINE COLLABORATION TOOL

The structure of the online collaboration tool provided users with access to all training materials, a place to upload materials to share, and a community of practice space to collaborate with each other. http://dataanalysisdiscussions.pbworks.com.



said
at 11:36 am on Oct 8, 2015
Reply Delete

I have started using weekly quizzes that are questions from the homework during the week. This is helping me to catch some of those students who I think understand the concept, but actually they are not grasping the concept.

said
at 7:50 am on Oct 21, 2015
Reply Delete

I feel that with Investigations I am not assessing the students often enough. I have started to use homework quizzes on Mondays, but I like the idea of the spiral review as well. This will give me more data and allow me to see what areas I can work with students on in flex.

said
at 10:47 am on Nov 9, 2015
Reply Delete

, I sent you a copy of my spiral review homework and quizzes that I use via email. Sorry I didn't send it earlier:(I got this resource from Teachers Pay Teachers.

said
at 5:57 pm on Oct 20, 2015
Reply Delete

To gather some snapshots of students needs and gaps, I took one of Donna Campbell's worksheet called RAP(Regular Assessment and Practice) and I love that it is a simple tool to see where students might need some help. I have used it in all academic areas: vocabulary, grammar skills, but mostly math. The students don't feel the pressure to complete a "test" but I can quickly pull those that need specific skills in my math RTI group.

APPENDIX H

RESEARCHER FIELD NOTES

Researcher Field Notes				
Observational Notes	**Theoretical Notes**	**Methodological Notes**	**Analytical Memos**	**Analysis**
My notes about what happened	My notes about deriving meaning as I think or reflect on experiences	My notes about reminders, instructions, or critiques to myself on the process	My notes about end-of-training sessions, data collection instruments, or online collaboration	
Teacher was late to session and ran too close to student pick up time—late to pick them up.	How can I sustain the online CoP after participants complete the 10-week study?	Arrive earlier and offer to take students to specials to increase time for teachers to meet personal needs.	How can I overcome the lack of time issue for posting online expressed by participants?	Need more time Sustaining online CoP
			SoC responses: "time during the holidays," "how do you get it all done?" "narrowing down for different student needs," "lack of student motivation"	Concerned about time Concerned about students

APPENDIX I

CODEBOOK – PLUS/DELTA

01.Skill Use
01.SKU-MAP.01 = Fishbone
01.SKU-WHY.02 = Five ‘why’ model
01.SKU-CAT.03 = Categorization
01.SKU-DAT.04 = Data analysis

02.Resources
02.RES-VIE.01 = Get more stakeholder’s viewpoints
02.RES-DAT.02 = Data sources

APPENDIX J

CODEBOOK DESCRIPTIONS – PLUS/DELTA

01.Skill Use
01.SKU-MAP.01 = Fishbone
01.SKU-WHY.02 = Five 'why' model
01.SKU-CAT.03 = Categorization
01.SKU-DAT.04 = Data analysis

The participants depicted the relevant aspects of the professional development session that they would implement in their own practice. I coded items that referred to participants' desire to use new skills in their classroom.

The term fishbone refers to the participants' desire to use the fishbone in their current practice. Examples of this code are "Use the fishbone with students," "Try the fishbone method with my struggling students," "Fishbone activity," "ask students to fishbone issues," and "I'd like to do it with my kiddos," "Looking at one branch at a time -- I need to constantly remind myself to slow down."

The term five 'why' model refers to the participants' desire to use the model in their current practice. Examples of this code are "Ask why more," "Asking more whys," "Look closely at the whys," "Looking more at why students struggle -- root cause of low scores," and "After fishbone take one category and again and again ask why."

The term categorization refers to the participants' desire to use categorization as a strategy in their current practice. Examples of this code are "Have kids categorize," "Have students do more categorizations," "Difficult to categorize, but helpful," "Thinking about categories for student issues with subject areas," and "Putting categories to the whys."

The term data analysis refers to the participants' desire to use data analysis to make decisions in their current practice. Examples of this code are "Watch to make sure I support with fact," "Think about all types of data before making a final question," "Gathering more data through school processes," "Look at more data before changing groups -- maybe a pair of students," "Look for trends in data," "Possibly use surveys," "Look at my target group (below 50% on DQ1 math (DVMAQ1)," "Collect data IXL, Survey Attitude," "Using Excel box and whiskers instead of averages with my students to reinforce our class goal setting and monitoring of their achievement," and "What other tools can I use to give me pictographs and box plots."

02.Resources
02.RES-VIE.01 = Get more stakeholder's viewpoints
02.RES-DAT.02 = Data sources

The participants depicted the relevant aspects of the professional development session that they would implement in their own practice. I coded items that referred to participants' desire to seek out resources for a more complete data analysis.

The term get more stakeholders' viewpoints refers to the participants' desire to seek out other human resources that can improve their data analysis efforts. Examples of this code are "Having another perspective -- talking it out," "It is so helpful to have another set of eyes and another brain working on the things I'm trying to do with data," "Collaboration and communication to solve student issues," "Reflecting on other participants' data," "Working more with team to brainstorm," "I will work with 3 points of data to discuss with kids," "Data analysis using student involvement," "Focus on 'seeing' situations from other viewpoints," and "Different points of view and perspective (be open)," "More people to brainstorm with," and "Remembering everyone has unique perceptions."

The term data sources refers to the participants' desire to use more than one data source to improve their data analysis efforts. Examples of this code are "I am more aware of data and types of data, everywhere," "Narrowing where I want to work through root cause: rSkills, ind. students, distractions," "Look at my students' demographics data as well as classroom," "Looking at other aspects of data," "Possibly use surveys," "Collect data IXL, Survey Attitude," "Looking at information that has effects on perceptions," "Looking at other areas that effect student learning that are outside of the norms," "Use SRI to see if this new RTI is successful versus small group in my room," and "Label the types of data I use."

APPENDIX K

CODEBOOK – ONLINE COLLABORATION

01.Data Management
01.DMA-CON.01 = Concerns
01.DMA-EXA.02 = Examples

02.Student Assessments
02.SAS-TYP.01 = Types
02.SAS-FRE.02 = Frequency
02.SAS-SGR.03 = Student grouping

03.Collaboration
03.COL-OTH.01 = Others

APPENDIX L

CODEBOOK DESCRIPTIONS – ONLINE COLLABORATION

01.Data Management
01.DMA-CON.01 = Concerns
01.DMA-EXA.02 = Examples

The term concerns refers to the participants' concerns about managing data. Examples of this code are "I think my biggest question is, how can I keep my data organized?" "I feel my data is all over the place, literally," "Data does get a little overwhelming for me…trying to keep it all organized is a challenge," "I am trying to narrow down my data," "Read 180 has so much data."

The term examples refers to the participants' shared strategies for managing data. Examples of this code are "I am thinking of going back to the old fashion monitoring notebook I used years ago for my target group." "Data folders work great for students, but I want it in one place," "I use the paper/pencil method," "At our school we have Excel grids that use colors for the cut scores. This helps to get a quick look at how students are doing," "I work best hands on, so paper, pencil, color coding and folders work best for me," "I use a SmartNotebook to keep my data on for discussion with the students. I find that this allows me to have ongoing discussions with the kids in each math class," "I use my gradebook to hold my data and export it to Excel then create graphs to compare the data week to week," "I'd like to see results by titles, locations, or even grade levels."

02.Student Assessments
02.SAS-TYP.01 = Types
02.SAS-FRE.02 = Frequency
02.SAS-SGR.03 = Student grouping

The term types refers to the types of student assessments shared by the participants. Examples of this code are "We completed our SRI and I now have the data," "I've never seen the SRI test except the samples when I walk by to m make sure everyone is on the right page," "I have been differentiating using the Reading Comp Report," "I use a classroom behavior management plan to handle most of the ADHD type behaviors in my class," "I find exit tickets to be wonderful sources of data," "I love the exit tickets for data," "I use the homework to reteach," "Last year I used exit tickets as bell work the day after the lesson," "Students have a chance to complete concept development with me, then homework at night," "I save the exit tickets as review for correcting mistakes, reviewing learned concepts just before mid module or module tests," "In math I am using a number concept assessment I give one-on-one," "I use exit tickets, sprints, and IXL reports to make instructional decisions," "In my math classes I am using a combination of exit tickets, unit assessments and a spiral review weekly test," "To gather some snapshots of student needs and gaps, I took one of Donna Campbell's worksheets called RAP (Regular Assessment and Practice)," "My 4th graders completed the DVMAQ1 assessment," "Along with the DVMAQ1, I use classroom assessments, and IXL," "I would like to use the DVLA assessment as an opportunity for learning while we go over the test."

The term frequency refers to how often participants are assessing students. Examples of this code are "We will not officially take the SRI again until the end of the year, but my low kids will have a chance to retake in Dec," "I'm really looking forward to checking out the October SRI," "I'm finding that the weekly assessments are helping me to analyze their basic skills and see what areas of misunderstanding they have," "I have started using weekly quizzes that are questions from the homework during the week," "I feel with Investigations I am not assessing the students often enough," "I have started using homework quizzes on Mondays, but like the idea of a daily spiral review as well," "I assess using the WTW assessment 3 times a year."

The term student grouping refers to participants' use of data to group students for instruction. Examples of this code are "I am planning to align my FLEX groups into SRI scores so I can spend a short 4 week focus on those skills," "I teach Read 180 and have been using SRI data as well as their daily software data to align my FLEX groups," "I use exit tickets to guide instruction and small group decisions," "I could start using homework to reteach during my flex time with students who need it," "I use exit tickets, sprints, and IXL reports to make small groups or provide one on one instruction," "Homework quizzes and spiral reviews will give me more data and allow me to see what areas I can work with students on in flex," "I can quickly pull those that need specific skills in my math RTI group using a RAP (Regular Assessment and Practice) worksheet," "I use writing samples and writing assessments to guide my small group instruction," "In reading I use words their way, reading assessments, and fluency to group my students," "I use sprints and exit tickets to group my students," "I am using their quiz results to support what areas of concern they are having and pull groups to meet their needs," "There are 5 of my 33 who did not improve on the SRI and they all seem to have different needs according to my data," "with continued RTI interventions, and data with a purpose, I know that my students should perform well as solid students and ready for their next challenge," "I've begun small SRI focused small groups during RTI time," "I love the break down the DVMAQ1 provides; if a student gets a question wrong, I can create an intervention group for the standard."

<u>03.Collaboration</u>
03.COL-OTH.01 = Others

The term others refers to people that the participants are collaborating with in their use of DIDM and RCA strategies learned in the professional development. Examples of this code are "I'm really trying hard to use Box and Whisker plots with my data to discuss with the kids where we are at as a class in our quest for mastery of the skills," "With Patti's help, I was able to create a way to use the Box and Whisker plots to analyze our data as a class," "We had such a great discussion of how we can best make sure that all students are learning and we set a goal as a class to have our Interquartile Range be 10% or less," "We're working on our differentiated learning groups and partners and discussing what a good mathematical problem solving partnership looks like," "This PDSA conversation was so much richer than any we've had before," "This allows me to have ongoing data discussions with the kids in each math class," "We had a discussion about trying to make the interquartile range smaller each week—showing that more of us

had learned the content," "I think it encourages kids to work together and ensure everyone at their table is grasping the concept," "I am in the process of scheduling a meeting with last year's teachers to see what they are/were doing that had such a positive influence," "We will implement and see if our grade level gets the same results," "I did not think data could be so exciting, but I can hardly wait to see each new plot to see if what we are doing is working or what we need to adjust," "We are finding we do not have enough time to pull as many groups as we want throughout the week," "I also do that with data and give the students an opportunity to see it and possibly discuss growth throughout the year," "I should do less and have students explore more with our class data," "For showing our data…we do a lot of circle graphs since it makes it easy for kids to remember that we are trying to 'make the entire circle purple and green only.'"

APPENDIX M

CODEBOOK – FIELD NOTES

01.Lack of Time
01.LOT-CON.01 = Concerns

02.Student Needs
02.SNE-CON.01 = Concerns

APPENDIX N

CODEBOOK DESCRIPTIONS – FIELD NOTES

01.Lack of Time
01.LOT-CON.01 = Concerns

The term concerns refers to the participants' concerns about lack of time. Examples of this code are "time for understanding," "time to keep up with the data," "time to gain knowledge," "time to analyze it all," "time to be creative enough to come up with theories," "time to pull it all together," "time to evaluate," "time to get on the computer to respond to other teachers," "time to analyze," "time during the holidays," "time," "how do you get it all done?" "time to meet the needs of all students," "enough time to do everything and meet the needs of students," "getting it all done and finding resources to help with struggling students," "time," "time, time, time…," "time to do what's helpful for all of my students," "time to meet the needs of all students," "time to find ways to enter student data," "none except for time," "time," "time," "time," "still time," "time," "time to make the technology work for me," "time," "time," "time," "time with district changes," "more time to look at, ingest, and record data," "still looking for time, but improving," "time," "time," "time," "time."

02.Student Needs
02.SNE-CON.01 = Concerns

The term student needs refers to the participants' concerns about meeting the needs of their students. Examples of this code are "am I looking at everything I need to?" "finding the correct root cause," "will my strategies work?" "hopefully reteaching at the point of need," "meeting the needs of students all of the time," "meeting needs of all students," "having my students ready for 6th grade math," "meeting needs of all," "meeting the needs of all students," "picking and choosing the correct data," "meeting needs of students," "resources to help struggling students," "doing what's helpful for all of my students," "meeting needs of all students," "using the correct data to help students," "narrowing down for different student needs," "lack of student motivation"