

AN ABSTRACT OF THE DISSERTATION OF

Robin DeLoach for the degree of Doctor of Philosophy in Education presented August 2, 2012.

Title: Factors that Affect a School District's Ability to Successfully Implement the Use of Data Warehouse Applications in the Data Driven Decision Making Process

Abstract approved: _____
Karen M. Higgins

The purpose of this study was to explore the factors that influence the ability of teachers and administrators to use data obtained from a data warehouse to inform instruction. The mixed methods study was guided by the following questions: 1) What data warehouse application features affect the ability of an educator to effectively use the application for data driven decision making? 2) What sorts of training or professional development and workplace norms are needed to help educators use data warehouse applications more effectively? 3) How do differences in leadership affect an organization's use of data warehouse applications? 4) What, if any, impact has the use of data warehouse applications had on instructional strategies and student performance?

Forty-five teachers and administrators completed the survey. A focus group of four administrators and interviews with four teachers provided qualitative data. Descriptive statistics were used to analyze the quantitative data. The qualitative data was coded in several cycles to determine common themes. The results from the

qualitative and quantitative data were then compared to determine areas of similarities and differences.

The factors that influenced an educator's ability to use a data warehouse application to inform instruction included ease of use of the application, access to student data in a timely manner, and the ability to view data on individual students and small groups of students. The type of data most useful to the participants was summative and formative assessment data.

Training and workplace norms influenced the use of the application. The more training received, the easier the educators found the application was to use. Dedicated time to review data and the opportunity to collaborate with colleagues also enhanced the ability of educators to use the application to inform instruction.

Educators who thought the use of the application was important to building and district level administrators tended to use the application more frequently.

Based on the educator's perceptions, the use of the data warehouse application appeared to have some impact on influencing changes in instructional strategies. Any changes in student performance were attributed to the changes in instructional strategies.

Two unexpected findings emerged from this study. The ability to use technology affected an educator's use of the data warehouse application. A greater comfort level with the use of technology in general was attributed to greater use of the application. Finally, educators needed to have sufficient skills in the use of data in the

data driven decision making process to successfully implement the use of the data warehouse application.

©Copyright by Robin DeLoach
August 2, 2012
All Rights Reserved

Factors that Affect a School District's Ability to Successfully Implement the Use of
Data Warehouse Applications in the Data Driven Decision Making Process

by
Robin DeLoach

A DISSERTATION

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Doctor of Philosophy

Presented August 2, 2012
Commencement June 2013

Doctor of Philosophy dissertation of Robin DeLoach presented on August 2, 2012.

APPROVED:

Major Professor, representing Education

Dean of the College of Education

Dean of the Graduate School

I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

Robin DeLoach, Author

ACKNOWLEDGEMENTS

It is with heartfelt thanks that I acknowledge the individuals who supported me in this journey. I could not have completed this dissertation without you.

I would like to express my deepest gratitude to my major professor, Dr. Karen Higgins, for her guidance and gentle prodding that kept me on track and for going above and beyond the call of duty to help me finish this dissertation on time. I would like to thank my doctoral committee, Drs. Michael Dalton, Greg Gruener, Karen Higgins, William Rhoades, and Susan Shaw, for taking time out of their busy schedules to provide feedback and support throughout this process.

I would also like to thank my friend and cohort member, Dr. Kathy Austin, who made my journey so much easier by sharing what she learned from traveling this same path last year. Thank you for forging the way. And to my friend and running buddy, Dr. Cecily McCaffery, thank you for always having faith in me even when I lacked faith in myself.

Finally, with love and gratitude, I would like to thank my partner in life, Bruce Eschenbacher, whose patience, understanding, support, and encouragement kept me going throughout this journey.

TABLE OF CONTENTS

	<u>Page</u>
I. Introduction.....	1
Definitions.....	7
II. Literature Review	11
Data Driven Decision Making	11
DDDM as a part of a Collaborative Process	12
Professional Learning Communities	12
Response to Intervention.....	13
Summative and Formative Assessment	14
Factors Affecting DDDM	16
Data Driven Decision Making Summary	19
Levels of Learning	20
Six Steps in Transforming Data into Knowledge	22
Levels of Learning Summary	23
Data Warehousing.....	23
Data Warehousing and DDDM.....	24
Review of Data Warehouse Research	25
Data Warehousing Summary	26
DDDM Research Methodologies	27
Connecting the Existing Research to this Study	28
Need for Additional Research.....	29
Summary	30
III. Research Method/Design of Study.....	33
Research Perspective.....	33
Methodology and Procedures.....	34
Role of the Researcher	35

TABLE OF CONTENTS (Continued)

	<u>Page</u>
 III. Research Method/Design of Study (continued)	
Selection of Participants.....	35
Protection of Rights of Participants	37
Quantitative Data Collection: On-line Survey	39
Survey Topics	39
Survey Questions	40
Qualitative Data Collection.....	42
Focus Group	42
Purpose of Focus Group.....	43
Focus Group Protocol	44
Teacher Interviews	45
Researcher Memos	46
Quantitative Data Analysis	46
Qualitative Data Analysis	47
Reliability	48
Validity.....	50
Experts in the Field of Data Warehousing and DDDM	50
Pilot Testing	50
Representation of Various Views.....	51
Triangulation	51
Summary	52
 IV. Results.....	
Survey Data.....	55
Participants	55
Data Warehouse Features.....	58
Professional Development	66
Impact on Instructional Practices and Student Performance.....	74
Work Place Norms	76
Leadership.....	82

TABLE OF CONTENTS (Continued)

	<u>Page</u>
IV. Results (continued)	
Participant Views of the Data Warehouse Application.....	93
Survey Data Summary	96
Focus Group and Interview Data	102
Data Warehouse Features.....	104
Professional Development and Support.....	105
Impact on Instructional Strategies and Student Performance	106
Work Place Norms	108
Leadership.....	109
Unexpected Findings.....	110
Focus Group and Interview Data Summary.....	111
Comparison of Findings from Quantitative and Qualitative Data	113
Data Warehouse Features.....	114
Professional Development and Support.....	114
Impact on Instructional Strategies and Student Performance	115
Work Place Norms	116
Leadership.....	117
Quantitative and Qualitative Data Comparison Summary.....	118
Summary	120
V. Discussion of Findings	127
Research Question Findings.....	127
Question 1	127
Question 2	129
Question 3	130
Question 4	131
Other Findings.....	132
Limitations	133
VI. Conclusions.....	135
Implications for Educators, Policy Makers, and Data Warehouse Providers	135

TABLE OF CONTENTS (Continued)

	<u>Page</u>
VI. Conclusions (continued)	
Implications for Researcher	136
Suggestions for Future Research.....	138
Concluding Thoughts	139
References	141
Appendices	146

LIST OF TABLES

<u>Tables</u>	<u>Page</u>
Table 1 Distribution of Participants by School District.....	56
Table 2 Distribution of Participants by Role	57
Table 3 Distribution of Participants by Student Grade Level of Position	58
Table 4 Distribution of Participants by Instructional Content Area	58
Table 5 Usefulness of Data Displays.....	60
Table 6 Mean Comparison of Usefulness of Data Display Responses	61
Table 7 Usefulness of Types of Data.....	62
Table 8 Mean Comparison of Usefulness of Types of Data.....	63
Table 9 Usefulness of Data Disaggregated by Student Groups.....	63
Table 10 Usefulness of Student Groups Disaggregated by Participant Role	65
Table 11 Comparison of Student Group Means	66
Table 12 Influence on Changes to Instructional Strategies or Intervention Techniques Compared to Amount of Data Warehouse Application Training Received.....	68
Table 13 Influence on Changes to Instructional Strategies or Intervention Techniques Compared to Amount of Training Received in Use of Data for Instruction.....	69
Table 14 Amount of Training by Role	71
Table 15 Amount of Data Warehouse Application Training Received Compared to Frequency of Use	72
Table 16 Amount of Data Warehouse Training Compared to Importance to Participant.....	73

LIST OF TABLES (Continued)

<u>Table</u>	<u>Page</u>
Table 17 Training in Use of Data Compared to Frequency of Use of Application.....	74
Table 18 Influence of Data Warehouse Application on Changes in Instructional Strategies or Intervention Techniques	75
Table 19 Influence of Data Warehouse Application on Student Performance.....	76
Table 20 Usefulness of Reviewing Data based on Group Size	77
Table 21 Frequency of Designated Data Review Time by Group Size.....	78
Table 22 Sufficient Time to Review Data Compared to Amount of Designated Time to Review Data Individually	79
Table 23 Amount of Designated Time to Review Data Individually Compared to Frequency of Use of the Data Warehouse Application	80
Table 24 Designated Time to Review Data in Small Groups Compared to Frequency of Use.....	81
Table 25 Amount of Help Available Compared to Changes in Instructional Strategies or Intervention Techniques	82
Table 26 Frequency of Use of the Application Compared to Leader Participation in Trainings.....	84
Table 27 Leader Participation in Data Trainings and Changes to Instructional Strategies	85
Table 28 Perceived Importance of Data Warehouse Application by Building Administrators Compared to the Frequency of Use	86
Table 29 Perceived Importance of Data Warehouse Application to Building Administrators Compared to Changes in Instructional Strategies	87
Table 30 Perceived Importance of Data Warehouse Application to District Administrators Compared to Frequency of Use	88
Table 31 Perceived Importance of Data Warehouse Application to Building Administrators Compared to Changes in Instructional Strategies	89

LIST OF TABLES (Continued)

<u>Table</u>	<u>Page</u>
Table 32 Perceived Importance of Data Warehouse Application to Building Administrators Compared to Importance to Participants	90
Table 33 Pearson Chi-square Test for Independence of Perceived Importance of the Data Warehouse Application by Building Administrators and the Importance of the Application to Participants	91
Table 34 Perceived Importance of Data Warehouse Application to Building Administrators Compared to Importance to Participants	92
Table 35 Perceived Importance to Building Teachers Compared to Importance to Participant.....	93
Table 36 Importance of Data Warehouse Application Compared to Frequency of Use.....	94
Table 37 Influence of the Data Warehouse Application on Changes to Instructional Strategies or Intervention Techniques Compared to Importance the Use of the Application had to Participant.....	95
Table 38 Influence of Data Warehouse Application on Improvements in Student Performance Compared to Importance of the Data Warehouse Application to Participant.....	96

LIST OF APPENDICES

<u>Appendix</u>	<u>Page</u>
Appendix A Database Searches	147
Appendix B Invitation to Participate in Survey Email	148
Appendix C Interview Invitation Email.....	150
Appendix D Focus Group Email.....	151
Appendix E Focus Group Informed Consent.....	152
Appendix F Verbal Consent Guidelines	155
Appendix G On-Line Survey	156
Appendix H Focus Group Protocols	162
Appendix I Interview Protocol.....	165

Factors that Affect a School District's Ability to Successfully Implement the Use of Data Warehouse Applications in the Data Driven Decision Making Process

I. INTRODUCTION

“Without data, you are just another person with an opinion” (Wenmoth, 2009, para. 4).

With the onset of No Child Left Behind (NCLB) Act (2002), educators found themselves in an age of accountability. NCLB is the reauthorization of the Elementary and Secondary Education Act (ESEA) adopted in 1965 to provide federal funds to school districts to supplement the educational services received by disadvantaged students (Reichback, 2004). In her review of NCLB, Reichback (2004) points out that, despite the adoption of ESEA and its revision as the Improving America's Schools Act of 1994, the gap between white and non-white students continued to grow. The intent of NCLB was to ensure an equitable education for all students. Under NCLB, states were required to report on student achievement annually. The results were to be disaggregated by gender, race, ethnicity, English proficiency, and migrant status to allow for comparisons between groups (Reichback, 2004). Schools and school districts were required to meet Adequate Yearly Progress (AYP), a measure, based on standardized tests, that indicated whether the students in a school or school district made appropriate academic gains (No Child Left Behind Act, 2002). Because of this, educators, from superintendents to classroom teachers, found themselves focused on the progress their students were making on standardized state assessments. In order to receive funds, as well as monitoring progress towards meeting AYP, schools and school districts in Oregon were required to develop

Continuous Improvement Plans and School Improvement Plans that, based on an examination of data, delineated the steps the school/school district would take to ensure improved academic performance (Oregon Department of Education, 2005).

In response to NCLB, there has been an increase in the use of data-driven decision making (Brunner, et al., 2005). In education, data driven decision making (DDDM) is the systematic collection and analysis of various types of data to guide decisions to help increase student achievement (Marsh, Pane, & Hamilton, 2006). The use of DDDM predates NCLB. In their review of the literature, Black and Wiliam (2010) found research on the use of formative assessments in education as early as 1986. Yet, with all of this emphasis on the use of data to increase student achievement, are educators truly equipped to effectively use data in a manner that will result in improved student achievement?

In 2007, Oregon Department of Education allocated \$4.7 million to implement the Oregon Direct Access to Achievement (DATA) Project (2009). This project focused on training educators at the district, school, and classroom levels in how to use data to improve student performance. Over 67% of school districts and approximately 1000 educators participated in the trainings focused on how to use data to improve instruction (The Oregon DATA Project, 2009). The Oregon DATA Project, as with many school reform initiatives, focused on specific school improvement processes. The assumption exists that if educators have access to data and have received initial training in the use of data, then they will be able to effectively use data to improve student achievement.

Recent studies have shown factors that influence an educator's ability to effectively use data to make informed decisions include the accessibility and quality of the data, timeliness of the data, ease of use, and ability to manipulate the data (Light, Wexler, & Heinze, 2004; Marsh, et al., 2006). School districts in Oregon turned to data warehousing services to address the need for data for use in instructional decision making and accountability (Wolff, 2010). A data warehouse allows educators to use and compare data from multiple sources. For example, teachers can compare student attendance rates to student assessment scores. The design of the data warehouses in Oregon was highly influenced by current trends in assessment. As of 2010, all of the regional data warehouses in Oregon provided information on both formative and summative assessments (Wolff, 2010). This allowed educators to easily access summative data for program level decision making. In addition, formative assessment data was available for instructional planning and interventions.

In my position as the director of a regional data warehouse for educational information, it is my role to work with educators to provide easily accessible, current, and user-friendly resources that show student demographic and achievement data in a graphical format. This resource is available to all administrators and teachers within a three-county region. Educators throughout Oregon also have access to student achievement data through the Oregon Department of Education. In addition, as mentioned earlier, at least 67% of Oregon school districts have participated in training on data driven decision making. Yet, even with these resources readily available, I observed educators struggling to make sense of data. This led me to wonder, what

was missing? With millions of dollars being spent by Oregon alone to address the need to effectively use data to drive instruction, it is imperative the factors that influence the success of the implementation of data warehouse applications for use in DDDM are identified and implemented in educational systems. A number of studies address the factors necessary to successfully implement school improvement initiative that include data driven decision making (for example, Brunner, et. al., 2005; Marsh, et al., 2006; Williams, et al., 2005). These studies do not address the use of data warehouse applications and how they influence the DDDM process.

The data warehouse collects, organizes, and summarizes data, presenting the data in the form of information. This enables the educator to begin the process of analyzing, synthesizing, and prioritizing the data to gain knowledge. A data warehouse enhances the DDDM process by gathering data from multiple sources and presenting the data in a comprehensive format. This allows educators to focus their time on exploring the question of why students are or are not performing at a desired level.

The purpose of this study was to explore the factors that influence the ability of teachers and administrators to use data obtained from a data warehouse to inform instruction that will lead to increased student performance. There are many studies on the benefits of the use of DDDM in K-12 educational systems, but few studies exist on the use of data warehouses in K-12 educational systems (LaPointe, et. al., 2009; Streifer & Schumann, 2005; Watson, 2002). However, none of the studies on the use of data warehousing explores the effect this use has on educational practices resulting

in increased student achievement. This study is strongly tied to the use of assessment, both formative and summative, and the process of DDDM. Specifically, this study seeks to find the perceptions of teachers and administrators regarding whether the data warehouse has had any influence on their instructional practices and any effect on increasing student performance, and what attributed to or detracted from that influence. The role leadership plays in the use of the data warehouse application, professional development, and work place norms were also explored.

As school districts begin to implement the use of data warehouses, it is important to know whether they will have a positive impact on student achievement and what factors influence such an impact. The study addressed four research questions:

What data warehouse application features affect the ability of an educator to effectively use the application for data driven decision making?

What sorts of training or professional development and workplace norms are needed to help educators use data warehouse applications more effectively?

How do differences in leadership affect an organization's use of data warehouse applications?

What, if any, impact has the use of data warehouse applications had on instructional strategies and student performance?

The study was a sequential mixed methods study (Creswell, 2009).

Quantitative, qualitative, and mixed methodologies have been used in similar studies (Brunner, et al, 2005; Hammond & Yeshanew, 2007; Marsh, et al., 2006; McMillan,

2005; Williams, et al., 2005). A mixed methods approach was chosen for four reasons. First, the use of a survey would provide quantitative data on the factors that affect the implementation of a data warehouse application and its use in the data driven decision making process. In addition, data could be gathered from a larger number of participants than if only qualitative methods were used. The use of interviews and a focus group provided the opportunity to gain a more in-depth understanding of how the factors identified in the survey affected the use of the data warehouse application. It also provided a means to triangulate the quantitative and qualitative data. Finally, the interviews and focus group provided an opportunity for participants to identify and discuss factors that were not addressed in the survey.

The intended audience for this study was educators and policy makers who are considering implementing the use of a data warehouse application, are in the process of implementing a data warehouse application, or have implemented a data warehouse application. It is hoped this study can be used by practitioners to assist in the planning and implementation of a data warehouse application or similar project in the field of education. The audience includes those at the planning and policy level, as well as the individuals who will work with educators to implement the project. This study was also intended for individuals working in school improvement and education such as curriculum directors, school improvement specialists, district and building administrators, school board members, and classroom teachers. This study was not designed to address the technical aspects of implementing a data warehouse but to

broaden the knowledge base in the area of the use of data warehousing in the field of education.

This research was conducted from a postpositivist perspective. A unifying postpositivist belief is that knowledge is based on conjecture (Phillips & Burbules, 2000). The purpose of research is to seek the truth, acknowledging that an absolute truth does not exist, realizing and embracing the understanding that, at some future point, evidence or criticisms may arise that prove the belief as false. It is the understanding that knowledge, based on observation, is influenced by the researcher's background and beliefs while striving to remain objective. Knowledge is based on *circumstantial* evidence (Phillips & Burbules, 2000, p 31), subject to imperfections and fallibility. From this stance, certain assumptions were made that might have influenced the research findings. The first assumption was that the proper use of DDDM will lead to an increase in student academic performance as measured by formative and summative assessments. The second assumption was that all educators, given the proper tools, training, and environment, can effectively use data to improve student achievement. The ability to move from data to understanding is a skill that can be learned. It is not a talent that is inherent. Finally, it was assumed that educators must understand how data can be used to drive instruction in order to effectively influence student achievement.

Definitions

Certain terms are used throughout this research. These terms are defined in this section.

Data driven decision making (DDDM) is the systematic collection and analysis of various types of data to guide decisions to help increase student achievement (Marsh, et al., 2006).

Data literacy is the knowledge of how to analyze and interpret data on which to base instructional decisions.

Data warehouse is a repository for student data collected from multiple sources. Data typically contained in a data warehouse includes student demographic information, attendance, behavioral incidents and actions, standardized assessment scores, and formative assessment information.

Data warehouse application is a tool which allows educators to view the data stored in a data warehouse. Data is presented in the form of charts, graphs, and reports. The application may offer the ability to disaggregate the data by various identifiers such as student grade level, race, or program participation.

Formative assessment is an assessment used to provide feedback for the purpose of informing the teaching and learning process (Dunn & Mulvenon, 2009). Formative assessments are used in the day-to-day decision making process used to adapt instruction to meet the specific needs of students (Black & Wiliam, 2010).

Professional Learning Community (PLC) is the use of systematic, school-wide strategies designed to provide additional time and support to students who are struggling in school. The process assumes the emphasis in schools is on learning and is based on the use of intervention instead of remediation. Collaboration is used to

improve the classroom practice of teachers by examining common formative assessment data to determine whether students are learning (DuFour, 2004).

Response to Intervention (RTI) is a process used to identify students with learning disabilities that utilizes a team approach to review data to make informed decision (Fuchs & Fuchs, 2006). The premise behind RTI is that appropriate interventions are implemented prior to students falling far behind their classmates (Buffum, Mattos, & Weber, 2010).

Summative assessment is an assessment used to evaluate “academic progress at the end of a specified time period...for the purposes of establishing a student’s academic standing relative to some established criterion” (Dunn & Mulvenon, 2009, p. 3). Summative assessments are often used for accountability, ranking, or certifying competence (Black, Harrison, Lee, Marshall, & Wiliam, 2004).

Chapter 2 explores the use DDDM in education and its relationship to data warehousing. Research on the factors that affect DDDM and the connections to knowledge acquisition and data warehousing are reviewed. Chapter 3 describes the data collection methods used in this study, how the data were analyzed, and addresses measures taken to ensure validity and reliability of the study. Chapter 4 provides an in-depth review of the analysis of the data. The chapter presents the findings from the on-line survey and the focus groups and interviews. The findings from the qualitative and quantitative data are then compared. Chapter 5 discusses how the findings relate to the research questions. Chapter 6 addresses implications for educators and data

warehouse providers. Limitations in the study and the need for additional research are also discussed.

II. LITERATURE REVIEW

The purpose of this study was to explore and identify the factors that affect the successful implementation of data warehousing to positively impact the ability of educators to make informed instructional decisions at the classroom, school, and district level. Data warehouses, and their accompanying analytic tools, provide a means to access data from a variety of sources and present the data in a meaningful format. At a time when data driven decision making (DDDM) is becoming prevalent in schools and school districts, data warehouses could assist educators in this process.

This chapter explores the use of DDDM in education. Studies on the factors influencing the use of DDDM in education are discussed. The conceptual framework of Ackoff's (2009) levels of learning are described as well as their role in the DDDM process. Finally, the relationship between a data warehouse, DDDM, and Ackoff's levels of learning are addressed.

In an attempt to cover all aspects of available literature, databases on education, business, computer science, psychology and sociology, as well as general topics, were searched for relevant articles. Key terms included related terms on data, data warehousing, DDDM, school improvement, education, and information management. A list of data bases and key search terms is included in Appendix A.

Data Driven Decision Making

DDDM is a continuous process. It involves the gathering and analysis of data from multiple sources and arranging it in a usable format that allows for the analysis of the data for strengths and challenges. Priorities are then determined based on the

strengths and challenges identified from the data, and goals are established (Reeves, 2002). Goals should be specific, measurable, achievable, realistic, and time-framed (Miller & Cunningham, 1981). Strategies should be developed and indicators identified to measure the successfulness of the strategies. Finally, a plan and schedule is developed to measure progress towards meeting goals. Strategies are adjusted, as needed, to continue to move towards the identified goals (Reeves, 2002).

If successful, new goals are set to address other areas of weakness or to strive for higher levels of student achievement. If the goals are not met, the process is examined to determine why the goals were not met, existing strategies are revised or new strategies are implemented, and the process is repeated (Reeves, 2002).

DDDM as a part of a Collaborative Process

While a critical element of school improvement, DDDM is only one part of a larger process. In his review of case studies on data use, Wayman (2005) found data initiatives were more likely to succeed if teachers worked collaboratively. Two current educational initiatives in which DDDM is used in a collaborative manner are Professional Learning Communities (PLC), and Response to Intervention (RTI).

Professional Learning Communities. There are three core principles that guide PLCs. The first is the assumption that emphasis in schools is on learning. Formal education is not about ensuring students are taught but that students learn (DuFour, 2004). To ensure students learn, systematic, school-wide strategies are designed to provide additional time and support to students who are struggling. These

strategies must be timely, based on intervention instead of remediation, and directive as opposed to optional.

The second principle is the use of collaboration. DuFour defines collaboration as “a systemic process in which teachers work together to analyze and improve their classroom practice. Teachers work in teams, engaging in an ongoing cycle of questions that promote deep team learning” (2004, p. 9). The intent of collaboration is to improve classroom practice of teachers.

The third principle is that the effectiveness of PLCs is based on results. PLCs use data to determine whether students are learning. Common formative assessments are used to compare how students in one class are doing to the performance of students in another class. Improved student learning is achieved by teachers benefiting from the sharing of ideas, materials, and strategies of successful team members (DuFour, 2004).

Response to Intervention. One form of DDDM used to identify students with learning disabilities is RTI. RTI is similar to PLCs in that it uses a team approach to review data to make informed decisions. RTI focuses on the use of data to determine possible recommendations for special education services whereas PLCs may focus on broader school improvement issues.

RTI differs in many identification approaches in that it is “a means to provide early intervention to all children at risk of school failure” (Fuchs & Fuchs, 2006, p. 93). The premise behind RTI is that schools should not wait until students qualify for special education services but should intervene prior to students falling far behind

their classmates (Buffum, et. al, 2010). Fuchs and Fuchs (2006) state the low achievement of some students identified as learning disabled may actually be the result of poor teaching. The intervention and progress monitoring process involved in RTI should reduce the misdiagnosis of students as learning disabled.

RTI is not a prescribed set of procedures, but a process that is used for decision making (VanDerHeyden, Witt, & Gilbertson, 2007). The process to identify students at risk of failing in school involves screening all students through a standardized test at the elementary level or graduation requirements at the secondary level (Fuchs & Fuchs, 2006). Once identified, the at-risk students are monitored to determine those who are unresponsive to classroom instruction. These students are provided with more intensive instruction through research-based interventions that address the students' educational needs (Davis Bianco, 2010). The students' rate and level of learning are monitored throughout the process with interventions increasing if students are not responsive. Evaluations occur at regular intervals. Teachers use the data from the evaluations to determine what changes they need to make in instruction. If students do not respond to the increased levels of intervention, eligibility for special education services is considered. Key to the success of RTI is that the interventions are implemented correctly and student progress is monitored throughout the process (VanDerHeyden, et. al., 2007).

Summative and Formative Assessment

The use of formative and summative assessment data plays a key role in the DDDM process (Black & Wiliam, 2010; Bernhardt, 2005)). Standardized summative

assessments, typically given once a year, have been used since the 1960s when district-wide standardized assessment programs were used to increase accountability (Stiggins, 2002). This moved to a state level with statewide testing programs in the 1970s. The 1980s brought national assessment programs to be expanded to international assessment programs in the 1990s (Stiggins, 2002). With the reauthorization of the Elementary and Secondary Schools Act, in what is commonly known as No Child Left Behind (NCLB, 2002), school districts were required to assess all students in grades three through eight and high school in reading and mathematics each year. The assessment must be a standardized assessment. The data from the standardized assessments was used to determine whether the school district, as well as the individual schools within the district, made what could be considered adequate yearly progress as measured by increased student academic achievement (NCLB, 2002). Yet, as Stiggins points out, while standardized assessments “provide comparable data that can be aggregated across schools, districts, and states to inform far-reaching programmatic decisions” (2002, p. 560), these summative assessments cannot provide the day-to-day information teachers need to make instructional decisions.

In their review of research and literature, Black and Wiliam (2010) found formative assessment to be “at the heart of effective teaching” (p. 82). They found the use of formative assessment produced significant learning gains especially for low achieving students. What was key to the success of the formative assessment was that it was used to adjust teaching and learning. Black and Wiliam (2010) found that the

research and literature showed that there is “firm evidence that formative assessment is an essential component of classroom work and that its development can raise standards of achievement” (p. 90).

In addition to providing information the teacher can use to inform instruction, students must be actively engaged in the formative assessment process (Stiggins, 2002). Students must understand the goal and what they must do to reach that goal. This can be accomplished through peer and self-assessments (Black et al., 2004).

Several problems exist with the use of formative assessment. First, teachers have difficulty separating formative and summative assessment (Taras, 2009). Teachers tended to use assessments designed for summative purposes as formative by focusing on weak areas of performance. Secondly, an assessment is only formative if it is used to provide feedback to the student (Dunn & Mulvenon, 2009). Few teachers are trained in using formative assessment in instruction (Stiggins, 2002). Teachers may not inherently change instructional practices based on the presence of data. Structured formative assessments must be coupled with strong guidance on instruction to see improvements (Dorn, 2010). Finally, time must be set aside for teachers to review data and revise instructional plans based on the data (Dorn, 2010).

Factors Affecting DDDM

There are many studies on the factors that affect DDDM. The studies discussed in this section were selected for various reasons. Reeves’ (2005) “90/90/90 Schools” study is the foundation for the systems of accountability process implemented throughout Oregon as a part of the Oregon DATA Project (2009). The

other studies discussed in this section provided comprehensive reviews of the factors affecting the use of DDDM in the school improvement process. The study by Williams, et al, (2005) involved a large data set across multiple school districts. Means, Padilla, DeBarger, & Bakia, (2009) and Light, et. al, (2004) both involved the use of a specific tool in the evaluation of the use of the DDDM process.

In his study on “90/90/90 Schools,” Reeves (2005) examined schools in Milwaukee, Wisconsin that shared the characteristics of being at least 90% low income (as defined by the number of students who qualified for free and reduced lunch), at least 90% minority population, and at least 90% of the students meeting or exceeding state standards on academic achievement tests. Through a review of four years of state assessment data and records on instructional practices and strategies, Reeves found five characteristics present in all schools involved in the study: a focus on academic achievement, clear curriculum choices, frequent assessment of student progress and multiple opportunities for improvement, an emphasis on nonfiction writing, and collaborative scoring of student work.

A large-scale study of California elementary schools with large populations of low income students examined why some schools out-performed others of similar demographics (Williams, et al., 2005). Williams, et al. surveyed approximately 5,500 teachers and 257 principals to examine statewide implementation reform. The study identified four practices of high performing schools: prioritizing student achievement; implementing a coherent, standards-based curriculum and instructional program; using assessment data to improve student achievement and instruction; and ensuring

availability of instructional resources. In addition, Williams, et al. found high performing schools had principals that drove the reform process. District leadership, accountability, and support also appeared to influence student achievement.

In their study on the implementation of student data systems and the practices involving the use of data to improve instruction, Means, et al. (2009) examined the case study of nine school districts selected based on the strength of their data use activities. Principals and teachers were interviewed and teacher understanding of student data was explored through the use of scenarios involving hypothetical student data. District and teacher surveys from the U.S. Department of Education's National Educational Technology Trends Study were used as secondary sources of information. Means, et al. found data from student data systems were used in school improvement efforts, but this use had little effect on teachers' daily instructional decisions. Data systems were not user friendly, did not contain the data teachers found most useful in instructional decision making, and lacked the instructional tools allowing teachers to act on the data provided. Means, et al. also found providing training and support was not sufficient. Supports such as leadership to model data use and time to reflect on data were needed. Leadership need not be limited to principals but could include instructional coaches and lead teachers. Although teachers in the study had received training on DDDM, teachers indicated additional training would be beneficial. Seventy-one percent of the teachers surveyed indicated they needed help in making sense of the data in the district systems. The study found that while teachers were able to locate data in a complex table, they lacked data literacy skills to enable them to

understand the data. The study found designated time for teachers to review and discuss data in small groups was beneficial.

The RAND Corporation (Marsh, et al., 2006) reviewed four studies on districts that implemented DDDM and its effectiveness. From this review, nine factors were identified that influence the use of data for decision making. These factors were accessibility of data, quality of data (real or perceived), motivation to use data, timeliness of data, staff capacity and support, curriculum pacing pressures, lack of time, organizational culture and leadership, and history of state accountability.

In their study of DDDM used in New York schools, Light, et al. (2004) interviewed educational leaders, administrators, and teachers on their beliefs and practices using Grow Reports, a report provided to educators that organized and summarized summative student assessments. Light, et al. found access and ease of use, timeliness, comprehensibility of data, manipulation of the data, utility and quality of the data, and links to instruction, to be instrumental in the effectiveness of DDDM.

Data Driven Decision Making Summary

DDDM, when used in the field of education, is the systematic collection and analysis of various types of data to guide decisions to help increase student achievement (Marsh, et al., 2006). Research has shown that school improvement must also focus on academic achievement, clear curriculum choices, and frequent assessment of student progress (Reeves, 2005; Williams, et al., 2005).

DDDM is a continuous process involving the gathering and analysis of data from multiple sources, determining priorities based on strengths and challenges

identified from the data, and setting priorities and establishing goals. Strategies are adjusted, as needed, to continue to move towards the identified goals (Reeves, 2002).

Several factors affect the DDDM process. These factors include accessibility and quality of data, the timeliness of data, and ease of use and ability to manipulate the data (Light, et al., 2004; Marsh, et al., 2006). Organizational processes that affect DDDM include the role of leadership, support, staff capacity to use data, and collaboration (Marsh, et al., 2006; Mean, et al, 2009; Reeves, 2002; Williams, et al., 2005).

Levels of Learning

One element that affects the success of DDDM is the teacher's or administrator's level of knowledge acquisition (Light, et al., 2004). The higher the level of knowledge acquisition, the more effective DDDM is. DDDM requires educators to reach the level of understanding to make effective changes in their instructional practices in order to raise student achievement. Educators must be able to identify pertinent data, transform the data into information by changing them into a usable format, analyze and synthesize the data to gain knowledge, and then use the knowledge to understand why their instructional strategies are or are not effective. Understanding why strategies are or are not effective allows educators to make informed decisions about the changes that need to be made in the educational setting, whether that is at the classroom, school, or district level.

Light, et al. (2004) present a conceptual framework of DDDM based on Ackoff's (1999) levels of learning. Mandinach, Honey, and Light (2006) further

expand on Ackoff's levels of learning in their framework for data-driven decision making. Levels of learning come from the field of knowledge management. Ackoff first mentioned levels of learning in 1990 and later expanded on this concept in 1999. Ackoff described five levels of learning: data, information, knowledge, understanding, and wisdom. These levels are hierarchical with data being the lowest level.

Data are defined by Ackoff (1990) as “symbols that represent properties of objects, events and their environments. They are products of observation” (p. 486). Data, by themselves, have no value or relevance.

Information is data that has been transformed into a usable form. It is data with meaning. Information provides answers to *who, what, when, where, and how many* questions.

Knowledge answers *how* questions. It is obtained from one's own experience or the experience of others. Knowledge is the ability to use information to guide actions.

Understanding answers *why* questions. It is not only using information to guide actions, but knowing why those actions are necessary. Ackoff (1999) explains that understanding comes from learning from one's mistakes. Understanding is the ability to identify what caused the mistake and what actions are needed to correct the problem. Understanding is necessary to causally relate objectives, actions, and outcomes.

Data, information, knowledge, and understanding are hierarchical and interdependent. At the top of the hierarchy is wisdom. Ackoff defines wisdom as “the

ability to perceive and evaluate the long-run consequences of behavior” (1999, p. 16). Wisdom differs from data, information, knowledge, and understanding in that it incorporates *value*. Wisdom is not only taking action, but taking action for the right reason. It involves evaluating the situation and making judgments of what actions will lead to the right end. These are decisions made with long-term effects in mind. Given that this study encompassed a one-year time period and wisdom requires judgments in value, it is beyond the scope of this study to determine the level of wisdom applied in the data driven decision processes considered.

Six Steps in Transforming Data into Knowledge

The framework of Light, et al. (2004) differs from Ackoff’s (1999) levels of learning in that they only address the first three levels of learning: data, information, and knowledge. They go on to further identify six steps in transforming data into knowledge. These steps are collecting data, organizing the data into a meaningful format, summarizing the data, analyzing the data, synthesizing the data, and finally, making decisions based on the data.

In Mandinach, et al.’s (2006) framework for data-driven decision making, data must first be collected and organized. Information is data with meaning. To gain meaning from data, it must first be analyzed and summarized. Once in a usable, meaningful format, the next steps are to synthesize and prioritize the information. It is through this process that an individual gains knowledge. Taking this framework for DDDM one step further, to make effective decisions, one must be able to answer *why*.

The ability to answer *why* a decision is the best one to make is what leads to understanding.

Levels of Learning Summary

According to Ackoff (1990), the five levels of learning are data, information, knowledge, understanding, and wisdom. Information is data that are organized in a way to show meaning. Knowledge is gained through prioritizing and synthesizing information (Mandinach, et al., 2006). Understanding is being able to apply knowledge to learn from one's mistakes and know what actions are needed to correct those mistakes (Ackoff, 1999). Wisdom is defined as understanding with value. It is not only knowing what the correct action to take is, but basing that decision on values.

An educator's level of knowledge acquisition will affect the success of the DDDM process. DDDM requires educators to reach the level of understanding to make effective changes in their instructional practices (Light, et al., 2004).

Data Warehousing

A data warehouse is a computer application that stores data from different sources in one location. In addition, it links that data together through some common element (Bernhardt, 2005). For example, in an educational setting, data may consist of student demographic information, attendance records, and assessment scores. The common element would be the individual student. The data is then displayed in a meaningful way, usually in the form of graphs, tables, or reports. The purpose is to provide current information in a manner that is easy to understand and analyze (Paré & Elovitz, 2005).

Data Warehousing and DDDM

A data warehouse addresses several of the factors that influence the success of DDDM. Because the data is updated regularly and provided through a technology interface, typically available to staff via internet or intranet, data is easily and readily accessible. Data is updated on a regular basis, typically weekly or nightly. Educators have on-going and immediate access to this data. This addresses the need for educators to access data in a timely manner. The analytical tools used to display the data allow users to view the data in an easily understandable format and also allow the users to manipulate the data. In considering Ackoff's (1999) levels of learning, the data warehouse collects, organizes, and summarizes the data, presenting the data in the form of information. This enables the educator to begin the process of analyzing, synthesizing, and prioritizing the data to gain knowledge. It allows educators to focus their time on exploring *why* questions that lead to understanding.

In response to the need for data to address accountability requirements and instructional decision making, school districts in Oregon turned to data warehousing services (Wolff, 2010). The design of the data warehouses in Oregon was highly influenced by current trends in assessment, such as PLCs and RTI. Currently, all of the regional data warehouses in Oregon provide information on both formative and summative assessments (Wolff, 2010). This allows educators to easily access summative data for program level decision making. In addition, formative assessment data is available for instructional planning and interventions.

Review of Data Warehouse Research

Data warehousing is relatively new to K-12 education. As of May, 2009, only eight out of 42 states that received federal funding from the Statewide Longitudinal Data Systems Grant Program had an operational system in place to provide access to longitudinal student data to teachers, and only 15 states provided this data to district level staff (National Center for Educational Statistics, 2009). Very little information is available about the use of data warehousing in education.

In their study examining the initiatives of state and educational agencies to support DDDM, LaPointe, et al. (2009) identified four components used by schools and school districts. These components were the use of a centralized data system or data warehouse, tools for data analysis and reporting, training on data systems or warehouses, and professional development in the DDDM process. While this study included a data warehouse component, the focus of the study was on state educational initiatives that support the DDDM process and to what extent the identified components were used by schools and school districts. The study also looked at service providers that supported educators in using DDDM and what services they provided.

Streifer and Schumann (2005) focused on indicators in a school district's data warehouse that would best predict the success of reading comprehension. Two findings addressed the manipulation of data to determine the indicators. The third finding addressed the need of the data to be presented in an easily understandable

format in order to make the information more useful to administrators in making curriculum decisions regarding student achievement.

Watson's (2002) analysis of information tools and systems used within Milwaukee Public Schools explored the use of multiple tools in the DDDM process. While most of the analysis focused on the technical aspects of the various tools, two aspects related to the use of data by individuals. Watson found teachers used tools daily to review classroom measures and test scores. They also aggregated data for small groups of students. School administrators viewed mark period grades, standardized tests, and longitudinal data. The average time frame for viewing data was by mark period and data aggregation ranged from individual students to school-wide data sets. District administrators viewed data annually and focused on standardized tests. They aggregated data by school and district-wide groups. Watson also identified the need for the reporting tools to be easy for individuals with limited computer skills to use and in a format that encouraged data analysis.

While none of these studies focused on the effective uses of data warehousing in K-12 educational systems, both Watson (2002) and Streifer and Schumann (2005) identified the need for data to be presented in a useful format. Watson also identified the importance that the reporting tool be easy for educators to use.

Data Warehousing Summary

A data warehouse is a computer application that stores data from different sources in one location. The data is then displayed in a meaningful way, usually in the form of graphs, tables, or reports. Because data in a data warehouse is updated on a

regular basis, educators have access to data in a timely manner. In addition, data warehouse applications allow for easy manipulation of the data by the user. The data warehouse collects, organizes, and summarizes the data allowing educators to begin analyzing, synthesizing, and prioritizing the data to gain knowledge. Data warehousing is relatively new to the field of education but could have a significant impact on the effectiveness of the DDDM process. Very little information is available about effective uses of data warehousing in K-12 educational systems. What research is available showed the need for data to be presented in an easily understood format that could be aggregated at various student group levels (Streifer & Schumann, 2005; Watson, 2002) and the application should be easy to use (Watson, 2002).

DDDM Research Methodologies

The existing research on the use of data warehousing in education is limited and focused primarily on implementation processes whereas studies on DDDM in education focus on changes in instructional practices and student achievement. The methodologies and research techniques used in DDDM research in education are more closely related to the purpose of this proposed study. Quantitative, qualitative, and mixed methodologies have been used in DDDM studies. McMillan (2005) relied on survey data to investigate the relationship between teachers' receipt of standardized student assessment data and changes in instructional practices. The large-scale study on California elementary schools serving low-income students relied both on survey data and primary regression analysis of student state assessment scores (Williams, et al., 2005). Hammond and Yeshanew (2007) used descriptive statistics and multilevel

modeling to analyze data from the United Kingdom's National Pupil Dataset. In the study on the use of the Grow Network assessment reporting system by the New York City public school system, mixed methods approach was used (Brunner, et al., 2005). The researchers conducted structured interviews, ethnographic research, and surveys. Furthermore, Marsh, et al. (2006) used surveys, interviews, case studies, document reviews, observations, and analysis of test scores for various studies which focused on DDDM (2006).

Connecting the Existing Research to this Study

The purpose of this study was to identify the factors that influence an educator's ability to use data obtained from a data warehouse to inform instruction that will lead to increased student achievement. The research discussed in this chapter was used to design the research questions for this study.

Several factors that could be addressed by a data warehouse application were discussed in the research review. Light, et al. (2004) identified ease of use, timeliness of data, the type of data available, the format in which the data is presented, and the ability to manipulate the data. Watson (2002) and Streifer and Schumann (2005) also identified the need for the application to be easy to use. In addition, Means, et al. (2009) identified the need for the data to be useful to instructional decision making. These findings led to the question, *What data warehouse application features affect the ability of an educator to effectively use the application for data driven decision making?*

Means, et al. found teachers lacked data literacy skills and needed additional training in how to use the data available to them. Collaboration also appeared to be a factor affecting the use of data (Means, et al, 2009; Reeves, 2002). Means, et al. (2009) also identified the need for designated time for teachers to review data. These findings led to the question, *What sorts of training or professional development and workplace norms are needed to help educators use data warehouse applications more effectively?*

Both Means, et al. (2009) and Williams, et al. (2005) identified the role of leadership as influencing the use of data in improving student achievement. This led to the question, *How do differences in leadership affect an organization's use of data warehouse applications?*

No research is available on the influence the use of a data warehouse application has on changes on instructional strategies and student performance. The final question, *What, if any, impact has the use of data warehouse applications had on instructional strategies and student performance?* was designed to gain the educators' perceptions on the influence the use of a data warehouse application had on changes to instructional strategies and student performance.

Need for Additional Research

There are many studies on the benefits of the use of DDDM in K-12 educational systems. Few studies exist on the use of data warehouses in K-12 educational systems (LaPointe, et. al., 2009; Streifer & Schumann, 2005; Watson, 2002). However, none of the studies on the use of data warehousing explored the

effect this use has on educational practices resulting in increased student performance. As school districts begin to implement the use of data warehouses, it is important to know whether they will have a positive impact on student achievement and what factors influence such an impact.

Summary

Data driven decision making (DDDM) is the process of the gathering and analyzing data from multiple sources, determining priorities based on strengths and challenges identified from the data, setting priorities, and establishing goals.

Professional Learning Communities (PLC) use a form of DDDM. PLCs emphasize a focus on learning, collaboration, and results. DDDM is also used in Response to Intervention (RTI), an identification and intervention process for students with possible learning disabilities. The premise of RTI is to provide interventions prior to students falling far behind their classmates. RTI emphasizes the use of both formative and summative assessments.

The DDDM process can use both formative and summative data. Summative assessments, typically in the form of yearly standardized assessment, provide information to be used in program planning. Summative assessments are not designed to assist teachers in day-to-day instructional decisions. Formative assessments are given on a more frequent basis than summative assessment and can provide data useful for planning instruction. Key to the success of formative assessment is the involvement of students in the learning process (Stiggins, 2002).

Many factors can affect an educator's ability to move through the DDDM process. These factors include accessibility and quality of data, timeliness of data access, ease of use, and the ability to manipulate the data (Light, et al., 2004; Marsh, et al., 2006). Organizational processes that affect DDDM include leadership, staff capacity to use data, and collaboration (Marsh, et al., 2006; Mean, et al, 2009; Reeves, 2002; Williams, et al., 2005).

DDDM is affected by an educators' level of knowledge acquisition (Light, et al., 2004). To make informed decisions, educators must be able to identify pertinent data, transform the data into information by changing it into a usable format, analyze and synthesize the data to gain knowledge, and then use the knowledge to understand why their instructional strategies are or are not effective. These actions are the first four steps in the levels of learning process: data, information, knowledge, and understanding (Ackoff, 1999). The level of understanding must be reached in order for an educator to make effective instructional decisions.

Data warehouse applications address several of the factors that affect the DDDM process. The data warehouse application presents data from multiple sources in a graphical format. In essence, the data warehouse completes the first steps of the levels of learning process for the educator, allowing the educator to focus on analyzing the data to change the information to knowledge and gain understanding of the effectiveness of instructional strategies and programs.

Research exists on the effectiveness of DDDM in education (Williams, et al., 2005; Marsh, et al., 2006; Reeves, 2005) and the use of levels of learning as a

theoretical framework on studies of DDDM (Light, et al., 2004; Mandinach, et al., 2006). However, very little research exists on the use of data warehousing in education. As school districts begin to implement the use of data warehouses, it is important to know whether they will have a positive impact on student achievement and what factors influence such an impact. This study hopes to inform these theories on the use of data in education by providing information on how professional development affects the educators' ability to use data for instructional planning, what impact the use of data has on instructional planning and student achievement, and what factors educators believed affect their ability to use data in instruction planning.

Chapter 3 discusses the research methods used in this study and the design of the study. The chapter begins with a discussion of the research perspective and the role of the researcher. The selection of participants is then addressed followed by the design of the quantitative and qualitative phases of the study. The data analysis processes for qualitative and quantitative data are addressed separately. Finally, the processes used to enhance reliability and validity of the study are discussed.

III. RESEARCH METHOD/DESIGN OF STUDY

The following chapter discusses the research methods and design of this study.

The research perspective is provided as a foundation of why a mixed methods approach was chosen for this study. The methodology and procedures are explained, including the development of the on-line survey, and focus group and interview questions and protocols.

Research Perspective

This study was approached from the perspective of postpositivism. The very foundation of postpositivism is one of objectivity. It is the search for reality with the acknowledgement that a perfect reality cannot be fully apprehended. A world exists that is observable and independent of human consciousness. Yet, in addition to this external world, there exists a world that is socially constructed. It is this socially constructed world that nullifies the possibility of one absolute truth. While an absolute truth may not be reached, the use of multiple research methods may lead to a truth that is closer to reality (Denzin & Lincoln, 2008). Because social constructs may affect the perception of reality, the influence a researcher's perspectives have on her research must be considered. The researcher's perspective can influence many areas of a study including what question the study is designed to answer, what direction the study takes, and the conclusions that are drawn. By being aware of one's perspectives, a researcher can counter how personal bias may influence the study and possible effects on that analysis of the research (Hill, et al., 2005).

The use of both qualitative and quantitative research methods is acceptable from a postpositivist perspective. The combination of both quantitative and qualitative methods adds strength to educational research (Creswell, 2007). The use of quantitative data alone may limit the scope of understanding of how educators effectively use data. Qualitative data is necessary to truly understand and validate the conclusions that are drawn from the quantitative data.

Methodology and Procedures

This study used a mixed methods approach conducted in three phases. The first phase of the study used an on-line survey of teachers and administrators to identify common factors that affect an educator's ability to use data warehouse applications to inform instructional practices. The survey focused on what data analysis features were available to the participants, what features they found most useful, what factors influenced their ability to use the data from the data warehouse, if data warehousing influenced their instructional practices, and if so, how, and whether they perceived an increase in student achievement. The common factors that were identified through the on-line survey were used to guide the focus group discussion in phase two and the interviews in phase three.

The focus group and interviews were conducted to gain a more in-depth understanding as to how the factors identified in the on-line survey affected the ability of educators to use a data warehouse application to inform instructional practices and increase student performance. In addition to gaining a deeper understanding of the factors identified in the survey, additional factors that influenced the participants' use

of the data warehouse application that were not addressed in the on-line survey were explored.

Role of the Researcher

As a postpositivist, the role of the researcher is to remain as neutral and objective as possible. During phase one, the on-line survey, information was provided about the study but not about the personal perspective of the researcher. No relationship existed between the participants and the researcher. During the collection of the qualitative data, the researcher served as the group facilitator for the focus group and as the interviewer for the interviews. This required some involvement with the participants. However, the role of the facilitator was to ask the questions that guided the topic of the discussion and to record responses. The facilitator also established procedures and protocols, kept the group on topic, ensured all voices were heard, and encouraged unexpected responses. While interaction with participants was required, the facilitator did not participate in the discussion beyond asking guiding questions and keeping the discussion on topic. Similarly, the interviewer asked guiding questions and encouraged participants to expand on their responses.

Selection of Participants

The participant population was restricted to teachers and administrators who had access to student information obtained from a regional data warehouse. Because the survey questions focused on the use of the information gained from a data warehouse application, the study targeted school districts where both teachers and administrators had access to such data. At the time this study was conducted, three

regional data warehouses within the state in which this study was conducted had fully developed access to data for both teachers and administrators. Two school districts from data warehouse regions that met these criteria agreed to participate in this study.

District A was an urban school district of approximately 17,500 students, 800 teachers, and 60 administrators. District B was a rural school district of approximately 5,200 students, 250 teachers, and 16 administrators. The two participating school districts used different data warehouse applications. An administrator in each participating school district was asked to forward an email inviting teachers and administrators within their school district who had access to a data warehouse application to participate in the survey (see Appendix B). The survey was distributed to approximately 125 teachers and administrators in District A and 265 teachers and administrators in District B. Forty-five survey responses were received, an estimated response rate of 12%. Of those, 11 were administrators and 31 were teachers or specialists. Three participants did not indicate their professional role. Information on the number of responses from each district and participants' position is provided in Chapter 4.

Focus group participants were selected from individuals who participated in the on-line survey and indicated that they were willing to participate in a focus group discussing the factors that influenced their use of the data warehouse application in instruction. The original intent was to hold separate focus groups for teachers and administrators. However, due to the limited response, one focus group consisting of

four school and district level administrators was held. All participants in the focus group were from District B.

Four teachers from District A and three teachers from District B indicated they were willing to participate in a focus group. Allowing for the possibility that not all participants that indicated an interest in participating in a focus group would attend and the need to have a minimum of four participants in a group, a focus group for teachers could not be formed. Due to the geographical locations of the school districts, the teachers from the two regions could not be combined to form one focus group. The teachers and administrators were not combined into one focus group as their different roles may have affected the ease of conversation (Morgan, 1997).

In order to ensure the voice of teachers was heard, teachers who participated in the on-line survey and expressed an interest in participating in a focus group were contacted via email and asked if they were willing to participate in an individual phone interview (see Appendix C). Four teachers agreed; one classroom teacher and one building level specialist from District A and two classroom teachers from District B.

Protection of Rights of Participants

At each phase of the study, informed consent was obtained. For the on-line survey, a description of the purpose of the study and possible risks was provided. Participants were required to check a box indicating informed consent to proceed with the survey. Participants who did not provide consent were exited from the survey. The survey was stored on a secure website with access limited to only individuals

provided with a link to the survey. The link to the survey was distributed by an administrator in each school district to ensure the identity of those completing the survey would be unknown to the researchers. The data obtained from the survey was stored on a password protected secure network while being analyzed then deleted upon completion of the analysis.

Survey participants who indicated an interest in participating in a focus group session were sent an email explaining the purpose of the study and possible risks to participants (see Appendix D). The email also contained a copy of the informed consent form (see Appendix E). At the start of the focus group session, the informed consent form was read to the focus groups participants and the participants were given an opportunity to ask questions about the study. Participants were required to sign the informed consent form to participate in the focus group. The focus group was held in an enclosed room at the school district central office building. The need for confidentiality was discussed with the members of the focus groups.

The possible risks of the study were explained to teachers at the start of the individual phone interviews. Informed consent was received verbally prior to conducting the interview (see Appendix F). No personally identifiable information from participants, beyond the region, instructional level, and teaching or administrative position, was included in the transcripts of the focus group and interviews.

All questions and procedures for each phase of the survey were submitted to the Internal Review Board for approval prior to administration. To ensure

confidentiality, the school districts and educators who participated in this study were not identified by name.

Quantitative Data Collection: On-line Survey

The survey developed to gather quantitative data for this study was administered in an on-line format using a program called SurveyMonkey. The on-line format allowed the participants to complete the survey at their convenience. In addition, Secure Sockets Layer (SSL) encryption was used by SurveyMonkey to protect the data during transmission (www.surveymonkey.com).

Survey Topics

The on-line survey covered five areas. Three of these areas, features of the data warehouse application, professional development and support, and leadership and organizational culture, were determined for inclusion in the survey based on the findings of Marsh, et al. (2006) and Light, et al. (2004) in their studies on DDDM. Demographic information and impact on instruction were included as cross references for the other areas. For each topic, the questions were arranged from most objective to most subjective, as recommended by Fink and Kosecoff (1998). For example, the topic of professional development and support started with questions on the type and amount of professional development received followed by questions on the perceived effectiveness of the professional development and support. The topics were sequenced as follows: features of the data warehouse application they were using, professional development and support, leadership and organizational culture, impact on instruction, and demographic information. Fink and Kosecoff point out that

“respondents may get tired and answer the last questions carelessly or not answer them at all” (1998, p. 29). To counter this possibility, questions about demographic information were placed at the end of the survey because they were relatively quick and easy to complete. The survey topics, as well as the questions, were reviewed by the directors of the regional data warehouses participating in this study and two educators experienced in the use of a data warehouse application and the DDDM process.

Survey Questions

The questions on the survey were developed by the researcher based on DDDM research of Light, et al. (2004) and Marsh, et al. (2006). The survey was piloted by two teachers who used data warehouse applications. In addition to question clarity, the teachers were asked to provide feedback on the appropriateness of the questions and topics.

The survey questions were in the form of single response multiple choice questions and multiple response multiple choice questions (see Appendix G). These forced choice items were used to increase efficiency and reliability (Fink & Kosecoff, 1998). Efficiency was increased through the ease of use, scoring, and analysis while the uniformity of the data provided by force response items enhanced reliability.

In their study on DDDM used in New York schools, Light, et al. (2004) found access, comprehensibility of data, manipulation of the data, and utility and quality of the data to be instrumental in the effectiveness of DDDM. The questions in the second section covered the usefulness of the type of information presented in the

application, the format in which the data were presented, and the various ways in which participants could disaggregate the information. To determine the perceived accuracy of the data, participants were asked how confident they were in the accuracy of the data presented in the application (Marsh, et al., 2006). A Likert scale was used to determine levels of agreement (Litwin, 2003).

The third section included questions on how easy the application was to use, and how much support was needed to use the application. Marsh, et al. (2006) found the capacity of staff and the support they received, as well as links to instruction, affected the DDDM process. The questions in the third section also asked participants about the professional development they received, in both how to use the data warehouse application and in using student data to help make instructional decisions. These questions used the Likert scale to provide ordinal data.

Marsh, et al. (2006) also found cultural organization as key to the effectiveness of DDDM. The fourth section addresses work place norms that affect the use of the data warehouse application. These included questions on amount of time available to review student data, in what setting participants found reviewing data most helpful, and how often participants used the application. This section generated both ordinal and nominal data.

Also key to the effectiveness of DDDM was the role educational leaders played (Marsh, et al., 2006). The fifth section of the survey addressed teachers' perceptions of how important the use of the data warehouse application was to the school and/or school district administration. The fifth section also addressed the

perceived effects of the use of the data warehouse on instruction and student performance. This study did not include a review of student achievement or behavior indicators, such as standardized or formative assessment data. Because of this, teacher perceptions were used to determine whether the use of the data warehouse had an effect on teacher instruction and on student performance. Participants were asked if they perceive a change in their instruction and if they perceive a change in student performance. These questions used a Likert scale to determine the level of agreement. The data from the questions in this section were cross-referenced with questions in other areas of the survey.

The sixth section of the survey asked for demographic information such as instructional grade level and content area. The final section pertained to the interest of the participants in participating in a focus group.

Qualitative Data Collection

Focus Group

A focus group is defined as “a research technique that collects data through group interaction on a topic determined by the researcher” (Morgan, 1997, p. 6). Focus groups are commonly used in conjunction with surveys (Morgan, 1997). One such use is to gather additional information as to why participants in the survey responded the way they did. While the suggested size of focus groups ranges greatly (Krueger & Casey, 2000; Morgan, 1997; Sim, 1998), the most common suggested size is between six and 10 participants per group with no fewer than four. The smaller the size of the group, the more difficult it is to maintain discussion of the topics while a

large group can make it difficult for all individuals to participate (Morgan, 1997). Key characteristics of a focus group include the following: the participants in the group share some commonality that is of interest to the researcher, the group provides qualitative data, and the group participates in a focused discussion that is facilitated by a moderator (Krueger & Casey, 2000). Two advantages of using focus groups to gather data include the ability to gather data from many participants at one time and the opportunity to gather information on attitudes and opinions through participant interaction (Morgan, 1997; Sim, 1998).

Purpose of using focus groups. Focus groups were used in this study to accomplish three objectives. The first objective was to gain a deeper understanding as to how the factors identified in the study affected the ability of educators to use a data warehouse application to inform instructional practices and increase student performance. For example, if leadership was identified as a factor affecting an educator's ability to use the data warehouse application to inform instructional practices, what was it that the leadership did or didn't do that caused the effect?

In addition to gaining a deeper understanding of the information gathered from the survey, the focus group provided an opportunity for additional factors to come to light beyond those that were addressed in the survey. The information gained from the on-line survey was limited to the questions that were asked. While questions were used to guide the focus groups, participants were encouraged to discuss additional factors that influenced the use of the data warehouse application in their school district.

Finally, the focus group served as a means to triangulate the data gathered from the on-line survey (Morgan & Spanish, 1984).

Focus group protocol. The focus group was held at the central school district office of the participating school district for the convenience of the participants (Krueger & Casey, 2000). The focus group lasted approximately one hour as suggested by Morgan (1997). The focus group session was audio recorded then transcribed. The focus group session followed a pre-designed protocol. A copy of the protocols is provided in Appendix H. The researcher facilitated the focus group.

The guiding questions for the focus group were based on the common themes identified through the on-line survey:

- How has the type and extent of professional development and support affected your ability to use the data warehouse application to make instructional decisions for your students?
- How has the amount of time you have to use the data warehouse application affected your ability to use the data warehouse application to make instructional decisions for your students?
- What role has leadership and the organizational culture played in your ability to use the data warehouse application to make instructional decisions for your students?
- What impact, if any, has the use of the data warehouse application had on your instructional practices and on student performance?

- What do you consider are the three factors that have had the most influence on your ability to use the data warehouse application to make instructional decisions for your students?

The first four questions were directly tied to the topics addressed in the on-line survey. The last question was included to ensure all participants had an opportunity to share their thoughts as well as to provide an opportunity to share factors that may not have been directly addressed in the guiding questions. Participants were prompted to expand on responses to the questions and participation from all participants was encouraged through the use of such prompts as the following:

- Would you explain further?
- Is there anyone who has had a different experience to that?
- Are there any additional comments on that?

Teacher Interviews

Four teachers were interviewed for this study. The interviews were held over the telephone and scheduled at the convenience of the participants. The interviews ranged from 20 minutes to one hour. The same protocol was used for all interviews. The interview protocol is provided in Appendix I. The same guiding questions were used in the interviews as were used in the focus groups. These questions were open-ended in order to gain the perspective of the participants (Chenail, 2011).

Interviewees were encouraged to discuss factors that influenced their use of the data warehouse application that were not addressed in the guiding questions. The same

protocols were used in each interview to ensure consistent information was gathered from all interviews (Hill, et al., 2005).

Researcher Memos

In addition to the focus group and interviews, data were collected through analytic memos. These were the notes taken by the researcher during the focus group session and interviews. These notes included the researcher's interpretation of comments and non-verbal actions, impressions received, and questions that arose during the focus group and interviews.

Quantitative Data Analysis

The data gathered from the on-line survey were analyzed using descriptive statistics. No attempt was made to generalize beyond the survey sample.

The survey provided two types of data sets, nominal and ordinal. The nominal data were gathered through questions of a categorical nature, such as instructional level of the participant. The ordinal data were gathered through questions that ask the participant to rate their experience on a Likert scale (Litwin, 2003). For example, participants reported the support they received as no support, little support, some support, adequate support, or excellent support.

The purpose of the analysis of the data was to identify the most common experience participants had in using the data warehouse application. Descriptive statistical methods were applied to both the nominal and ordinal data sets. The analysis included the frequency of item responses represented in both count of responses and percentages based on total responses (Fink, 1995a).

The possibility of relationships between the nominal and ordinal data sets was explored. However, in most cases, the data sets were too small to determine if such relationships existed. For the one case in which the data sets were large enough, the Chi-square test for independence was used. The Chi-square test for independence is appropriate for use with nonparametric nominal and ordinal data where the data set is not normal and of small size (De Veaux, Velleman, & Bock, 2008). The null hypothesis was that no relationship existed. The expected frequencies were compared to the observed frequencies. The null hypothesis was rejected if “the observed frequencies depart from the expected frequencies by more than the amount you can expect by chance” (Fink, 2003, p. 84), meaning that a relationship existed between the two nominal data sets. A confidence interval of 95% was used. While the Chi-square method established if a relationship existed, it did not establish a causal relationship between the two variables (De Veaux, Velleman, & Bock, 2008).

Qualitative Data Analysis

The transcript data were analyzed in two cycles. The first cycle used descriptive coding. Each passage was coded through the use of a word or phrase that captured the topic of the passage (Saldaña, 2009). The transcripts were coded after completion of each focus group session or interview. Codes that emerged on one set of transcripts influenced the coding of the next set of transcripts. Conversely, transcripts that had already been coded were reviewed and recoded based on the coding of other transcripts. The coding of all transcripts was reviewed to ensure consistency in coding throughout and between sets of transcripts, to refine the use of

codes, and to seek additional insights that may emerge from multiple readings of the transcripts.

A second cycle of coding was used to identify broader categories or themes that emerge from the data (Saldaña, 2009). The codes developed in the first cycle were organized into groups based on commonalities between the initial codes. This process was repeated until all initial codes were placed in a category. Codes that resisted categorizing were examined to determine whether their lack of conformity suggested an unexpected but significant finding, that they were outliers and an exception to what was typically indicated, or if they indicated a need to explore the use of a different system of categorization of the initial codes.

Analytic memos were taken by the researcher during the focus group and interviews to record non-verbal cues and used in the analysis process to indicate level of agreement by the other participants. For example, during the focus group, participants would nod their heads to indicate agreement with the speaker. The analytic memos were also used to record possible connections to other qualitative or quantitative data gathered. These possible connections were used to guide the comparison of the qualitative and quantitative data.

Reliability

To increase reliability, an on-line format was used to deliver the survey. This controlled the possible responses of the participants through the use of forced choice questions. In addition, it eliminated errors in data entry. The survey was piloted with classroom teachers to ensure question clarity.

According to Fink and Kosecoff (1998), how participants respond to the survey can indicate the reliability of the survey. “For reliability, focus on the clarity of the questions and the general format of the survey. ...Look for

- Failure to answer questions
- Giving several answers to the same question
- Writing comments in the margins” (Fink & Kosecoff, 1998, p. 36)

SurveyMonkey, the program used for the on-line survey, provided the ability to limit the number of responses a participant could choose. In addition, all questions were close ended meaning that the participants must select one of the options that were provided (Fink, 1995b). This eliminated the possibility of respondents “giving several answers to the same questions” and “writing comments in the margins” (Fink & Kosecoff, 1998, p. 36). One issue that can arise in surveys is questions that participants do not answer (Fink & Kosecoff, 1998). While SurveyMonkey, can be set to force participants to respond to a question before going on to the next, this option was not used (www.surveymonkey.com). Forcing a response increases the possibility that respondents select meaningless answers to allow them to move on to the next question in the survey (Fink, 2003). Part of the pilot process was used to determine if there were questions to which the participants might not respond. If the teachers in the pilot failed to answer a question, they could be questioned as to why they did not answer the question. The teachers piloting the survey responded to all survey questions. The response rate for all questions in the survey was 91% or greater.

Validity

Content validity was used to measure the validity of this survey. Content validity is the appropriateness of items as determined by individuals with knowledge of the subject matter (Litwin, 1995).

Experts in the Field of Data Warehousing and DDDM

The survey involved the integration of two topics: DDDM and the use of data warehousing in education. Because of this, it was necessary that the individuals reviewing the survey had knowledge of both areas. To measure content validity, two individuals involved in teaching teachers how to use the data warehouse and how to use data for DDDM were asked to review the survey. The survey was revised based on the feedback of these individuals. In addition, the directors of the regional data warehouses involved in this study were asked to review the survey to ensure the questions align with the characteristics of the regional data warehouse applications.

Pilot Testing

Content validity was also strengthened by pilot testing the survey with two teachers who had experience using a data warehouse application in DDDM. The pilot teachers were asked to check for face validity to ensure the questions made sense and were not misleading. In addition, they were asked whether the content of the questions was appropriate to the use of data warehousing in DDDM and if there are any areas that were not included but should be. Based on feedback from these teachers, the survey was revised before distribution.

Focus group and interview questions were also piloted with educators familiar with the use of a data warehouse application and revised based on feedback received. Teachers participating in the pilot were excluded from the study.

Representation of Various Views

Content validity can be increased by ensuring that various views are represented by the participants (Fink & Kosecoff, 1998). To help increase validity, the on-line survey was sent to teachers and administrators in two districts of varying sizes and using different regional data warehouses. Each regional data warehouse presented information to its teachers and administrators in a different format. For example, if Region A focuses on the use of charts and graphs whereas Region B provides data in the form of reports, it was important to consider how these varying formats affected the participants' ability to use the data warehouse applications to inform instruction. The individuals who distributed the survey were asked to send it to all teachers and administrators within their school or district who had access to the data warehouse applications, not just those who had found the most success in using the application.

Triangulation

Creswell identifies several steps in collecting data to minimize the threat to validity in sequential mixed method designs:

- a) Select the same individuals for an Explanatory Design...
- b) Use large sample for quantitative and small for qualitative
- c) Choose the same individuals for the qualitative follow-up and the quantitative first phase
- d) Use rigorous procedures for developing and validating the new instrument (2007).

This mixed methods study used a sequential explanatory design to minimize the threats to validity in the analysis of the data by choosing strong predictors to follow up on with the qualitative method and to address both quantitative and qualitative validity (Creswell, 2007). The qualitative data derived from the focus group and interviews was used to explain the findings of quantitative data as well as to support or contradict the results of the on-line survey (Creswell, 2007).

Summary

This study was conducted from a postpositive perspective. The use of both qualitative and quantitative research methods are acceptable from a postpositivist perspective and may lead to a more accurate view of reality reducing researcher bias (Denzin & Lincoln, 2008).

This study utilized a sequential mixed methods approach. This allowed data to be gathered from a larger sample population through the use of an on-line survey. Following the survey, data were collected through a focus group and individual teacher interviews. The focus group and interviews provided in-depth information that could not be obtained through a survey. There were five topics covered in the on-line survey: demographic information, available data warehouse features, professional development, leadership, and instructional strategies and student performance. The questions were in the form of single response multiple choice or multiple response multiple choice. Response options were categorical or used a Likert scale.

A focus group comprised of administrators and individual teacher interviews were used to gain a deeper understanding of how the factors identified in the on-line

survey affected the educator's ability to use the data warehouse application to inform instructional practices and increase student performance. In addition, the use of a focus group and interviews allowed additional factors to come to light beyond those addressed in the survey. Finally, the focus group and interviews provided a means to triangulate the data gathered from the on-line survey (Morgan & Spanish, 1984).

The participant population was restricted to teachers and administrators who had access to student information from a regional data warehouse application. Two school districts from different regional data warehouses agreed to participate in the study. Out of approximately 390 teachers and administrators who received the survey, 45 completed the survey of which 11 were administrators, 31 were teachers. Informed consent was received for each phase of the study. To ensure confidentiality, the school districts and educators who participated in this study were not identified by name.

The data gathered from the on-line survey were analyzed using descriptive statistics. The focus of the analysis of the survey data was on determining common themes to guide and inform the qualitative phases of the study. No attempt was made to generalize beyond the survey sample.

The transcripts from the focus group session and interviews were analyzed in two cycles. The first cycle used descriptive coding where each passage was coded through the use of a word or phrase that captured the topic of the passage. The second cycle of coding was used to identify broader categories or themes that emerged from the data (Saldaña, 2009).

To increase reliability, an on-line format was used to deliver the survey. This controlled the possible responses of the participants. In addition, it eliminated errors in data entry. The survey was piloted with classroom teachers to ensure question clarity.

Content validity was used to measure the validity of this survey. The survey and focus group questions were reviewed by educators familiar with the use of a data warehouse application and the DDDM process. Teachers and administrators from two different school districts of varying sizes and two different regional data warehouse applications were included in this study to reduce the possibility of bias that may result based on implementation in only one region.

The findings from this study are discussed in Chapter 4. The results of the survey are presented, followed by an analysis of the focus group and interview data. The findings of the quantitative and qualitative data are then compared for similarities and differences.

IV. RESULTS

Chapter 4 presents the data collected through the three methods used in this study; on-line survey, focus group, and interviews. The results of the survey are discussed first, followed by a discussion of the focus group and interview results. Finally, a comparison of the qualitative and quantitative data is discussed. Each section is organized by the five areas explored in this study: data warehouse features, professional development and support, impact on instructional practices and student performance, work place norms, and leadership.

Survey Data

Data collected through an on-line survey developed by the researcher is presented in this section. The survey addressed usefulness of type and presentation format of data available in the data warehouse application, ease of use and support of data warehouse application, professional development, leadership, and participants' views of the importance of the application to self and others. Participants had the option of answering or not answering each of the questions.

Participant demographic information is presented first. Each area is then addressed in a separate section with an explanation of the statistical analysis used. The statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) 16.0.

Participants

The survey asked participants to provide information about their professional roles. Included was information about what school district the participant worked in,

what professional role the participant served in, the grade levels the participant worked with, and the content areas the participant taught, if applicable. Tables 1 through 3 provide the frequency and percentages of demographic information obtained from the survey. In Tables 1 and 2, the frequency, or number of participants who indicated that response, is listed. Two types of percentages are listed, the percent of responses based on total participants and the percent of responses based on the total number of participants who responded. The percentages of total number of participants who responded are listed as a valid percent. For example, Table 1 shows that 42 out of a total of 45 participants responded to this question. Nineteen individuals responded that they were from District A. These 19 individuals represent 42.2% of the total respondents or 45.2% of the individuals who responded.

Two school districts participated in the on-line survey. Table 1 shows the distribution of participants by school district. Out of all 45 participants, 42.2% were from District A and 51.1% were from District B. Three of the 45 participants did not indicate which school district they were from.

Table 1

Distribution of Participants by School District

School District	Frequency	Percent	Valid Percent
District A	19	42.2%	45.2%
District B	23	51.1%	54.8%
Total Responses	42	93.3%	100.0%
No Response	3	6.7%	
Total Participants	45	100.0%	

Table 2 shows the distribution of the roles of the participants. Of the 42 participants who responded to the question, most were teachers, at the classroom, building, or district level, with 35.7% being classroom teachers and 35.7% being district or building level teachers or specialists. The next largest group represented in the survey was building level administrators with 21.4% of the valid responses. Two district level administrators and one building/school level counselor participated in the study. Three participants did not respond to the question.

Table 2

Distribution of Participants by Role

Role	Frequency	Percent	Valid Percent
District Level Administrator	2	4.4%	4.8%
Building Level Administrator	9	20.0%	21.4%
Building/School Counselor	1	2.2%	2.4%
District/building Level Specialist	15	33.3%	35.7%
Classroom Teacher	15	33.3%	35.7%
Total Responses	42	93.3%	100.0%
No Response	3	6.7%	
Total Participants	45	100.0%	

Table 3 shows the grade level of the students with whom the participants worked. District level indicates participants who worked in a central office position as opposed to working with a specific grade level of students. For example, an elementary principal may check grade bands K-2 and 3-5 whereas an assistant superintendent would select district level. Participants could select more than one grade level resulting in a total percentage of over 100%. The grade level representation was fairly evenly distributed across the grade levels, ranging between 14 and 20 participants per grade level grouping, with the exception of district level

representation which was less than half the amount of participants of any other level having only seven participants.

Table 3

Distribution of Participants by Student Grade Level of Position

	<u>Grade Level</u>				
	K-2	3-5	6-8	9-12	District level
Valid Responses	17	20	14	16	7
Percent	37.8%	44.4%	31.1%	35.6%	15.6%

Table 4 shows the content area of instruction of the participants. Content area listed as *other* could include such subjects as physical education, music, and English language development. Participants could select more than one content area resulting in a total percentage of over 100%. The two highest areas of instruction were Language Arts and All Content Areas followed by Mathematics and Non-teaching staff.

Table 4

Distribution of Participants by Instructional Content Area

	All content areas	Language Arts	Mathematics	Science	Social Studies	Content -Other	Non-teaching staff
Valid Responses	12	13	10	4	4	8	10
Percent	26.7%	28.9%	22.2%	8.9%	8.9%	17.8%	22.2%

Data Warehouse Features

To determine what data warehouse application features affect the ability of an educator to effectively use the application for DDDM, survey participants were asked to rate how useful they found various features on a Likert-type scale where 1 = not

very useful, 2 = somewhat useful, and 3 = very useful. The features included the format in which data were displayed, the type of student data available, and how the data were disaggregated or grouped.

Table 5 shows the distribution of the responses to questions on how useful participant found data that was displayed in the form of charts or tables; graphs, such as bar or pie graphs; reports, such as lists of information about students; or spreadsheets. Table 5 displays the number of responses to ratings and the percent of responses to each rating category for the type of data listed. For example, 44 participants rated the usefulness of charts or tables. Of the 44 responses, 1 participant, or 2.3% of all participants who responded to this question, responded that charts or tables were not available, 1 participant (2.3%) responded charts or tables were not very useful, 16 participants (36.4%) responded charts or tables were somewhat useful, and 26 (59.1%) responded charts or tables were very useful. Of the participants who responded, over 50% found all of the display formats very useful. Between 22.2% and 36.4% found all types of display formats somewhat useful.

Table 5

Usefulness of Data Displays

		Not Available	Not Very Useful	Somewhat Useful	Very Useful	Total
Charts or tables	Counts	1	1	16	26	44
	Percent of responses	2.3%	2.3%	36.4%	59.1%	100.0%
Graphs	Counts	2	1	16	25	44
	Percent of responses	4.5%	2.3%	36.4%	56.8%	100.0%
Reports	Counts	2	2	10	31	45
	Percent of responses	4.4%	4.4%	22.2%	68.9%	100.0%
Spreadsheets	Counts	3	4	13	24	44
	Percent of responses	6.8%	9.1%	29.5%	54.5%	100.0%

Means and standard deviations were calculated for respondents who had access to data displayed in the specified format. Table 6 shows the means for how useful participants found methods for displaying data. The means were calculated based on a Likert-type rating scale where 1 = not very useful, 2 = somewhat useful, and 3 = very useful. Responses of participants who indicated the display format was not available or did not respond to the question were excluded from the mean calculation. The means for each data display format rating ranged between 2.49 and 2.58. The standard deviations ranged between 0.675 and 0.545 indicating a high level of agreement in the responses of the participants.

Table 6

Mean Comparison of Usefulness of Data Display Responses

Display Type	Mean	N	Standard Deviation
Charts or tables	2.58	43	.545
Graphs	2.57	42	.547
Reports	2.67	43	.566
Spreadsheets	2.49	41	.675

Note. Scale: 1 = Not Very Useful, 2 = Somewhat Useful, and 3 = Very Useful

In addition to how data were displayed, participants were asked how useful they found different types of data. The types of data were attendance, discipline, summative assessment, and formative assessment. Table 7 shows the distribution of the responses to the questions on how useful participants found the various types of data. The two types of data that appear to be most useful to the participants were formative assessments and summative assessments. The type of data that appeared to be least useful was data on discipline.

Table 7

Usefulness of Types of Data

		Not Available	Not Very Useful	Somewhat Useful	Very Useful	Total
Attendance	Counts	1	4	14	25	44
	Percent of responses	2.3%	9.1%	31.8%	56.8%	100.0%
Discipline	Counts	4	8	18	13	43
	Percent of responses	9.3%	18.6%	41.9%	30.2%	100.0%
Summative Assessment	Counts	1	2	10	32	45
	Percent of responses	2.2%	4.4%	22.2%	71.1%	100.0%
Formative Assessment	Counts	6	2	6	30	44
	Percent of responses	13.6%	4.5%	13.6%	68.2%	100.0%

Table 8 compares the means of the responses to questions on how useful participants found the various types of data where 1 = not very useful, 2 = somewhat useful, and 3 = very useful. Responses of participants who indicated the display format was not available or did not respond to the question were excluded from the mean calculation. The means indicate that the most useful type of data was formative assessments with a mean of 2.74 followed closely by summative assessments with a mean of 2.68. The least useful was discipline data with a mean of 2.13. The discipline data also had the widest range of responses with a standard deviation of 0.732.

Table 8

Mean Comparison of Usefulness of Types of Data

	Mean	N	Standard Deviation
Attendance	2.49	43	.668
Discipline	2.13	39	.732
Summative assessment	2.68	44	.561
Formative assessments	2.74	38	.554

Note. Scale: 1 = Not Very Useful, 2 = Somewhat Useful, and 3 = Very Useful

Participants were asked how useful they found data as grouped by all students in their school district, students in their school, and students in their class or classes.

Table 9 shows the mean score on a three-point scale where 1 = not very useful, 2 = somewhat useful, and 3 = very useful. The number of responses, N, and the standard deviation of participants who responded to the questions are also listed. As Table 9 shows, the type of student group that was found to be most useful was students in a class or classes with a mean score of 2.78.

Table 9

Usefulness of Data Disaggregated by Student Groups

	Mean	N	Standard Deviation
All students in your district	2.17	36	.697
All students in your school or schools	2.64	42	.618
All students in a class or classes	2.78	40	.577

Note. Scale: 1 = Not Very Useful, 2 = Somewhat Useful, and 3 = Very Useful

Table 10 shows mean scores of the responses to the question on how useful the participant found data on different groups of students disaggregated by the participants' role. For building level administrators, the highest mean score was for *all students in your school or schools* with a mean of 3.00. The standard deviation

was also smallest at 0, indicating that every building administrator responded that data on all the students in their school was very useful. The highest mean for classroom teachers in response to the question was 2.73 for *all students in a class or classes*. The responses by classroom teachers for *all students in a class or classes* had a smaller standard deviation than the other options of *all students in your district* and *all students in your school or schools* indicating less range in the responses for this question.

Table 10

Usefulness of Student Groups Disaggregated by Participant Role

Role		All students		
		All students in your district	in your school or schools	All students in a class or classes
District Level Administrator	Mean	3.00	3.00	3.00
	N	2	2	2
	Standard Deviation	.000	.000	.000
Building Level Administrator	Mean	2.50	3.00	2.86
	N	6	9	7
	Standard Deviation	.548	.000	.378
Building/School Counselor	Mean	3.00	3.00	
	N	1	1	
	Standard Deviation	*	*	
District/building Level Teacher/specialist	Mean	2.00	2.71	2.69
	N	12	14	13
	Standard Deviation	.739	.611	.751
Classroom Teacher	Mean	2.00	2.29	2.73
	N	13	14	15
	Standard Deviation	.707	.726	.594
Total	Mean	2.18	2.65	2.76
	N	34	40	37
	Standard Deviation	.716	.622	.597

Note. Scale: 1 = Not Very Useful, 2 = Somewhat Useful, and 3 = Very Useful

*Unable to determine standard deviation due to too few responses

Participants were also asked how useful they found data disaggregated by various student groups. The groups participants were asked to rate student

performance groups such as reading levels or intervention groups; student programs such as Talented and Gifted, Special Education, or English Language Learners; and demographic information such as gender, ethnicity, race, age, or grade level. Table 11 shows the mean score participants rated each group where 1 = not very useful, 2 = somewhat useful, and 3 = very useful. The student group type rated as most useful with a mean of 2.67 was student performance groups such as reading and intervention groups. In addition, the standard deviation was lower for this group than that of student programs or demographic information even though there were less respondents indicating less variance in responses.

Table 11

Comparison of Student Group Means

	Mean	N	Standard Deviation
Student performance groups	2.67	39	.662
Student programs	2.53	43	.667
Demographic information	2.35	43	.720

Note. Scale: 1 = Not Very Useful, 2 = Somewhat Useful, and 3 = Very Useful

Professional Development

Participants were questioned about the professional development they received. Two types of professional development were specified in the survey: using data to make instructional decisions and how to use the data warehouse application. Professional development on the use of data to make instructional decisions included training on professional learning communities (PLCs), data teams, or Response to Intervention (RTI). To determine how the type and extent of the professional development affected the educators' ability to make instructional decisions for

students, the number of hours of professional development received by participants was compared to what influence the participants felt the use of the data warehouse application had on instructional practices, their frequency of use of the data warehouse application, and how important the participant felt the use of the application was in helping teachers make informed instructional decisions.

The amount of training in the use of the data warehouse application varied between no training and two to four hours of training. Most participants received less than two hours of training. Table 12 compares number of hours of training participants received in the use of the data warehouse application with the amount of influence the participants felt the use of the data warehouse application had on instructional strategies and interventions. Participants were given the options of no training, less than two hours of training, two to four hours of training, four to eight hours of training, and over eight hours of training. No respondents indicated that they received more than two to four hours of training. Regardless of the amount of training in the use of the data warehouse application received, the majority of participants (61.9%) rated the effect of the use of the data warehouse as having somewhat of an influence on changes to instructional strategies or intervention techniques.

Table 12

*Influence on Changes to Instructional Strategies or Intervention Techniques
Compared to Amount of Data Warehouse Application Training Received*

			Changes to Instructional Strategies or Intervention Techniques			Total
			Little or No Influence	Some Influence	A Great Deal of Influence	
Data Warehouse Training	No	Count	3	5	1	9
	Training	Percent	33.3%	55.6%	11.1%	100.0%
	Less	Count	3	17	7	27
	than 2 hours	Percent	11.1%	63.0%	25.9%	100.0%
	2-4	Count	1	4	1	6
	hours	Percent	16.7%	66.7%	16.7%	100.0%
Total		Count	7	26	9	42
		Percent	16.7%	61.9%	21.4%	100.0%

Participants were asked about the amount of training they received in the use of data, such as data teams, PLCs, or RTI techniques. The number of hours of training received in the use of data was compared to the influence the use of the data warehouse application had on changes to instructional strategies and intervention techniques as shown in Table 13. The amount of training the participants received in the use of data varied between no training and eight or more hours of training. As with training in the use of the data warehouse application, most participants received less than two hours of training in the use of data to inform instruction. While most participants indicated the data warehouse application had some influence on changes to instructional strategies or intervention techniques, there are too few responses to determine whether there was a statistically significant correlation between the amount

of training in the use of data received and the influence on changes to instructional strategies or intervention techniques.

Table 13

Influence on Changes to Instructional Strategies or Intervention Techniques Compared to Amount of Training Received in Use of Data for Instruction

		Changes to Instructional Strategies or Intervention Techniques				
			Little or No Influence	Some Influence	A Great Deal of Influence	Total
Data Training	No Training	Count	2	3	1	6
		Percent	33.3%	50.0%	16.7%	100.0%
	Less than 2 hours	Count	3	14	2	19
		Percent	15.8%	73.7%	10.5%	100.0%
	2-4 hours	Count	0	3	0	3
		Percent	.0%	100.0%	.0%	100.0%
	4-8 hours	Count	1	0	1	2
		Percent	50.0%	.0%	50.0%	100.0%
	More than 8 hours	Count	1	4	2	7
		Percent	14.3%	57.1%	28.6%	100.0%
Total	Count	7	24	6	37	
	Percent	18.9%	64.9%	16.2%	100.0%	

Seven participants indicated they received more than eight hours of training in data use. Seven participants also indicated they worked at the district level. This led to the exploration of whether there appeared to be a relationship between the number of hours of training an educator received and the role of the participant. Table 14 shows the means and standard deviation of the responses for the number of hours of instruction the participant received for training in the data warehouse application and the use of data disaggregated by the role of the participant. Training values were rated

based on the scale where 0 = no training, 1 = less than two hours of training, 2 = two to four hours of training, 3 = four to eight hours of training, and 4 = eight or more hours of training. Although the amount of training received by each role category varied greatly for training in the use of data as indicated by the high standard deviations, the mean score for the amount of training a participant received was consistently higher for the use of data as compared to the training in the data warehouse application. On average, classroom teachers received more training in the use of data than district/building level teachers whereas building/district level teachers received more training in using the data warehouse application than classroom teachers. Building administrators received more hours of training than both classroom teachers and district/building level teachers in both the use of the data and the data warehouse application.

Table 14

Amount of Training by Role

		Data Warehouse	
Role		Training	Data Training
District Level Administrator	Mean	2.00	3.50
	N	2	2
	Standard Deviation	.000	2.121
Building Level Administrator	Mean	2.33	2.71
	N	9	7
	Standard Deviation	.707	1.380
Building/School Counselor	Mean	2.00	1.00
	N	1	1
	Standard Deviation	*	*
District/Building Level Teacher	Mean	1.93	2.50
	N	15	14
	Standard Deviation	.458	1.454
Classroom Teacher	Mean	1.67	2.62
	N	15	13
	Standard Deviation	.617	1.261
Total	Mean	1.93	2.59
	N	42	37
	Standard Deviation	.601	1.363

Note. Scale: 0= no training, 1=less than 2 hours of training, 2=2-4 hours of training, 3=4-8 hours of training, 4=8 or more hours of training

*Unable to determine standard deviation due to too few responses

To determine how much training is sufficient, the amount of training participants received in the use of the data warehouse application was compared to the

amount of help needed to use the application. While the amount of training varied greatly, 63.8% of the participants received between two and four hours of training. There did not appear to be any difference in the amount of training received and the amount of help needed. The majority of the participants indicated they needed little or no help using the application (53.5%) while only 4.7% indicated they needed a great deal of help.

Frequency of use was also considered in determining the amount of training needed to help educators use the data warehouse application more effectively. Table 15 shows that of the participants who received no training, 33.3% used the data warehouse application one or more times a week compared to 44.4% who received less than two hours of training and 83.3% who received between two and four hours of training.

Table 15

Amount of Data Warehouse Application Training Received Compared to Frequency of Use

			Frequency				Total
			1 or More Times a Week	1-2 Times a Month	1-2 Times a Grading Period	1-2 Times a Year	
Data Warehouse training	No	Count	3	4	1	1	9
	Training	Percent	33.3%	44.4%	11.1%	11.1%	100.0%
	Less than	Count	12	9	4	2	27
	2 hours	Percent	44.4%	33.3%	14.8%	7.4%	100.0%
	2-4 hours	Count	5	0	1	0	6
		Percent	83.3%	.0%	16.7%	.0%	100.0%
Total		Count	20	13	6	3	42
		Percent	47.6%	31.0%	14.3%	7.1%	100.0%

Amount of training participants received in use of data warehouse application was compared to how important the data warehouse was to instruction as rated by the participants. As Table 16 shows, all participants who responded to the question rated the importance of the use application as somewhat important or very important. Only 22.2% of participants who received no training in the use of the data warehouse application rated its use as very important compared to 77.8% of participants who received less than two hours of training and 66.7% who received between two and four hours of training.

Table 16

Amount of Data Warehouse Training Compared to Importance to Participant

			Importance to Participant		
			Somewhat Important	Very Important	Total
Data	No Training	Count	7	2	9
Warehouse		Percent	77.8%	22.2%	100.0%
training	Less than 2 hours	Count	6	21	27
		Percent	22.2%	77.8%	100.0%
	2-4 hours	Count	2	4	6
		Percent	33.3%	66.7%	100.0%
Total		Count	15	27	42
		Percent	35.7%	64.3%	100.0%

The amount of training participants received in the use of data, such as data teams or PLCs, was also compared to the frequency of use of the data warehouse application. The amount of training in the use of data varied greatly. Of the 37 participants who responded, six received no training, 19 received less than two hours of training, and seven received more than eight hours of training. Table 17 shows that

50% of the participants who received no training used the data warehouse application one to two times a month. Of the participants who received less than two hours of training, 42.1% used the application one or more times a week compared to 71.4% of the participants who received eight or more hours of training.

Table 17

Training in Use of Data Compared to Frequency of Use of Application

			Frequency				Total
			1 or More Times a Week	1-2 Times a Month	1-2 Times a Grading Period	1-2 Times a Year	
Data Training	No Training	Count	1	3	2	0	6
		Percent	16.7%	50.0%	33.3%	.0%	100.0%
	Less than 2 hours	Count	8	7	2	2	19
		Percent	42.1%	36.8%	10.5%	10.5%	100.0%
	2-4 hours	Count	1	1	1	0	3
		Percent	33.3%	33.3%	33.3%	.0%	100.0%
	4-8 hours	Count	1	1	0	0	2
		Percent	50.0%	50.0%	.0%	.0%	100.0%
	More than 8 hours	Count	5	0	1	1	7
		Percent	71.4%	.0%	14.3%	14.3%	100.0%
	Total	Count	16	12	6	3	37
		Percent	43.2%	32.4%	16.2%	8.1%	100.0%

Impact on Instructional Practices and Student Performance

To determine what impact the use of a data warehouse application had on instructional practices, participants were asked what impact, if any, the use of the data warehouse application had on changes to instructional strategies or intervention techniques. Response choices were little or no influence, some influence, and a great

deal of influence. Table 18 shows the number or frequency each response received, the percent of all participants included ones who did not respond to the question, and the valid percent, or percent of participants who responded to the question. As Table 18 shows, 61.0% of the participants who responded found use of the data warehouse application had some influence on their instructional practices.

Table 18

Influence of Data Warehouse Application on Changes in Instructional Strategies or Intervention Techniques

	Frequency	Percent	Valid Percent
Little or No Influence	7	15.6%	16.7%
Some Influence	26	57.8%	61.9%
A Great Deal of Influence	9	20.0%	21.4%
Total	42	93.3%	100.0%
No Response	3	6.7%	
Total	45	100.0%	

Participants were also asked what their perception of the impact, if any, the use of the data warehouse application had on student academic or behavioral performance. To clarify, the use of the data warehouse application would not have a direct influence on student achievement. However, an educator may attribute his or her use of the data warehouse application to having an indirect influence on student performance.

Response choices were little or no influence, some influence, and a great deal of influence. Table 19 shows the number or frequency each response received, the percent of all participants including ones who did not respond to the question, and the valid percent, or percent of participants who responded to the question. As Table 19

shows, 67.5% of the participants who responded found use of the data warehouse application had some influence on student performance.

Table 19

Influence of Data Warehouse Application on Student Performance

	Frequency	Percent	Valid Percent
Little or No Influence	7	15.6%	17.5%
Some Influence	27	60.0%	67.5%
A Great Deal of Influence	6	13.3%	15.0%
Total	40	88.9%	100.0%
No Response	5	11.1%	
Total	45	100.0%	

Work Place Norms

Three factors were considered to determine the workplace norms needed to help educators use data warehouse applications more effectively. The first factor considered was the setting under which a participant reviewed student data.

Participants were asked how useful they found reviewing data in a large group, such as all school staff; a small group, such as grade level teams; and as an individual. The second factor considered was the amount of designated time provided by a school or school district for participants to review student data. The third factor considered was the amount of technical support participants received in using the data warehouse application. Frequency of use was used to measure effectiveness of the various workplace norms considered.

Table 20 provides a summary of the participants' responses to the question on how useful they found various settings for reviewing data. The largest number of respondents found reviewing data as an individual was very useful (69.8%), followed

by reviewing data in a smaller group (61.9%). Reviewing data as a large group, such as an entire school staff, was found as somewhat useful by 52.4% of the participants who responded to the question.

Table 20

Usefulness of Reviewing Data based on Group Size

		Of Little or No Use	Somewhat Useful	Very Useful	Total
Large Group	Counts	10	22	10	42
	Percent	23.8%	52.4%	23.8%	100.0%
Small Group	Counts	1	15	26	42
	Percent	2.4%	35.7%	61.9%	100.0%
Individual	Counts	0	13	30	45
	Percent	0%	30.2%	69.8%	100.0%

Participants were also asked whether designated time was provided by their school or school district to review student data. Participants could receive designated time to review data as an individual, in a small a group, in a large group, or a combination of these options. Table 21 shows that 35% of the participants received designated time to review data as an individual on a weekly basis and an additional 15% received dedicated time monthly. However, 42.5% did not receive any designated time to review data as an individual. Designated time for reviewing data in small groups, the next form of data review that was found most useful, was provided weekly to 35% of the respondents and monthly to an additional 27.5%.

Table 21

Frequency of Designated Data Review Time by Group Size

		Weekly	Monthly	Per Grading Period	Once or Twice a Year	No Designat ed Time	Total
Large Group	Counts	3	6	6	13	12	40
	Percent	7.5%	22.5%	36.4%	37.5%	70.0%	100.0%
Small Group	Counts	14	11	4	6	5	40
	Percent	35.0%	27.5%	10.0%	15.0%	12.5%	100.0%
Individual	Counts	14	6	3	0	17	45
	Percent	35.0%	15.0%	7.5%	0%	42.5%	100.0%

Participants were asked if they felt they had sufficient time to review data. Of the 41 participants who responded to the question, 58.5% felt they had sufficient time and 41.5% indicated they did not have sufficient time to review data. Of the 24 participants who responded that they had sufficient time to review data, 22 responded to the question on the amount of designated time provided to review data as an individual. Table 22 shows that, of these 22 participants, 50% had designated time to review data as an individual on a weekly basis. Conversely, 17 respondents who indicated they did not have sufficient time to review data. Sixteen of these participants also responded to the question on the amount of designated time provided to review data as an individual. Of these 16 participants, 62.5% indicated that no designated time was provided to review data as an individual.

Table 22

Sufficient Time to Review Data Compared to Amount of Designated Time to Review Data Individually

			Designated Time to Review Data				
			Individually				
					Per	No	
			Weekly	Monthly	Grading	Designated	Total
			Period		Time		
Sufficient Time	Yes	Count	11	3	2	6	22
		Percent	50.0%	13.6%	9.1%	27.3%	100.0%
	No	Count	3	2	1	10	16
		Percent	18.8%	12.5%	6.3%	62.5%	100.0%
Total		Count	14	5	3	16	38
		Percent	36.8%	13.2%	7.9%	42.1%	100.0%

Table 23 shows the frequency of use of the data warehouse application compared to the amount of time designated by the school or school district for an individual to review student data. For individuals with weekly designated time, 71.4% used the data warehouse application one or more times a week and 21.4% used it one to two times a month. For those with no designated time, 37.5% used the data warehouse application one or more times a week and 28.2% used it one to two times per month.

Table 23

Amount of Designated Time to Review Data Individually Compared to Frequency of Use of the Data Warehouse Application

			Frequency of Use of Data Warehouse Application				
			1 or More Times a Week	1-2 Times a Month	1-2 Times a Grading Period	1-2 Times a Year	Total
Designated Time as an Individual	Weekly	Count	10	3	1	0	14
		Percent	71.4%	21.4%	7.1%	.0%	100.0%
	Monthly	Count	2	2	1	1	6
		Percent	33.3%	33.3%	16.7%	16.7%	100.0%
	Per Grading Period	Count	1	2	0	0	3
		Percent	33.3%	66.7%	.0%	.0%	100.0%
	No Designated Time	Count	6	4	4	2	16
		Percent	37.5%	25.0%	25.0%	12.5%	100.0%
Total		Count	19	11	6	3	39
		Percent	48.7%	28.2%	15.4%	7.7%	100.0%

Frequency of use of the data warehouse application was also compared to the amount of designated time individuals were given to review student data in small groups, such as grade level teams, data teams, or PLCs. Of the individuals given dedicated time weekly to review data in small groups, 42.9% used the data warehouse application one or more times a week and 28.6% used it one to two times a month as shown in Table 24. For participants given dedicated time to review data monthly as a small group, 54.5% used the data warehouse application one or more times a week and 27.3% used it one to two times a month.

Table 24

Designated Time to Review Data in Small Groups Compared to Frequency of Use

			Frequency				
			1 or More Times a Week	1-2 Times a Month	1-2 Times a Grading Period	1-2 Times a Year	Total
Designated Time in Small Group	Weekly	Count	6	4	2	2	14
		Percent	42.9%	28.6%	14.3%	14.3%	100.0%
	Monthly	Count	6	3	1	1	11
		Percent	54.5%	27.3%	9.1%	9.1%	100.0%
	Per Grading Period	Count	2	1	0	0	3
		Percent	66.7%	33.3%	.0%	.0%	100.0%
	Once or Twice a Year	Count	1	4	1	0	6
		Percent	16.7%	66.7%	16.7%	.0%	100.0%
No Designat ed Time	Count	2	1	2	0	5	
	Percent	40.0%	20.0%	40.0%	.0%	100.0%	
Total		Count	17	13	6	3	39
		Percent	43.6%	33.3%	15.4%	7.7%	100.0%

The availability of support available to participants was compared to the participants' views on the influence the use of the data warehouse application had on changes in instructional strategies or intervention techniques. Table 25 shows that 78.9% of the participants for which some help was provided found that use of the data warehouse application had some influence on changes to instructional strategies or intervention techniques. For participants who indicated adequate help was provided, 53.3% felt the use of the data warehouse application had some influence on changes to

instructional strategies or intervention techniques and 40% felt it had a great deal of influence.

Table 25

Amount of Help Available Compared to Changes in Instructional Strategies or Intervention Techniques

			Changes to Instructional Strategies or Intervention Techniques			Total
			Little or No Influence	Some Influence	A Great Deal of Influence	
Amount of Available Help	No Help Provided	Count	0	1	1	2
		Percent	0%	50.0%	50.0%	100.0%
	Little or No Help Provided	Count	3	2	1	6
		Percent	50.0%	33.3%	16.7%	100.0%
	Some Help Provided	Count	3	15	1	19
		Percent	15.8%	78.9%	5.3%	100.0%
	Adequate Help Provided	Count	1	8	6	15
		Percent	6.7%	53.3%	40.0%	100.0%
Total	Count	7	26	9	42	
	Percent	16.7%	61.9%	21.4%	100.0%	

Leadership

To determine how differences in leadership affect an organization's use of data warehouse applications, participation in training by educators in leadership positions was considered. Also considered was how important the participants thought the use of the data warehouse was to those in a leadership role. Leadership roles were defined as educators serving as school district level administrators, such as superintendents, curriculum directors, or special education directors; and school

administrators, such as building principals or vice principals. The effect on the organization was measured by the frequency of use of the data warehouse application and the changes in instructional strategies attributed to the use of the data warehouse application. How important the participants thought the use of the data warehouse application was in helping teachers make instructional or intervention decisions for students was also compared to how important the participants thought the use of the data warehouse application was to those in a leadership role.

Survey respondents were asked how often educators in a leadership role participated in data warehouse or related trainings. These responses were compared to the frequency of use of the data warehouse application by the respondent as shown in Table 26. Although there does not appear to be a discernible pattern between the amount of training school or school district leaders participated in and the frequency of use of the data warehouse application, 69.2% of the respondents who indicated their school or district leaders participated in all or most of the trainings used the data warehouse application one or more times a week.

Table 26

Frequency of Use of the Application Compared to Leader Participation in Trainings

			Frequency				
			1 or More Times a Week	1-2 Times a Month	1-2 Times a Grading Period	1-2 Times a Year	Total
Leader Participation	No Training	Count	2	2	2	0	6
	Provided	Percent	33.3%	33.3%	33.3%	.0%	100.0%
	Few or No	Count	4	3	1	1	9
	Trainings	Percent	44.4%	33.3%	11.1%	11.1%	100.0%
	Some	Count	5	5	1	2	13
	Trainings	Percent	38.5%	38.5%	7.7%	15.4%	100.0%
	Most or All	Count	9	2	2	0	13
	Trainings	Percent	69.2%	15.4%	15.4%	.0%	100.0%
Total	Count	20	12	6	3	41	
	Percent	48.8%	29.3%	14.6%	7.3%	100.0%	

In addition to frequency of use, change in instructional strategies or intervention techniques was also compared to participation of educators in leadership positions in data warehouse or related trainings. Table 27 shows the mean scores of the participants' changes in instructional strategies or intervention techniques where 1 = little or no influence, 2 = some influence, and 3 = a great deal of influence. Based on the mean scores, there does not appear to be a discernible pattern between the amount of training educators in leadership roles participated in as perceived by the survey respondents and the influence on instructional strategies or intervention techniques of the respondents.

Table 27

Leader Participation in Data Trainings and Changes to Instructional Strategies

Leader Participation	Mean	N	Standard Deviation
No Training Provided	1.83	6	.753
Few or No Trainings	2.22	9	.667
Some Trainings	1.92	13	.494
Most or All Trainings	2.15	13	.689
Total	2.05	41	.631

Note: 1=Little or no influence, 2=some influence, 3=a great deal of influence.

Participants were asked how important they felt the use of the data warehouse application was to their building administrators. Over half of the participants who responded indicated their building administrators thought the use of the data warehouse application was very important. Of these respondents, 60.9% used the data warehouse one or more times a week compared to 31.3% who felt their administrators thought the use of the data warehouse was somewhat important (see Table 28).

Table 28

Perceived Importance of Data Warehouse Application to Building Administrators Compared to the Frequency of Use

			Frequency				
			1 or More Times a Week	1-2 Times a Month	1-2 Times a Grading Period	1-2 Times a Year	Total
Importance to Building Administrators	Not	Count	0	1	0	0	1
	Important	Percent	0%	100.0%	0%	0%	100.0%
	Somewhat	Count	5	6	3	2	16
	Important	Percent	31.3%	37.5%	18.8%	12.5%	100.0%
	Very	Count	14	6	2	1	23
	Important	Percent	60.9%	26.1%	8.7%	4.3%	100.0%
Total		Count	19	13	5	3	40
		Percent	47.5%	32.5%	12.5%	7.5%	100.0%

The respondents' perception of how important they believed the use of the data warehouse was to their building administrator was also compared to the mean score of how influential the use of the data warehouse application was to changes to instructional strategies and intervention techniques. The mean scores were based on the scale where 1 = not important, 2 = somewhat important, and 3 = very important. Table 29 shows a higher mean score for the respondents who thought the use of the data warehouse was very important to their building administrators. Only one participant indicated the use of the data warehouse was not important to their building administrator. The mean score for the influence the use of the data warehouse application had on changes to instructional strategies or intervention techniques was higher for participants who felt the use of the data warehouse was very important to

their building administrator compared to the participants who felt the use of the data warehouse application was somewhat important to their administrator.

Table 29

Perceived Importance of Data Warehouse Application to Building Administrators Compared to Changes in Instructional Strategies

Importance to Building Administrators	Mean	N	Standard Deviation
Not Important	2.00	1	.
Somewhat Important	1.81	16	.655
Very Important	2.26	23	.541
Total	2.07	40	.616

Note: 1=Not Important, 2=Somewhat Important, 3=Very Important

Table 30 shows that 60.9 % of respondents who indicated the use of the data warehouse application was very important to district administrators used the data warehouse application one or more times a week compared to 23.1% who indicated the use of the data warehouse was somewhat important to district administrators.

Table 30

*Perceived Importance of Data Warehouse Application to District Administrators
Compared to Frequency of Use*

			Frequency				Total
			1 or More Times a Week	1-2 Times a Month	1-2 Times a Grading Period	1-2 Times a Year	
Importance to District Administrators	Not	Count	0	1	0	0	1
	Important	Percent	0%	100.0%	0%	0%	100.0%
	Somewhat	Count	3	6	3	1	13
	Important	Percent	23.1%	46.2%	23.1%	7.7%	100.0%
	Very	Count	14	6	2	1	23
	Important	Percent	60.9%	26.1%	8.7%	4.3%	100.0%
Total		Count	17	13	5	2	37
		Percent	45.9%	35.1%	13.5%	5.4%	100.0%

The influence of the use of the data warehouse application on changes to instructional strategies or intervention techniques was compared to how important the respondents thought the use of the application was to building administrators. As shown in Table 31, the mean score was higher for participants who felt district administrators thought the use of the data warehouse application was very important compared to district administrators who thought the use was somewhat important.

Table 31

Perceived Importance of Data Warehouse Application to Building Administrators Compared to Changes in Instructional Strategies

Importance to District Administrators	Mean	N	Standard Deviation
Not Important	2.00	1	*
Somewhat Important	1.77	13	.725
Very Important	2.26	23	.541
Total	2.08	37	.640

Note: 1=Not Important, 2=Somewhat Important, 3=Very Important

*Unable to determine standard deviation due to too few responses

Survey participants were asked how important the use of the data warehouse application was to district administrators, building administrators, other teachers, and themselves. The perceived importance of district and building administrators was compared to the importance the use of the data warehouse was to the respondent. Table 32 shows that only one respondent indicated the use of the data warehouse application was not important to the building administrators. Of the 16 respondents who indicated the use of the data warehouse was somewhat important to the building administrator, 62.5% said the use of the data warehouse application was somewhat important to themselves. Of the 20 respondents who indicated the use of the data warehouse application was very important to their building administrator, 87.0% indicated the use of the data warehouse application was very important to themselves.

Table 32

Perceived Importance of Data Warehouse Application to Building Administrators Compared to Importance to Participants

		Importance to Participant		Total
		Somewhat Important	Very Important	
Importance to Building Administrators	Not Important	Count	1	1
		Percent	100.0%	100.0%
	Somewhat Important	Count	10	16
		Percent	62.5%	100.0%
	Very Important	Count	3	23
		Percent	13.0%	100.0%
Total	Count		14	40
	Percent		35.0%	100.0%

The Chi-square test of independence was used to determine if there was significance in the relationship between participant's perception of how important the use of the data warehouse was to building administrators and how important the participant believed the use of the data warehouse (Table 33). For this test, only responses indicating the use of the data warehouse application was somewhat important or very important to building administrators were considered. The χ^2 ($N = 39$) = 10.386, $p = .001$, suggested there was significance in the relationship between the perceived importance of the data warehouse application by the building administrators and the importance of the use of the application to help the participant make instructional or intervention decisions for students.

Table 33

Pearson Chi-square Test for Independence of Perceived Importance of the Data Warehouse Application to Building Administrators and the Importance of the Application to Participants

	Value	df	Assumption Significance (2-sided)
Pearson Chi-Square	10.386	1	.001
Likelihood Ratio	10.666	1	.001
Linear-by-Linear Association	10.120	1	.001
N of Valid Cases	39		

Table 34 compares the participants' perceived importance to district administrators of the use of the data warehouse application, and the importance the use of the data warehouse holds for the participants. As with the perceived importance of building administrators, 69.2% of the participants who indicated district administrators thought the use of the data warehouse was somewhat important also indicated they believed the use of the data warehouse was somewhat important. The greatest number of participants (20 of the 23) who indicated the use of the data warehouse application was very important to their district administrators also indicated the use of the data warehouse application was important to them (87.0%).

Table 34

Perceived Importance of Data Warehouse Application to Building Administrators Compared to Importance to Participants

			Importance to Participant		Total
			Somewhat Important	Very Important	
Importance to District Administrators	Not Important	Count	1	0	1
		Percent	100.0%	0%	100.0%
	Somewhat Important	Count	9	4	13
		Percent	69.2%	30.8%	100.0%
	Very Important	Count	3	20	23
		Percent	13.0%	87.0%	100.0%
	Total		Count	13	24
			Percent	35.1%	64.9%

Participants were asked to rate how important they, personally, thought the use of the data warehouse application was in helping teachers make instructional or intervention decisions for students. As shown in Table 35, all respondents indicated the use of the data warehouse application was somewhat important or very important. No participants responded that the use of the data warehouse was not important. These responses were compared to how important the respondent thought the use of the data warehouse application was to building teachers. Three respondents thought the use of the data warehouse application was not important to the building teachers. Of the respondents who thought the use of the data warehouse application was

somewhat important to the building teachers, 62.5% indicated they also thought the use of the data warehouse application was somewhat important. Of the respondents who thought the use of the data warehouse application was very important to the building teachers, 95.0% indicated they also thought the use of the data warehouse application was very important.

Table 35

Perceived Importance to Building Teachers Compared to Importance to Participant

			Importance to Participant		
			Somewhat Important	Very Important	Total
Importance to Building teachers	Not Important	Count	3	0	3
		Percent	100.0%	.0%	100.0%
	Somewhat Important	Count	10	6	16
		Percent	62.5%	37.5%	100.0%
	Very Important	Count	1	19	20
		Percent	5.0%	95.0%	100.0%
Total		Count	14	25	39
		Percent	35.9%	64.1%	100.0%

Participant Views of the Data Warehouse Application

The apparent relationship between the participants' view of the importance of the use of the data warehouse application to help teachers make instructional or intervention decisions for students to the perceived importance to building and district level administrators led to further exploration. All participants indicated the use of the

data warehouse application was somewhat important or very important. To explore whether a relationship existed between the importance of the data warehouse application to other factors, the participants' ratings of their view of the importance of the application was compared to frequency of use and changes to instructional strategies or intervention techniques. Of the participants who indicated they used the data warehouse application one or more times a week, 85% found the use of the data warehouse application very important (Table 36).

Table 36

Importance of Data Warehouse Application Compared to Frequency of Use

			<u>Importance to Participant</u>		
			Somewhat	Very	Total
			Important	Important	
Frequency	1 or More Times a Week	Count	3	17	20
		Percent	15.0%	85.0%	100.0%
	1-2 Times a Month	Count	7	6	13
		Percent	53.8%	46.2%	100.0%
	1-2 Times a Grading Period	Count	2	4	6
		Percent	33.3%	66.7%	100.0%
	1-2 Times a Year	Count	3	0	3
		Percent	100.0%	.0%	100.0%
	Total	Count	15	27	42
		Percent	35.7%	64.3%	100.0%

Also considered was how important a participant believed the use of the data warehouse application was in helping teachers make instructional or intervention decisions for students and how much influence the participant believed the use of the application made on changes to instructional strategies or intervention techniques. As Table 37 indicates, 100% of the participants who indicated the use of the data

warehouse application had a great deal of influence on changes to instructional strategies or intervention techniques believed the data warehouse was very important as compared to 28.6% of the participants who believed the use of the application had little or no influence on changes to instructional strategies or intervention techniques.

Table 37

Influence of the Data Warehouse Application on Changes to Instructional Strategies or Intervention Techniques Compared to Importance the Use of the Application had to Participant

			Importance to Participant		
			Somewhat Important	Very Important	Total
Changes to Instructional Strategies or Intervention Techniques	Little or No Influence	Count	5	2	7
		Percent	71.4%	28.6%	100.0%
	Some Influence	Count	10	16	26
		Percent	38.5%	61.5%	100.0%
	A Great Deal of Influence	Count	0	9	9
		Percent	.0%	100.0%	100.0%
Total	Count	15	27	42	
	Percent	35.7%	64.3%	100.0%	

Finally, the importance the use of the data warehouse application had for the participant and perceived improvement in student performance, either academic or behavioral, was explored. As with the influence on changes to instructional strategies or intervention techniques, 100% of the individuals who indicated the application had a great deal of influence rated the importance the use of the application had in helping teachers make instructional decisions as very important (Table 38). Only 14.3% of the individuals who indicated the use of the data warehouse application had little or no

influence on improvement in student performance rated the importance of the application to help teachers make instructional decision for students as very important.

Table 38

Influence of Data Warehouse Application on Improvements in Student Performance Compared to Importance of the Data Warehouse Application to Participant

		Importance to Participant			
			Somewhat Important	Very Important	Total
Improvement in Student Performance	Little or No Influence	Count	6	1	7
		Percent	85.7%	14.3%	100.0%
	Some Influence	Count	9	18	27
		Percent	33.3%	66.7%	100.0%
	A Great Deal of Influence	Count	0	6	6
		Percent	.0%	100.0%	100.0%
Total	Count	15	25	40	
	Percent	37.5%	62.5%	100.0%	

Survey Data Summary

A total of 45 educators from two school districts participated in the on-line survey, including educators from elementary, middle, and high school levels, as well as teachers and administrators who worked at the district level. The majority of the participants taught Language Arts, however all instructional content areas were represented including non-teaching staff. Of the 45 participants, 31 were teachers or specialists, half of which were classroom teachers and half building or district level specialists. Nine building level and two district level administrators completed the survey. Three participants did not indicate what role they were in.

To determine what data warehouse application features affected the ability of an educator to effectively use the application for DDDM, participants were asked how useful they found various data display formats, types of data, and disaggregated groups of data. Participants rated the various data warehouse features as not very useful, somewhat useful, and very useful. Over 50% of the participants indicated they found charts or tables, graphs, reports, and spreadsheets as very useful. When asked how useful they found information on attendance, discipline, summative assessments, and formative assessments, 71.1% found summative assessment data and 68.2% found formative assessment data very useful. Participants also indicated viewing student data at the class level was most useful, followed by school-wide data, then by district-wide data. Building administrators found viewing school-wide data most helpful whereas teachers, whether at the district/building or classroom level, indicated viewing data at the classroom level most helpful. At a more granular level, participants found data disaggregated by student performance groups, such as reading levels, more useful than student program groups, such as special education, talented or gifted, or English language learners. Student groups based on demographic information such as grade level or race were rated as least useful.

Participants were asked about the type and extent of professional development they received to determine how this affected the use of the data warehouse application in instructional decision making. The amount of professional development participants received in the use of the data warehouse application varied from no training to two to four hours of training, with most participants receiving less than two

hours of training. Similarly, the amount of professional development participants received on using data to inform instructional decisions varied from no training to more than eight hours of training. On average, classroom teachers received more training in using data for instructional decision making than district/building level teacher whereas district/building level teachers received more training in the use of the data warehouse application. Building administrators received more training in both the use of the data warehouse application and using data to inform instructional decisions than either classroom or district/building level teachers. Regardless of the amount of training received in either the use of the data warehouse application or using data to inform instructional decision making, over 60% of the participants indicated the use of the data warehouse application had some influence on changes to the instructional strategies or intervention techniques they used in the classroom.

Most participants received less than two hours of training in the use of the data warehouse application. Similarly, most participants also received fewer than two hours of training in how to use data to make informed instructional decisions. The amount of training received, whether in the use of the data warehouse application or in using data to make informed instructional decisions, did not appear to affect the frequency of use of the data warehouse application.

The amount of training received was compared to how important the participant believed the use of the data warehouse application was in helping teachers make instructional decisions. The percentage of participants who rated the use of the application as very important was much higher for participants who received up to two

hours of training (77.8%) or two to four hours of training (66.7%) than those who received no training in the use of the application (22.2%).

What impact, if any, the use of the data warehouse application had on teachers' instructional practices and on the perception of impact on student achievement was also explored. Participants were asked what influence they attributed to their use of the data warehouse application to changes in instructional strategies or intervention techniques they used with their students. Of those who responded, 61.9% indicated the use of the data warehouse application had some influence. Similarly, 67.5% of those who responded indicated they attributed the use of the data warehouse as having some influence on changes in student performance.

The factors used to determine the work place norms needed to help educators use the data warehouse applications more effectively included the frequency participants used the data warehouse application, the amount of dedicated time they received to review data, and the size of the group in which they found reviewing data useful. More participants found reviewing data individually or in small groups as very useful compared to viewing data in a large group. Fifty percent of the individuals indicated that they received dedicated time by their school or school district to review data weekly or monthly as an individual. However, 42.5% indicated they did not receive any dedicated time to review data as an individual. Over 50% indicated they received dedicated time weekly or monthly to review data in small groups. When asked if they had sufficient time to review data, 58.5% said they did. Of those who indicated they had sufficient time to review data, 50% had dedicated time weekly and

13.6% had dedicated time monthly. Yet, 27.3% of those who indicated they had sufficient time to review student data were not provided with any designated time. Of the participants who were given designated time weekly to review data as an individual, 71.4% used the data warehouse application at least once a week. Of the participants who were given dedicated time to review data weekly, 42.9% used the data warehouse application at least once a week and 28.6% used it at least once a month. Of the participants who were given dedicated time monthly to review data in a small group, 54.5% used the data warehouse application weekly and 27.3% used it monthly.

Administrator participation in data warehouse and related trainings, as well as how important survey participants felt the use of the data warehouse was to their administrators, were used to determine how differences in leadership affect an organization's use of a data warehouse application. School and school district leaders, such as building and school district administrators, appeared to influence the frequency of use of the participants. Almost 70% of the participants whose administrators participated in most or all data warehouse or related trainings used the data warehouse application one or more times a week. In addition, participants who thought their building or district administrators felt the use of the data warehouse application was very important used the application one or more times per week. Participants were also asked how important they personally thought the use of the data warehouse application was to district and building administrators. Of the participants who indicated the use of the data warehouse application was somewhat important to

their building administrators, 62.5% indicated they also personally thought the use of the data warehouse was somewhat important. Of the participants who indicated the use of the data warehouse was very important to their building administrators, 87% indicated the use of the data warehouse application was very important. Similar results were obtained when participants were asked how important they felt the use of the data warehouse was to district administrators. This same pattern held true when participants were asked about their perceptions of how important they thought the use of the data warehouse was to other teachers in their building. Over 62% of the respondents who indicated the use of the data warehouse application was somewhat important also indicated other teachers in their building thought the use of the data warehouse application was somewhat important. Ninety-five percent of the respondents who indicated they believed the use of the data warehouse application was very important also indicated the use of the data warehouse was very important to other teachers. The Chi-square test for independence was used to determine whether there was significance in the relationship between the importance the use of the application held for the participant and how important the use of the application was to building administrators. The Chi-square test indicated significance in this relationship at a confidence level of 95%.

How important the participant believed the use of the data warehouse application was in helping make instructional decisions was compared to frequency of use of the application, changes in instructional strategies or intervention techniques, and perceived improvement in student performance. Eighty-five percent of the

participants who used the application one or more times a week indicated they believed the use of the data warehouse was very important. The more influence the participants believed the application had on changes to instructional strategies or intervention techniques, the greater percentage of the participants indicated the use of the application was very important. Finally, a comparison between the participants' view of the importance the use of the application and the influence that use had on improvement in student behavior was made. The greater the perceived influence of the application on improvement in student behavior, the greater the percentage of participants who thought the use of the application was very important.

Focus Group and Interview Data

A focus group and interviews were held to gain deeper insight into the participants' views of the factors that affect the ability of a school district to implement a data warehouse application. The focus group consisted of four administrators from the same school district; an elementary principal, a middle school principal, a district-level special education director, and a district-level assistant superintendent. The interview participants were two classroom teachers and two specialists. The classroom teachers were at the middle and high school level and taught mathematics, social studies, and industrial technology courses. The specialists were a special education teacher and a school psychologist at the elementary and high school level. The following information is based on the responses of four school district administrators who participated in the focus group (FG) and four teachers who

were interviewed (I). The same questions were used to guide the discussion in the focus group and to guide the interviews.

- Please tell us your name and your teaching/administrative assignment including grade level and/or content area.
- How has the type and extent of professional development and support affected your ability to use the data warehouse application to make instructional decisions for your students/school/district?
- How has the amount of time you have to use the data warehouse application affected your ability to use the data warehouse application to make instructional decisions for your students/school/district?
- What role has leadership and the organizational culture played in your ability to use the data warehouse application to make instructional decisions for your students/school/district?
- What impact, if any, has the use of the data warehouse application had on your instructional practices and on student achievement?
- What do you consider are the three factors that have had the most influence on your ability to use the data warehouse application to make instructional decisions for your students? These factors can be, but do not have to be ones we have discussed today.

The responses of the administrators and teachers were combined for analysis.

The discussion of the qualitative data results is organized into six sections followed by

a summary. Each section addresses one of the areas explored in this study plus additional findings that were not included in the research questions.

Data Warehouse Features

Data warehouse features refers to the design and functionality of the application the participants used. While various features were identified, two stood out as impacting the participants' use of the data warehouse application. Foremost was the ease of use of the application. The administrators specifically identified a point in time when use of the application increased after the application changed to a more user-friendly format. As one administrator expressed, "If it's simple and it looks appealing, if it's customer friendly, we are going to use it" (FG). The teachers interviewed stated that many teachers did not use the application because they found it cumbersome and difficult to understand. Items that affected the ease of use included how the data were presented as well as how intuitive the application was to use.

The second feature that stood out was the immediate access to student data. In many cases, teachers and administrators could access data through the data warehouse application that they were unable to access previously. Especially useful was the ability to view historical data on students. For example, teachers could view the past academic and behavioral performance of students prior to the students entering their classes, allowing the teachers to identify and prepare for the specific needs of incoming students. Administrators found the ability to access multiple types of data from one source, instead of using several sources to access the data, saved valuable time.

Additional features that were of benefit were the ability to view the data by various groups of students, such as viewing data on all third grade students across the school district or all students identified as English language learners. The participants also indicated the ability to customize how they viewed the data as helpful. While the ability to view formative assessment data was limited, both administrators and teachers claimed this information was very useful and speculated the use of the data warehouse application would increase if this feature were expanded. Participants also like that the application changed gradually over time, allowing them to slowly learn the new features as they became available.

Professional Development and Support

The teachers and administrators who participated in the study indicated a need for professional development in the use of the data warehouse application. Administrators expressed the benefit of receiving initial training in the use of the data warehouse application. Conversely, teachers who had received minimal training found the data warehouse application more difficult to use. Teachers expressed the lack of training they received affected their ability to use the data warehouse application. In addition, the need for training in how to use data to make informed instructional decisions was noted.

Professional development also needed to be targeted for the specific audience. Teachers' level of understanding and use of the data warehouse application varied greatly. Trainings needed to address the different ability levels of the teachers.

Administrators attributed their use of the application to training focused on how the application could be used to address the specific needs of administrators.

Administrators indicated that professional development for the data warehouse application should be sustainable, utilizing school district staff to provide trainings throughout the school year. Various features of the application should be introduced over time, allowing teachers the opportunity to use what they have learned in order to remember how to use the application.

In addition to training, teachers and administrators needed time to become familiar with using the application. One administrator stated, “I foresee as [teachers] get more comfortable with it, we will see more usage” (FG). This was supported by the teachers who said, “The more we use it, the better it will be” (I).

The participants talked about two areas of support, response time and materials. Administrators emphasized the helpfulness of receiving immediate response to requests for help. Problems they encountered were addressed in a timely manner. In addition, responses to questions about the application were communicated to the administrators in a manner that was easy for them to understand. The need for support materials was also identified. Examples included written documents providing simple instructions on procedures or short videos on how to use the application that the participants could watch at their convenience.

Impact on Instructional Strategies and Student Performance

Participants expressed clearly that any changes in student achievement were the result of changes in instructional strategies. While they acknowledged that the use

of the data warehouse application did lead to changes in instructional strategies, they did not feel they had used the data warehouse application long enough to determine if the changes in instructional strategies would lead to changes in student achievement.

Participants expressed that the use of the data warehouse application had the greatest impact on intervention strategies. Teachers were able to use the application to identify specific areas of need for both individual and groups of students. Through the use of the data warehouse application, the teachers were able to access the data needed in the RTI process used by the school district to address academic needs of students.

Participants also found the application helpful in providing information to parents on the progress their children were making in school. The school district was able to use the data warehouse application to create reports to share with parents during parent-teacher conferences. An example one administrator gave regarding student attendance was, “Well, they are only here 76% of the time which means we can’t teach them 24% of the curriculum. So if you want to know why they are flunking, that would be part of it” (FG).

Participants were able to use the application in planning. The ability to see data on incoming students allowed teachers to plan for the specific needs of students entering their classes. The application also allowed for school-wide or district-wide planning. As one participant described, “We hold various meetings to get ourselves back on track and, hopefully, we can use this [application] to guide us a little better. I think this would be a great way for us to actually see the data instead of trying to come up with all these fancy things to do” (I).

Work Place Norms

The participants found certain work place norms useful in implementing the use of the data warehouse application. One norm identified by the participants was the importance of meeting with colleagues to discuss student data. Administrators found helping each other was useful in learning to use the application. Administrators also expressed they thought teachers would learn the application by working together. One teacher stated a good method of teaching other teachers to use the application would be to have a team of teachers provide support to other teachers in their school.

Not only did participants need the opportunity to work together, but designated time needed to be provided in order for that to happen. Both the teachers and administrators indicated they had enough time to use the data warehouse application in the way it was currently being used. However, the administrators emphasized the importance of teachers meeting together to discuss student data and the teachers indicated they did not have enough time to meet with other teachers to discuss data.

The two other norms identified were the need for correct access to the application features and having accurate data. The administrators discussed the necessity for individuals to have access to the correct data. For example, team leaders needed access to student data for the grade levels they supported. Two teachers expressed that the lack of use of the data application in their schools was related to the difficulty in gaining access to the application.

As the school district implemented the use of the data warehouse application, the administrators found they needed to track student data accurately and completely.

Data that was entered inaccurately in data systems that provided data to the data warehouse application would result in inaccurate information being displayed in the data warehouse application. As one interviewee expressed, “in my work anything less than 100% accurate is not accurate” (I).

Leadership

All participants identified the role of leaders as essential in the implementation of the use of the data warehouse application. Three key factors were identified in the area of the leadership. Both the teachers and administrators expressed that administrators must require teachers to use the data warehouse application in order to ensure all teachers would use the application. In addition to requiring the use of the data warehouse application, administrators should specify when and how teachers should use the application. One teacher stated, “I think our district should do a better job of guiding our [Professional Learning Communities] and say ‘you need to be looking at the data warehouse and bring this information to your next meeting’ because we are not doing that. I know my fellow teachers will not like that but if we are going to use it correctly, that’s what we have to do” (I).

Secondly, both the teachers and administrators expressed the need for teachers to serve as leaders in the implementation of the data warehouse application. Administrators agreed that teachers would learn from sharing their knowledge on how to use the application with each other. This was supported by the teacher who stated that teachers would benefit by the creation of a team of teachers to help others in

learning how to use the application. The support should focus on how to use the application as opposed to how to use data to make instructional decisions.

The final factor identified was the need for overall guidance from administrators in the use of data. One teacher stated it would be beneficial if teachers were directed as to where teachers should go to find specific data if multiple sites were available. The teacher summed up the importance of leadership, “If your team isn’t going for the same goal, then you’re probably not going to be very successful. School leadership is a big part of how well, or not well, your school goes” (I).

Unexpected Findings

Three additional factors had an influence on the implementation of the data warehouse application. Both the teachers and administrators discussed how teachers’ ability to use technology influenced their ability to use the data warehouse application. Teachers with higher technology skills seemed able to navigate the application with minimal support whereas teachers with limited technology skills seemed to struggle.

The administrators attributed part of the school district’s success in implementing the data warehouse application was that they were ready to use data to make informed decisions. The school district had been using Professional Learning Communities for the past two years. Teachers understood why it was important to base instructional decisions on student performance data. Teachers understood what the data meant and how they were to use it to make informed decisions.

Reaching a point where they were ready to use data to make informed instructional decisions led to a need to have access to student data. Teachers needed

data on which to base discussions about student performance during the PLC meetings. School district staff also needed data to use in the RTI process. Teachers needed access to determine student placement in reading groups. Teachers became more focused on the academic and behavioral performance of individual students.

Focus Group and Interview Data Summary

Several factors were identified as influencing the ability of the participants to implement the use of a data warehouse application. Two features of the design and functionality of the application that greatly influenced its use were ease of use and immediate access to data. The easier the application was to use, the more likely a teacher or administrator was to use it. The ability to immediately access data from one source also increased the use of the application. As one administrator stated, “If it’s friendly enough, the power of what they are seeing is at their fingertips” (FG).

Participants identified a need for training in how to use the application. The training needed to be targeted to the ability level of the audience. Training should be sustainable, utilizing teachers within the school district. It should also be on-going and provide opportunity for teachers and administrators to become comfortable with the application.

Support for the application also played a factor in the implementation. Support needed to be provided in a timely manner. Questions were answered in a way that was easy for administrators to understand. Support materials were also needed, such as help documents or short videos.

Participants attributed changes in instructional practices and planning to the use of the data warehouse application. The application was especially helpful in providing data on which to determine appropriate interventions for students. The application provided individual student data which allowed teachers and administrators to better communicate with parents about their children. The application also provided student data in a manner that allowed for school and district level planning.

Two work place norms were important in the implementation of the data warehouse application. Both teachers and administrators needed the opportunity to meet with colleagues to discuss student data. However, in order for that to happen, designated time had to be provided.

Leadership played a key role in the implementation of the data warehouse application. Administrators must require the use of the application to ensure teachers are using it. In addition, administrators should specify when and how the application was to be used. Teachers also played an important role in leadership by working with colleagues to share their knowledge in how to use the application. Beyond the use of the application, administrators needed to provide guidance in how data were to be used and the goals for their schools.

Three additional factors affected the implementation of the data warehouse application. A teacher's ability to use technology greatly affected their ability to use the data warehouse application. The higher the teacher's technology skills, the easier it was to use the application. A school district also needed to be ready to use data to

make informed instructional decisions. This allowed teachers to understand why they were using the data and how to use the data to make decisions. Understanding how to use data lead to the final factor, the need for data. Teachers needed data on students to guide their instructional discussions and decisions.

Comparison of Findings from Quantitative and Qualitative Data

Both quantitative and qualitative data were gathered for this study.

Quantitative data were gathered through an on-line survey. Qualitative data were gathered through a focus group and interviews. Educational administrators and teachers participated in the study. The focus group and interview participants were selected from the on-line survey participants. The collection of quantitative and qualitative data in this study served three purposes. First, the results from the focus group and interviews (qualitative data) were for possible validation of the results of the on-line survey (quantitative data). Second, the focus group and interview results were used to provide deeper insight into the results of the on-line survey. Finally, the focus group and interview results were used to seek other factors that might affect the implementation of the data warehouse application that were not addressed in the survey.

The following discussion is organized in the same manner as the discussions of the on-line survey results and the focus group and interview results. Each section is aligned with the areas explored in this study.

Data Warehouse Features

The display of summative and formative assessment data and the ability to view student data in small subgroups such as reading level groups were identified in the on-line survey as key features that affected the use of the data warehouse application. These findings were supported by the focus group and interview results. Focus group participants identified the use of formative assessment data as highly useful. Also identified was the ability to access summative assessment data, particularly sub-strand data for summative assessment. The ability to view student data on individual students, as well as groups of students, was also identified as important by the focus group and interview participants.

The focus group and interview results identified the ease of use of the application as a key factor in the use of the data warehouse application. The easier the participants found the application was to use, the more likely they were to use it. Over half of the survey respondents indicated they needed little or no help using the data warehouse application.

Focus group and interview results also showed immediate access to data provided by the application increased its use. While this feature was not directly addressed in the on-line survey, over 50% of the survey participants rated all forms of data display (charts, tables, graphs, reports, and spreadsheets) as very useful.

Professional Development and Support

Both the on-line survey and the focus group and interview results showed that administrators received more training in the use of the data warehouse application, as

well as using data in decision making, than classroom teachers. The focus group and interview data indicated teachers received minimal to no training in the use of the application. While the survey data indicated that the amount of training did not influence the participants' use of the data warehouse application, the focus group and interview data revealed the opposite. Participants who had more training found the application easier to use while those with less training found it more difficult. In addition, participants who received two to four hours of training used the application more frequently than those who received no training.

Also identified in the focus group and interview data were the need for training targeted to a specific audience. Administrators found training that focused on how an administrator might use the data warehouse helpful whereas teachers would benefit from training targeted at their ability level to use the application. Both teachers and administrators identified the need to use the application over time to become familiar with its functionality.

The survey data showed sufficient support in the use of the application was available to participants. The administrators in the focus group supported this finding and specified the timely response to questions and issues as highly beneficial. The teachers interviewed identified the need for additional support materials such as written procedural guides or instructional videos.

Impact on Instructional Strategies and Student Performance

When asked what influence the use of the data warehouse application had on changes to instructional strategies or intervention techniques, 61.9% of the survey

participants responded that the use of the application had some impact. The results were slightly higher when asked about the influence on student achievement where 67.5% responded that the use of the application had some influence. The focus group participants clarified this finding by explaining the use of the application may have had an indirect influence on changes in student achievement. The use of the application influenced instructional strategies teachers used by providing data that helped teachers identify the specific needs of their students. This, in turn, led to changes in instructional strategies or intervention techniques. Administrators expressed that changes in instructional strategies or intervention techniques would be what led to changes in student achievement. While the administrators did attribute changes to instructional strategies and intervention techniques to the use of the application, they specified that it was too soon to determine if these changes would lead to improvement in student achievement.

Work Place Norms

Work place norms addressed the amount of time a participant used the data warehouse application, whether time was provided that was specifically designated to reviewing student data, and under what conditions participants found reviewing data most useful (individually, in a small group, or in a large group). The majority of the survey participants found it very useful to review data as an individual (69.8%) and in small groups (61.9%) whereas a much smaller number found reviewing data in a large group very useful (23.8%). The focus group and interview data supported the importance of reviewing data in small groups. The teachers interviewed expressed the

need for more time to meet with colleagues to discuss student data. Administrators participating in the focus group expressed the helpfulness of working together and learning from their colleagues. The survey results revealed that participants with designated time used the data warehouse application more frequently than individuals who were not provided designated time to review data. Teachers supported the need for designated time to be provided to review student data. Regardless of whether designated time was provided, 48.7% of survey participants indicated they used the data warehouse application individually on a weekly basis and 28.2% indicated they used the application at once or twice a month.

Leadership

In both the survey results and the focus group and interview results, leadership appeared to influence the implementation of the data warehouse application. Leadership referred to school administrators, such as principals and vice principals; district level administrators, such as curriculum directors and superintendents; and lead teachers, such as grade-level team leaders or instructional coaches. The survey results showed that almost 70% of participants whose building or district level administrators participated in most or all of the data warehouse or related trainings used the data warehouse application one or more times a week. The survey results also showed that 87% of the participants who indicated they thought the use of the data warehouse application was very important to building administrators also indicated that they themselves thought the use of the data warehouse application was very important. Similar results were found when participants were asked how

important they felt the use of the data warehouse application was to district level administrators and other teachers.

The focus group and interview data also identified the role leadership played in the implementation of the data warehouse application. Both the teachers and administrators expressed the need for administrators to require the use of the application in order to ensure teachers used the application. One teacher who was interviewed expressed the need for administrators to provide guidance in the use of the application to the extent of specifying when and how it was to be used. Also expressed was the need for administrators to provide overall guidance in the use of data and setting goals for schools.

Quantitative and Qualitative Data Comparison Summary

This study gathered both quantitative data through the use of an on-line survey and qualitative data through the use of a focus group and interview. Qualitative data (focus group and interviews) were gathered to validate the quantitative (on-line survey) data. the qualitative data were also used to provide a deeper understanding of the results of the on-line survey and seek additional factors that might influence the implementation of a data warehouse application that were not addressed in the survey.

Key features of the data warehouse application that were identified in both the on-line survey and the focus group were the ability to view data for an individual or small groups of students. Two types of data that both the survey and focus group and interview participants indicated were useful were formative assessment and summative assessment data. The focus group and interview results indicated

immediate access to student data positively affected the implementation of the application. Ease of use of the application was also identified as a factor in its use.

The amount of professional development received by participants varied greatly. Both the on-line survey and the focus group results showed administrators received more training than classroom teachers. The focus group and interview data indicated there was a higher level of use among the administrators who received more training than the teachers who received minimal training. The focus group and interview results highlighted the need for training to be specific to the role and ability level of the audience.

Both the on-line survey and the focus group and interview results indicated sufficient support was provided for the use of the application. Teachers identified the need for support materials to be provided through written documentation and short informational videos.

The majority of the survey participants indicated the use of the data warehouse application had an influence on instructional strategies and intervention techniques. Survey participants also indicated an influence on student achievement. The focus group participants clarified that the use of the data warehouse application influenced instructional strategies and intervention techniques which, in turn, influenced student achievement.

The survey results showed participants found reviewing data individually and in small groups very useful. The need for teachers and administrators to review student data in small groups was supported by the results of the interview and focus

group. Also identified by both the survey and interview and focus group results was the need for designated time to be provided to review student data.

Both the survey and the focus group and interview results showed leadership played a role in implementation of the data warehouse application. Survey participants who indicated the administrators participated in all or most of the data warehouse training used the application more frequently. Survey participants who indicated the use of the data warehouse application was important to their building administrators also indicated that they felt it was important. Both the teachers and administrators in the focus groups expressed the need for administrators to stress the importance of the use of the data warehouse application.

Summary

This study gathered both quantitative data through the use of an on-line survey and qualitative data through the use of a focus group and interviews. Qualitative data were gathered to validate the quantitative data, provide a deeper understanding of the results of the on-line survey, and to seek additional factors that might influence the implementation of a data warehouse application that were not addressed in the survey. The study involved two school districts. A total of 45 educators, including elementary, middle, and high school teachers and administrators, as well as district-level administrators and specialists, participated in the study.

When asked to rate how useful they found various features of the data warehouse application, over 71% of the survey participants found summative assessment data very useful and 68.2% found formative assessment data very useful.

School-wide data was most helpful to building administrators whereas teachers indicated classroom level data was most helpful. Data disaggregated by student performance groups, such as reading levels, was more useful than data viewed by student program groups, such as special education students.

The amount of professional development participants received in the use of the data warehouse application varied from no training to two to four hours of training with most participants receiving less than two hours of training. The amount of professional development they received on using data to inform instructional decisions also varied greatly from no training to more than eight hours of training. Regardless of the amount of training, over 60% of the survey participants indicated the use of the data warehouse application had some influence on changes to the instructional strategies or intervention techniques they used in the classroom.

The percentage of participants who rated the use of the application as very important was much higher for participants who received up to two hours of training (77.8%) or two to four hours of training (66.7%) than those who received no training in the use of the application (22.2%).

When participants were asked what influence they attributed to their use of the data warehouse application to changes in instructional strategies or intervention techniques they used with their students, 61.9% indicated the use of the data warehouse application had some influence. Similarly, 67.5% indicated they attributed the use of the data warehouse as having some influence on changes in student performance.

In terms of work place norms, more participants found reviewing data individually or in small groups to be very useful. Fifty percent of the individuals indicated that they received dedicated time by their school or school district to review data weekly or monthly as an individual. Over 50% indicated they received dedicated time weekly or monthly to review data in small groups. When asked if they had sufficient time to review data, 58.5% said they did. Of those who indicated they had sufficient time to review data, 50% had dedicated time weekly and 13.6% had dedicated time monthly.

Almost 70% of the participants whose administrators participated in most or all data warehouse or related trainings used the data warehouse application one or more times a week. Participants who thought their building or district administrators felt the use of the data warehouse application was very important used the application one or more times per week.

Of the participants who indicated the use of the data warehouse application was somewhat important to their building administrators, 62.5% indicated they also personally thought the use of the data warehouse was somewhat important compared to 87% indicated the use of the data warehouse application was very important personally and to building administrators. The Chi-square test for independence indicated a significance in the relationship at a 95% level of confidence between the importance the use of the application held for the participant and how important the participant perceived the use of the application was to building administrators.

Eighty-five percent of the participants who used the application one or more times a week indicated they believed the use of the data warehouse was very important. The more influence the participants believed the application had on changes to instructional strategies or intervention techniques, the greater percentage of the participants indicated the use of the application was very important. Finally, the greater the perceived influence of the application on improvement in student performance, the greater the percentage of participants who thought the use of the application was very important.

Qualitative data were gathered through a focus group and four individual interviews. The focus group consisted of four administrators at the school and district level. The interviews involved two classroom teachers and two building level specialists. The data from the on-line survey was used to guide the focus group discussion and interviews.

Two features of the design and functionality of the application that greatly influenced its use were ease of use and immediate access to data. The easier the application was to use, the more likely a teacher or administrator was to use it. The ability to immediately access data from one source also increased the use of the application.

The teachers who were interviewed indicated they had received little to no training in the use of the data warehouse application. These teachers also emphasized how the lack of training inhibited their ability to use of the application. Also expressed was the need for training to be targeted to the ability level of the audience,

on-going, and provide opportunity for teachers and administrators to become comfortable with the application.

The focus group and interview participants indicated the application was helpful in providing data on which to determine appropriate interventions for students. Information on individual students was useful in determining interventions and enhancing parent communication. The application also provided student data in a manner that allowed for school and district level planning.

Designated time to meet with colleagues to discuss student data was key to the implementation of the data warehouse application. Administrators found they learned ways from their colleagues in which the application could be useful, whereas teachers expressed a lack of time to meet with other teachers to discuss student data.

Both teachers and administrators expressed the need for individuals in a leadership role to support the use of the data warehouse application. Administrators must provide guidance in how the application is to be used, ensure teachers are using it, and provide guidance in the use of data and school goals. Teachers and administrators also indicated that teachers could play an important role in leadership by working with colleagues to share their knowledge in how to use the application.

Three unexpected findings came to light in the focus group and interviews. The higher the teacher's technology skills, the easier it was to use the application. Individuals needed to possess the knowledge of how to use data to make informed instructional decisions. Once educators understood how and why they should use data

to make informed instructional decisions, they realized the need to have student data available on which to base their instructional discussions and decisions.

Key features of the data warehouse application identified in both the on-line survey and the focus group and interviews were the ability to view data for an individual or small groups of students and the usefulness of formative assessment and summative assessment data. Information that was not addressed in the survey but came to light in the focus group and interview results was that immediate access to student data positively affected the implementation of the application. While the survey results indicated very little support was needed, the focus group and interview results showed ease of use of the application as a determining factor in its use.

Both the on-line survey and the focus group results showed administrators received more training in the use of the application than classroom teachers. While the survey results did not indicate a relationship between the amount of training received and the level of use of the application, the focus group and interview data indicated there was a higher level of use among the administrators who received more training than the teachers who received minimal training. The focus group and interview results highlighted the need for training to be specific to the role and ability level of the audience.

Two work place norms that influenced the implementation of the data warehouse application identified by both the survey data and the focus group and interview data were the usefulness of reviewing data in small groups and the need for designated time to be provided to review student data.

Survey participants who indicated the use of the data warehouse application was important to their building administrators also indicated that they felt it was important. Both the teacher and administrators in the focus group and interviews expressed the need for administrators to stress the importance of the use of the data warehouse application.

The findings of this study are discussed in Chapter 5. The findings are based on the review of the literature and the results of the data analysis. Each research question is addressed along with limitations of the study.

V. DISCUSSION OF FINDINGS

The findings in this study were based on a review of the factors that affect the data driven decision making (DDDM) process as presented in the literature and the analysis of the qualitative and quantitative results. The results of the data analysis were aligned with the research questions then compared to the findings in the literature. While the commonalities between the qualitative and quantitative data served as a guiding factor, emphasis was placed on the qualitative data. The focus group and interviews provided a deeper insight into the questions explored in this study.

The discussion of the findings is organized by the four research questions explored in this study. Additional findings beyond the research questions are also discussed. Limitations of the study are presented after the findings.

Research Question Findings

Question 1

What data warehouse application features affect the ability of an educator to effectively use the application for data driven decision making?

Data warehouse application features were factors that were within the control of the developer of the application. The type of data the participants found most useful was formative and summative assessment data. This was supported by the responses from the on-line survey, focus group, and interviews. Focus group and interview participants indicated that, in some cases, they were unable to access this information prior to having access to the data warehouse application.

Research supports the need for access to formative and summative student data. Formative and summative data is used in the data driven decision making (DDDM) process (Marsh, et al., 2006). Response to Intervention (RTI) involves the use of summative assessments to identify students at risk of failing in school (Fuchs & Fuchs, 2006) and the use of formative assessment to monitor the on-going progress of students (VanDerHeyden, et. al., 2007). Professional Learning Communities (PLC) also focus on the use of formative assessments to compare student performance by one group of students to that of another group (DuFour, 2004).

A second feature the participants found useful was the ability to view data by groups of students such as reading groups. While not included in the survey, teachers found viewing data at the individual student level very helpful. Watson (2002) identified the need for data to be aggregated at various student levels. While not specifically addressing data aggregation, Light, et al. (2004) did identify manipulation of data as a factor in the effectiveness of DDDM.

A third feature identified by the participants in the focus group and interviews was ease of use. Participants attributed lack of use of the application to its difficulty to use. Conversely, the participants who found the application easy to use compared to other applications, expressed that this factor contributed to its use. This finding was not substantiated by the on-line survey. However, most survey participants indicated they needed little or no help to use the application. Light, et. al. (2004) also identified ease of use as a key factor influencing the effectiveness of DDDM whereas Watson (2002) identified ease of use as a factor in using a data warehouse application.

The fourth feature that was identified as influencing the use of the application for DDDM was immediate access to data. Focus group and interview participants expressed past difficulties in obtaining current data on students. The ability to access current data through a data warehouse application resolved this issue. The on-line survey did not address immediate access to data. When asked what type of data they found useful, over 70% of the participants responded they found the data somewhat or very useful, regardless of the type of data. Similarly, over 80% found data somewhat or very useful regardless of the format in which the data were presented. This finding is supported by the research of Marsh, et al. (2006) in their review of four studies on the effectiveness of the implementation of DDDM in school districts.

Question 2

What sorts of training or professional development and workplace norms are needed to help educators use data warehouse applications more effectively?

The training participants received in the use of the data warehouse application varied from no training to four hours of training with most participants receiving less than two hours of training. While the survey data indicated that the amount of training did not influence the participants' use of the data warehouse application, the focus group and interview data revealed the opposite. Participants who received more training found the application easier to use than participants who received little or no training. In addition, participants identified the need for training in how to use data in the DDDM process. Marsh, et al. (2006) identified staff capacity as a factor

influencing the effectiveness of DDDM. One way to build capacity would be to provide sufficient training to staff.

The survey showed participants found it most useful to review data individually and in small groups, such as professional learning communities or data teams. In addition, designated time needed to be provided to review the data. The survey showed participants who received dedicated time to review data used the application more frequently than participants who did not receive dedicated time. These findings were supported by the focus group and interview data. Collaboration is key in both PLCs and RTI. DuFour cites collaboration as key in improving the classroom practices of teachers (2004). RTI uses a team approach to review data to make informed decisions about the needs of students (VanDerHeyden, et al., 2007)

The need for teachers to have designated time to review data as an individual and in small groups, such as grade level teams or PLCs was also identified in this study. Educators who received designated time to review student data used the data warehouse application more frequently than those who did not receive dedicated time. Marsh, et al. (2006) found lack of time as influencing the effectiveness of using the DDDM process.

Question 3

How do differences in leadership affect an organization's use of data warehouse applications?

The results of the survey showed leadership played a key role in an organization's use of a data warehouse application. Participants whose building or

district level administrators participated in data warehouse application or related trainings used the application more frequently than participants whose administrators participated in fewer trainings. Participants were also influenced by how important they perceived the use of the application was to their building and district administrators. The more important the participant believed the use of the data warehouse was to administrators, the more important the participant thought the use of the application was in helping teachers make instructional decisions for students. The focus group and interview participants also expressed the need for administrators to support the use of the data warehouse application. Teachers attributed the low use of the application in their schools to the lack of administrative support for the use of the application and for use of DDDM in general. Marsh, et al. (2006) found administrators with strong commitments to DDDM and collaboration affected teachers' ability to use data.

Question 4

What, if any, impact has the use of data warehouse applications had on instructional strategies and student performance?

Over 61% of the survey participants indicated the use of the data warehouse application had at least some impact on changes in instructional strategies or intervention techniques. This was supported by the focus group and interview participants who stated the application was especially helpful in identifying areas in which students needed additional support. Over 67% of the survey participants believed changes in student performance were influenced by the use of the data

warehouse application. However, this was clarified by the focus group and interview participants. Any changes in student behavior were the result of changes in instructional strategies or intervention techniques. A data warehouse application provides data to educators. The premise behind RTI is to use data to determine what interventions would best address a student's educational needs (Davis Bianco, 2010; VanDerHeyden, 2007). Student progress is then monitored throughout the process (VanDerHeyden, 2007). The availability of data to educators through a data warehouse application should enhance the process of reviewing data, selecting an intervention, and monitoring progress.

Other Findings

Although not addressed in the survey, two key findings emerged from the focus group and interviews. The first finding was the role a participant's ability to use technology played in the use of the data warehouse application. The more comfortable and experienced participants were in using technology, the more comfortable they were using the data warehouse application. This could possibly relate to the lack of training teachers received. All teachers interviewed identified themselves as having a high level of skill using technology. While these individuals were able to figure out on their own how to use the application, they all expressed that using the application would have been much easier if they had received more training.

The second finding was that school districts needed to understand why the use of data in making instructional decisions was important. Both administrators and teachers identified the lack of understanding in how to use data to make instructional

decisions inhibited the use of the application. Once educators understood the importance of using data to make informed instructional decisions and how to apply the process, they then recognized the need to have student data available on which to base their decisions.

Limitations

As with all studies, there were limitations within this one. Because the study used a convenience sample, the participants in this study may not have been a true representation of the population. Individuals willing to participate have been those who found the data warehouse application useful. Individuals who found the data warehouse application difficult to use may have felt they did not have enough knowledge to participate in the study.

In addition to the concern regarding representation of the population, this study was limited to two school districts, about 1% of the districts throughout the state. Approximately 14% of the individuals who received an invitation to participate in the study completed the survey. The focus group from which qualitative data was gathered contained only four administrators from the same school district. Similarly, only four teachers were interviewed. The sample size was very small limiting the ability to generalize the results to a larger population.

Finally, the researcher works in the field of educational data warehousing. This may contribute to researcher bias.

Chapter 6 explores the implications the findings of this study have for educators and data warehouse providers. Suggestions for further research are discussed and concluding thoughts provided.

VI. CONCLUSIONS

This chapter discusses the implications for data warehouse providers and school districts in the process of implementing the use of a data warehouse application or considering the implementation of a data warehouse application. As the results of this study were analyzed, additional areas of research became apparent. These areas are discussed. Concluding thoughts are provided.

Implications for Educators, Policy Makers and Data Warehouse Providers

Several key features of a data warehouse application were identified by this study as influencing an educator's ability to effectively use the application for DDDM. In order to ensure an application provides the information an educator needs in a format that is useful, a data warehouse application provider needs to include the following in the application: summative and formative student assessment data; the ability to disaggregate the data into small student groups, such as reading groups; and data on individual students. In addition, the application should be easy to use and must be accessible to educators in a timely manner.

School districts that are implementing a data warehouse application must provide at least two hours training in the use of the application. Data warehouse providers must offer training in the use of the application to the districts that are implementing a data warehouse application. For school districts, this means they must provide time to train the educators who will use the application. In addition, school districts should provide dedicated time for teachers to review student data and provide opportunity for teachers to meet in small groups to review data.

Individuals in leadership roles in a school district are key to the implementation of a data warehouse application. To increase the use of the application within their school district, building and district-level administrators should attend trainings in the use of the application as well as other related trainings on the use of data. School and district-level administrators must show teachers they believe the use of the application is important, and support the use of the application in the DDDM process.

Policy makers need to ensure their staff has the skills necessary to use the data warehouse application. Beyond receiving training in how to use the application, educators must have the technical skills to be comfortable using the technology involved. In addition, educators must understand how to use data to make informed educational decisions. A structure should be in place that allows educators to collaborate on the use of student data and designated time should be provided for that collaboration.

Implications for Researcher

These implications have a direct effect in my role as a project director of a regional data warehouse. It is necessary to ensure the data warehouse application has the features that will meet the needs of educators. The findings of this study will guide future development of the data warehouse application I oversee. In addition, I can assist school district staff in the key factors necessary to support a successful implementation of a data warehouse application within their school district.

At the beginning of this study, my focus was on the findings that would directly affect the design of the data warehouse application and the factors that were within my control in assisting districts as they implement the application. However, through this research, I realized that the application is only one piece of a much larger puzzle. In order for a successful implementation to occur, the other pieces of the puzzle must be in place. This study has already influenced my work with school districts. I now start all implementation planning sessions talking to school district leaders about how they are using the DDDM process in their district. I will use what I learned from this study to guide the implementation process and training of school district staff.

I now realize I must emphasize to school districts the importance of school and district-level administrators supporting the use of the data warehouse application. The administrators must believe in the importance of the use of the application in order for teachers to believe the use of the application is important.

My next steps will be to determine how I can help districts evaluate the technical skills of their staff to ensure they have the basic technical foundation necessary to use the application. The most important concept this study has brought to light for me is if a school district does not have the necessary foundation, the other pieces of the puzzle so to speak, then the implementation of the application will not be successful.

Suggestions for Future Research

Ease of use was a key factor in an educator's ability to use a data warehouse application in the DDDM process. However, the factors that make an application easy to use were not identified. Additional research to identify these factors could assist vendors in designing applications that would be more user-friendly.

The study identified the need for training in the use of the data warehouse application. However, the exact amount of training needed was not identified. Future research is needed to identify how much training should be provided to support a successful implementation of the application.

Participants who thought the use of the data warehouse application was important in helping teachers make instructional decisions used the application more frequently and thought the application had a greater influence on changes in instructional strategies and intervention techniques. A relationship was identified between how important the participant thought the use of the application was and how important they perceived the use of the application was to building level administrators. However, the reason why the participant thought the use of the data warehouse application was important to building administrators was not identified. By identifying the factors that contribute to the belief that the use of the application is important to administrators, these factors can then be used to support the implementation of the application.

While many patterns emerged from this study, the sample size was too small to determine whether a significant relationship existed between the factors examined. A

replication of this study with a larger sample population could strengthen the validity of this study and provide the potential for greater generalizability.

An unanticipated finding of this study was the indication that an individual's skill level in the use of technology affected the ability to use the data warehouse application. This was identified through the qualitative data analysis as a contributing factor inhibiting the use of the data warehouse application. Further research is needed to determine how much of an influence this had as well as what level of technical skills are needed to enable educators to successfully use the data warehouse application in the DDDM process.

Concluding Thoughts

The use of data in education and the factors that influence DDDM served as the foundation for this study. This study brought the added element of how the use of a data warehouse application affected the DDDM process. Specifically, this study looked at the factors that influenced an educator's ability to use a data warehouse application in the DDDM process. Many of the factors that influenced the DDDM process held true for the use of the data warehouse application in this research. Light, et al., (2004) describe six steps needed to transform data into knowledge. These steps are collecting data, organizing data into a meaningful format, summarizing the data, analyzing the data, synthesizing the data, and making decisions based on the data. A data warehouse application performs the first three steps of data collection, data organization, and data summarization, allowing the educator to then focus on analyzing and synthesizing the data in order to make a decision based on the data. The

ability to access data in a format that allows educators to make informed decisions should lead to changes in instructional strategies and intervention techniques with the end result being increased student performance.

Yet, eliminating the first three steps in transforming data to knowledge did not eliminate many of the issues that existed in using data in the DDDM process. For the data warehouse application developer, it is essential that the application includes summative and formative data, allows for data manipulation, and is easy to use. For school districts implementing the use of the application, they must consider the need for training in the use of the application, the importance of leadership in supporting the application, the need for designated time for teachers to review student data, and the opportunity for teachers to meet with colleagues to discuss student data.

Beyond what was supported by previous research, this study brought to light the need for educators to have sufficient skills in the use of technology in order to be able to use the application. Finally, the school district must have sufficient knowledge of the importance of using data to make informed instructional decisions and recognize the need to have student data on which to base these decisions.

The researcher would like to acknowledge the school districts that participated in this study. It is through the generosity of the teachers and administrators in these school districts who took time out of their busy schedules to participate that this study was possible.

REFERENCES

- Ackoff, R. (1990). From data to wisdom. *Informatie*, 32(5), 486-490. Retrieved from Inspec database.
- Ackoff, R. (1999). On learning and the systems that facilitate it. *Reflections*, 1(1), 14-24. doi:10.1162/152417399570250
- Bernhardt, V. (2005). Data tools for school improvement. *Educational Leadership*, 62(5), 66-69. Retrieved from Education Research Complete database.
- Black, P., & Wiliam, D. (2010). Inside the black box: raising standards through classroom assessment. *Phi Delta Kappan*, 91(9), 81-90. Retrieved from Education Research Complete database.
- Black, P., Harrison, C., Lee, C., Marshall, B., & Wiliam, D. (2004). Working inside the black box: Assessment for learning in the classroom. *Phi Delta Kappan*, 86(1), 9-21. Retrieved from Education Research Complete database.
- Brunner, C., Fasca, C., Heinze, J., Honey, M., Light, D., Mandinach, E., & Wexler, D. (2005). Linking data and learning: The grow network study. *Journal of Education for Students Placed at Risk*, 10(3), 241-267. doi:10.1207/s15327671espr1003_2
- Buffum, A. Mattos, M. & Weber, C. (2010). Interventions that work: The why behind RTI. *Educational Leadership*, 68(2), 10-16. Retrieved from <http://www.ascd.org/publications/educational-leadership/oct10/vol68/num02/The-Why-Behind-RTI.aspx>
- Chenail, R. (2011). Interviewing the Investigator: Strategies for addressing instrumentation and research bias concerns in qualitative research. *The Qualitative Report*, 16(1), 255-262.
- Creswell, J. (2007). *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage Publications.
- Creswell, J. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Los Angeles, CA: Sage.
- Davis Bianco, S. (2010). Improving student outcomes: Data-driven instruction and fidelity of implementation in a response to intervention (RTI) model. *Teaching Exceptional Children Plus*, 6(5), 2-13. Retrieved from Education Research Complete database.

- De Veaux, R., Velleman, P., & Bock, D. (2008). *Stats: Data and models* (2nd ed.). Boston, MA: Pearson.
- Denzen, N. & Lincoln, Y. (2008). *The landscape of qualitative research*. Thousand Oaks, CA: Sage Publications.
- Dorn, S. (2010). The political dilemmas of formative assessment. *Exceptional Children*, 76(3), 325-337. Retrieved from Education Research Complete database.
- DuFour, R. (2004). What is a "Professional Learning Community"? *Educational Leadership*, 61(8), 6-11. Retrieved from Education Research Complete database.
- Dunn, K. & Mulvenon, S. (2009). A critical review of research on formative assessment: The limited scientific evidence of the impact of formative assessment in education. *Practical Assessment, Research, & Evaluation*, 14(7), 1-11.
- Fink, A. (1995a). *How to analyze survey data*. Thousand Oaks, CA: Sage Publications.
- Fink, A. (1995b). *The survey handbook*. Thousand Oaks, CA: Sage Publications.
- Fink, A. (2003). *How to manage and interpret survey data*. Thousand Oaks, CA: Sage Publications.
- Fink, A. & Kosecoff, J. (1998). *How to conduct surveys: A step-by-step guide* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Fuchs, D., & Fuchs, L. (2006). Introduction to response to intervention: What, why, and how valid is it? *Reading Research Quarterly*, 41(1), 92-99. Retrieved from Education Research Complete database.
- Hammond, P., & Yeshanew, T. (2007). The impact of feedback on school performance. *Educational Studies* (03055698), 33(2), 99-113. doi:10.1080/03055690601068212
- Hill, C., Knox, S., Thompson, B., Williams, E. Hess, S., & Ladany, N. (2005). Consensual qualitative research: An update. *Journal of Counseling Psychology*, 52(2), 196-205. doi: <http://dx.doi.org/10.1037/0022-0167.52.2.196>
- Krueger, R. & Casey, M. (2000). *Focus groups: A practical guide for applied research*. Thousand Oaks, CA: Sage Publications.

- LaPointe, M., Brett, J., Kagle, M., Midouhas, E., Sanchez, M., Oh, Y., & North, C. (2009). How state education agencies in the Northeast and Islands region support data-driven decisionmaking in districts and schools. Issues & Answers Report, REL 2009-No. 072. *Regional Educational Laboratory Northeast & Islands*, Retrieved from ERIC database.
- Light, D., Wexler, D. & Heinze, J. (2004, April). *How practitioners interpret and link data to instruction: Research findings on New York Schools' implementation of the Grow Network*. Paper presented at the annual meeting of the American Educational Research Association, San Diego, CA. Retrieved from http://cct.edc.org/admin/publications/speeches/Grow_AERA04_fin.pdf
- Litwin, M. (1995). *How to measure survey reliability and validity*. Thousand Oaks, CA: Sage Publications.
- Litwin, M. (2003). *How to assess and interpret survey psychometrics*. Thousand Oaks, CA: Sage Publications.
- Mandinach, E., Honey, M., & Light, D. (2006, April). A theoretical framework for data-driven decision making. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA. Retrieved on February 24, 2010 from http://cct.edc.org/admin/publications/speeches/DataFrame_AERA06.pdf
- Marsh, J.A., Pane, J. F., & Hamilton, L. S. (2006). Making sense of data-driven decision making in education. *RAND Corporation*. Retrieved from http://www.rand.org/pubs/occasional_papers/2006/RAND_OP170.pdf
- McMillan, J. (2005). The impact of high-stakes test results on teachers' instructional and classroom assessment practices. *Online Submission*, Retrieved from ERIC database.
- Means, B., Padilla, C., DeBarger, A., & Bakia, M. (2009). Implementing data-informed decision making in schools—teacher access, supports and use. US Department of Education. Retrieved from <http://www2.ed.gov/rschstat/eval/tech/data-informed-decision/data-informed-decision.doc>
- Miller, A., & Cunningham, J. (1981). How to avoid costly job mismatches. *Management Review*, 70(11), 29. Retrieved from Business Source Premier database.

- Morgan, D. & Spanish, M. (1984). Focus groups: A new tool for qualitative research. *Qualitative Sociology*, 7(3), 253. Retrieved from Academic Search Premier database.
- Morgan, D. (1997). *Focus groups as qualitative research*. Thousand Oaks, CA: Sage Publications.
- National Center for Educational Statistics. (2009). Statewide longitudinal data systems grant program: SLDS features. Retrieved from http://nces.ed.gov/Programs/SLDS/pdf/features_summary.pdf
- No Child Left Behind Act, Public Law 107-110 (2002).
- Oregon DATA Project. (2009). The Oregon data project: The first two years. Retrieved on March 5, 2010, from <http://www.oregondataproject.org/content/two-year-summary-report>
- Oregon Department of Education. (2005). Guide to writing the continuous improvement plan. Retrieved July 26, 2010 from <http://www.ode.state.or.us/schoolimprovement/cdip/planguid.pdf>
- Oregon Education Enterprise Steering Committee. (2010). Data warehouse spring sharing, 2010. Retrieved from <http://www.oregoneesc.org/node> June 4, 2010.
- Paré, R., & Elovitz, L. (2005). Data warehousing: An aid to decision-making. *THE Journal*, 32(9), 32-33. Retrieved from Academic Search Premier database.
- Phillips, D. C., & Burbules, N. (2000). *Postpositivism and educational research*. Lanham, MD: Rowman & Littlefield Publishers.
- Reeves, R. B. (2002). Data-driven decision making. *The Leader's Guide to Standards: A Blueprint for Educational Equity and Excellence*. (pp. 95-111). San Francisco, CA: John Wiley & Sons.
- Reeves, R. B. (2005). The 90/90/90 schools: A case study. *Accountability in Action: A Blueprint for Learning Organizations*. (pp. 185-208). Englewood, CO: Advanced Learning Centers.
- Reichback, A. (2004). The power behind the promise: Enforcing no child left behind. *Boston College Law Review*, 45, 667-704.
- Saldaña, J. (2009). *The coding manual for qualitative researchers*. Los Angeles, CA: Sage Publications

- Sim, J. (1998). Collecting and analysing qualitative data: Issues raised by the focus group. *Journal of Advanced Nursing*, 28(2), 345-352. doi:10.1046/j.1365-2648.1998.00692.x.
- Stiggins, R. (2002). Assessment crisis: The absence of assessment FOR learning. *Phi Delta Kappan*, 83(10), 758-765. Retrieved from Education Research Complete database.
- Streifer, P., & Schumann, J. (2005). Using data mining to identify actionable information: Breaking new ground in data-driven decision making. *Journal of Education for Students Placed at Risk*, 10(3), 281-293. doi:10.1207/s15327671espr1003_4
- SurveyMonkey. Retrieved on November 3, 2010 from <http://www.surveymonkey.com>
- Taras, M. (2009). Summative assessment: The missing link for formative assessment. *Journal of Further & Higher Education*, 33(1), 57-69. doi:10.1080/03098770802638671.
- VanDerHeyden, A., Witt, J., & Gilbertson, D. (2007). A multi-year evaluation of the effects of a response to intervention (RTI) model on identification of children for special education. *Journal of School Psychology*, 45(2), 225-256. Retrieved from ERIC database.
- Watson, J. (2002). QSP and the MPS Information System. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA. Retrieved from ERIC database.
- Wayman, J. (2005). Involving teachers in data-driven decision making: Using computer data systems to support teacher inquiry and reflection. *Journal of Education for Students Placed at Risk*, 10(3), 295-308.
- Wenmoth, D. (2009, April 23). Without data, you are just another person with an opinion [Web log post]. Retrieved from <http://blog.core-ed.net/derek/2009/04/without-data-you-are-just-another-person-with-an-opinion.html>
- Williams, T., Kirst, M., Haertel, E., Reardon, S., Woody, E., Livine, J.,...Livine, R. (2005). Similar students, different results: Why do some schools do better? A large-scale survey of California elementary schools serving low-income students. Mountain View, CA: EdSource.
- Wolff, D. (April 4, 2010). Data warehouse updates. Retrieved on June 4, 2010 from <http://www.oregoneesc.org/content/data-warehouse-updates>

APPENDICES

APPENDIX A

Database Searches

EBSCOhost

- General
 - Academic Search Premier
 - MasterFILE Premier
 - Newspaper Source
 - TOPICsearch
- Business
 - Academic Search Premier
 - Business Source Premier
- Computer Science
 - Computer Source
 - Library, Information Science & Technology Abstracts
- Education
 - Education Research Complete
 - ERIC
 - Professional Development Collection
 - Psychology and Behavioral Science collection
- Psychology & Sociology
 - Academic Search Premier
 - Alt HealthWatch
 - America: History & Life
 - Business Source Premier
 - Education Research Complete
 - Health Source – consumer Edition
 - Health Source – Nursing/Academic Edition
 - MEDLINE
 - Psychology and Behavioral Science Collection

Key Terms

- Data
- Data warehouse/data warehousing
- School improvement
- School reform
- Educational reform
- Data driven decision making
- SMART goals/objectives
- Education
- Information management

APPENDIX B

**Invitation to Participate in Survey
Email Text**

You are invited to participate in an on-line study entitled “Factors that Affect an Educator’s Ability to Use a Data Warehouse Application in the Data Driven Decision Making Process.” This study is designed to gather information on what factors affect the ability of a teacher or administrator to use a data warehouse for planning and instruction.

The use of data warehousing in education is in its infancy. No studies have been completed as to the effects it will have on classroom instruction and improving student achievement. By participating in this study, you can help other school districts, teachers, and administrators as they work through the process of implementing a data warehouse application.

Risks of participating in this study are minimal but include possible breach of confidentiality and risks of transmitting data over the internet. All information provided in this survey is confidential. Participation is voluntary and will in no way impact your employment within your school district. You may skip questions or exit the survey at any time. The survey will take approximately 10 minutes.

The security and confidentiality of information collected from you online cannot be guaranteed. Information collected online can be intercepted, corrupted, lost, destroyed, arrive late or incomplete, or contain viruses.

A report summarizing the researchers’ findings of the study will be sent to the school districts participating in the study. However, no names of participants or identifiable information will be included in the reports.

If you have any questions about this research project, please contact:

Robin DeLoach at deloachr@onid.orst.edu

Dr. Karen Higgins at higginsk@oregonstate.edu

If you have questions about your rights or welfare as a participant, please contact the Oregon State University Institutional Review Board (IRB) Office, at (541) 737-8008 or by email at IRB@oregonstate.edu

If you would like to participate in this survey, please click on the following link:

<INSERT LINK ONCE SURVEY IS FINALIZED>

If the link does not take you to the on-line survey, copy and paste the link into the address line on your internet browser.

Thank you for your assistance,

Robin DeLoach

APPENDIX C

Interview Invitation Email

Last spring, you participated in an on-line survey on the factors that affect the ability of a teacher or administrator to use a data warehouse application for planning and instruction. At the end of the survey, you indicated a willingness to participate in a focus group for the study, Factors that Affect an Educator's Ability to Use a Data Warehouse Application in the Data Driven Decision Making Process. Unfortunately, there were not enough volunteers to hold a focus group in your area. However, the researchers would still like to hear your views on your use of your data warehouse application.

Would you be willing to participate in a telephone interview and share your views on your use of your data warehouse application? The interview will take approximately 45 minutes. I will work with you to schedule the interview at your convenience.

The interviews will be recorded then transcribed. Your name will not be associated with the transcript. Once the recording is transcribed, it will be destroyed. Your participation in this study will be kept confidential. If you do not wish to be recorded, please do not participate in this portion of the study.

Thank you again for your participation in this study. If you have any questions, please contact one of the research team members.

Thank you,

Robin DeLoach
deloachr@onid.orst.edu

Dr. Karen Higgins
higginsk@oregonstate.edu

If you have questions about your rights or welfare as a participant, please contact the Oregon State University Institutional Review Board (IRB) Office, at (541) 737-8008 or by email at IRB@oregonstate.edu

APPENDIX D

Focus Group Email

Thank you for your interest in participating in a focus group for the study, Factors that Affect an Educator's Ability to Use a Data Warehouse Application in the Data Driven Decision Making Process. This study is designed to gather information on what factors affect the ability of a teacher or administrator to use a data warehouse application for planning and instruction.

Your focus group session will be held on Tuesday, May 31, at 3:30 PM at a location in your school district. I will contact you with the specific location once it is determined.

The focus group will consist of between 4 and 10 educators from your region and will take approximately 90 minutes. You will be asked questions about your experience using a data warehouse application. Separate focus groups will be held for teachers and administrators.

Because all participants in the focus groups will be from your school district or region, it is possible you will know other participants and they will know you. All participants will be asked to keep the identities of other participants, as well as the comments made in the focus groups, confidential. Participation is voluntary and will in no way impact your employment within your school district.

The focus group sessions will be audio recorded. This is not optional. If you do not wish to be recorded, please do not participate in this part of the study.

An informed consent form is attached. This form provides additional information about the study, focus group, and possible risks. You will be asked to sign a copy of this form at the focus group session.

Thank you again for your willingness to participate in this study. If you have any questions, please contact:

Robin DeLoach
deloachr@onid.orst.edu

Dr. Karen Higgins
higginsk@oregonstate.edu

APPENDIX E

Focus Group Informed Consent

1. WHAT IS THE PURPOSE OF THIS FORM?

This form contains information you will need to help you decide whether to be in this study or not. Please read the form carefully and email questions about anything that is not clear to deloachr@onid.orst.edu.

2. WHY IS THIS STUDY BEING DONE?

The purpose of this study is to determine what factors affect the ability of a teacher or administrator to use a data warehouse application to make informed data-based decisions on instructional strategies and programs. Because the use of data warehousing in education is in its infancy, no studies have been completed as to the effects it will have on classroom instruction and improving student achievement. It is hoped that, by knowing the factors that affect educators ability to use a data warehouse application, school districts will be better prepared to successfully implement a data warehouse, or similar, project.

This study is being conducted by Robin DeLoach for the completion of a dissertation.

Up to 400 teachers and administrators will be invited to take part in this study.

3. WHY AM I BEING INVITED TO TAKE PART IN THIS STUDY?

You are being invited to take part in this study because your district provides access to student information through the use of a data warehouse dashboard.

4. WHAT WILL HAPPEN IF I TAKE PART IN THIS RESEARCH STUDY?

The study activities include participating in a focus group. The focus group will involve group discussions with other teachers from your school district or administrators from your region. The focus group will take approximately 90 minutes.

Storage and Future use of data:

Because it is not possible for us to know what studies may be a part of our future work, we ask that you give permission now for us to use comments without being contacted about each future study. Future use of survey responses will be limited to studies about the use of data in educational settings. Because your name will not be included in the transcripts, your responses cannot be removed at later date. By

agreeing to participate in this study, you are also agreeing to allow future use of your survey responses.

5. WHAT ARE THE RISKS AND POSSIBLE DISCOMFORTS OF THIS STUDY?

Because all participants in the focus groups will be from your school district or region, it is possible you will know other participants and they will know you. All participants will be asked to keep the identities of other participants, as well as the comments made in the focus groups, confidential.

Your name will not be associated with any comments used in the final report.

6. WHAT ARE THE BENEFITS OF THIS STUDY?

This study is not designed to benefit you directly. It is designed to inform educators about the factors that may affect the successful implementation of a data warehouse project.

7. WILL I BE PAID FOR BEING IN THIS STUDY?

You will not be paid for being in this research study.

8. WILL IT COST ME ANYTHING TO BE IN THIS STUDY?

There are no costs to participate in this study.

9. WHO WILL SEE THE INFORMATION I GIVE?

The information you provide during this research study will be kept confidential to the extent permitted by law. Research records will be stored securely and only researchers will have access to the records. Federal regulatory agencies and the Oregon State University Institutional Review Board (a committee that reviews and approves research studies) may inspect and copy records pertaining to this research. Some of these records could contain information that personally identifies you.

If the results of this project are published your identity will not be made public.

The focus group sessions will be audio recorded and transcribed. Once transcribed, the audio recordings will be destroyed.

The data warehouse region and the instructional level of the school (elementary, middle, or high school) will be included in the transcriptions but participants will not be identified. Code numbers will be used to indicate when different participants are speaking. All participants will be asked to keep the names of other participants, as well as the comments made within the focus groups, confidential.

During analysis, the data will be stored on a password protected encrypted network. All participant identifiable information will be destroyed.

10. WHAT OTHER CHOICES DO I HAVE IF I DO NOT TAKE PART IN THIS STUDY?

Participation in this study is voluntary. If you decide to participate, you are free to leave the focus group at any time. If you choose to leave the focus group before completion, the researchers may keep information collected about you and this information may be included in study reports.

All responses to questions asked in the focus group are voluntary. You may choose to not answer any or all of the questions.

11. WHO DO I CONTACT IF I HAVE QUESTIONS?

If you have any questions about this research project, please contact:

Robin DeLoach at deloachr@onid.orst.edu

Dr. Karen Higgins at higginsk@oregonstate.edu

If you have questions about your rights or welfare as a participant, please contact the Oregon State University Institutional Review Board (IRB) Office, at (541) 737-8008 or by email at IRB@oregonstate.edu

12. WHAT DOES MY SIGNATURE ON THIS CONSENT FORM MEAN?

Your signature indicates that this study has been explained to you, that your questions have been answered, and that you agree to take part in this study. You will receive a copy of this form.

Participant's Name (printed): _____

(Signature of Participant)	(Date)

(Signature of Person Obtaining Consent)	(Date)

APPENDIX F

Verbal Consent Guidelines

These guidelines are to be reviewed at the beginning of the interview. Participant must give consent and consent must be documented by the person conducting the interview before proceeding with the interview.

Purpose: The purpose of this study is to gather information on what factors affect the ability of a teacher or administrator to use a data warehouse application for planning and instruction.

Risks: There are no foreseeable risks to participating in this study. Your name will not be included in the study, nor will any other identifiable information. The interview will be recorded and then transcribed. Once the interview is transcribed, the recording will be destroyed.

Benefits: There are no direct benefits to you as a participant. It is hoped that the information gained from this study will help other districts in the planning and implementation of a data warehouse project.

Voluntariness: Participation in this study is completely voluntary. You may decline to answer any question that is asked. You may end the interview at any time. At any point in the interview you may request that part or all of your responses not be included in the study.

Contact Information: After the interview is ended, if you have questions about the study, you may contact a member of the research team:

Robin DeLoach
deloachr@onid.orst.edu

Dr. Karen Higgins
higginsk@oregonstate.edu

Oregon State University Institutional Review Board (IRB) Office
IRB@oregonstate.edu
(541) 737-8008

APPENDIX G

On-Line Survey

1. Informed Consent

This survey contains 23 questions and will take approximately 10 minutes to complete.

The survey must be completed in one session.

You may skip any questions that you prefer not to answer.

You can exit the survey at any time by closing your internet browser.

1. Do you want to participate in this study by taking this survey?

By checking “yes” you are indicating that this research study has been explained to you, that your questions have been answered, and that you agree to take part in this study.

- ☐ Yes, I want to participate in this study.
- ☐ No, I want to exit this survey.

2. Usefulness**2. How useful do you find each of the following in helping you use information about your students in making decisions for instruction, intervention, or planning?**

	Not useful at all	Somewhat useful	Very useful	Not available
Charts or tables	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Graphs, such as bar or pie graphs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reports, such as lists of information about students	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Spreadsheets, such as Microsoft Excel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3. How useful do you find information on each of the following in helping you make decisions for instruction, intervention, or planning?

	Not useful at all	Somewhat useful	Very useful	Not available
Attendance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Discipline	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Summative assessment, such as Oregon Assessment of Knowledge & Skills (OAKS), PSAT, SAT, or other annual standardized assessments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Formative assessments such as DIBELS, DRA, easyCBM, NWEA MAPs or other formative measures used throughout the year	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4. How useful is information on the following groups:

	Little or no use	Somewhat useful	Very useful	Not provided
All students in your district	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All students in your school or schools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All students in a class or classes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Student performance groups (such as reading levels or intervention groups)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Student programs (such as Talented and gifted, Special Education, English Language Learners)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Demographic information (such as gender, ethnicity, race, age, or grade level)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5. How confident are you that the information in your data warehouse application is accurate?

	Little or no confidence	Somewhat confident	Very confident	No idea
Confidence level	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3. Training and Support**6. How easy is it for you to use your data warehouse application?**

	I need a great deal of help	I need some help	I need little or no help
Amount of help needed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7. How much training have you received in each of the following areas?

	No training was provided	Less than 2 hours	2-4 hours	4-8 hours	More than 8 hours
How to use the data warehouse application	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How to use data in making instructional, intervention, or planning decisions (such as Data Teams, Data Driven Decision Making, RTI, Professional Learning Communities)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

8. Did building leaders (such as administrators or program leaders) participate in the trainings provided for the data warehouse application or related trainings?

	Few or no trainings	Some of the trainings	Most or all of the trainings	No trainings were provided
Participation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. When you need help to use the data warehouse application, what help available?

	Little or no help	Some help	Adequate help	No help is needed
How much help is available?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4. Time

10. Does your school or district provide designated time for you to look at student data:

	Weekly	Monthly	Per grading period	Once or twice a year	No designated time is provided
As a large group such as all staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In smaller groups such as grade level teams, data teams, or PLCs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
As an individual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

11. How beneficial do you find reviewing student data

	Of little or no use	Somewhat useful	Very useful
As a large group such as all staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In smaller groups such as grade level teams, data teams, or PLCs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
As an individual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12. Approximately how often to you use the data warehouse application?

- ☐ 1 or more times a week
- ☐ 1-2 times a month
- ☐ 1-2 times a grading period
- ☐ 1-2 times a year

13. Do you have sufficient time to use the data warehouse application to help you make instructional, intervention, or planning decisions for your students?

- ☐ Yes
- ☐ No

5. Importance**14. Is the use of the data warehouse application (check all that apply):**

- ☐ Required by building administrators
- ☐ Required by district administrators
- ☐ Encouraged by building administrators
- ☐ Encouraged by district administrators
- ☐ None of the above

15. How important do you think the use of the data warehouse application to help teachers make instructional or intervention decisions for students is to:

	Not important	Somewhat important	Very important	I don't know
Yourself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Building teachers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Building administrators	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
District administrators	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

16. What influence has your use of the data warehouse application had on

	No or little influence	Some influence	A great deal of influence
Changes to instructional strategies or intervention techniques	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improvement in student performance (academic or behavioral)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6. About you

17. What school district do you work in?

- ☐ Eugene 4J
- ☐ Hermiston SD

18. What description most closely matches your role?

If you have multiple roles in your district, please choose the one that most closely relates to your use of the data warehouse application.

- ☐ District level administrator
- ☐ Building level administrator
- ☐ Building/School Counselor
- ☐ District/building level teacher/specialist
- ☐ Classroom teacher

19. What grade levels do you work with? Check all that apply.

If you work with multiple grade levels, please choose all that most closely match your position.

- ☐ K-2
- ☐ 3-5
- ☐ 6-8
- ☐ 9-12
- ☐ District level

20. What content areas do you teach or support? Check all that apply.

If you provide support services to students, please identify the content area that most closely describes the content you support

- ☐ All content areas
- ☐ Language Arts
- ☐ Mathematics
- ☐ Science
- ☐ Social Studies
- ☐ Other
- ☐ Non-teaching staff

21. How long have you have you been using your data warehouse application?

- ☐ 3 months or less
- ☐ 3-6 months
- ☐ 6 months-1 year
- ☐ 1-2 years
- ☐ More than 2 years

7. Focus Groups

22. Would you be willing to participate in a focus group?

***The focus group would involve a discussion among 4-10 teachers or administrators (separate groups) about the factors that influence your use of the data warehouse application in instruction.**

***It will be held near your school district.**

***It will take approximately 90 minutes.**

***We encourage individuals who have had both positive and negative experiences with the use of the data warehouse application to participate.**

If you are willing to participate in a focus group, please provide your:

Name

Email Address

23. Please indicate the times that would be best for you to attend a focus group. Check all that apply.

	Daytime (8:30 AM -3:30 PM)	Afternoon (3:30 PM -6:00 PM)	Evening(6:00 PM -8:00 PM)
May	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
June	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. Thank you

Thank you.

If you have any questions, please contact:

Robin DeLoach
deloachr@onid.orst.edu

APPENDIX H

Focus Group Protocols

The following procedures and guiding questions will be used for all focus groups conducted during this study.

1. Welcome the participants
2. Provide overview of the topic:

The purpose of this study is to determine what factors affect the ability of a teacher or administrator to use a data warehouse application to make informed data-based decisions on instructional strategies and programs. It is hoped that, by knowing the factors that affect teachers and administrators use of a data warehouse application, school districts will be better prepared to successfully implement a data warehouse, or similar, project.

I am conducting this study for the completion of a dissertation.

You were invited to take part in this study because your district provides access to student data through the use of a data warehouse dashboard and you indicated your willingness to participate in a focus group.

The focus group will take approximately 90 minutes.

3. Informed Consent
 - a. Before we begin the discussion, we need to go over the informed consent.
 - i. Hand out copies of the informed consent form, 2 to each individual.
 - ii. Read the informed consent form aloud
 - b. Are there any questions about the informed consent form?
 - i. Answer questions that are asked
 - c. If you wish to participate in the focus group, please sign one of the informed consent forms. The second copy is for you to keep.
 - i. Collect signed consent forms
 - ii. Thank individuals who do not sign the form for their time before they leave
4. Explain procedures
 - a. Thank you for taking time to participate in this focus group. I would like to find out what you think are the most important factors that

have affected your ability to use the data warehouse application. I will ask several questions of the group. There are no right or wrong answers. I expect that you will have differing points of views. Please feel free to share your point of view even if it differs from what others have said. You are not required to answer any question you prefer not to answer.

I am recording the session because I don't want to miss any of your comments. No names will be included in any reports. Your comments are confidential. Keep in mind I am just as interested in negative comments as positive ones. If you want to follow up on something that someone has said, feel free to do so.

I am here to ask questions, listen, and make sure everyone has a chance to share. I am interested in hearing from each of you. If you are doing a lot of talking, I may ask you to give others a chance. I just want to make sure I hear from all of you.

5. Go over Ground Rules

- a. Before we start, I would like to go over some ground rules to help the discussion go more smoothly.
 - i. One member will speak at a time
 - ii. Refrain from having side conversations with a neighbor
 - iii. Give everyone a chance to speak
 - iv. Disagree respectfully
 - v. Silence your cell phones. If you must take a call, please leave the room to do so. You may re-enter the discussion after you complete your call.
 - vi. To ensure everyone feels free to speak their mind, keep the identities of the participants and comments made in the group confidential.

6. Begin questions

- a. Please tell us your first name and your teaching/administrative assignment including grade level and/or content area.
- b. How has the type and extent of professional development and support affected your ability to use the data warehouse application to make instructional decisions for your students/school/district?
- c. How has the amount of time you have to use the data warehouse application affected your ability to use the data warehouse application to make instructional decisions for your students/school/district?

- d. What role has leadership and the organizational culture played in your ability to use the data warehouse application to make instructional decisions for your students/school/district?
 - e. What impact, if any, has the use of the data warehouse application had on your instructional practices and on student achievement?
 - f. What do you consider are the three factors that have had the most influence on your ability to use the data warehouse application to make instructional decisions for your students? These factors can be, but do not have to be ones we have discussed today.
7. Additional prompts to use to draw additional information from participants, if needed
- a. Would you explain further?
 - b. Would you give me an example of what you mean?
 - c. Would you say more?
 - d. Tell us more.
 - e. Say more.
 - f. Is there anything else?
 - g. Please describe what you mean
 - h. Is there anyone who has a different experience?
 - i. Are there additional comments on what was shared?
8. Conclude the focus group. Thank everyone for coming.

Adapted from:

Krueger, R. & Casey, M. (2000). *Focus groups: A practical guide for applied research*. Thousand Oaks, CA: Sage Publications, and

Morgan, D. (1997). *Focus groups as qualitative research*. Thousand Oaks, CA: Sage Publications.

APPENDIX I

Interview Protocol

1. Review Verbal Consent guidelines.
2. Ask participant if they consent to participating in the interview. If yes, then record the date, time, and name of the participant. This information will be kept separate from the participant's responses to maintain confidentiality. If the participant declines to give verbal consent, thank them for their time and end the interview.
3. Begin questions
 - a. Please tell us your first name and your teaching/administrative assignment including grade level and/or content area.
 - b. How has the type and extent of professional development and support affected your ability to use the data warehouse application to make instructional decisions for your students/school/district?
 - c. How has the amount of time you have to use the data warehouse application affected your ability to use the data warehouse application to make instructional decisions for your students/school/district?
 - d. What role has leadership and the organizational culture played in your ability to use the data warehouse application to make instructional decisions for your students/school/district?
 - e. What impact, if any, has the use of the data warehouse application had on your instructional practices and on student achievement?
 - f. What do you consider are the three factors that have had the most influence on your ability to use the data warehouse application to make instructional decisions for your students? These factors can be, but do not have to be ones we have discussed today.
4. Additional prompts to use to draw additional information from participants, if needed
 - a. Would you explain further?
 - b. Would you give me an example of what you mean?
 - c. Would you say more?
 - d. Is there anything else?
 - e. Please describe what you mean
 - f. Is there anything else you would like to share?

Conclude the interview by thanking the participant.